General Information

Specifications

Description		Specifications	Limit
General			
Type		In-line, Double Overhead Camshaft	
Number of cylinder		4	
Bore		82mm (3.228in)	
Stroke		93.5mm (3.681in)	
Total displacement		1975cc (120.52cu.in)	
Compression ratio		10.1 : 1	
Firing order		1 - 3 - 4 - 2	
Valve timing			
Intake valve	Opens (ATDC)	ATDC 11° ~ BTDC 29°	
	Closes (ABDC)	ABDC 59° ~ ABDC 19°	
Exhaust	Opens (BBDC)	42°	
	Closes (ATDC)	6°	
Valve			
Valve length	Intake	114.34mm (4.5016in)	
	Exhaust	116.8mm (4.598in)	
Stem outer diameter	Intake	5.965 ~ 5.98mm (0.2348 ~ 0.2354in)	
	Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in)	
Face angle thickness of valve head (Margin)			
Intake		1.6±0.15mm (0.0630±0.0059in)	0.8mm (0.031in)
Exhaust		1.8±0.15mm (0.0709±0.0059in)	1.0mm (0.039in)
Valve stem to valve guide clearance			
Intake		0.02 ~ 0.05mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
Exhaust		0.035 ~ 0.065mm (0.0014 ~ 0.0026in)	0.13mm(0.0051in)
Valve guide			
Installed dimension o-uter diameter	Intake	45.8~46.2mm (1.8031~1.8189in)	
	Exhaust	52.8~53.2mm (2.0787~2.0945in)	
Service oversize		0.05, 0.25, 0.50mm (0.002, 0.010, 0.020in) ove-rsize	
Valve seat			
Width of seat contact	Intake	1.1 ~ 1.5mm (0.043 ~ 0.059in)	
	Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066in)	
Oversize		0.3, 0.6mm (0.012, 0.024in) oversize	

Description		Specifications	Limit
Valve spring			
Free length		48.86mm (1.9236in)	
Load		18.8k±0.9kg/39.0mm(41.4±2.0lb/1.5354in) 41.0±1.5kg/30.5mm(90.4±3.3lb/1.2008in)	
Squarences		1.5° or less	
Valve clearance			
Cold (20°C[68°F])	Intake	0.20mm (0.0079in)	0.17~0.23mm (0.0067~0.0091in)
	Exhaust	0.28mm (0.0110in)	0.25~0.31mm (0.0098~0.0122in)
Hot (80°C[176°F]) : only for reference	Intake	0.29mm (0.0114in)	
	Exhaust	0.34mm (0.0134in)	
Cylinder head			
Flatness of gasket surface		Max. 0.03mm (0.0012in)	0.06mm(0.0024in)
Flatness of manifold mounting surface		Max. 0.15mm (0.0059in)	0.03mm(0.0012in)
Oversize rework dimensions of valve seat hole			
Intake	0.3mm (0.012in) O.S.	33.300 ~ 33.325mm (1.3110 ~ 1.3120in)	
	0.6mm (0.024in) O.S.	33.600 ~ 33.625mm (1.3228 ~ 1.3238in)	
Exhaust	0.3mm (0.012in) O.S.	28.800 ~ 28.821mm (1.1338 ~ 1.1346in)	
	0.6mm (0.024in) O.S.	29.100 ~ 29.121mm (1.1456 ~ 1.1465in)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)			
0.05mm (0.002in) O.S		11.05 ~ 11.068mm (0.435 ~ 0.4357in)	
0.25mm (0.010in) O.S		11.25 ~ 11.268mm (0.443 ~ 0.4436in)	
0.50mm (0.020in) O.S		11.50 ~ 11.518mm (0.453 ~ 0.4535in)	
Cylinder block			
Cylinder bore		82.00 ~ 82.03mm (3.2283 ~ 3.2295in)	
Out-of-round and taper of cylinder bore		Less than 0.01mm (0.0004in)	
Clearance with piston (To set limits to new parts)		0.02 ~ 0.04mm (0.0008 ~ 0.0016in)	
Piston			
Outer diameter (To set limits to new parts)		81.97 ~ 82.00mm (3.2271 ~ 3.2283in)	
Service oversize		0.25, 0.50mm (0.010, 0.020in) oversize	
Piston ring			
Side clearance	No.1	0.04 ~ 0.08mm (0.0015 ~ 0.0031in)	0.1mm (0.004in)
	No.2	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)	

Description		Specifications	Limit
End gap	No.1	0.20 ~ 0.35mm (0.0079 ~ 0.0138in)	1mm (0.039in)
	No.2	0.37 ~ 0.52mm (0.0146 ~ 0.0205in)	1mm (0.039in)
Oil ring side rail		0.20 ~ 0.60mm (0.0078 ~ 0.0236in)	1mm (0.039in)
Service oversize		0.25, 0.50mm (0.010, 0.020in.) oversize	
Piston pin			
Outer diameter		20.001 ~ 20.006mm (0.7874 ~ 0.7876in)	
Hole inner diameter		20.016 ~ 20.021mm (0.7880 ~ 0.7882in)	
Hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end inner diameter		19.974 ~ 19.985mm (0.7864 ~ 0.7868in)	
Connecting rod			
Bend		0.05mm (0.0020in) or less	
Twist		0.1mm (0.004in) or less	
Connecting rod big end to crankshaft side clearance		0.100 ~ 0.250mm (0.0039 ~ 0.010in)	0.4mm(0.0157in)
Connecting rod bearing			
Oil clearance (To seat limits to new parts)		0.024 ~ 0.042mm (0.0009 ~ 0.0017in)	
Undersize		0.25mm (0.01in)	
Camshaft			
Cam height	Intake	44.618mm (1.7566in)	44.518mm(1.7527in)
	Exhaust	44.518mm (1.7527in)	44.418mm (1.7487in)
Journal outer diameter		28mm (1.1023in)	
Bearing oil clearance		0.02 ~ 0.061mm (0.0008 ~ 0.0024in)	0.1mm(0.0039in)
End play		0.1 ~ 0.2mm (0.0040 ~ 0.0079in)	
Crankshaft			
Pin outer diameter		44.946 ~ 44.966mm (1.7695 ~ 1.7703in)	
Journal outer diameter		56.942 ~ 56.962mm (2.2418 ~ 2.2426in)	
Bend		0.03mm (0.0012in) or less	
Out-of-round, taper of journal and pin		0.01mm (0.0004in) or less	0.030mm (0.0012in)
End play		0.06 ~ 0.260mm (0.0023 ~ 0.010in)	
Undersize rework dimension of pin	0.25mm (0.010in)	44.725 ~ 44.740mm (1.7608 ~ 1.7614in)	
Undersize rework dimension of journal	0.25mm (0.010in)	56.727 ~ 56.742mm (2.2333 ~ 2.2339in)	
Crankshaft bearing			
Oil clearance		0.028 ~ 0.046mm (0.0011 ~ 0.0018in)	
Flywheel			

Description	Specifications	Limit
Runout	0.1mm (0.0039in)	0.13mm(0.0051in)
Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
Coolant		
Quantity	6.2~6.3liter (6.55~6.66U.S qts, 5.46~5.54Imp. qts)	
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	93.16 ~ 122.58kpa(0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)	
Vacuum valve opening pressure	MAX. 6.86 kpa(0.07kg/cm², 1.00 psi)	
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (177°F)	
Valve closing temperature	77°C (170.6°F)	
Full-opening temperature	95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt		
Type	V-ribbed belt	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59kΩ at 20°C (68°F) 0.3222kΩ at 80°C (176°F)	
Oil pump		
Clearance between outer circumference and front case.	0.120 ~ 0.185mm (0.0049 ~ 0.0073in)	
Front case tip clearance	0.025 ~ 0.069mm (0.0009 ~ 0.0027in)	
Side clearance		
Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)	
Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in)	
Engine oil pressure at 1500 RPM [Oil temperature is 90 to 110°C 194 to 230°F)]	245KPa (2.5kg/cm², 35.5psi)	
Engine oil		

Description		Specifications	Limit
Oil quantity	Total	4.1L (4.33US qt, 3.60Imp qt)	When replacing a short engine or a block assembly
	Oil pan	3.7L (3.91US qt, 3.26Imp qt)	
	Drain and refill	4.0L (4.23US qt, 3.52Imp qt)	Including oil filter
Oil grade	Recommendation (except Middle East)	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"
Oil pressure (at 800rpm)		100kPa (1.0kg/cm², 14.5psi) or above	Oil temperature in oil pan : 90 ~ 100°C (194 ~ 212°F)
Relief spring			
Free height		43.8mm (1.725in.)	
Load		3.7kg at 40.1mm (3.15lb/1.578in)	
Air cleaner			
Type		Dry type	
Element		Unwoven cloth type	
Exhaust pipe			
Muffler		Expansion resonance type	
Suspension system		Rubber hangers	

Service Standrds

Standard value	
Antifreeze	Maxture ratio of anti-freeze in coolant
Ethylene glycol base for aluminum	50%

Tightening Torques

Item	Nm	kgf.m	lb-ft
Cylinder Block			
Front engine support bracket bolt and nut	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Front roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear engine stopper bracket bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Engine Mounting			
Right mounting insulator (large) nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Right mounting insulator (small) nut	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Right mounting bracket to engine nuts and bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transmission mount insulator nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Transmission insulator bracket to side member bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Rear roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper bracket to center member bolts	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Front roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Front roll stopper bracket to center member bolts.	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Main Moving			
Connecting rod cap nut	49.0 ~ 52.0	5.0 ~ 5.3	36.2 ~ 38.3
Crankshaft bearing cap bolt	(27.5~31.4) + (60°~64°)	(2.8~3.2) + (60°~64°)	(20.3~23.1) + (60°~64°)
Fly wheel M/T bolt	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Drive plate A/T bolt	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Engine cover	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Heat protector	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~14.5
Water pipe bracket bolts	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Cooling system			
Alternator support bolt and nut	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Alternator lock bolt	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Alternator brance mounting bolt	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Coolant pump pulley bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Coolant pump bolts	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
Coolant temperature sensor	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Coolant inlet fitting nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5

Item	Nm	kgf.m	lb-ft
Thermostat housing bolts and nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Lubrication system			
Oil filter	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~32.5
Oil screen bolts	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~15.9
Oil pressure switch	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~10.8
Intake and Exhaust system			
Air cleaner body mounting bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Intake manifold to cylinder head nuts and bolts	15.7 ~ 22.6	1.6 ~ 2.3	11.6 ~ 16.6
Intake manifold stay to cylinder block bolts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Throttle body to surge tank nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold to cylinder head nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Exhaust manifold cover to exhaust manifold b-olts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Oxygen sensor to front muffler	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Oxygen sensor to exhaust manifold	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Front exhaust pipe to exhaust manifold nuts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe bracket bolts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe to catalytic converter bolts	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Main muffler hanger support bracket bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Cylinder head			
Cylinder head bolts - M10	(22.6~26.5) + (60°~65°) + (60°~65°)	(2.3~2.7) + (60°~65°) + (60°~65°)	(16.6~19.5) + (60°~65°) + (60°~65°)
Cylinder head bolts - M12	(27.5~31.4) + (60°~65°) + (60°~65°)	(2.8~3.2) + (60°~65°) + (60°~65°)	(20.3~33.1) + (60°~65°) + (60°~65°)
Intake manifold nuts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Cylinder head cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolts	13.7 ~ 14.7	1.4 ~ 1.5	10.1 ~ 10.8
Oil control valve bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV Filter	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
CVVT unit to exhaust camshaft bolt	64.7 ~ 76.5	6.6 ~ 7.8	47.7~ 56.4
Rear plate bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Timing Belt			
Crankshaft pulley bolt	156.9 ~ 166.7	16.0 ~ 17.0	115.7 ~ 123.0

Item	Nm	kgf.m	lb-ft
Camshaft sprocket bolt	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Timing belt auto tensioner bolts	22.6 ~ 28.4	2.3 ~ 2.9	16.6 ~ 21.0
Timing belt cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Front case bolts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Timing belt idler bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8

Inspection

Compression Pressure

NOTICE

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

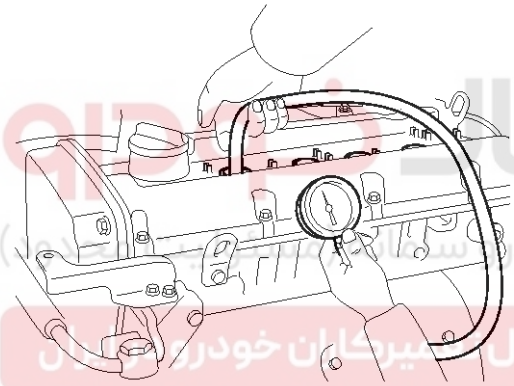
1. Warm up and stop engine.

   Allow the engine to warm up to normal operating temperature.

2. Remove ignition coils.
3. Remove spark plugs.

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

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



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

      NOTICE

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

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

      NOTICE

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

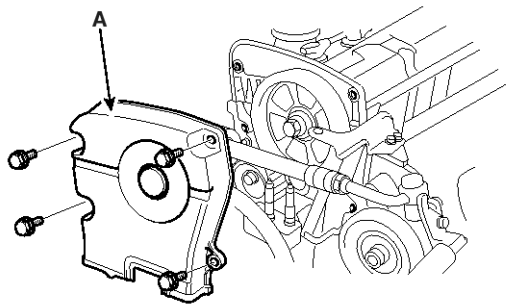
Compression pressure :
1421.96kPa (14.5kgf/cm², 206.24psi)
Minimum pressure :
1274.86kPa (13.0kgf/cm², 184.90psi)
Difference between each cylinder :
98.07kPa (1.0kgf/cm², 14.22psi) or less

   e. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
      - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
      - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall spark plugs.
6. Install ignition coils.

Timing Belt Tension Adjustment

1. Remove the engine cover.
2. Remove RH front wheel.
3. Remove the 4bolts and timing belt upper cover (A).



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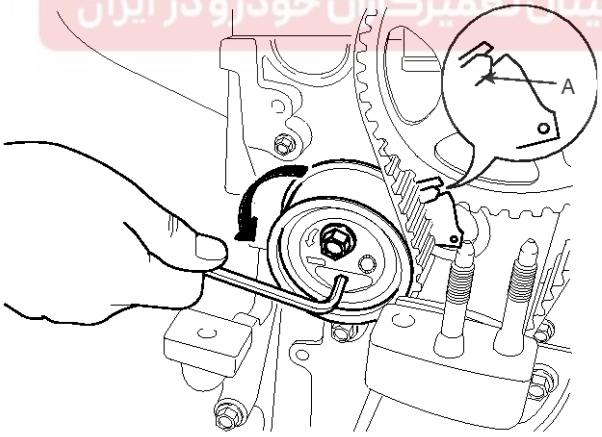
4. Slacker the tensioner bolt.

NOTICE

When check the timing belt tension or install the timing belt tensioner, must it the engine oil temperature is between 15˚C(59˚F) and 25˚C(77˚F)

5. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm(A) located at the center of the base notch.



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CAUTION

Do not rotate the adjuster clockwise.

It will result in auto tensioner's functional problem.

6. Tightening tensioner bolt with fixing the indicator not to move.

Tightening torque

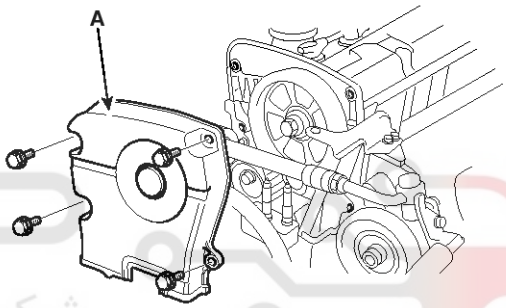
Tensioner bolt :

22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

7. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
8. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
9. Install the timing belt upper cover (A).

Tightening torque :

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



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10. Install RH front wheel.
11. Install the engine cover.

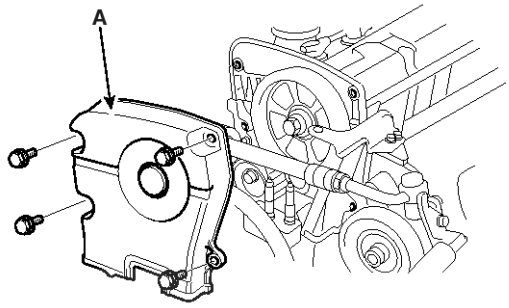
Valve Clearance Inspection And Adjustment

MLA (MECHANICAL LASH ADJUSTER)

NOTICE

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

1. Remove the engine cover.
2. Remove the upper timing belt cover (A).



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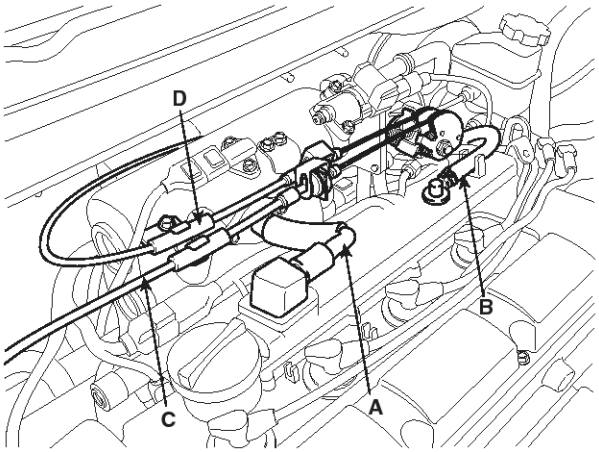
   a. Loosen the upper timing cover bolts and then remove the cover.

3. Remove the cylinder head cover.
   1) Disconnect the spark plug cables and do not pull on the spark plug by force.

      NOTICE

      Pulling on or bending the cables may damage the connductor inside.

   2) Disconnect the P.C.V hose (A) and the breather hose (B) from the cylinder head cover.
   3) Disconnect the accelerater cable (C) and the auto-cruise cable(D) from the cylinder head cover.



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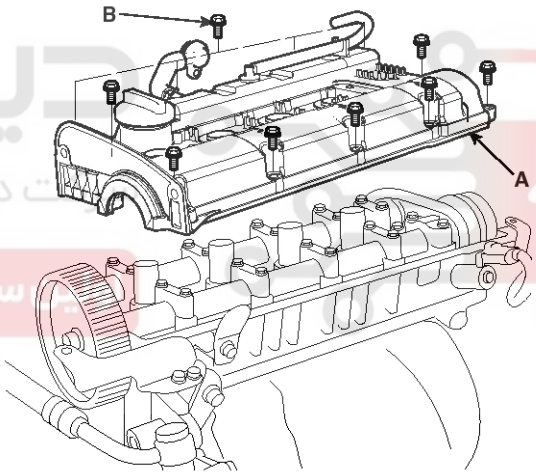
   4) Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



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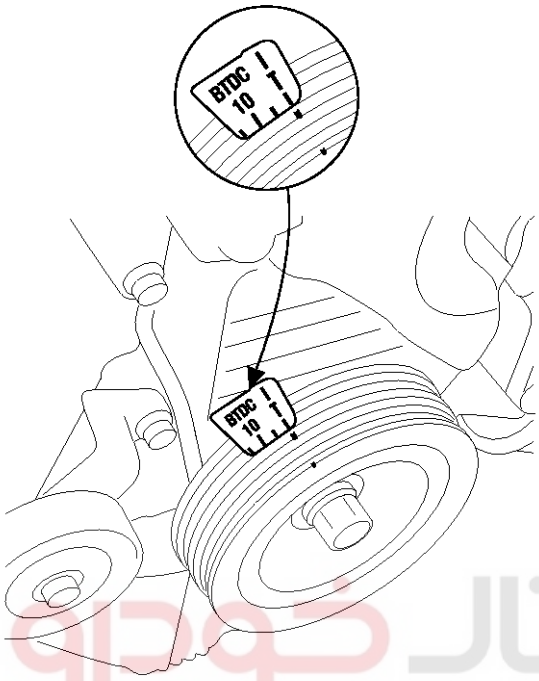
4. Set No. 1 cylinder to TDC/compression.
   1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



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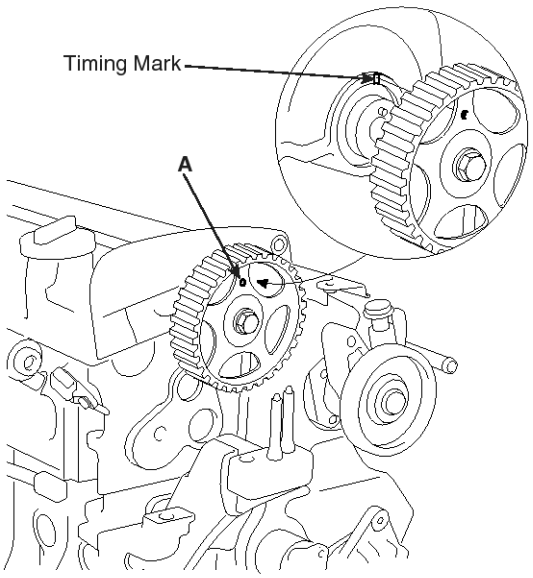
   2) Check that the hole of the camshaft timing pulley (A) is aligned with the timing mark of the bearing cap.
   If not, turn the crankshaft one revolution (360˚)



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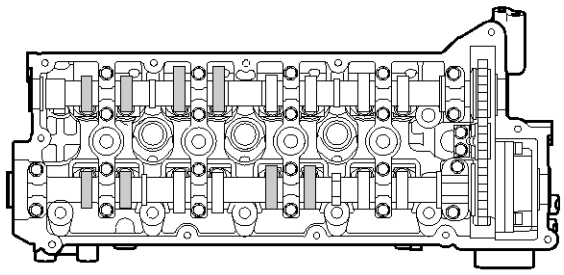
5. Inspect the valve clearance
   1) Check only the valve indicated as shown. [No. 1 cylinder : TDC/Compression] measure the valve clearance.



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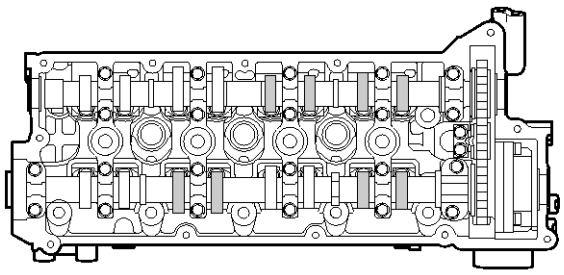
   - Using a thickness gauge, measure the clearance between the tappe shim and the base circle of camshaft.
   - Record the out-of-specification valve clearance measurements. They will be used later to determine the required replaement adjusing shim.

Valve clearance

Specitication
Engine coolant temperature : 20˚C [68˚F]
Intake : 0.20mm (0.0079in.)
Exhaust : 0.28mm (0.0110in.)
Engine coolant temperature : 80˚C [176˚F]
Intake : 0.29mm (0.0114in.)
Exhaust : 0.34mm (0.0134in.)
Limit
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.091in.)
Exhaust : 0.25 ~ 0.31mm (0.0098 ~ 0.0122in.)

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

3) Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance. (See procedure in step (6))



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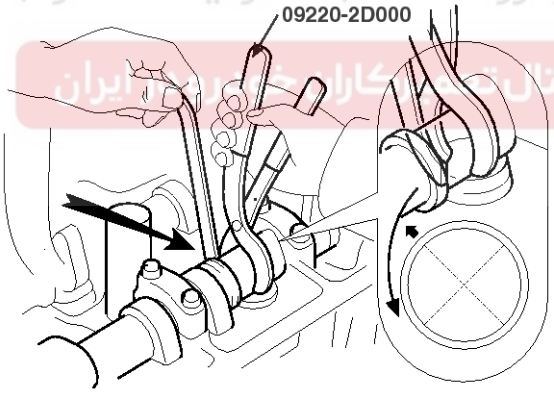
6. Adjust the intake and exhaust valve clearance.
   1) Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.
   2) Using the SST(09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



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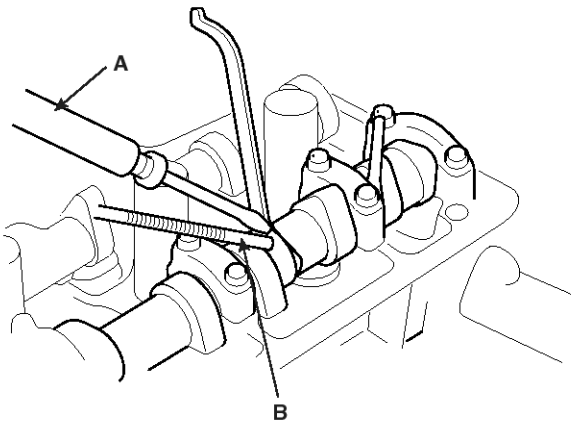
3) Remove the adjusting shim with a small screw driver (A) and magnet(B).



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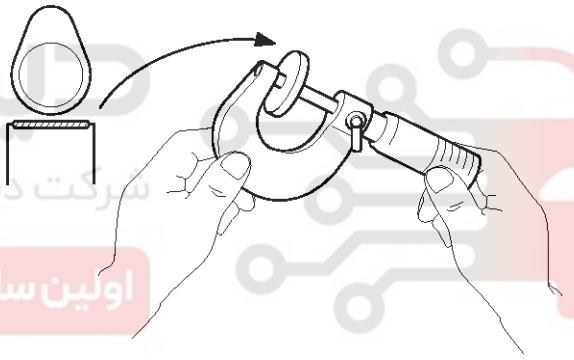
4) Measure the thickness of the removed shim using a micrometer.



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5) Calculate the thickness of a new shim so that the valve clearance comes within the specificified value.

Valve clearance (Engine coolant temperature : 20°C)
T : Thickness of removed shim
A : Measured valve clearance
N : Thickness of new shim
Intake : N = T + [A - 0.20mm(0.0079in.)]
Exhaust : N = T + [A-0.28mm (0.0110in.)]

6) Select a new shim with a thickness as close as possible to the caculated value. [Refer to the Adjusting shim selection chart]

NOTICE

Shims are available in 20size increments of 0.04mm (0.0016in.) from 2.00mm (0.079in.) to 2.76mm (0.1087in.)

7) Place a new adjusting shim on the valve lifter.
8) Using the SST(09220 - 2D000), press down the valve lifter and remove the stopper.
9) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20˚C)

[Specification]
Intake : 0.20mm (0.0079in.)
Exhaust : 0.28mm (0.0110in.)
[Limit] (After adjusting valve clearance)
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091in.)
Exhaust : 0.25 ~ 0.31mm (0.0098 ~ 0.0122in.)

Adjusting Shim Selection Chart (Intake)

Measured clearance mm	(in.)	2.00 (0.0787)	2.02 (0.0795)	2.04 (0.0803)	2.06 (0.0811)	2.08 (0.0819)	2.10 (0.0827)	2.11 (0.0831)	2.12 (0.0835)	2.13 (0.0839)	2.14 (0.0843)	2.15 (0.0846)	2.16 (0.0850)	2.17 (0.0854)	2.18 (0.0858)	2.19 (0.0862)	2.20 (0.0866)	2.21 (0.0870)	2.22 (0.0874)	2.23 (0.0878)	2.24 (0.0882)	2.25 (0.0886)	2.26 (0.0890)	2.27 (0.0894)	2.28 (0.0898)	2.29 (0.0902)	2.30 (0.0906)	2.31 (0.0909)	2.32 (0.0913)
0.000 - 0.020	(0.0000 - 0.0008)													1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4
0.021 - 0.040	(0.0008 - 0.0016)											1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5
0.041 - 0.060	(0.0016 - 0.0024)									1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
0.061 - 0.080	(0.0024 - 0.0031)							1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6
0.081 - 0.100	(0.0032 - 0.0039)						1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6
0.101 - 0.119	(0.0040 - 0.0047)					1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7
0.120 - 0.280	(0.0047 - 0.0110)																												
0.281 - 0.300	(0.0111 - 0.0118)	3	4	4	5	5	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11
0.301 - 0.320	(0.0119 - 0.0126)	4	4	5	5	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12
0.321 - 0.340	(0.0126 - 0.0134)	4	5	5	6	6	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12
0.341 - 0.360	(0.0134 - 0.0142)	5	5	6	6	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13
0.361 - 0.380	(0.0142 - 0.0150)	5	6	6	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13
0.381 - 0.400	(0.0150 - 0.0157)	6	6	7	7	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14
0.401 - 0.420	(0.0158 - 0.0165)	6	7	7	8	8	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14
0.421 - 0.440	(0.0166 - 0.0173)	7	7	8	8	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15
0.441 - 0.460	(0.0174 - 0.0181)	7	8	8	9	9	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15
0.461 - 0.480	(0.0181 - 0.0189)	8	8	9	9	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16
0.481 - 0.500	(0.0189 - 0.0197)	8	9	9	10	10	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16
0.501 - 0.520	(0.0197 - 0.0205)	9	9	10	10	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17
0.521 - 0.540	(0.0205 - 0.0213)	9	10	10	11	11	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17
0.541 - 0.560	(0.0213 - 0.0220)	10	10	11	11	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18
0.561 - 0.580	(0.0221 - 0.0228)	10	11	11	12	12	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18
0.581 - 0.600	(0.0229 - 0.0236)	11	11	12	12	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19
0.601 - 0.620	(0.0237 - 0.0244)	11	12	12	13	13	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19
0.621 - 0.640	(0.0244 - 0.0252)	12	12	13	13	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20
0.641 - 0.660	(0.0252 - 0.0260)	12	13	13	14	14	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20
0.661 - 0.680	(0.0260 - 0.0268)	13	13	14	14	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20		
0.681 - 0.700	(0.0268 - 0.0276)	13	14	14	15	15	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20				
0.701 - 0.720	(0.0276 - 0.0283)	14	14	15	15	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20						
0.721 - 0.740	(0.0284 - 0.0291)	14	15	15	16	16	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20								
0.741 - 0.760	(0.0292 - 0.0299)	15	15	16	16	17	17	18	18	18	18	19	19	19	19	20	20	20	20										
0.761 - 0.780	(0.0300 - 0.0307)	15	16	16	17	17	18	18	18	19	19	19	19	20	20	20	20												
0.781 - 0.800	(0.0307 - 0.0315)	16	16	17	17	18	18	19	19	19	19	20	20	20	20														
0.801 - 0.820	(0.0315 - 0.0323)	16	17	17	18	18	19	19	19	20	20	20	20																
0.821 - 0.840	(0.0323 - 0.0331)	17	17	18	18	19	19	20	20	20	20																		
0.841 - 0.860	(0.0331 - 0.0339)	17	18	18	19	19	20	20	20																				
0.861 - 0.880	(0.0339 - 0.0346)	18	18	19	19	20	20																						
0.881 - 0.900	(0.0347 - 0.0354)	18	19	19	20	20																							
0.901 - 0.920	(0.0355 - 0.0362)	19	19	20	20																								
0.921 - 0.940	(0.0363 - 0.0370)	19	20	20																									
0.941 - 0.960	(0.0370 - 0.0378)	20	20																										
0.961 - 0.980	(0.0378 - 0.0386)	20																											

Measured clearance mm	(in.)	2.33 (0.0917)	2.34 (0.0921)	2.35 (0.0925)	2.36 (0.0929)	2.37 (0.0933)	2.38 (0.0937)	2.39 (0.0941)	2.40 (0.0945)	2.41 (0.0949)	2.42 (0.0953)	2.43 (0.0957)	2.44 (0.0961)	2.45 (0.0965)	2.46 (0.0969)	2.47 (0.0972)	2.48 (0.0976)	2.49 (0.0980)	2.50 (0.0984)	2.51 (0.0988)	2.52 (0.0992)	2.53 (0.0996)	2.54 (0.1000)	2.56 (0.1008)	2.58 (0.1016)	2.6 (0.1024)	2.62 (0.1031)	2.64 (0.1039)	2.66 (0.1047)	2.68 (0.1055)	2.70 (0.1063)	2.72 (0.1071)	2.74 (0.1079)	2.76 (0.1087)
0.000 - 0.020	(0.0000 - 0.0008)	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.021 - 0.040	(0.0008 - 0.0016)	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	12	12	13	13	14	14	15	15	16
0.041 - 0.060	(0.0016 - 0.0024)	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	13	13	14	14	15	15	16	16
0.061 - 0.080	(0.0024 - 0.0031)	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	14	14	15	15	16	16	17
0.081 - 0.100	(0.0032 - 0.0039)	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17
0.101 - 0.119	(0.0040 - 0.0047)	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17	18
0.120 - 0.280	(0.0047 - 0.0110)																																	
0.281 - 0.300	(0.0111 - 0.0118)	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	18	18	19	19	20	20				
0.301 - 0.320	(0.0119 - 0.0126)	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	19	19	20	20					
0.321 - 0.340	(0.0126 - 0.0134)	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	19	19	20	20						
0.341 - 0.360	(0.0134 - 0.0142)	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	20	20							
0.361 - 0.380	(0.0142 - 0.0150)	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	20	20								
0.381 - 0.400	(0.0150 - 0.0157)	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20									
0.401 - 0.420	(0.0158 - 0.0165)	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20										
0.421 - 0.440	(0.0166 - 0.0173)	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20											
0.441 - 0.460	(0.0174 - 0.0181)	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20													
0.461 - 0.480	(0.0181 - 0.0189)	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20															
0.481 - 0.500	(0.0189 - 0.0197)	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20																	
0.501 - 0.520	(0.0197 - 0.0205)	17	17	18	18	18	18	19	19	19	19	20	20	20	20																			
0.521 - 0.540	(0.0205 - 0.0213)	18	18	18	18	19	19	19	19	20	20	20	20																					
0.541 - 0.560	(0.0213 - 0.0220)	18	18	19	19	19	19	20	20	20	20																							
0.561 - 0.580	(0.0221 - 0.0228)	19	19	19	19	20	20	20	20																									
0.581 - 0.600	(0.0229 - 0.0236)	19	19	20	20	20	20																											
0.601 - 0.620	(0.0237 - 0.0244)	20	20	20	20																													
0.621 - 0.640	(0.0244 - 0.0252)	20	20																															

New shim thickness mm(in.)

Shim No.	Thickness		Shim No.	Thickness	
1	2.00	(0.0787)	11	2.40	(0.0945)
2	2.04	(0.0803)	12	2.44	(0.0961)
3	2.08	(0.0819)	13	2.48	(0.0976)
4	2.12	(0.0835)	14	2.52	(0.0992)
5	2.16	(0.0850)	15	2.56	(0.1008)
6	2.20	(0.0866)	16	2.60	(0.1024)
7	2.24	(0.0882)	17	2.64	(0.1039)
8	2.28	(0.0898)	18	2.68	(0.1055)
9	2.32	(0.0913)	19	2.72	(0.1071)
10	2.36	(0.0929)	20	2.76	(0.1087)

HINT : New shims have the thickness in milimeters imprinted on the face

Intake valve clearance (Cold) :
0.20 mm (Spec.) 0.12 ~ 0.28mm (Limit)
Example : The 2.24 mm shim is installed, and the measured clearance is 0.450 mm. Replace the 2.24mm shim with a new No. 13 shim.

EDKB888D

Adjusting Shim Selection Chart (Exhaust)

Install shim thickness mm (in.) / Measured clearance mm (in.)

Measured clearance mm	(in.)	2.00(0.0787)	2.02(0.0795)	2.04(0.0803)	2.06(0.0811)	2.08(0.0819)	2.10(0.0827)	2.11(0.0831)	2.12(0.0835)	2.13(0.0839)	2.14(0.0843)	2.15(0.0846)	2.16(0.0850)	2.17(0.0854)	2.18(0.0858)	2.19(0.0862)	2.20(0.0866)
0.000-0.020	(0.0000-0.0008)																
0.021-0.040	(0.0008-0.0016)																
0.041-0.060	(0.0016-0.0024)																
0.061-0.080	(0.0024-0.0031)															1	1
0.081-0.100	(0.0032-0.0039)													1	1	1	1
0.101-0.120	(0.0040-0.0047)											1	1	1	1	2	2
0.121-0.140	(0.0048-0.0055)									1	1	1	1	2	2	2	2
0.141-0.160	(0.0056-0.0063)							1	1	1	1	2	2	2	2	3	3
0.161-0.180	(0.0063-0.0071)						1	1	1	2	2	2	2	3	3	3	3
0.181-0.199	(0.0071-0.0078)					1	1	1	2	2	2	2	3	3	3	3	4
0.200-0.360	(0.0079-0.0142)																
0.361-0.380	(0.0142-0.0150)	3	4	4	5	5	6	6	6	7	7	7	7	8	8	8	8
0.381-0.400	(0.0150-0.0157)	4	4	5	5	6	6	7	7	7	7	8	8	8	8	9	9
0.401-0.420	(0.0158-0.0165)	4	5	5	6	6	7	7	7	8	8	8	8	9	9	9	9
0.421-0.440	(0.0166-0.0173)	5	5	6	6	7	7	8	8	8	8	9	9	9	9	10	10
0.441-0.460	(0.0174-0.0181)	5	6	6	7	7	8	8	8	9	9	9	9	10	10	10	10
0.461-0.480	(0.0181-0.0189)	6	6	7	7	8	8	9	9	9	9	10	10	10	10	11	11
0.481-0.500	(0.0189-0.0197)	6	7	7	8	8	9	9	9	10	10	10	10	11	11	11	11
0.501-0.520	(0.0197-0.0205)	7	7	8	8	9	9	10	10	10	10	11	11	11	11	12	12
0.521-0.540	(0.0205-0.0213)	7	8	8	9	9	10	10	10	11	11	11	11	12	12	12	12
0.541-0.560	(0.0213-0.0220)	8	8	9	9	10	10	11	11	11	11	12	12	12	12	13	13
0.561-0.580	(0.0221-0.0228)	8	9	9	10	10	11	11	11	12	12	12	12	13	13	13	13
0.581-0.600	(0.0229-0.0236)	9	9	10	10	11	11	12	12	12	12	13	13	13	13	14	14
0.601-0.620	(0.0237-0.0244)	9	10	10	11	11	12	12	12	13	13	13	13	14	14	14	14
0.621-0.640	(0.0244-0.0252)	10	10	11	11	12	12	13	13	13	13	14	14	14	14	15	15
0.641-0.660	(0.0252-0.0260)	10	11	11	12	12	13	13	13	14	14	14	14	15	15	15	15
0.661-0.680	(0.0260-0.0268)	11	11	12	12	13	13	14	14	14	14	15	15	15	15	16	16
0.681-0.700	(0.0268-0.0276)	11	12	12	13	13	14	14	14	15	15	15	15	16	16	16	16
0.701-0.720	(0.0276-0.0283)	12	12	13	13	14	14	15	15	15	15	16	16	16	16	17	17
0.721-0.740	(0.0284-0.0291)	12	13	13	14	14	15	15	15	16	16	16	16	17	17	17	17
0.741-0.760	(0.0292-0.0299)	13	13	14	14	15	15	16	16	16	16	17	17	17	17	18	18
0.761-0.780	(0.0300-0.0307)	13	14	14	15	15	16	16	16	17	17	17	17	18	18	18	18
0.781-0.800	(0.0307-0.0315)	14	14	15	15	16	16	17	17	17	17	18	18	18	18	19	19
0.801-0.820	(0.0315-0.0323)	14	15	15	16	16	17	17	17	18	18	18	18	19	19	19	19
0.821-0.840	(0.0323-0.0331)	15	15	16	16	17	17	18	18	18	18	19	19	19	19	20	20
0.841-0.860	(0.0331-0.0339)	15	16	16	17	17	18	18	18	19	19	19	19	20	20	20	20
0.861-0.880	(0.0339-0.0346)	16	16	17	17	18	18	19	19	19	19	20	20	20	20		
0.881-0.900	(0.0347-0.0354)	16	17	17	18	18	19	19	19	20	20	20	20				
0.901-0.920	(0.0355-0.0362)	17	17	18	18	19	19	20	20	20	20						
0.921-0.940	(0.0363-0.0370)	17	18	18	19	19	20	20	20								
0.941-0.960	(0.0370-0.0378)	18	18	19	19	20	20										
0.961-0.980	(0.0378-0.0386)	18	19	19	20	20											
0.981-1.000	(0.0386-0.0394)	19	19	20	20												
1.001-1.020	(0.0394-0.0402)	19	20	20													
1.021-1.040	(0.0402-0.0409)	20	20														
1.041-1.060	(0.0410-0.0417)	20															

Measured clearance mm	(in.)	2.21(0.0870)	2.22(0.0874)	2.23(0.0878)	2.24(0.0882)	2.25(0.0886)	2.26(0.0890)	2.27(0.0894)	2.28(0.0898)	2.29(0.0902)	2.30(0.0906)	2.31(0.0909)	2.32(0.0913)	2.33(0.0917)	2.34(0.0921)	2.35(0.0925)	2.36(0.0929)	2.37(0.0933)	2.38(0.0937)	2.39(0.0941)	2.40(0.0945)
0.000-0.020	(0.0000-0.0008)					1	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4
0.021-0.040	(0.0008-0.0016)			1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5
0.041-0.060	(0.0016-0.0024)	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
0.061-0.080	(0.0024-0.0031)	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6
0.081-0.100	(0.0032-0.0039)	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6
0.101-0.120	(0.0040-0.0047)	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7
0.121-0.140	(0.0048-0.0055)	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7
0.141-0.160	(0.0056-0.0063)	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8
0.161-0.180	(0.0063-0.0071)	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8
0.181-0.199	(0.0071-0.0078)	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9
0.200-0.360	(0.0079-0.0142)																				
0.361-0.380	(0.0142-0.0150)	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13
0.381-0.400	(0.0150-0.0157)	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14
0.401-0.420	(0.0158-0.0165)	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14
0.421-0.440	(0.0166-0.0173)	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15
0.441-0.460	(0.0174-0.0181)	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15
0.461-0.480	(0.0181-0.0189)	11	11	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16
0.481-0.500	(0.0189-0.0197)	12	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16
0.501-0.520	(0.0197-0.0205)	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17
0.521-0.540	(0.0205-0.0213)	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17
0.541-0.560	(0.0213-0.0220)	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18
0.561-0.580	(0.0221-0.0228)	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18
0.581-0.600	(0.0229-0.0236)	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19
0.601-0.620	(0.0237-0.0244)	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19
0.621-0.640	(0.0244-0.0252)	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20
0.641-0.660	(0.0252-0.0260)	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20
0.661-0.680	(0.0260-0.0268)	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20		
0.681-0.700	(0.0268-0.0276)	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20	20				
0.701-0.720	(0.0276-0.0283)	17	17	18	18	18	18	19	19	19	19	20	20	20	20						
0.721-0.740	(0.0284-0.0291)	18	18	18	18	19	19	19	19	20	20	20	20								
0.741-0.760	(0.0292-0.0299)	18	18	19	19	19	19	20	20	20	20										
0.761-0.780	(0.0300-0.0307)	19	19	19	19	20	20	20	20												
0.781-0.800	(0.0307-0.0315)	19	19	20	20	20	20														
0.801-0.820	(0.0315-0.0323)	20	20	20	20																
0.821-0.840	(0.0323-0.0331)	20	20																		

Measured clearance mm	(in.)	2.41(0.0949)	2.42(0.0953)	2.43(0.0957)	2.44(0.0961)	2.45(0.0965)	2.46(0.0969)	2.47(0.0972)	2.48(0.0976)	2.49(0.0980)	2.50(0.0984)	2.51(0.0988)	2.52(0.0992)	2.53(0.0996)	2.54(0.1000)	2.56(0.1008)	2.58(0.1016)	2.60(0.1024)	2.62(0.1031)	2.64(0.1039)	2.66(0.1047)	2.68(0.1055)	2.70(0.1063)	2.72(0.1071)	2.74(0.1079)	2.76(0.1087)
0.000-0.020	(0.0000-0.0008)	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.021-0.040	(0.0008-0.0016)	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	10	10	11	11	12	12	13	13	14
0.041-0.060	(0.0016-0.0024)	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	11	11	12	12	13	13	14	14
0.061-0.080	(0.0024-0.0031)	6	6	7	7	7	7	8	8	8	8	9	9	9	9	10	10	11	11	12	12	13	13	14	14	15
0.081-0.100	(0.0032-0.0039)	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	11	11	12	12	13	13	14	14	15	15
0.101-0.120	(0.0040-0.0047)	7	7	8	8	8	8	9	9	9	9	10	10	10	10	11	11	12	12	13	13	14	14	15	15	16
0.121-0.140	(0.0048-0.0055)	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	12	12	13	13	14	14	15	15	16	16
0.141-0.160	(0.0056-0.0063)	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	13	13	14	14	15	15	16	16	17
0.161-0.180	(0.0063-0.0071)	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17
0.181-0.199	(0.0071-0.0078)	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	14	14	15	15	16	16	17	17	18
0.200-0.360	(0.0079-0.0142)																									
0.361-0.380	(0.0142-0.0150)	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	18	18	19	19	20	20				
0.381-0.400	(0.0150-0.0157)	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	19	19	20	20					
0.401-0.420	(0.0158-0.0165)	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18	19	19	20	20						
0.421-0.440	(0.0166-0.0173)	15	15	16	16	16	16	17	17	17	17	18	18	18	18	19	19	20	20							
0.441-0.460	(0.0174-0.0181)	16	16	16	16	17	17	17	17	18	18	18	18	19	19	19	20	20								
0.461-0.480	(0.0181-0.0189)	16	16	17	17	17	17	18	18	18	18	19	19	19	19	20	20									
0.481-0.500	(0.0189-0.0197)	17	17	17	17	18	18	18	18	19	19	19	19	20	20	20										
0.501-0.520	(0.0197-0.0205)	17	17	18	18	18	18	19	19	19	19	20	20	20	20											
0.521-0.540	(0.0205-0.0213)	18	18	18	18	19	19	19	19	20	20	20	20													
0.541-0.560	(0.0213-0.0220)	18	18	19	19	19	19	20	20	20	20															
0.561-0.580	(0.0221-0.0228)	19	19	19	19	20	20	20	20																	
0.581-0.600	(0.0229-0.0236)	19	19	20	20	20	20																			
0.601-0.620	(0.0237-0.0244)	20	20	20	20																					
0.621-0.640	(0.0244-0.0252)	20	20																							

EDKB888E

New shim thickness mm(in.)

Shim No.	Thickness		Shim No.	Thickness	
1	2.00	(0.0787)	11	2.40	(0.0945)
2	2.04	(0.0803)	12	2.44	(0.0961)
3	2.08	(0.0819)	13	2.48	(0.0976)
4	2.12	(0.0835)	14	2.52	(0.0992)
5	2.16	(0.0850)	15	2.56	(0.1008)
6	2.20	(0.0866)	16	2.60	(0.1024)
7	2.24	(0.0882)	17	2.64	(0.1039)
8	2.28	(0.0898)	18	2.68	(0.1055)
9	2.32	(0.0913)	19	2.72	(0.1071)
10	2.36	(0.0929)	20	2.76	(0.1087)

HINT : New shims have the thickness in milimeters imprinted on the face

Intake valve clearance (Cold) :
0.28 mm (Spec.), 0.20 ~ 0.38 mm (Limit)
Example : The 2.24 mm shim is installed, and the measured clearance is 0.450 mm. Replace the 2.24 mm shim with a new No. 11 shim.

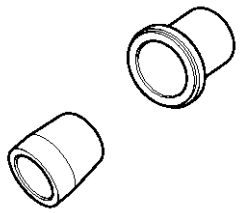
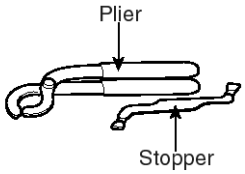
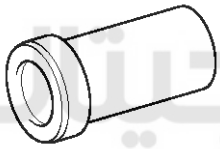
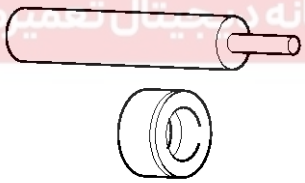
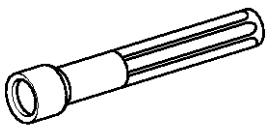
Troubleshooting

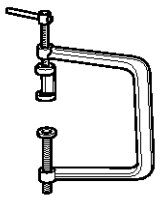
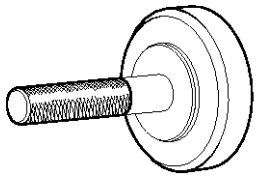
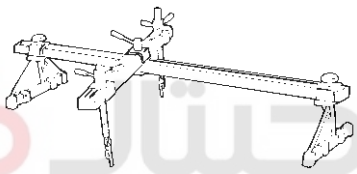
Symption	Suspect area	Remedy (See page)
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil cousnmption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss 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 buidup on the valve stem)	Repair or replace as required
	Excessive worn or mis-aligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant cousmption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	• Inspect the cylinder for a loss of compression. • Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity	• Drain the oil. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.

Symption	Suspect area	Remedy (See page)
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or repalce as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stetched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	• Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair 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 oli pressure.	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restircted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-clearance	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing rod clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearing. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.

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

Special Service Tools

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-23100)	 KDRF233A	Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)	 EDKB001A	Removeal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)	 EDDA005B	Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)	 ECKA010B	Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 ECKA010A	Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Valve spring compressor & adaptor (09222-28000, 09222-28100)	 EDDA005C	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-23200, 09231-H1100)	 SAMM19102N	Installation of the crankshaft rear oil seal
Engine support fixture and adapter (09200-38001, 09200-1C000)	 AMJF002B	Engine fixing

Engine And Transaxle Assembly

Removal

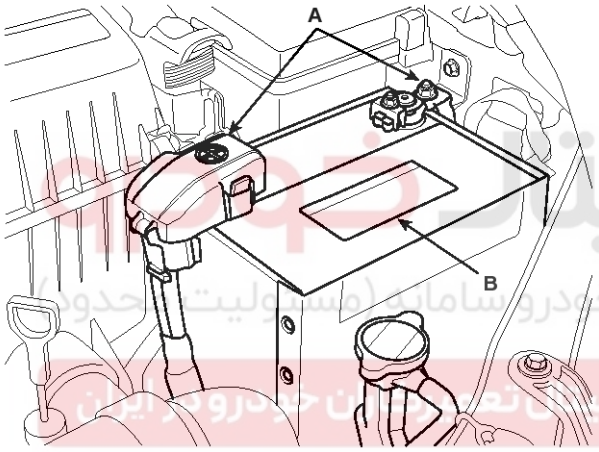
CAUTION

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

NOTICE

- *Mark all wiring and hoses to avoid misconnection.*
- *Inspection the timing belt before removing the cylinder head.*
- *Turn the crankshaft pulley so that the No. 1 piston is at top dead center.*

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

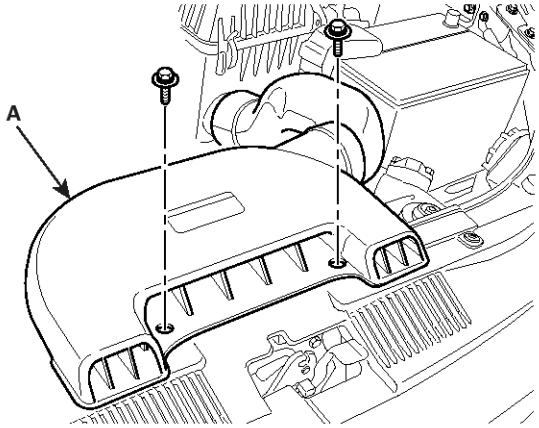


SHDM16004L

2. Remove the engine cover.

3. Remove the air duct (A).

Tightening torque :
7.8 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0lb-ft)



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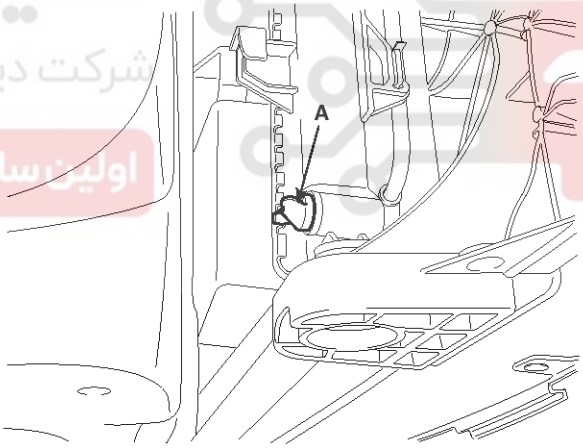
4. Remove the radiator cap to speed daring.
5. Loosen the radiator drain plug (A) and drain engine coolant.



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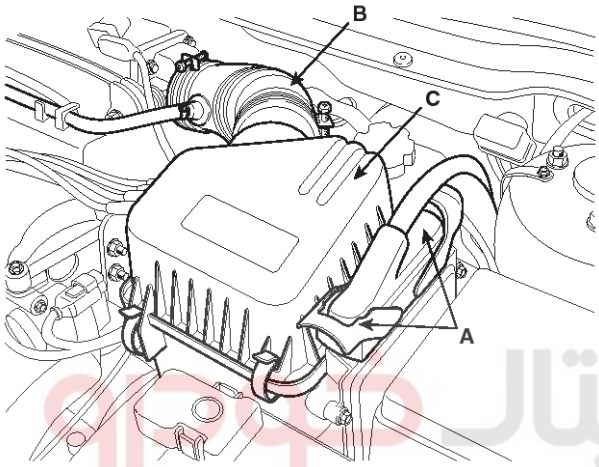
6. Remove the air cleaner assembly.
   1) Disconnect the power train control module (PCM) connector (A).
   2) Disconnect the intake hose (B).
   3) Remove the air cleaner assembly (C).

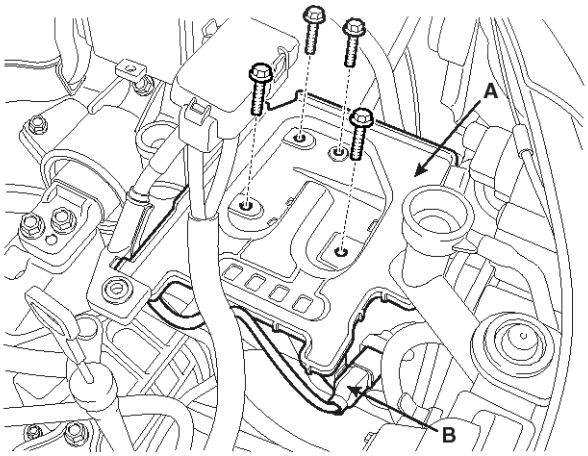
Tightening torque :
Hose clamp :
2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 2.6lb-ft)
Mounting bolt :
7.8 ~ 10.8N.m (0.8 ~ 1.1kgf.m, 5.8 ~ 8.0lb-ft)



SEDM17004L

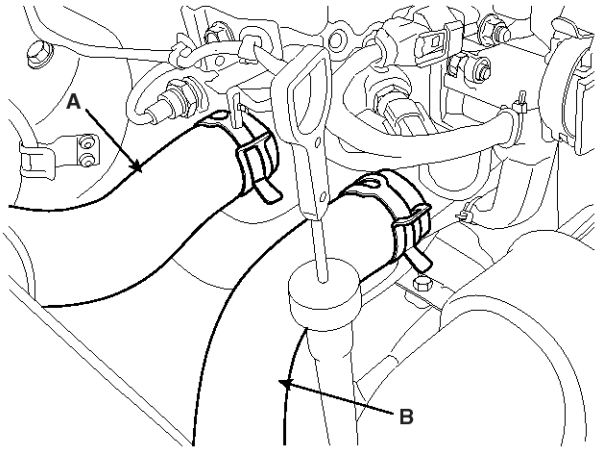
7. Remove the battery tray (A) and the front connector (B).

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



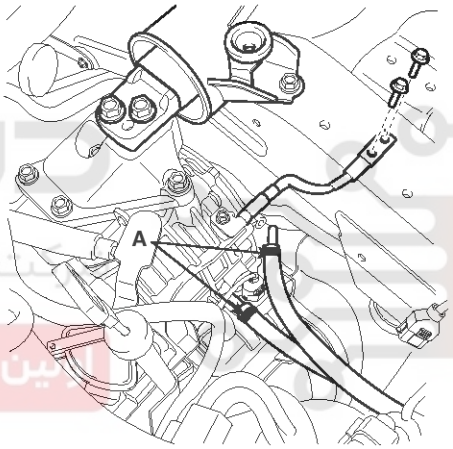
SEDM17005L

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



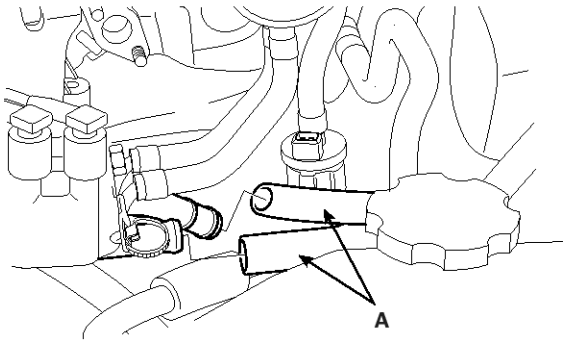
SHDM16006L

9. Disconnect the auto transaxle fluid (ATF) hose (A).



SEDM17006L

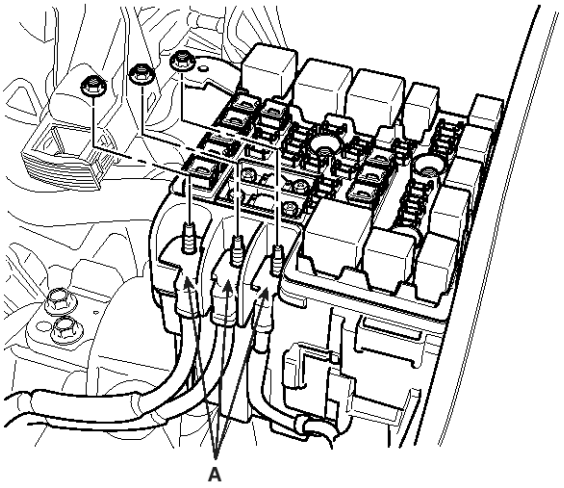
10. Remove the heater hose (A).



ECKD202A

11. Remove the junction box cover.
12. Disconnect the terminals(A) from the fuse box.

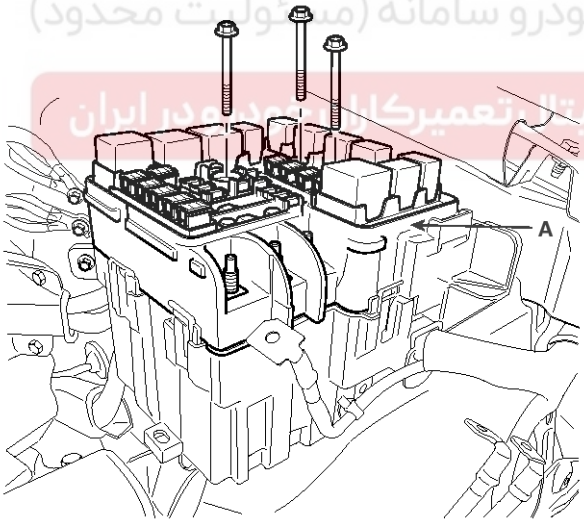
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



SHDEM6006D

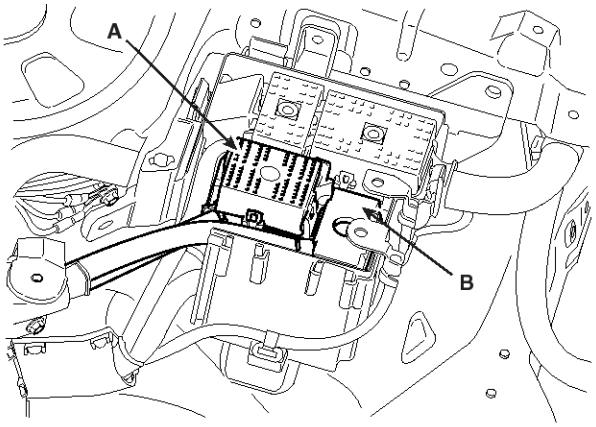
13. After removing the mounting bolts, remove the relay and fuse assembly(A).

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



SFDM38013L

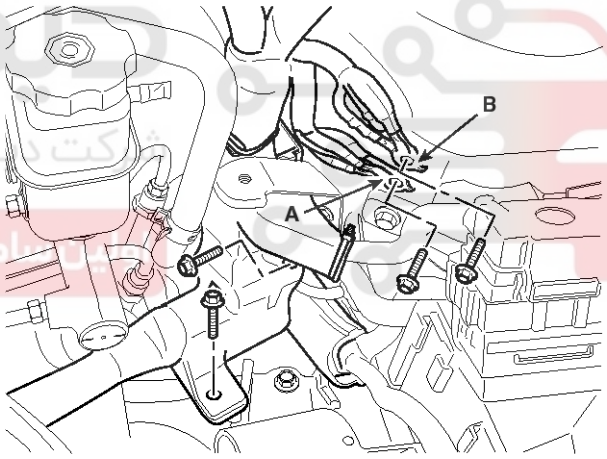
14. Remove the connector wiring(A) and the engine wiring(B).



SHDEM6066D

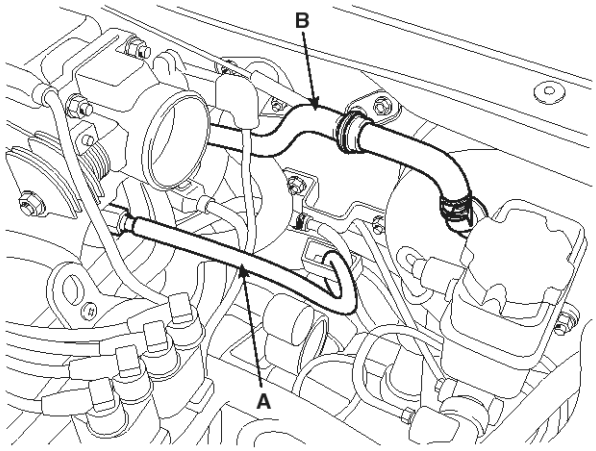
15. Remove the engine control side ground(A) and, the transaxle control side one(B).

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



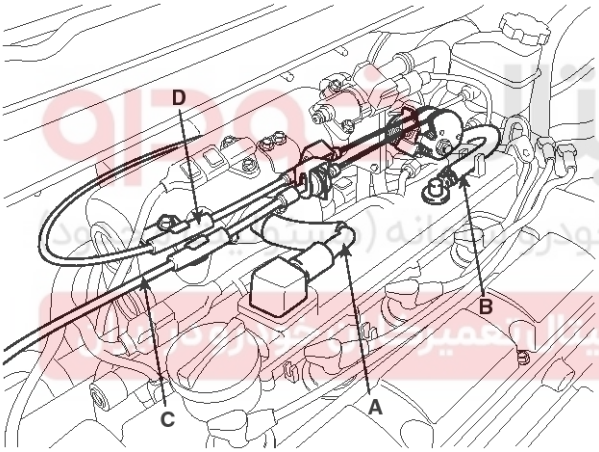
SFDEM8008L

16. Remove the fuel inlet from delivery pipe (A) and brake booster vacuum hose (B).



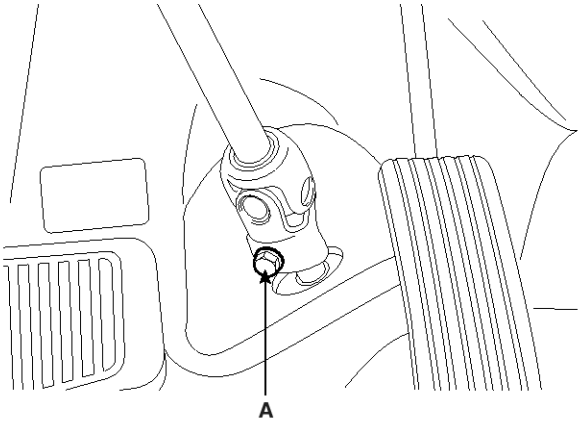
SEDM17007L

17. Disconnect the accelerator cable (C) and the auto-cruise cable(D) from the cylinder head cover.



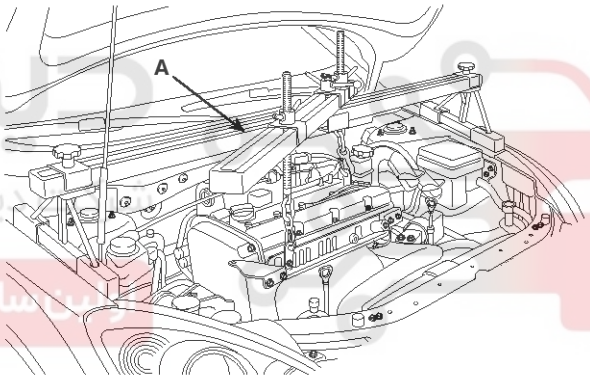
SFDM18005L

18. Remove the transaxle wire and control cable. (Refer to Transaxle control system in MTA or ATA Group).
19. Remove the high & low pressure pipe. (Refer to Air conditioner compressor in HA Group).
20. Remove the steering u-joint mounting bolt(A).



ECKD616A

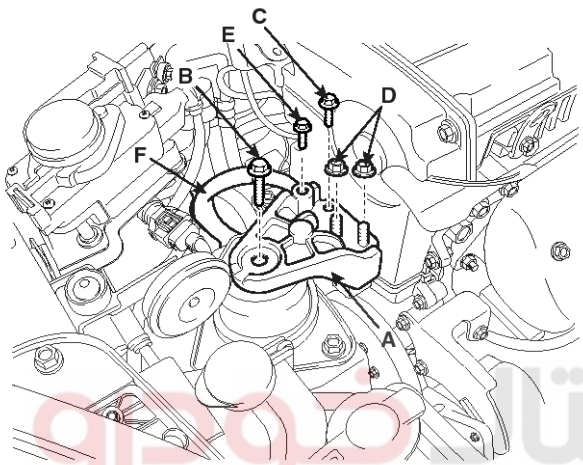
21. Install the SST (09200-38001, 09200-1C000), the engine support fixture and the adapter, on the engine and transaxle assembly.



SFDM18001L

22. Remove the engine mounting bracket (A) by removing the bolts(B, C) and nuts(D) and ground line (F).

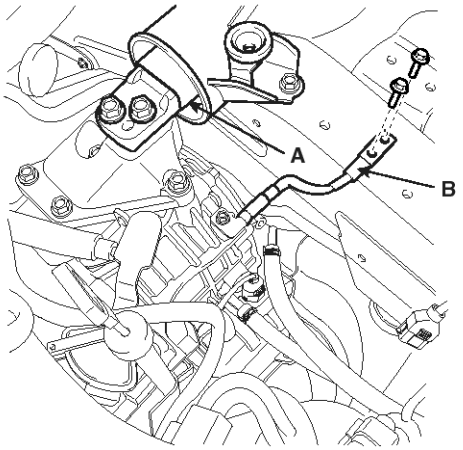
Tightening torque :
Bolt (B) :
63.7 ~ 83.3N.m (6.5 ~ 8.5kgf.m, 47.0 ~ 61.5lb-ft)
Bolt (C), Nuts (D) :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)
Bolt (E) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



SFDM18004L

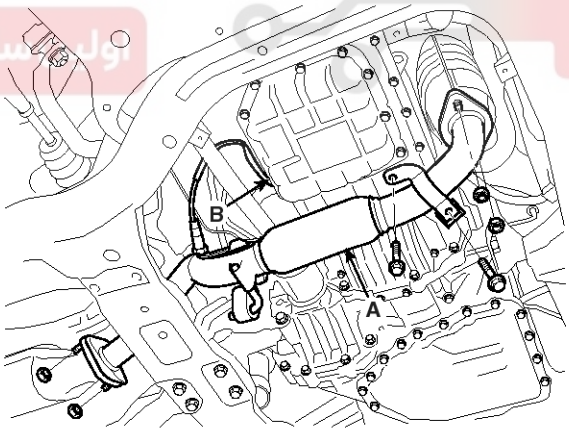
23. Remove the transaxle mounting bracket (A) and the ground line (B).

Tightening torque :
A : 88.2 ~ 107.8N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.5lb-ft)
B : 9.8 ~ 14.7N.m (1.0 ~ 1.5kgf.m, 7.2 ~ 10.8lb-ft)



SEDM17110L

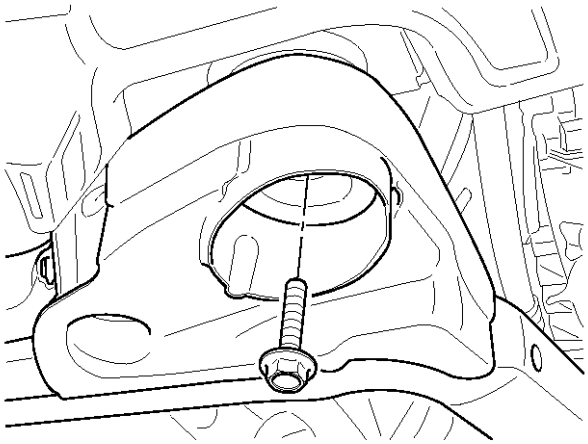
24. Remove the front tires.
25. Disconnect the stabilizer bar link and remove the mounting bolts from the lower arm and the front axles.
26. Remove the front muffler (A) and disconnect the rear oxygen sensor connector(B).



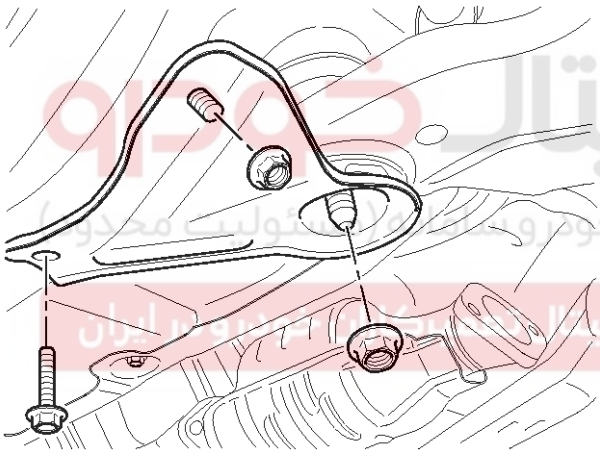
SFDM18002L

27. Remove the sub frame bolts (A).

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



SFDEM8009L



SHDEM6019D

28. Remove the engine support fixture and the adapter.
29. Jack up the vehicle.

Installation

Installation is in the reverse order of removal.

Perform the following :

- Adjust shift cable.
- Adjust throttle cable.
- Refill engine with engine oil.
- Refill transaxle with fluid.
- Refill radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

  After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressureizes.

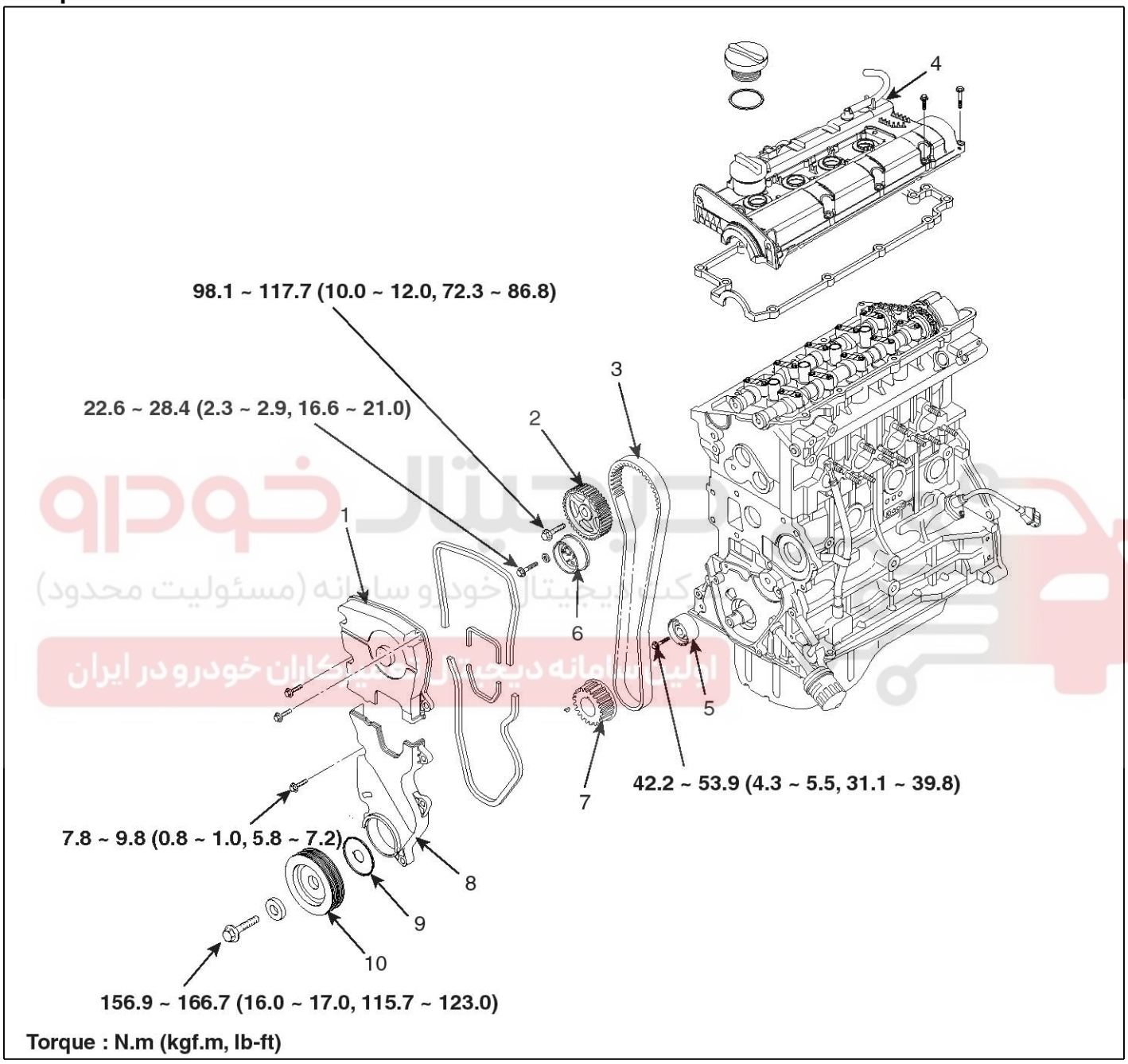
  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

Timing System

Timing System

Timing Belt

Components



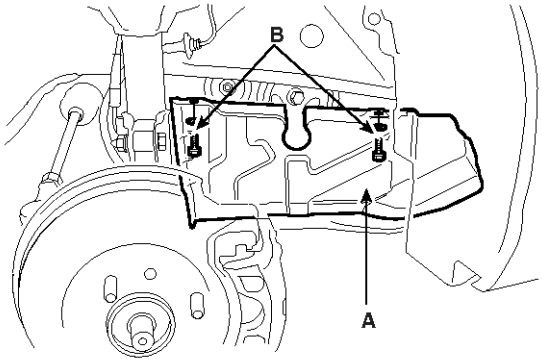
SFDM18006L

1. Timing belt upper cover
2. Camshaft sprocket
3. Timing belt
4. Cylinder head cover
5. Idler
6. Tensioner
7. Crankshaft sprocket
8. Timing belt lower cover
9. Flange
10. Crankshaft pulley

Removal

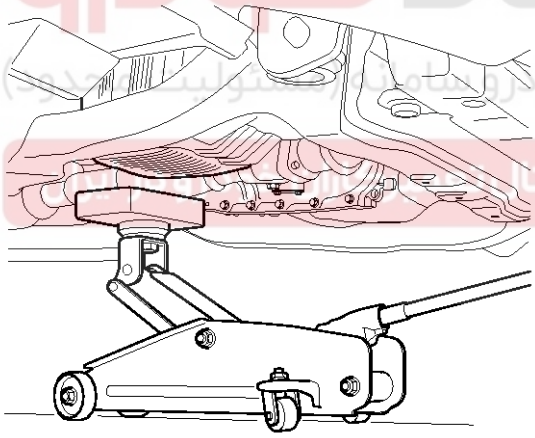
Engine removal is not required for this procedure.

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



KXDSE16A

4. Remove the engine mount bracket.
   1) Set the jack to the engine oil pan.

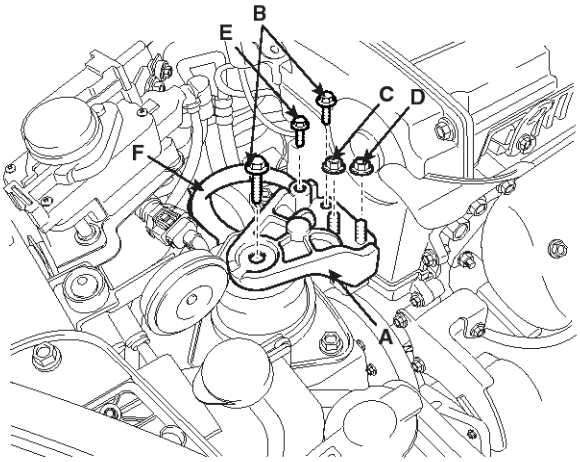


ECKD102A

NOTICE

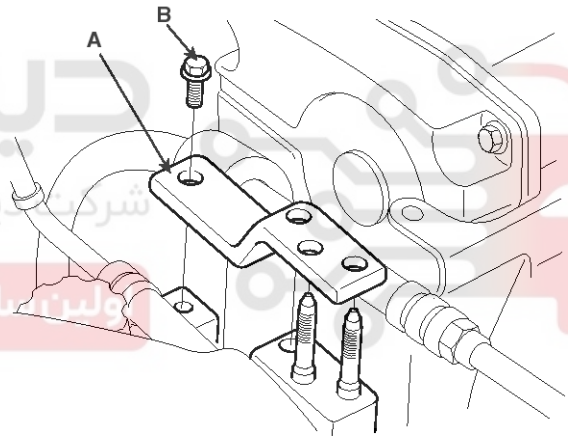
Place wooden block between the jack and engine oil pan.

   2) Remove the bolts(B), nuts(C, D) and engine mount bracket (A), and the groud line(F).



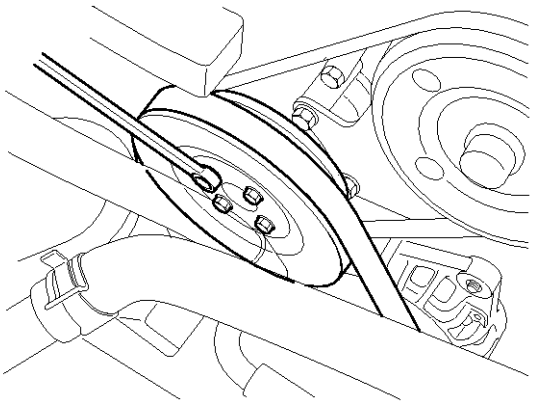
SEDM17009L

   3) Remove the bolt (B) and stay plate (A).



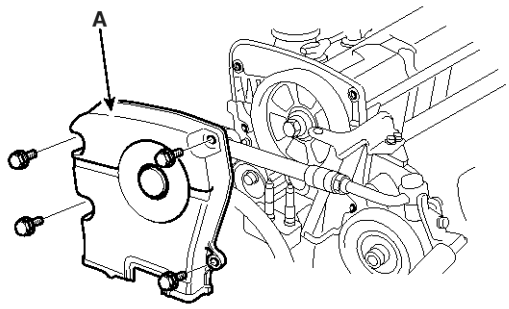
ECKD104A

5. Temporarily loosen the water pump pulley bolts.



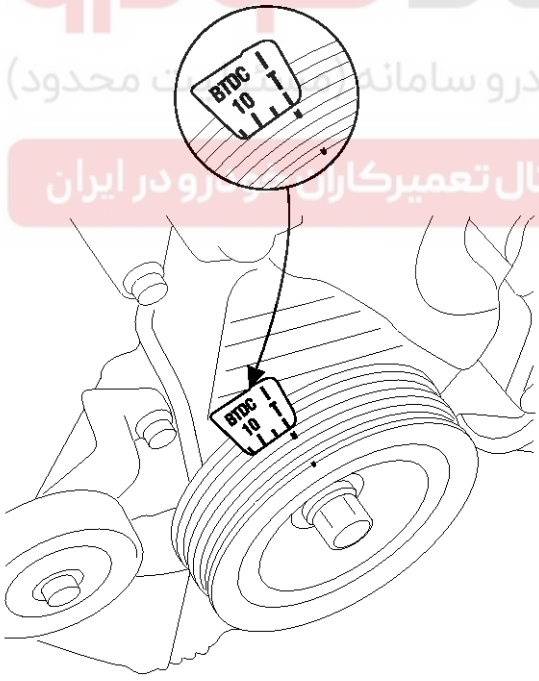
ECKD104B

6. Remove alternator belt.
7. Remove air compressor belt.
8. Remove power steering belt.
9. Remove four bolts and water pump pulley.
10. Remove the timing belt upper cover (A).



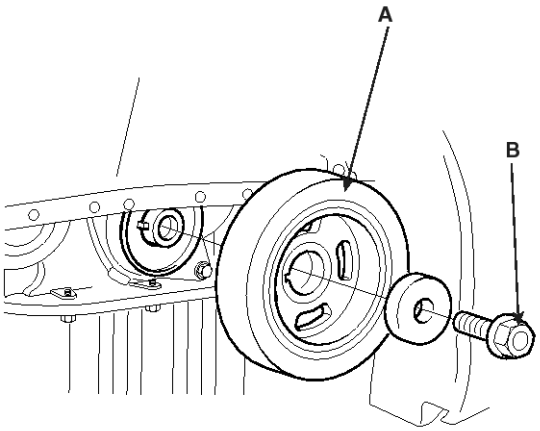
SEDM17201L

11. Turn the crankshaft pulley, and align its groove with timing mark “T”of the timing belt cover.



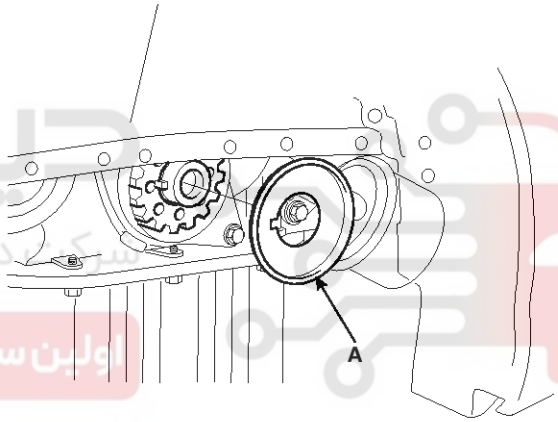
ECKD106A

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



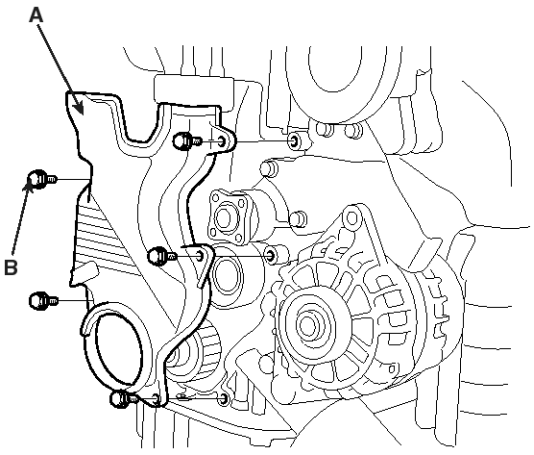
ECKD107A

13. Remove the crankshaft flange (A).



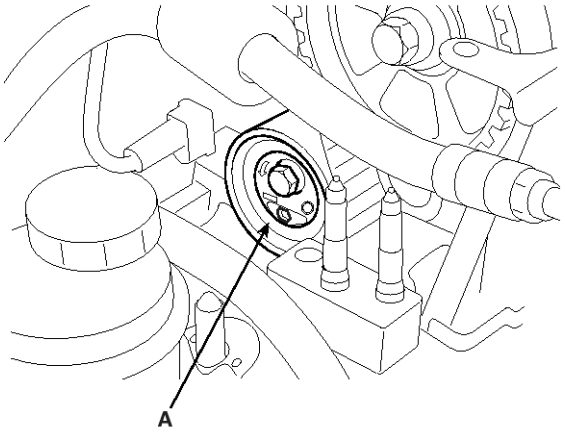
ECKD108A

14. Remove the 5bolts (B) and timing belt lower cover (A).

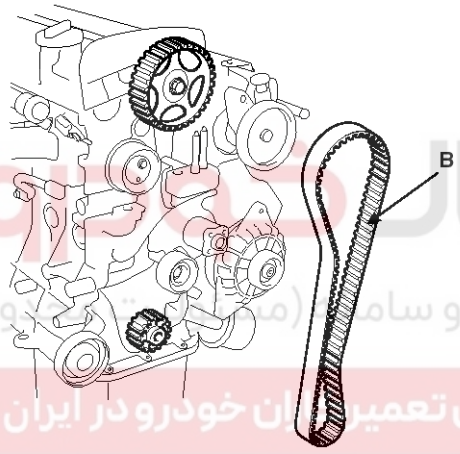


ECKD108B

15. Remove the timing belt tensioner (A) and timing belt (B).



SHDM16316L

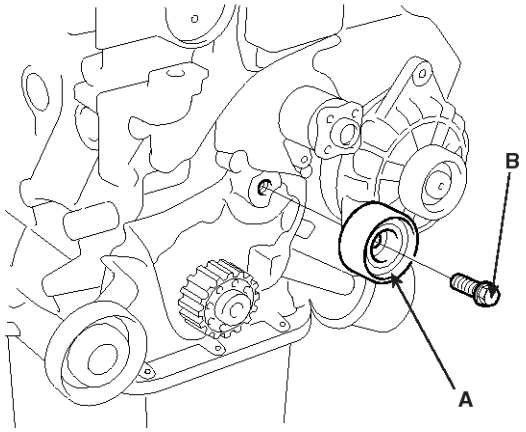


ECKD109B

NOTICE

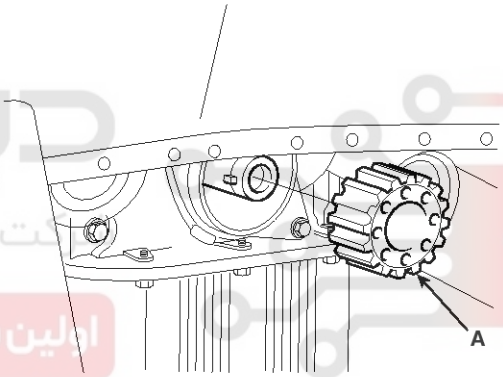
If the timing belt is reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

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



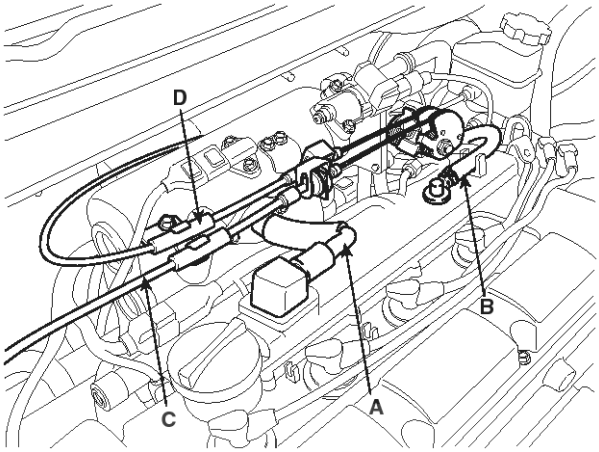
ECKD109C

17. Remove the crankshaft sprocket (A).



ECKD110A

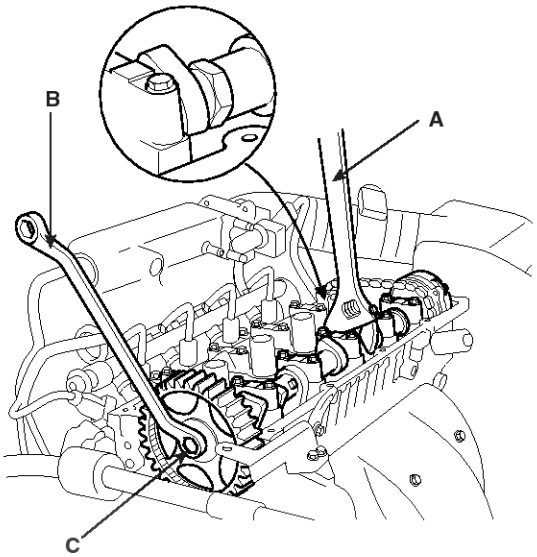
18. Remove the cylinder head cover.
    1) Remove the spark plug cable.
    2) Remove the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.
    3) Remove the PCV(Positive Crankcase ventilation) hose (A) and breather hose (B).



SFDM18005L

    4) Remove the bolts and cylinder head cover.

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



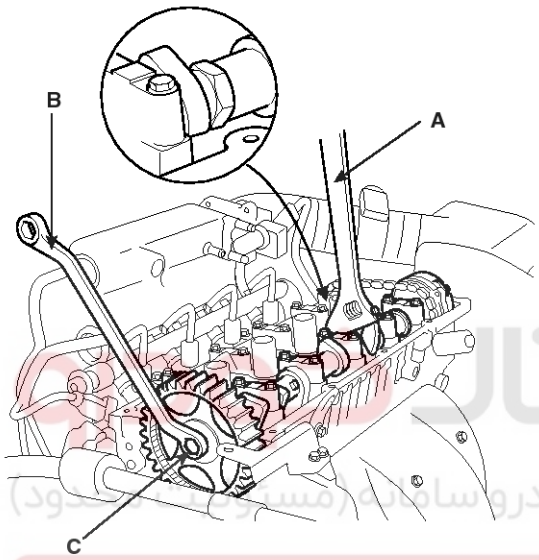
ECKD114A

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

Installation

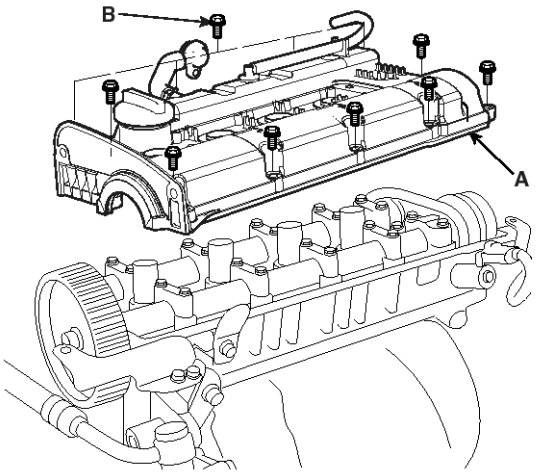
1. Install the camshaft sprocket and tighten the bolt to the specified torque.
   1) Temporarily install the camshaft sprocket bolt.
   2) Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and tighten the camshaft sprocket (C) bolt.

Tightening torque
Camshaft sprocket bolt :
98.1 ~ 117.7Nm (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



ECKD114A

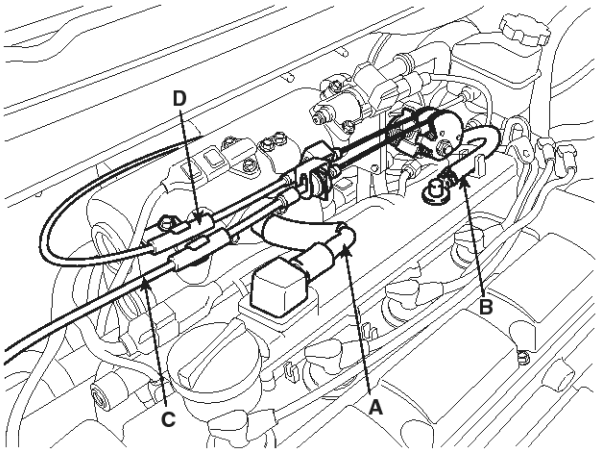
2. Install cylinder head cover.
   1) Install cylinder head cover (A) and the twelve bolts (B).



SHDM16315L

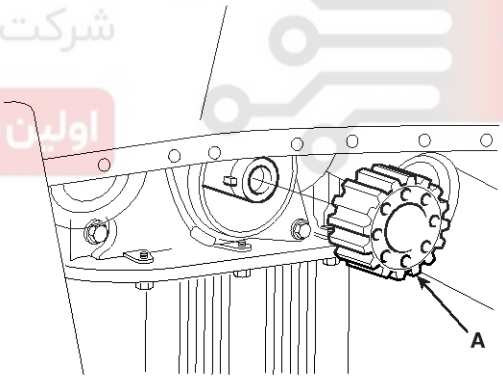
Tightening torque :
7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

   2) Install the PCV hose (A) and breather hose (B).
   3) Install the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.



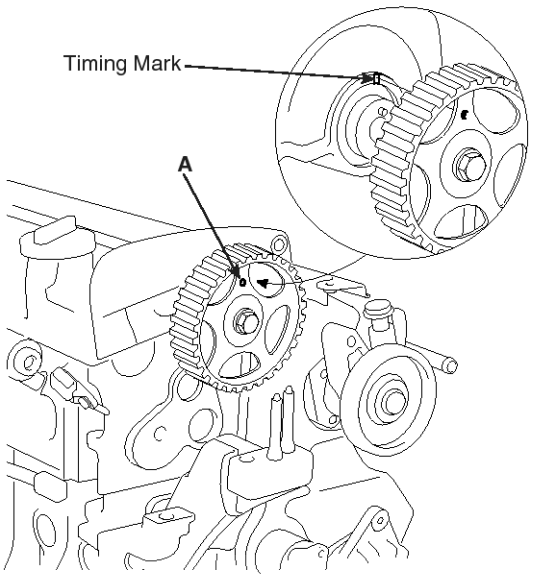
SFDM18005L

   4) Install the spark plug cable.
3. Install the crankshaft sprocket (A).

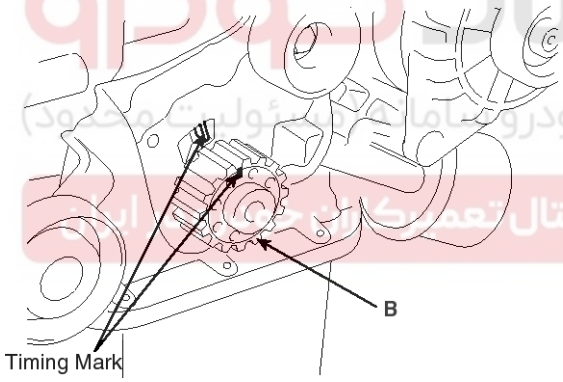


ECKD110A

4. Align the timing marks of the camshaft sprocket (A) and crankshaft sprocket (B) with the No. 1 piston placed at top dead center and its compression stroke.



ECKD110B



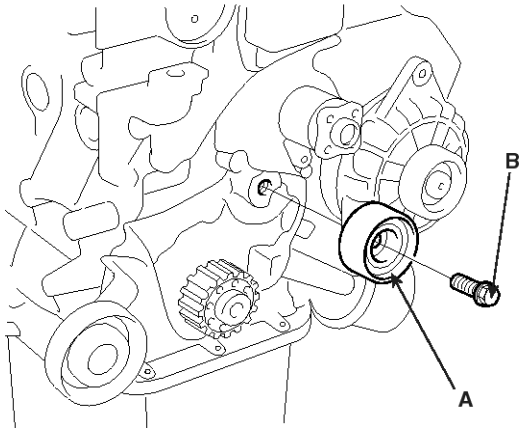
ECKD110C

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

Tightening torque

Idler pulley bolt :

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



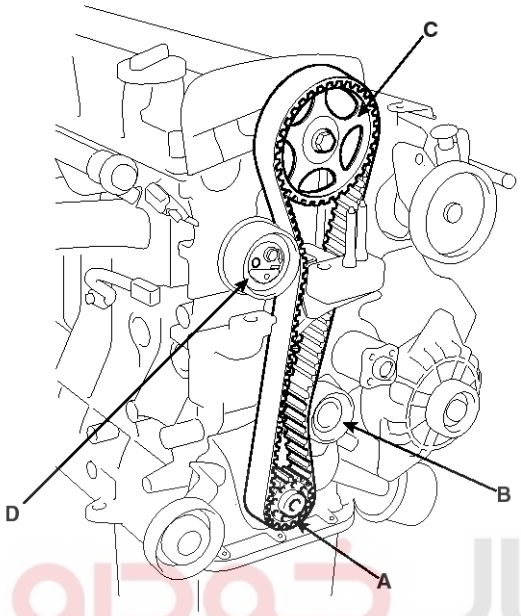
ECKD109C

6. Install the timing belt tensioner loosely enough for the adjuster to rotate. Make sure that the stopper of base is leaning against the lowering sealing cap on the cylinder head.

7. Belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt.

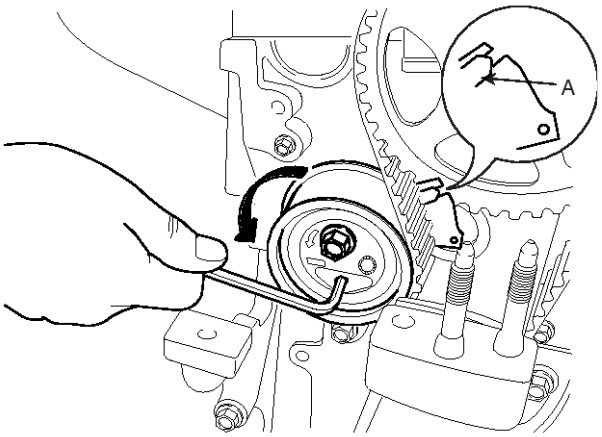
   Crankshaft sprocket (A) → Idler pulley (B) → Camshaft sprocket (C) → timing belt tensioner (D).

   (The tensioner can be installed after the timing belt.)



SHDM16302D

8. Check the alignment of the timing marks on each sprocket.
9. Remove the pin fixing the tensioner arm.
10. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm(A) located at the center of the base notch.



SHDEM7002N

⚠CAUTION

Do not rotate the adjuster clockwise.

It will result in auto tensioner's functional problem.

11. Tightening tensioner bolt with fixing the indicator not to move.

Tightening torque

Tensioner bolt :

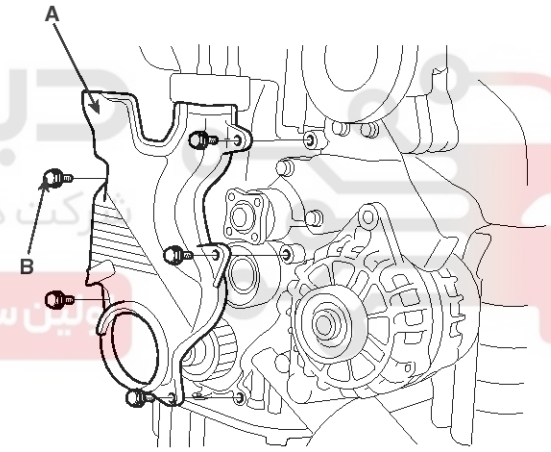
22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

12. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
13. If the indicator is not located at the center of base, slacken the bolt and repeat the abore procedure.
14. Install the timing belt lower cover (A) with 5 bolts (B).

Tightening torque

Timing belt cover bolt :

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

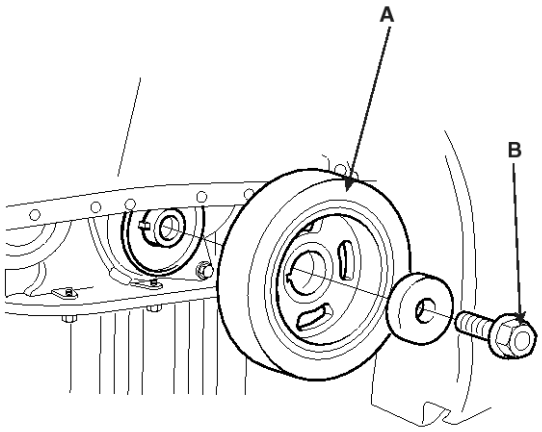


ECKD108B

15. Install the flange and crankshaft pulley (A).

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

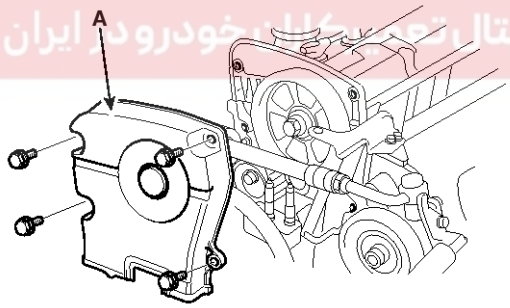
Tightening torque
Crankshaft pulley bolt :
156.9 ~ 166.7N.m (16.0 ~ 17.0kgf.m, 115.7 ~ 123.0lb-ft)



ECKD107A

16. Install the timing belt upper cover (A).

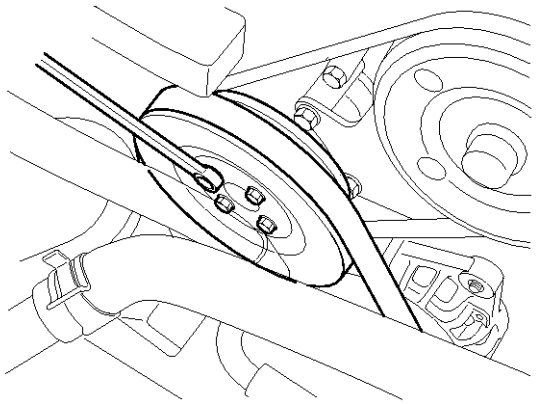
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



SEDM17201L

17. Install the coolant pump pulley with 4bolts.

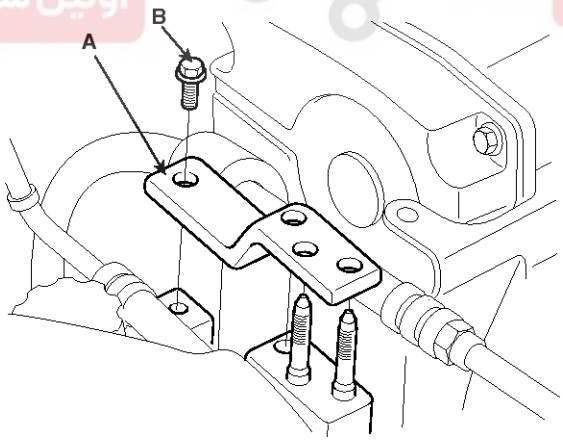
Tightening torque :
7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m 5.8 ~ 7.2lb-ft)



ECKD104B

18. Install power steering belt.
19. Install air compressor belt.
20. Install alternator belt.
21. Install the engine mount bracket
    1) Install the stay plate (A) with bolt (B).

Tightening torque
Stay plate bolt :
42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m 31.1 ~ 39.8lb-ft)

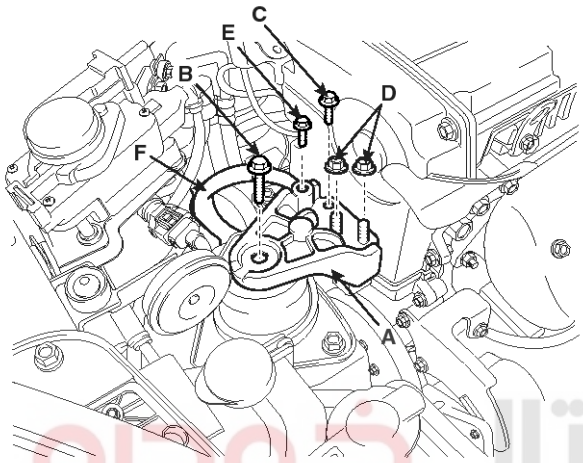


ECKD104A

2) Install engine mount bracket(A) and ground line (F).

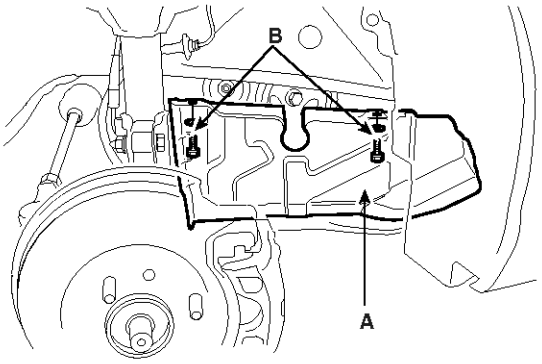
Tightening torque

Bolt (B) :
63.7 ~ 83.3N.m (6.5 ~ 8.5kgf.m, 47.0 ~ 61.5lb-ft)
Bolt (C), Nuts (D) :
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)
Bolt (E) :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



SFDM18004L

22. Install RH side cover (A) with 2bolts (B).



KXDSE16A

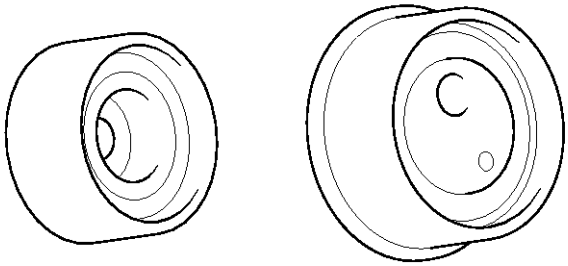
23. Install RH front wheel.
24. Install the engine cover.

Inspection

Sprockets, Tensioner, Idler

1. Check the camshaft sproket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise.

   Replace as necessary.



ECKD115A

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

Timing Belt

1. Check the belt for oil or dust deposits.

   Replace, if necessary.

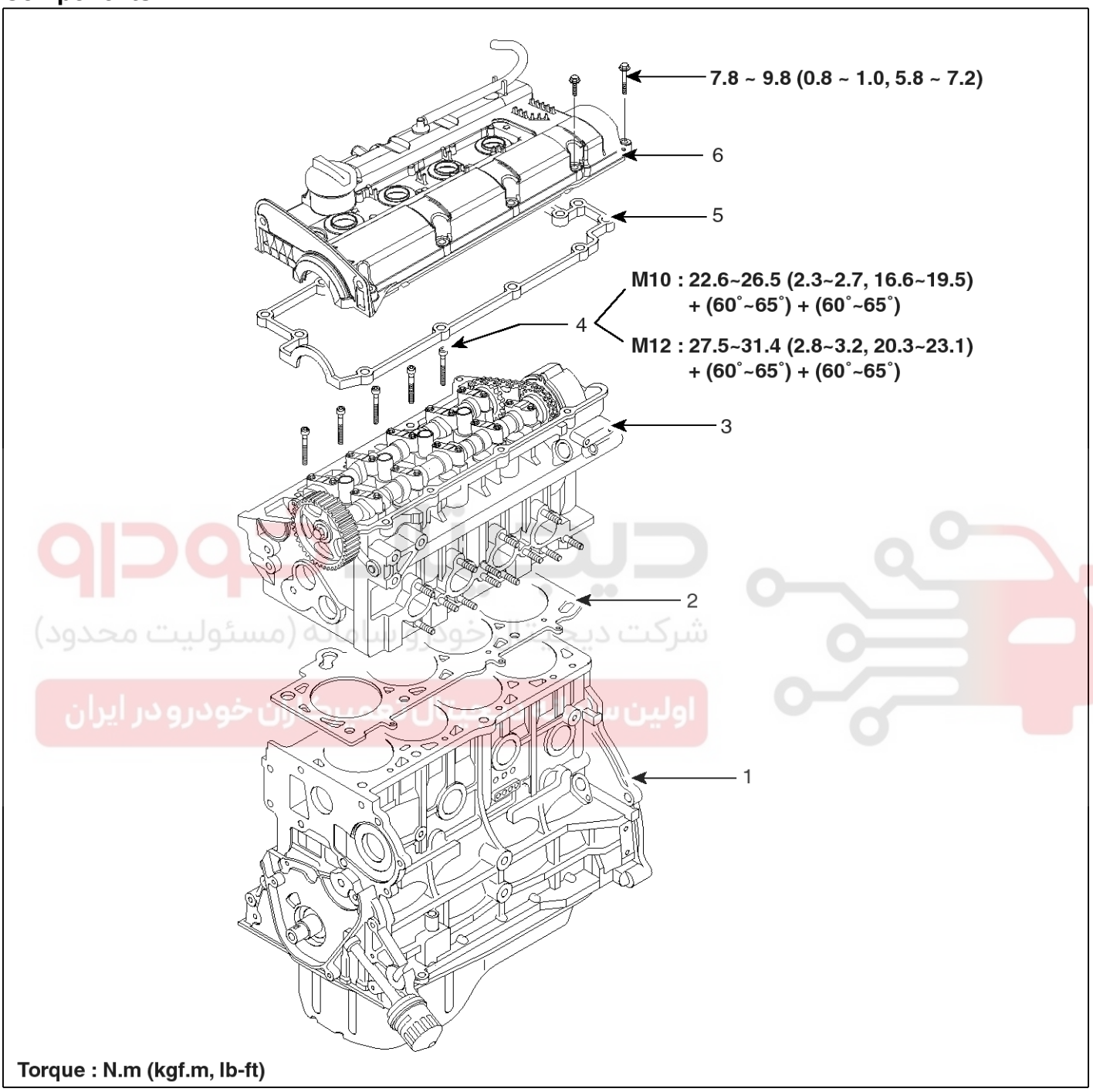
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

   NOTICE

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

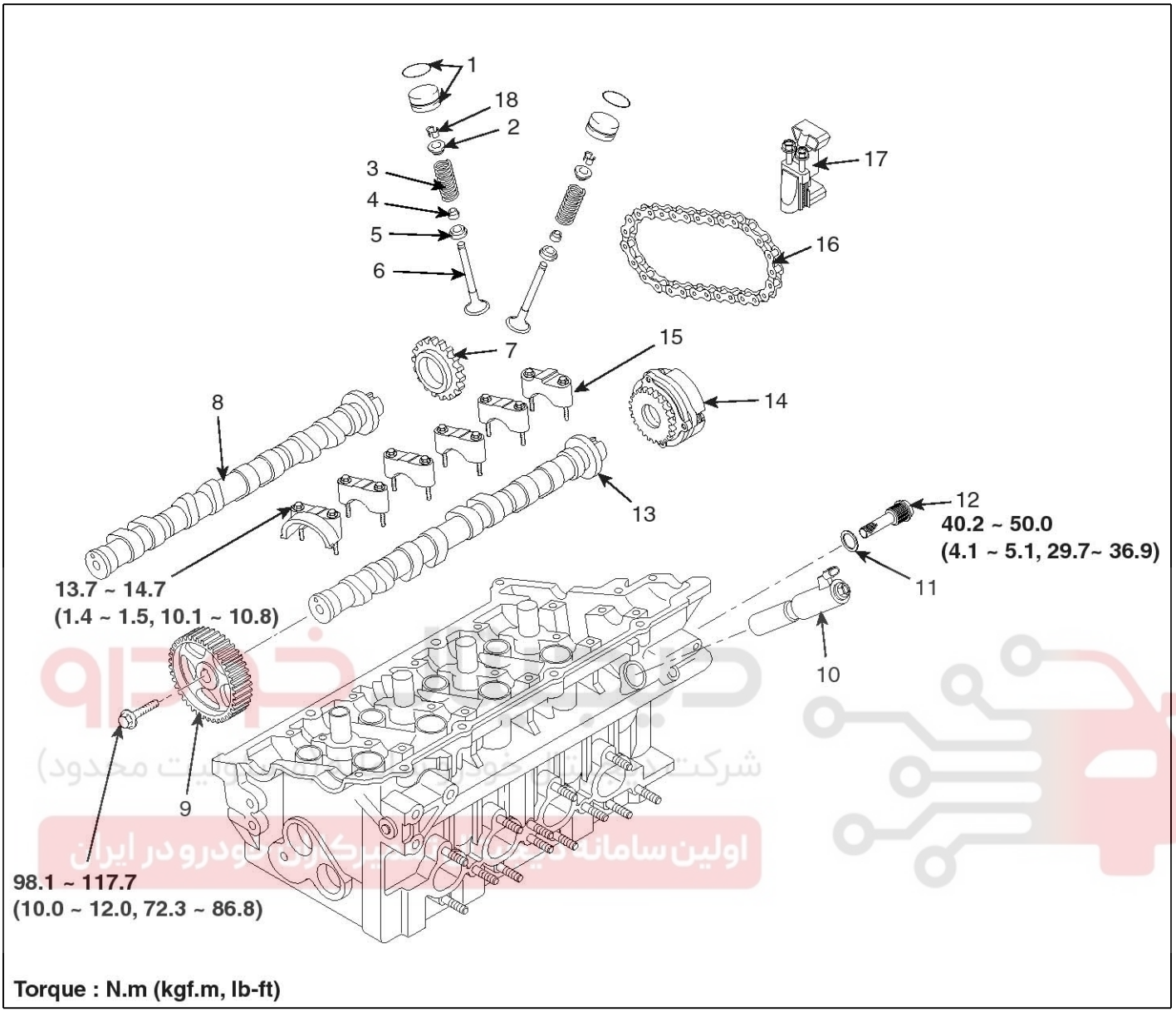
Cylinder Head Assembly

Components



SFDM18011L

1. Cylinder block
2. Cylinder head gasket
3. Cylinder head
4. Cylinder head bolt
5. Gasket
6. Cylinder head cover



SFDM18012L

1. Mechanical lash adjuster(MLA)
2. Retainer
3. Valve spring
4. Stem seal
5. Spring seat
6. Valve
7. Chain sprocket
8. Intake camshaft
9. Camshaft sprocket
10. Oil control valve(OCV)
11. Washer
12. OCV filter
13. Exhaust camshaft
14. CVVT assembly
15. Camshaft bearing cap
16. Timing chain
17. Auto Tensioner
18. Retainer lock

Removal

Engine removal is not required for this procedure.

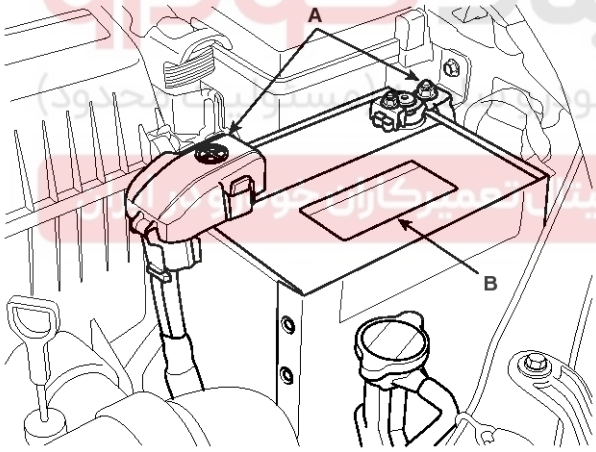
CAUTION

- **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.**

NOTICE

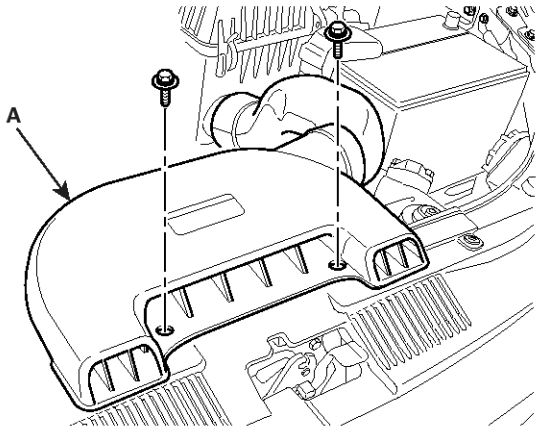
- *Mark all wiring and hoses to avoid misconnection.*
- *Inspect the timing belt before removing the cylinder head.*
- *Turn the crankshaft pulley so that the No. 1 piston is at top dead center.*

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



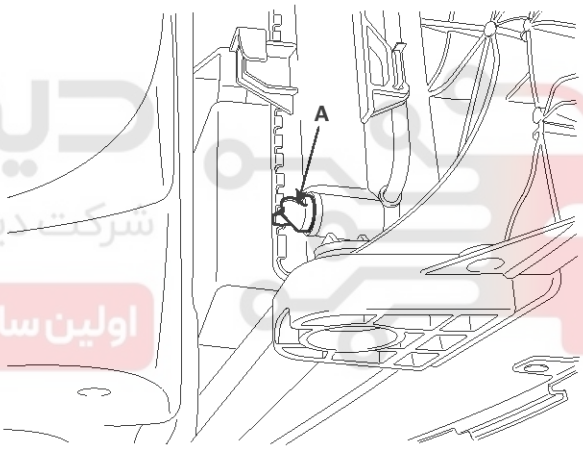
SHDM16004L

2. Remove the engine cover.
3. Remove the air duct(A).



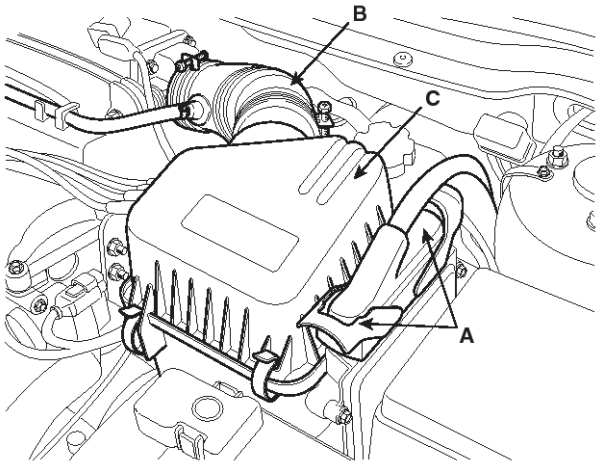
SFDM38001L

4. Remove the radiator cap to speed draing.
5. Loosen the radiator drain plug(A) and drain engine coolant.



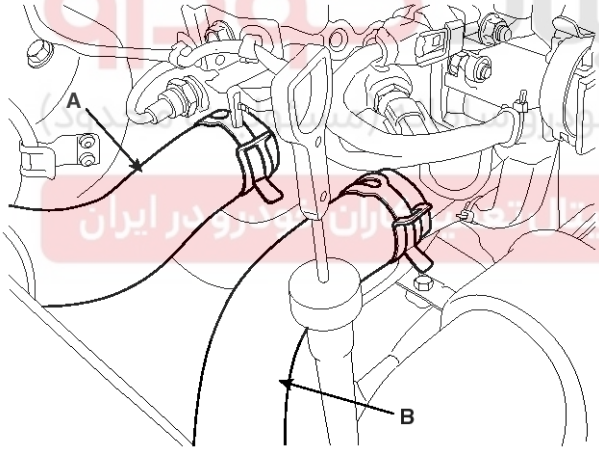
SEDM17003L

6. Remove the intake air hose and air cleaner assembly.
   1) Disconnect the PCM connectors (A).
   2) Remove the intake air hose (B) and the air cleaner assembly (C).



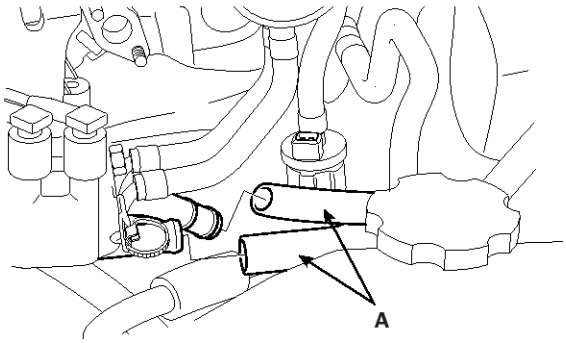
SEDM17004L

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



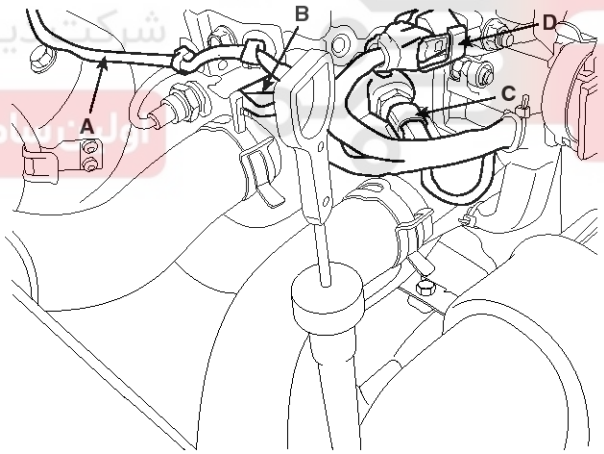
SHDM16006L

8. Remove the heater hoses (A).



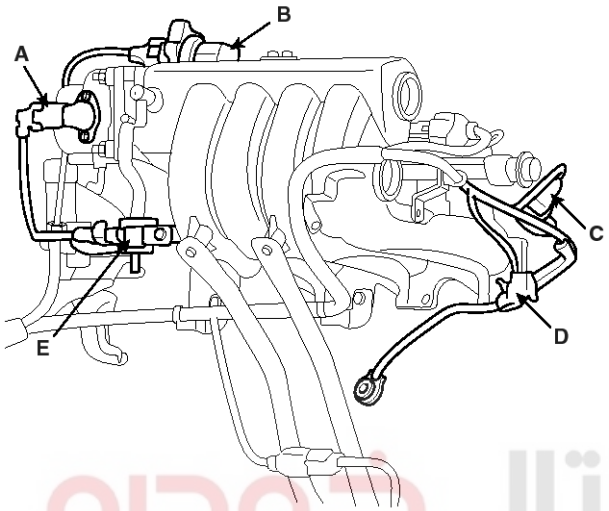
ECKD202A

9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   1) OCV(Oil control Valve) connector (A).
   2) Oil temperature sensor (OTS) connector (B).
   3) Engine coolant temperature (ECT) sensor connector (C).
   4) Ignition coil connector (D).



SHDM16317L

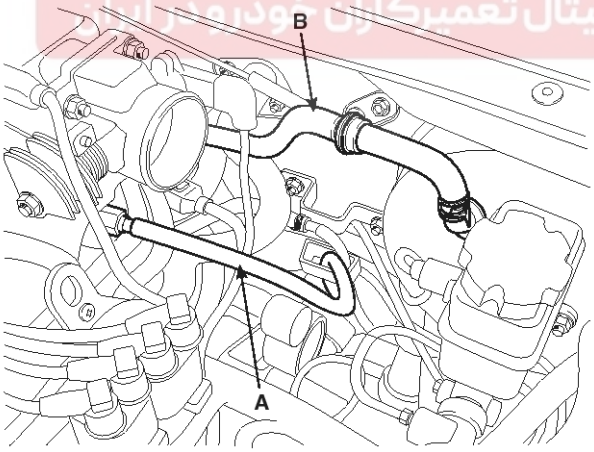
5) TPS(Throttle Position Sensor) connector (A).
6) ISA(Idle Speed Actuator) connector (B).
7) CMP(Camshaft Position Sensor) connector (C).
8) Four fuel injector connectors.
9) Knock sensor connector (D).
10) PCSV(Purge Control Solenoid Valve) connector (E).



SHDM16007L

11) Front heated oxygen sensor connector.

10. Remove the fuel inlet hose (A) from delivery pipe and brake booster vacuum hose(B).

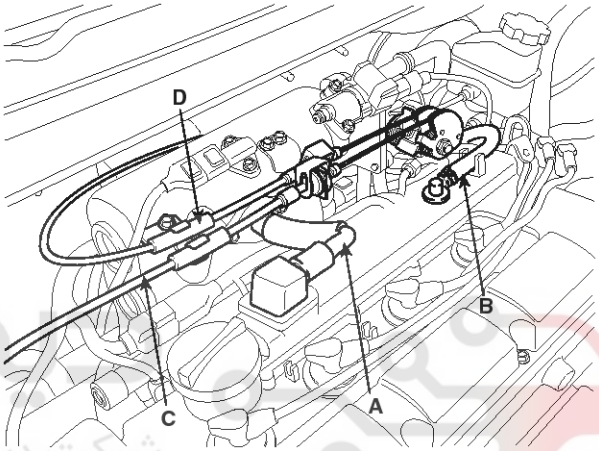


SEDM17007L

11. Remove the cylinder head cover.
    1) Disconnect the spark plug cables and do not pull on the spark plug by force.

       NOTICE
       Pulling on or bending the cables may damage the conductor inside.

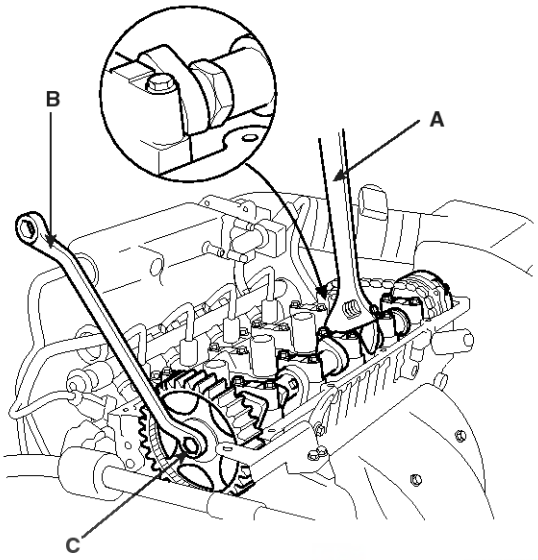
    2) Disconnect the positive crankcase ventilation (P.C.V) hose (A) and the breather hose (B) from the cylinder head cover.
    3) Disconnect the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.



SFDM18005L

12. Remove the timing belt. (Refer to Timing system in this group)
13. Remove the exhaust manifold and intake manifold. (Refer to Intake and exhaust system in this group)

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



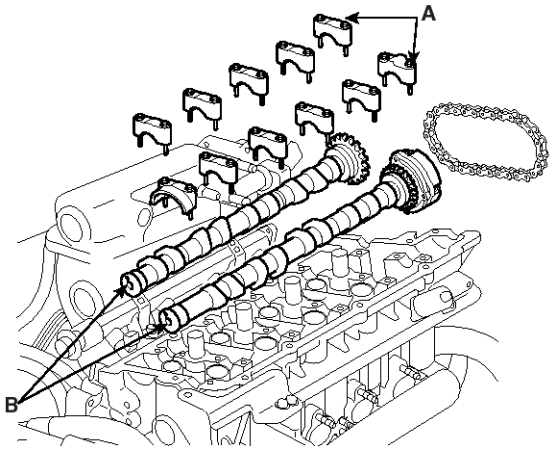
ECKD114A

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

15. Remove the timing chain auto tensioner (A).

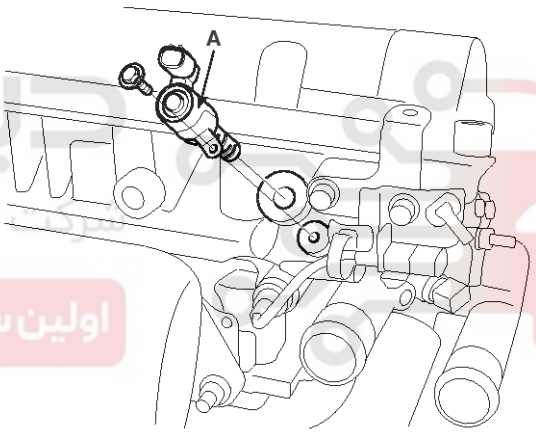
ECKD212A

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



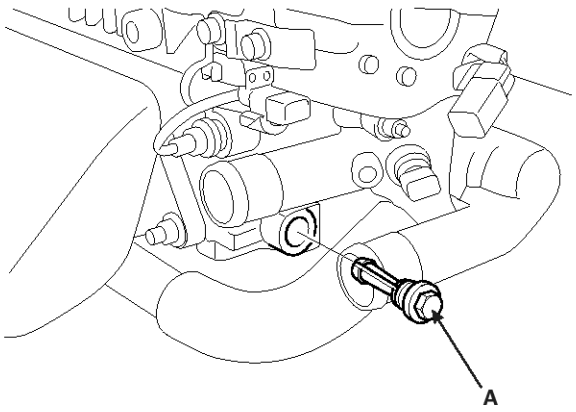
ECKD213A

17. Remove the OCV(oil control valve) (A).



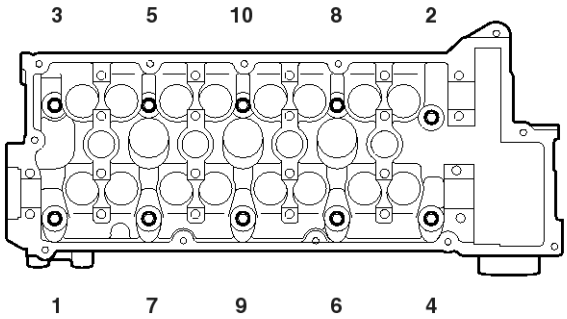
ECKD214A

18. Remove the OCV(oil control valve) filter (A).



ECKD215A

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



ECKD216A

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

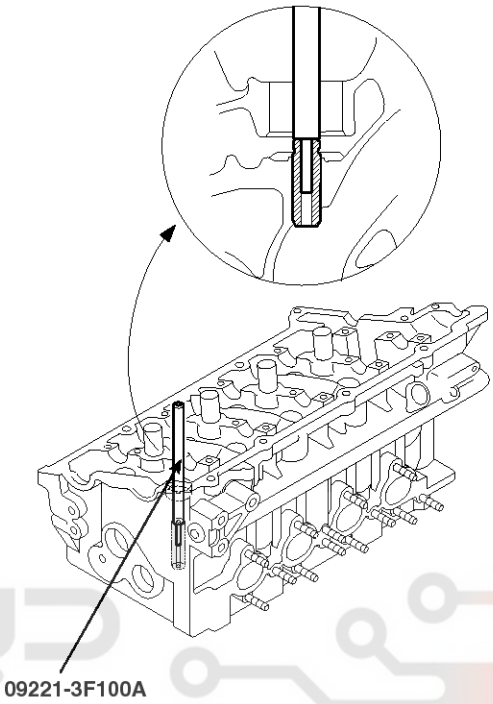
    2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

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

Replacement

Valve Guide

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

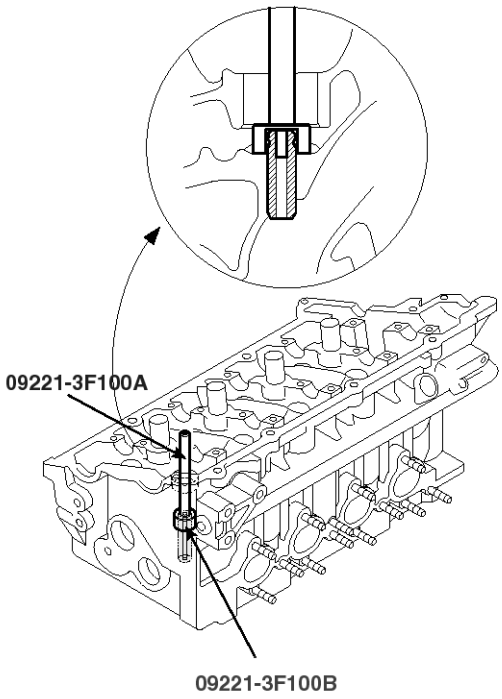


ECKD900A

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

Over size mm(in.)	Size mark	Oversize valve guide hole size mm(in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length
Intake : 46mm (1.8in.)
Exhaust : 54.5mm (2.15in.)



ECKD900B

NOTICE

Before the valve guide is press-fitted using the SST (09221-3F100A/B), remove the valve spring seat to install the valve guide correctly.

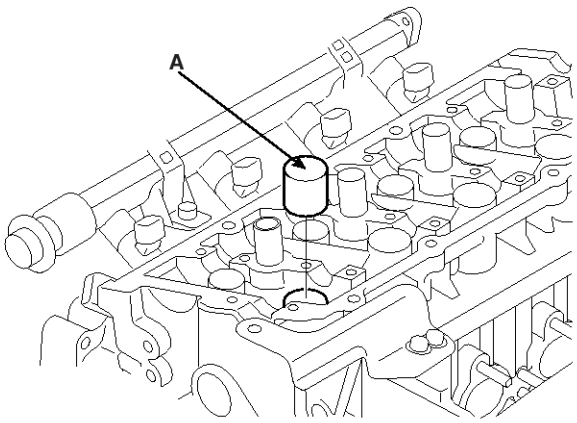
4. After the valve guide is press-fitted, insert a new valve and check for proper stem -to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

Disassembly

NOTICE

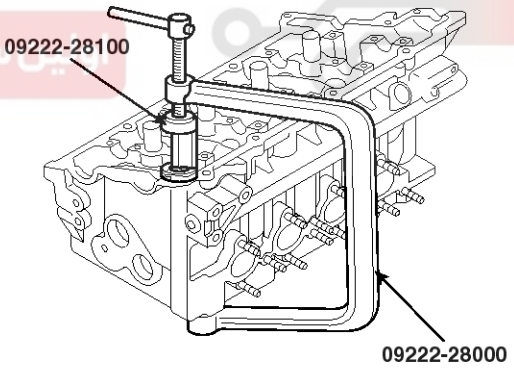
Identify MLA(Mechanical Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs (A).



ECKD217A

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



ECKD218A

   2) Remove the spring retainer.
   3) Remove the valve spring.
   4) Remove the valve.
   5) Remove the using needle-nose pliers, remove the oil seal.
   6) Using a magnetic finger, remove the spring seat.

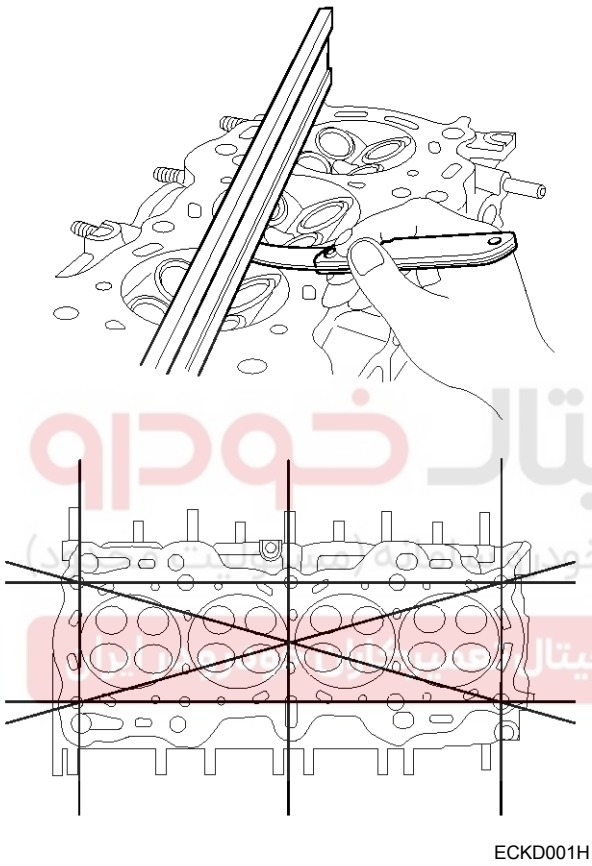
Inspection

Cylinder Head

1. Inspect for flatness.

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

Flatness of cylinder head gasket surface
Standard : Less than 0.03mm(0.0012 in)
Limit : 0.06 mm (0.0024 in)



ECKD001H

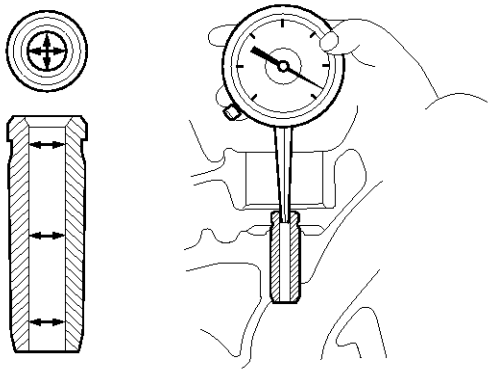
2. Inspect for cracks.

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

Valve And Valve Spring

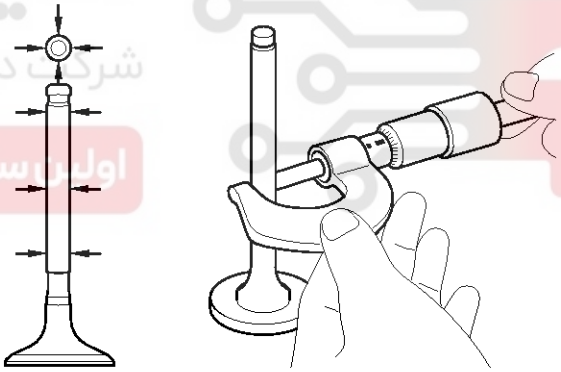
1. Inspect valve stems and valve guides.
   1) Using a caliper gauge, measure the inside diameter or the valve guide.

      Valve guide inside.



ECKD219A

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



ECKD220A

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

Valve stem-to-guide clearance

[Standard]
Intake : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in)
Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in)
[Limit]
Intake : 0.1mm (0.0040in)
Exhaust : 0.13mm (0.0051in)

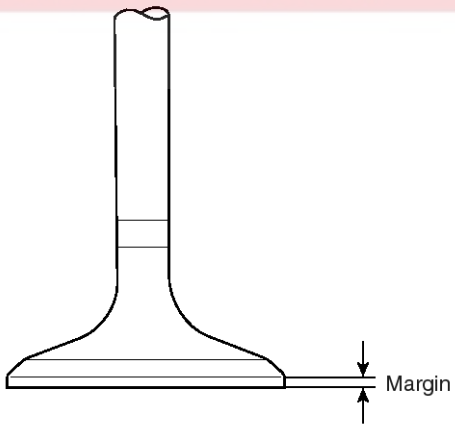
If the clearance is greater than maximum, replace the valve and valve guide.

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

      If the valve face is worn, replace the valve.
   3) Check the valve head margin thickness.

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

Margin
[Standard]
Intake : 1.6 mm(0.0630 in)
Exhaust : 1.8 mm(0.0709 in)
[Limit]
Intake : 1.45 mm(0.0571 in)
Exhaust : 1.65 mm(0.0650 in)



ECKD221A

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

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

3. Inspect valve seats

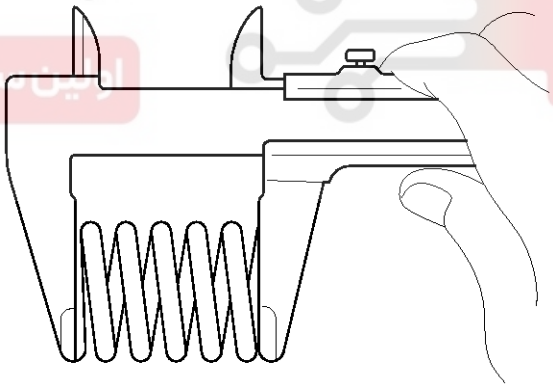
   Check the valve seat for evidence of overheating and improper contact with the valve face.

   Replace the seat if necessary.

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

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

Valve spring
[Standard]
Free height : 48.86mm (1.9236 in)
Load :
18.8±0.9kg/39.0mm (41.4±2.0lb/1.5354in)
41.0±1.5kg/30.5mm (90.4±3.3lb/1.2008in)
Out-of-square : 1.5°
[Limit]
Out-of-square : 3°



ECKD222A

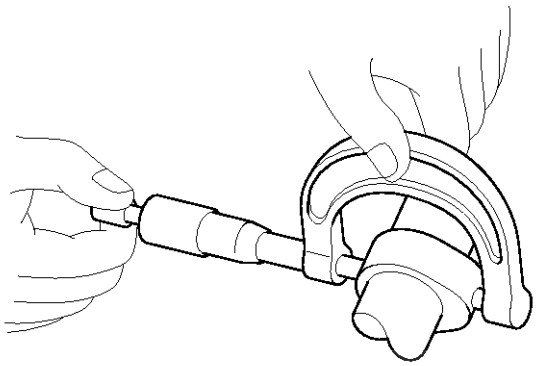
If the free length is not as specified, replace the valve spring.

Camshaft

1. Inspect cam lobes.

   Using a micrometer, measure the cam lobe height.

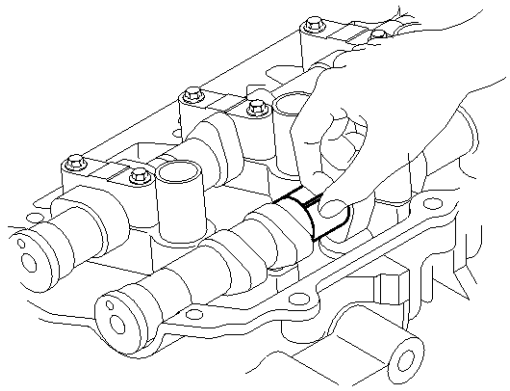
Cam height
[Standard value]
Intake : 44.518~44.718mm (1.7527~1.7605in)
Exhaust : 44.418~44.618mm (1.7487~1.7566in)



ECKD223A

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

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



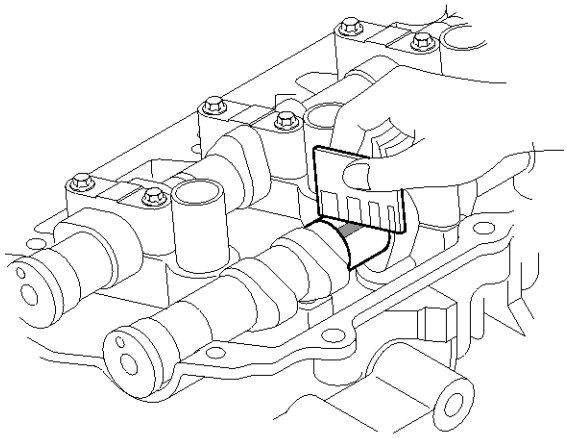
ECKD224A

   4) Install the bearing caps.

      ⚠CAUTION
      Do not turn the camshaft.

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

Bearing oil clearance :
[Standard value] : 0.02 ~ 0.061mm(0.0008 ~ 0.0024in)
[Limit] : 0.1mm(0.0039in)



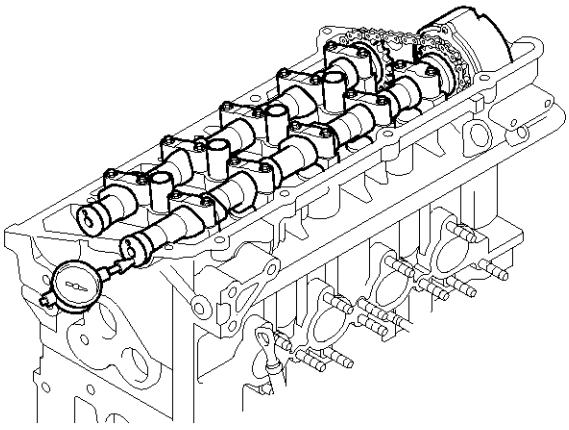
ECKD225A

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

   7) Completely remove the plastigage.
   8) Remove the camshafts.

3. Inspect camshaft end play.
   1) Install the camshafts.
   2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
[Standard value] : 0.1 ~ 0.15mm(0.0039 ~ 0.0059in)



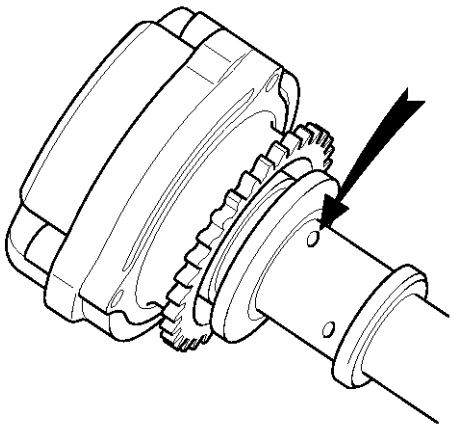
ECKD226A

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

   3) Remove the camshafts.

CVVT Assembly

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



EDKD270B

   3) Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm², 14psi) to the port of the camshaft.

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

      NOTICE

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

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

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

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

Standard: Movable smoothly in the range about 20°

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

Reassembly

NOTICE

Thoroughly clean all parts to be assembled.

Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.

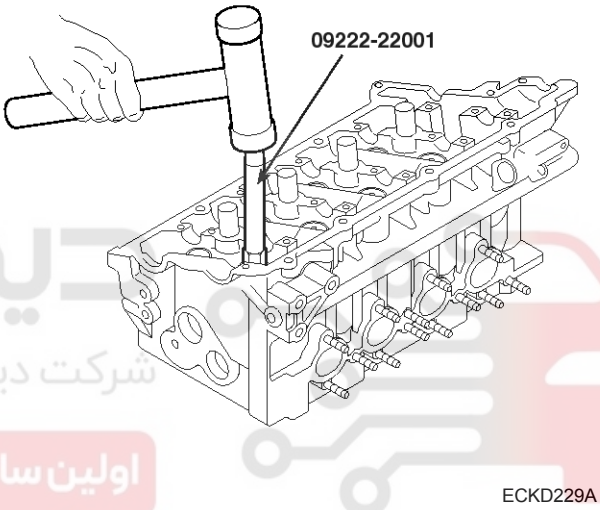
Replace oil seals with new ones.

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

      NOTICE

      Do not reuse old valve stem seals.

      Incorrect installation of the seal could result in oil leakage past the valve guides.



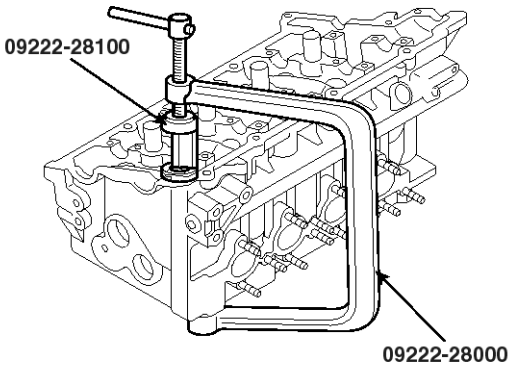
ECKD229A

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

      NOTICE

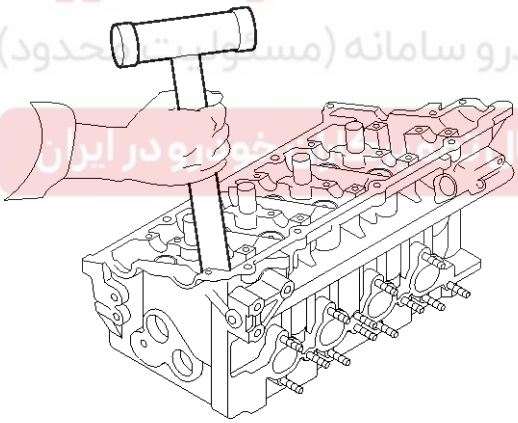
      Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

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



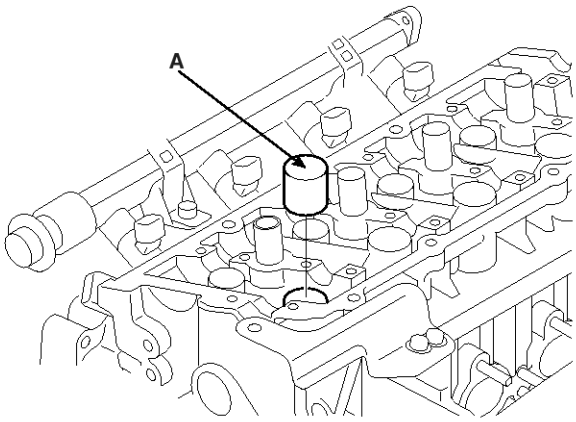
ECKD218A

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



ECKD230A

2. Install MLAs.
   Check that the MLA rotates smoothly by hand.



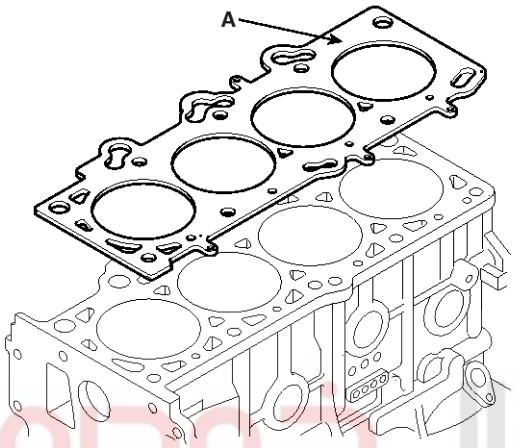
ECKD217A

Installation

NOTICE

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

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



ECKD231A

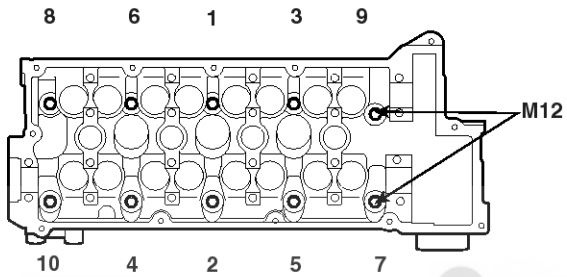
NOTICE

Be careful of the installation direction.

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
   1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.
   2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque

M10 :
22.6~26.5Nm (2.3~2.7kgf.m, 16.6~19.5lb-ft) + (60° ~ 65°) + (60° ~ 65°)
M12 :
27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + (60° ~ 65°) + (60° ~ 65°)

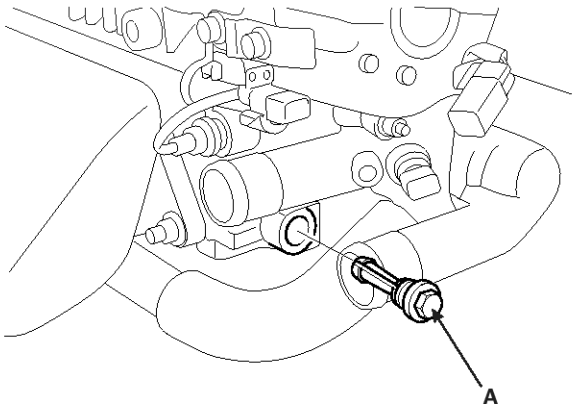


ECKD232A

4. Install OCV filter (A).

Tightening torque

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



ECKD215A

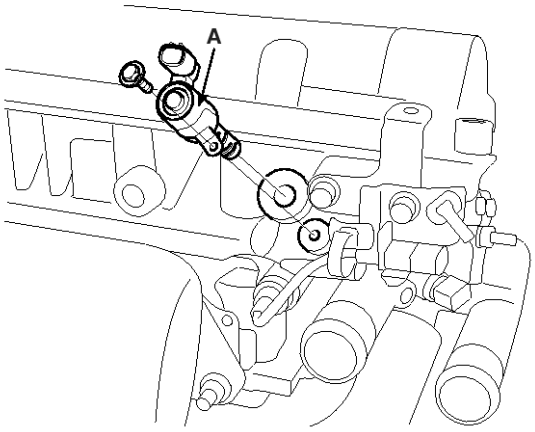
NOTICE

Always use a new OCV filter gasket.

Keep clean the OCV filter.

5. Install OCV (A).

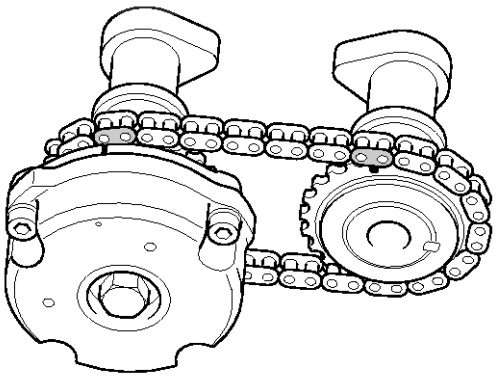
Tightening torque
9.8 ~ 11.8Nm(1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



ECKD214A

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

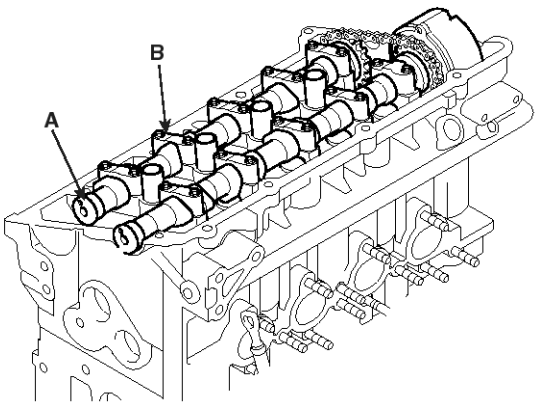
6. Install the camshafts.
   1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



ECKD233A

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

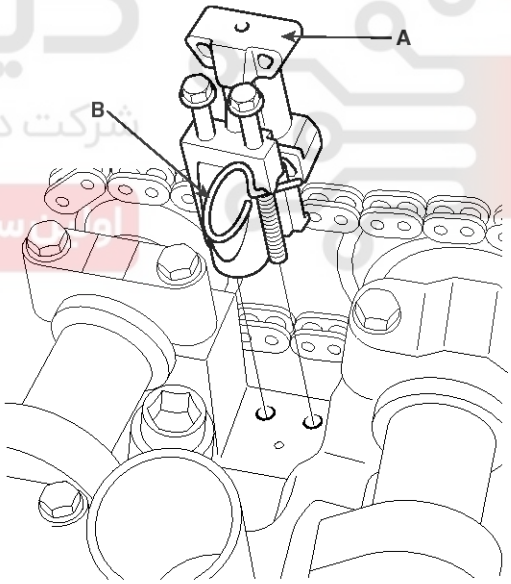
Tightening torque
13.7 ~ 14.7Nm (1.4 ~ 1.5kgf.m, 10.1 ~ 10.8lb-ft)



ECKD234A

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

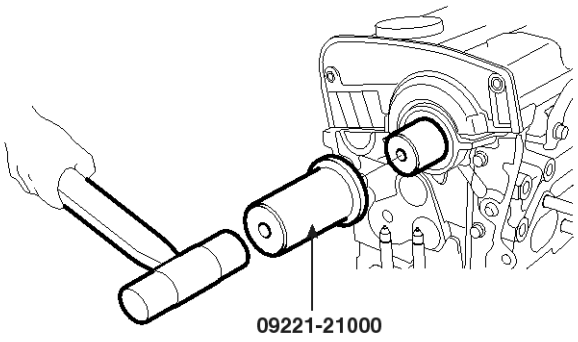
Tightening torque
7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



ECKD212A

   4) Remove the auto tensioner stopper pin (B).

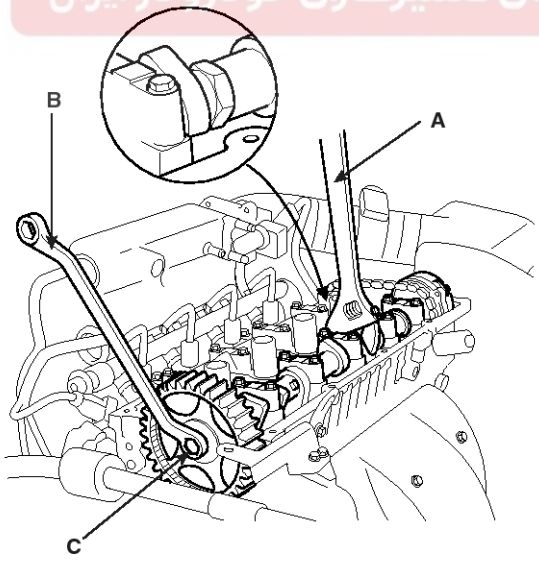
7. Check and adjust valve clearance.
8. Using the SST (09221-21000), install the camshaft bearing oil seal.



ECKD235A

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

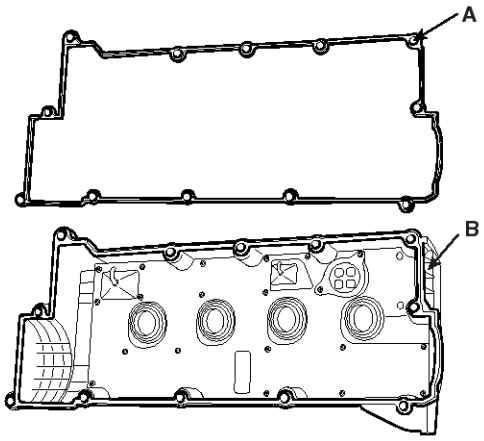
Tightening torque
Camshaft sprocket bolt :
98.1 ~ 117.7Nm (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



ECKD114A

10. Install the timing belt. (Refer to Timing system in this group)

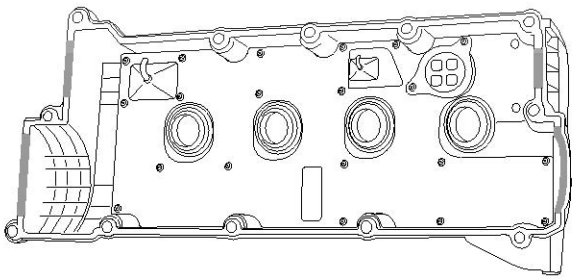
11. Install the cylinder head cover.
    1) Install the cylinder head cover gasket (A) in the groove of the cylinder head cover(B).



SHDM16318L

NOTICE
- *Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.*
- *When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.*

    2) Apply liquid gasket to the head cover gasket at the corners of the recess.

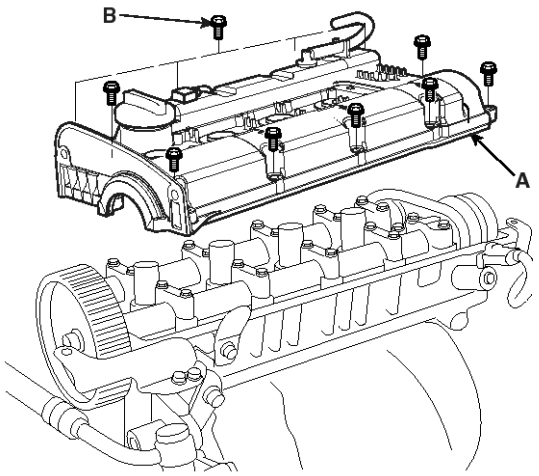


SHDM16319L

NOTICE
- *Use liquid gasket, loctite No. 5999.*
- *Check that the mating surfaces are clean and dry before applying liquid gasket*
- *After assembly, wait at least 30 minutes before filling the engine with oil.*

3) Install the cylinder head cover (A) with the 12bolts(B). Uniformly tighten the bolts in several passes.

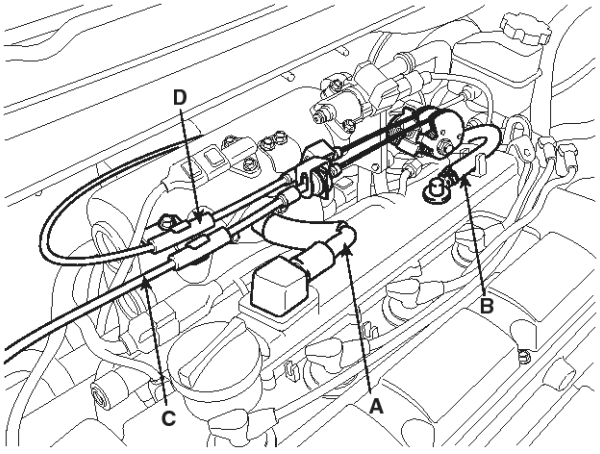
Tightening torque
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2 lb-ft)



SHDEM7004N

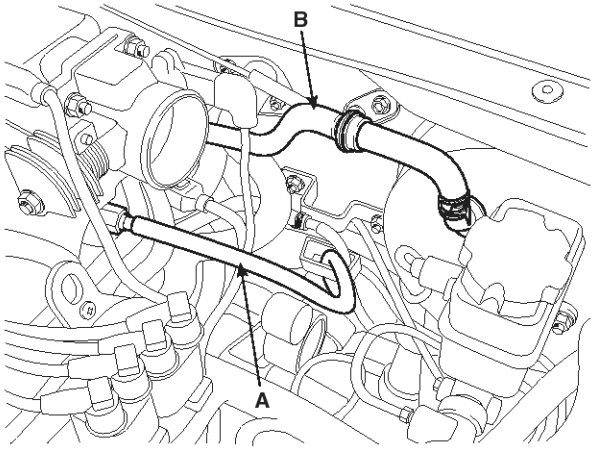
4) Connect the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.
5) Connect the positive crankcase ventilation (P.C.V) hose (A) and the breather hose (B) from the cylinder head cover.
6) Disconnect the spark plug cables and do not pull on the spark plug by force.

NOTICE
Pulling on or bending the calbes may damage the conductor inside.



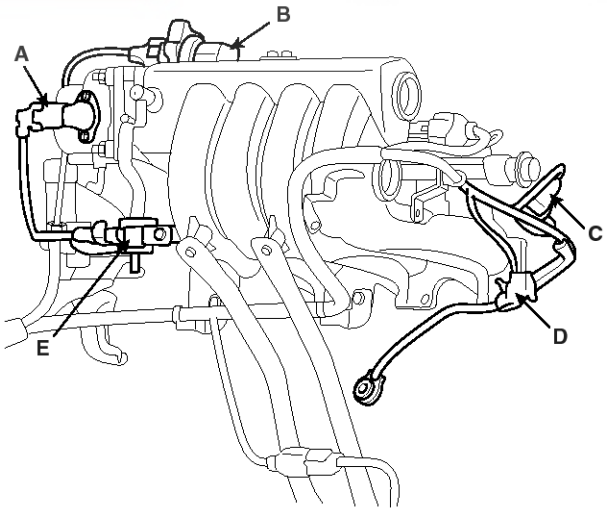
SFDM18005L

12. Install the intake manifold and exhaust manifold. (Refer to Intake and exhaust system in this group)
13. Install the fuel inlet hose (A).



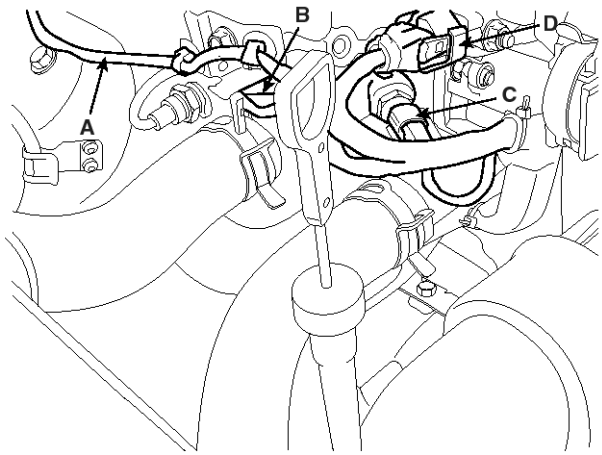
SEDM17007L

14. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    1) Front heated oxygen sensor connector.
    2) Knock sensor connector (D).
    3) Four fuel injector connectors.
    4) CMP connector (C).
    5) PCSV connector (E).
    6) ISA connector (B).
    7) TPS connector (A).



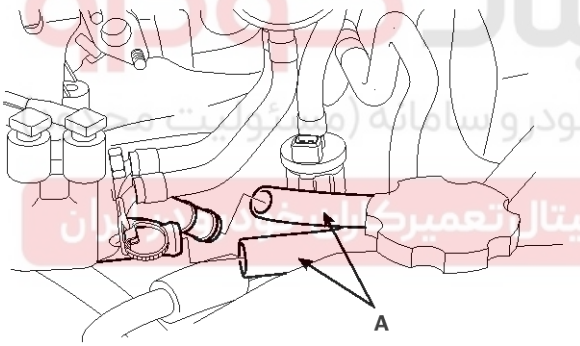
SHDM16007L

8) Ignition coil connector (D).
9) ECT sensor connector (C).
10) Oil temperature sensor connector (B).
11) OCV connector (A).



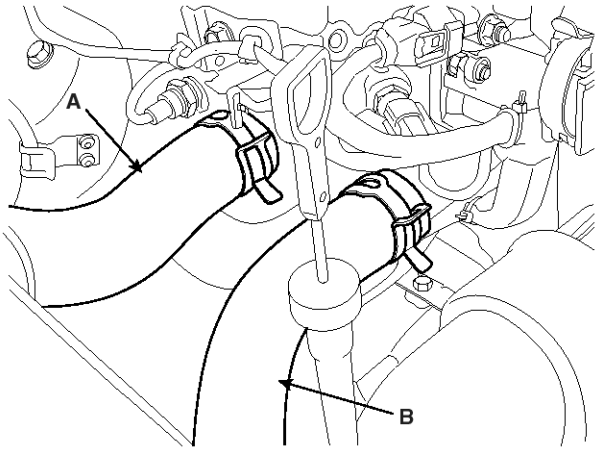
SHDM16317L

15. Install the heater hoses (A).



ECKD202A

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

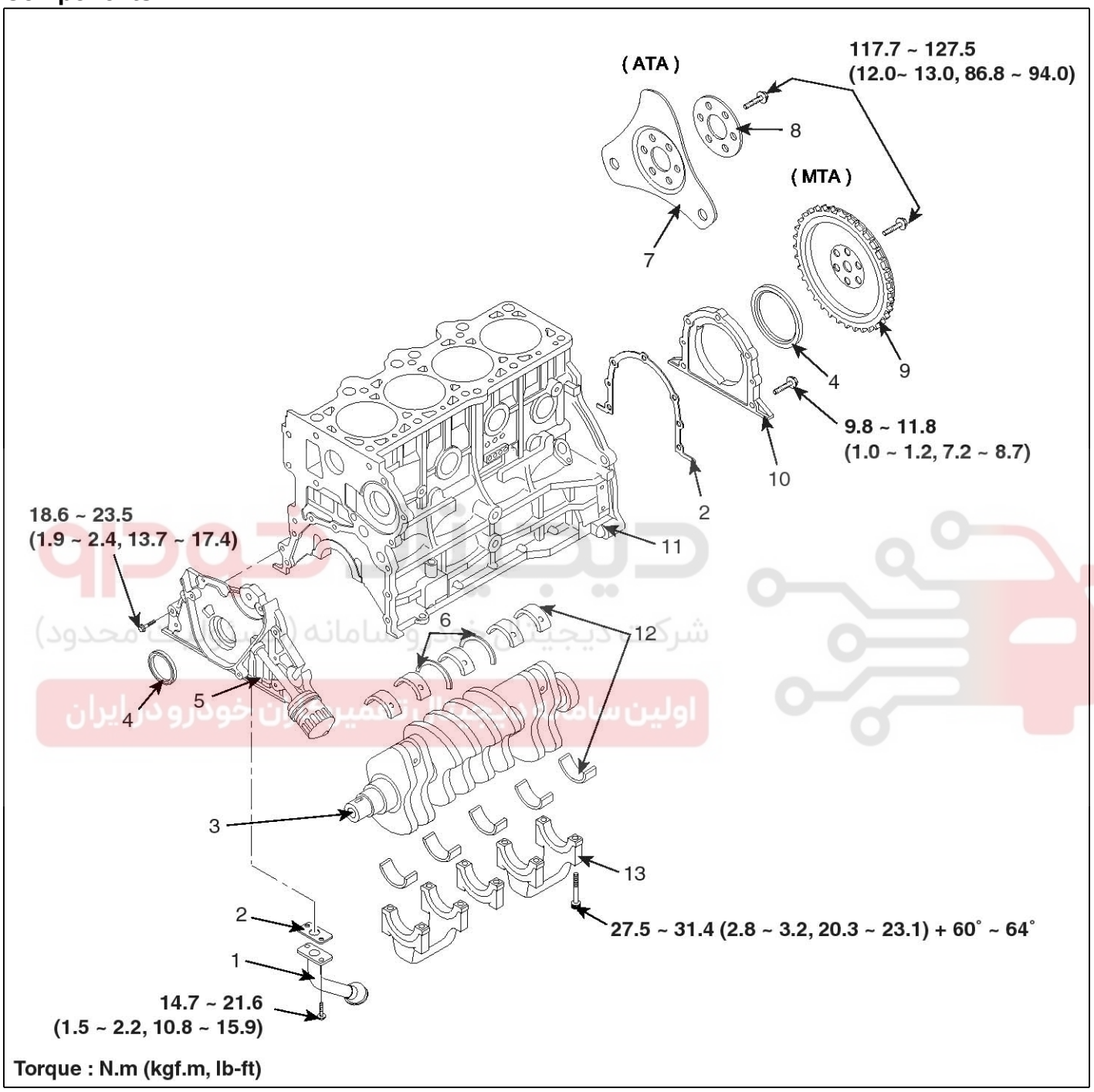


SHDM16006L

17. Install the intake air hose and air cleaner assembly.
18. Install the engine cover.
19. Install the battery and connect terminals.
20. Filll with engine coolant.
21. Start the engine and check for leaks.
22. Recheck engine coolant level and oil level.

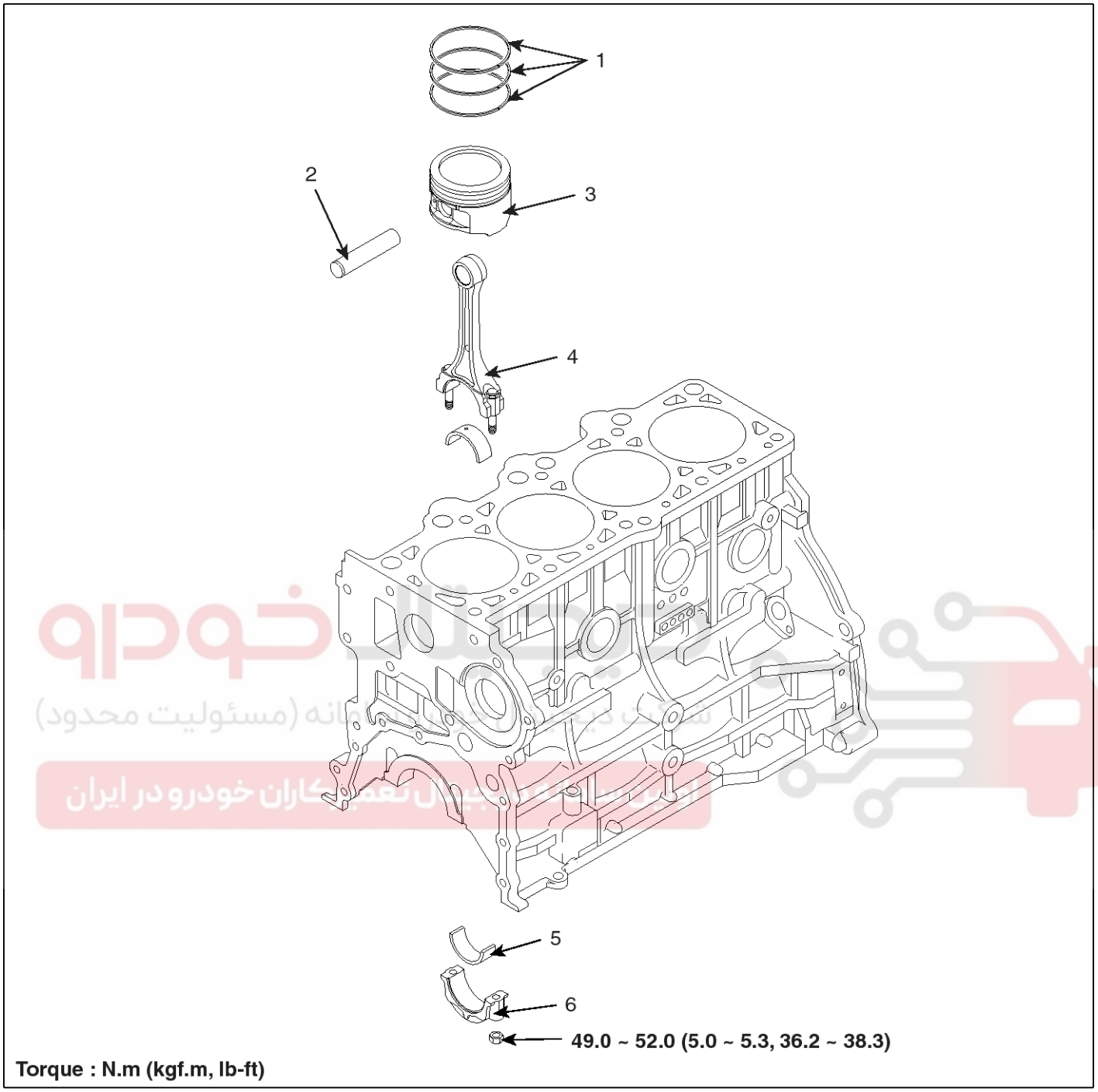
Cylinder Block

Components



SFDM18013L

1. Oil screen
2. Gasket
3. Crankshaft
4. Oil seal
5. Front case
6. Thrust bearing
7. Drive plate
8. Washer
9. Adapter plate
10. Rear oil seal case
11. Cylinder block
12. Main bearing
13. Main bearing cap

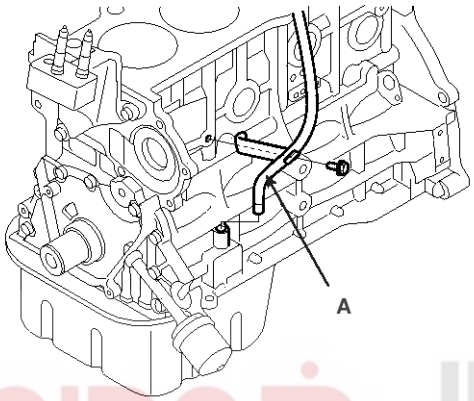


SFDM18014L

1. Piston ring
2. Piston pin
3. Piston
4. Connecting rod
5. Connecting rod bearing
6. Connecting rod bearing cap

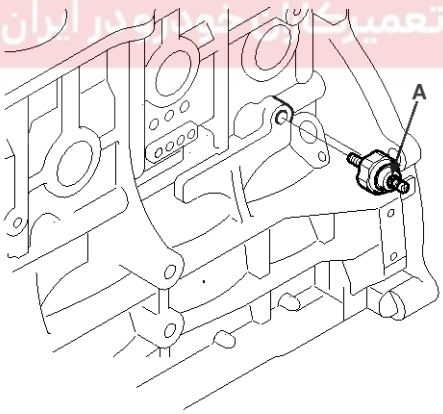
Disassembly

1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing belt. (Refer to Timing system in this group)
5. Remove cylinder head. (Refer to Cylinder head in this group)
6. Remove oil level gauge assembly (A).



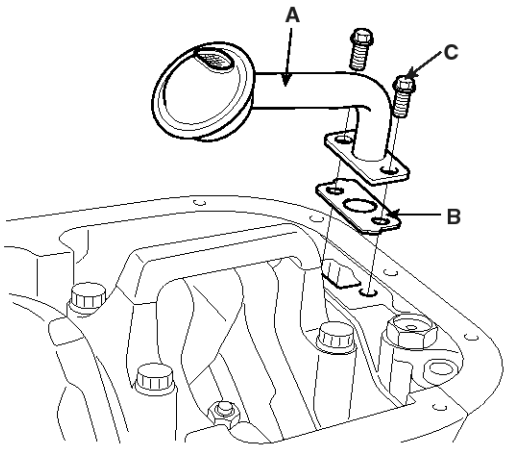
ECKD301A

7. Remove knock sensor.
8. Remove oil pressure sensor (A).



ECKD303A

9. Remove water pump.
10. Remove oil pan.
11. Remove oil screen.
    Remove the 2bolts(C), oil screen (A) and gasket (B).

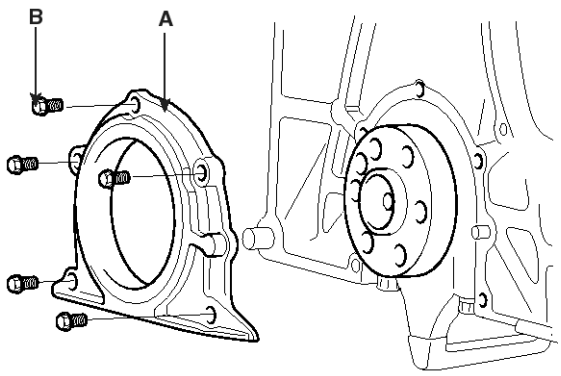


ECKD305A

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

    NOTICE
    - *Keep the bearings, connecting rod and cap together.*
    - *Arrange the piston and connecting rod assemblies in the correct order.*
15. Remove front case.

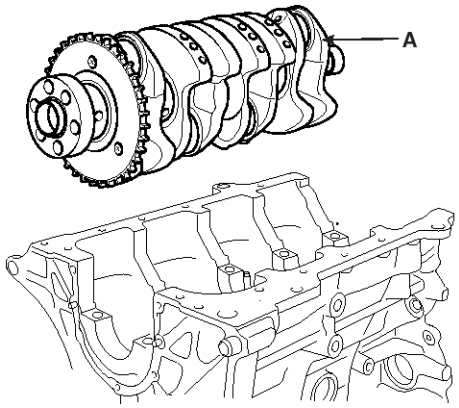
16. Remove rear oil seal case.
    Remove the 5 bolts(B) and rear oil seal case (A).



ECKD306A

17. Remove 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.

    NOTICE
    Arrange the main bearings and trust washers in the correct order.



ECKD307A

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 piston rings.
    1) Using a piston ring expender, remove the 2 compression rings.
    2) Remove the 2side rails and oil ring by hand.

    NOTICE
    Arrange the piston rings in the correct order only.
22. Disconnect connecting rod from piston.

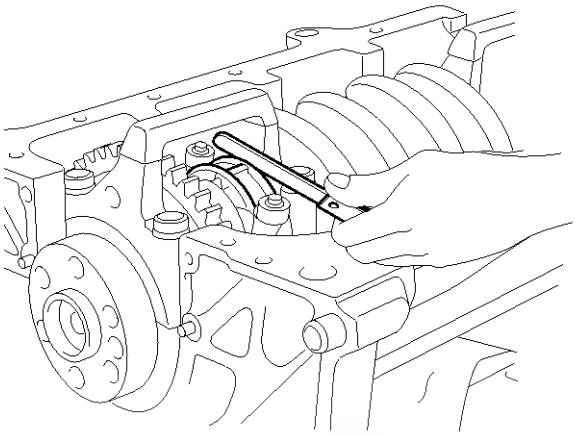
Inspection

Connecting Rod And CrankshafT

1. Check the connecting rod end play.

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

Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in)
Maximum end play : 0.4mm(0.016in)



ECKD308A

- If out-of-tolerance, install a new connecting rod.
- If still out-of-tolerance, replace the crankshaft.

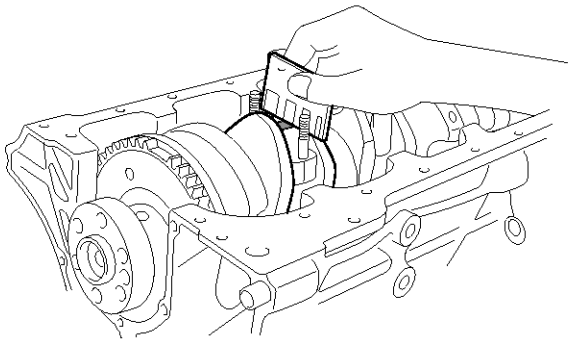
2. Check the connecting road bearing oil clearance.
   1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
   2) Remove the 2 connecting rod cap nuts.
   3) Remove the connecting rod cap and bearing half.
   4) Clean the crank pin and bearing.
   5) Place plastigage across the crank pin.
   6) Reinstall the bearing half and cap, and torque the nuts.

Tightening torque
49.0 ~ 52.0 Nm (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lb-ft)

NOTICE
Do not turn the crankshaft.

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

Standard oil clearance
0.024 ~ 0.042mm(0.0009 ~ 0.0017in)



ECKD309A

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

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

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

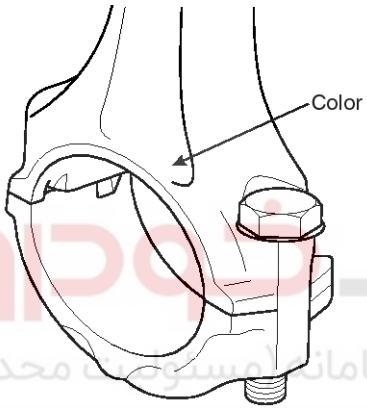
NOTICE

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

CAUTION

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

Connecting rod mark location

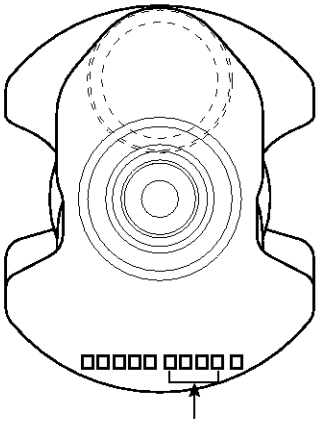


ECKD310A

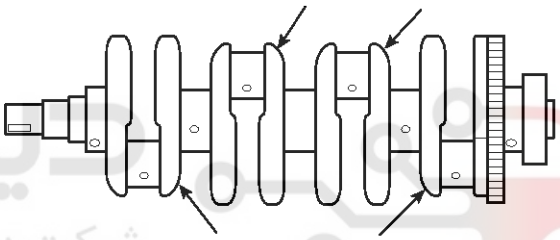
Discrimination of connecting rod

Class	Mark	Inside Diameter
A	White	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
B	None	48.006 ~ 48.012mm (1.8899 ~ 1.8902in.)
C	Yellow	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

Crankshaft pin mark location



ECKD311A

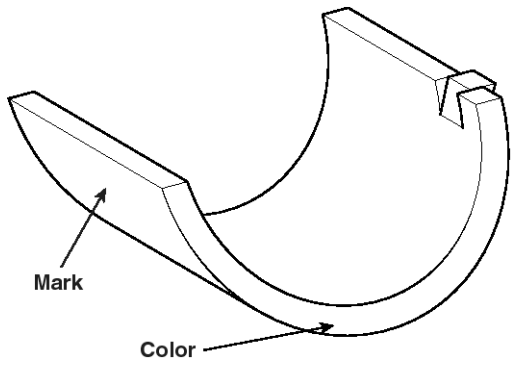


ECKD312A

Discrimination of crankshaft

Class	Mark	Outside Diameter Of Pan
I	Yellow	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	None	44.954 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	White	44.948 ~ 44.954mm (1.7696 ~ 1.7698in.)

Place of identification mark (Connecting rod bearing)



ECKD313A

Discrimination of connecting rod bearing

Class	Mark	Thickness Of Bearing
AA	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
A	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	None	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
D	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

11) Selection of connecting rod.

Crankshaft Identification Mark	Connecting Rod Identification Mark	Assembing Classification Of Bearing
I (Yellow)	A (White)	D (Yellow)
	B (None)	C (Green)
	C (Yellow)	B (None)
II (None)	A (White)	C (Green)
	B (None)	B (None)
	C (Yellow)	A (Black)
III (White)	A (White)	B (None)
	B (None)	A (Black)
	C (Yellow)	AA (Blue)

3. Check the connecting rod.

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

Allowable bend of connecting rod :
0.05mm / 100mm (0.0020 in./3.94 in) or less
Allowable twist of connecting rod :
0.1mm / 100mm (0.0039 in./3.94 in) or less

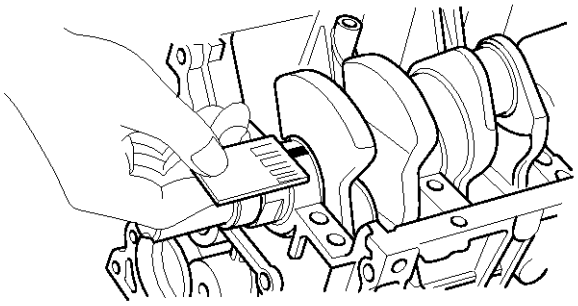
4. Check the crankshaft bearing oil clearance.
   1) To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
   2) Clean each main journal and bearing half with a clean shop tower.
   3) Place one strip of plastigage across each main journal.
   4) Reinstall the bearings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

Tightening torque :
27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.11lb-ft) + 60° ~ 64°

NOTICE
Do not turn the crankshaft.

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

Standard oil clearance :
0.028 ~ 0.046mm (0.0011 ~ 0.0018in)



ECKD001I

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

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

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

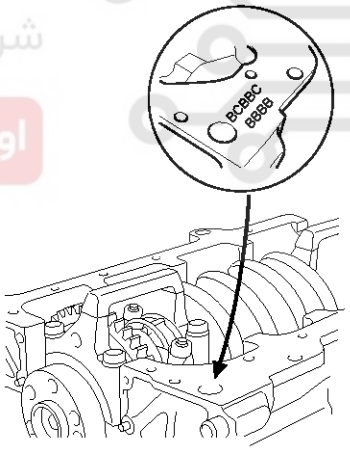
NOTICE
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

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

Crankshaft Bore Mark Location

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

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

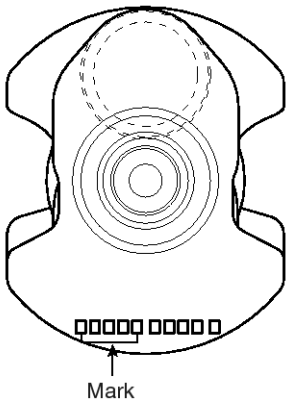


ECKD314A

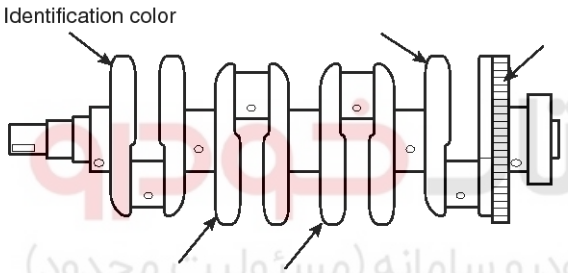
Discrimination of cylinder block

Calss	Mark	Inside Diameter
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

Crankshaft journal mark location



SHDM16325L

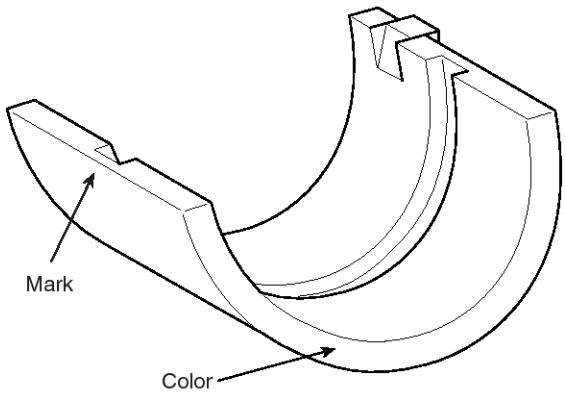


SHDM16326L

Discrimination of crankshaft

Class	Mark	Outside Diameter Of Journal
I	Yellow	54.956 ~ 54.962mm (2.1636 ~ 2.1638in.)
II	None	54.950 ~ 54.956mm (2.1633 ~ 2.1636in.)
III	White	54.944 ~ 54.950mm (2.1631 ~ 2.1633in.)

Place of identification mark (Crankshaft bearing)



ECKD316A

Discrimination of crankshaft bearing

Class	Mark	Thickness Of Bearing
AA	Blue	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
A	Black	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	None	2.008 ~ 2.011mm (0.0790 ~ 0.0791in.)
C	Green	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	Yellow	2.002 ~ 2.005mm (0.0788 ~ 0.0789in.)

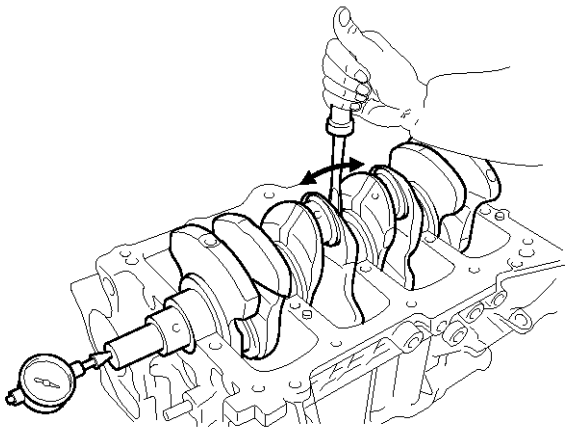
Selection

Crankshaft Identification Mark	Crankshaft Bore Identification Mark	Assembling Classification Of Bearing
I (Yellow)	a (A)	D (Yellow)
	b (B)	C (Green)
	c (C)	B (None)
II (None)	a (A)	C (Green)
	b (B)	B (None)
	c (C)	A (Black)
III (White)	a (A)	B (None)
	b (B)	A (Black)
	c (C)	AA (Blue)

5. Check crankshaft end play.

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

: 0.06 ~ 0.26mm (0.0023 ~ 0.010in)
Limit : 0.30mm (0.0118in)



ECKD001B

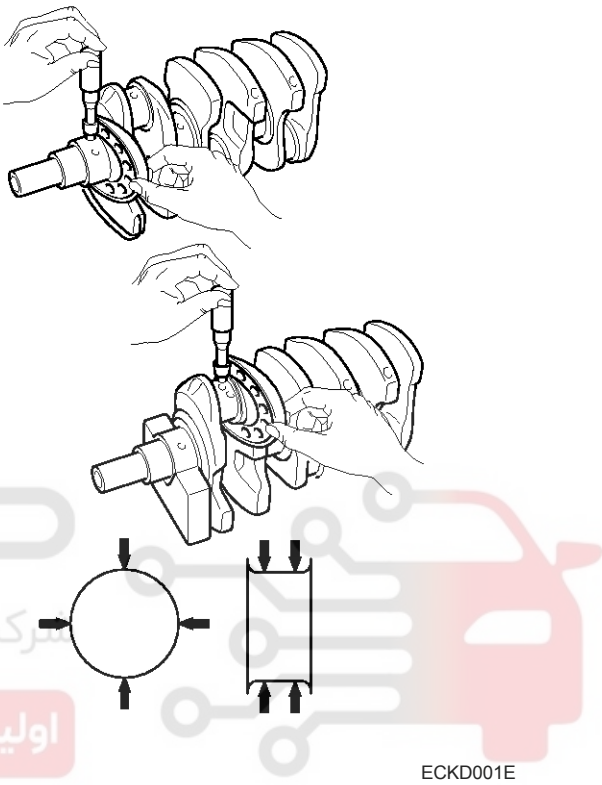
If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness :
2.44 ~ 2.47mm(0.096 ~ 0.097in)

6. Inspect main journals and crank pins

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

Main journal diameter :
56.942 ~ 56.962mm (2.2418~2.2426in)
Crank pin diameter :
44.946 ~ 44.966mm (1.7695 ~ 1.7703in)



ECKD001E

Cylinder Block

1. Remove gasket material.

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

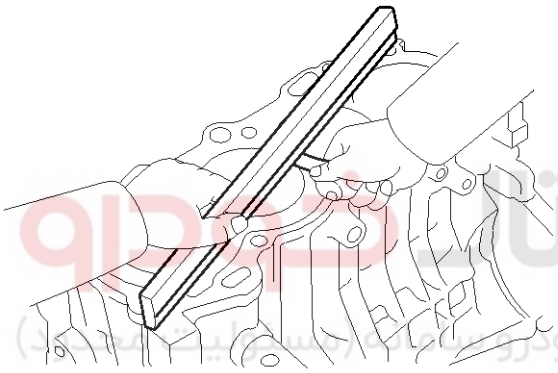
2. Clean cylinder block

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

3. Inspect top surface of cylinder block for flatness.

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

Flatness of cylinder block gasket surface
Standard : Less than 0.03mm(0.0012 in)
Limit : 0.05 mm (0.0020 in)



ECKD001L

4. Inspect cylinder bore diameter

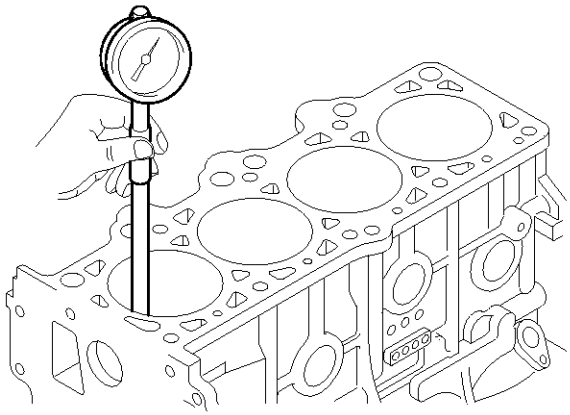
   Visually check the cylinder for vertical scratchs.

   If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

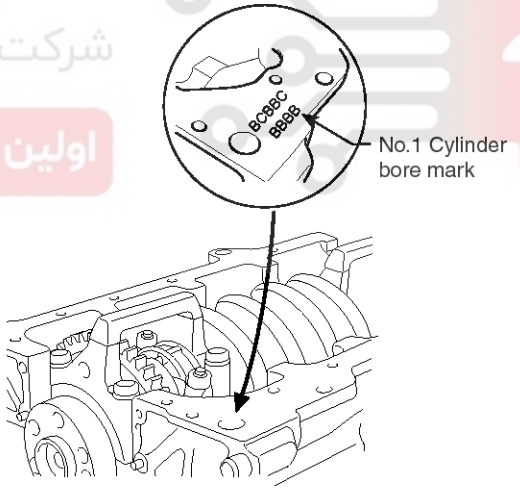
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

Standard diameter :
82.00 ~ 82.03mm (3.2283 ~ 3.2295in)



ECKD318A

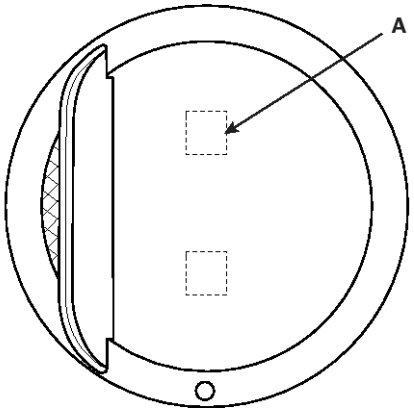
6. Check the cylinder bore size code on the cylinder block bottom face.



SHDEM7013N

Class	Cylinder bore inner diameter	Size code
A	82.00 ~ 82.01mm (3.228~ 3.2287in)	A
B	82.01 ~ 82.02mm (3.2287~ 3.2291in)	B
C	82.02 ~ 82.03mm (3.2291~ 3.2295in.)	C

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



SHDM16321L

NOTICE
Stamp the grade mark of basic diameter with rubber stamp.

Class	Piston outer diameter	Size code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in)	A
-	81.98 ~ 81.99mm (3.2275 ~ 3.2279in)	-
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)	C

8. Select the piston related to cylinder borre class.

Clearance
0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

Boring Cylinder

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

Identification Mark	Size
0.25	0.25mm (0.010in)
0.50	0.50mm (0.020in)

NOTICE
The size of piston is stamped on top of the piston.

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

New bore size = Piston O.D + 0.02 to 0.04 mm (0.0008 to 0.0016 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

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

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

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

Standard : 0.02-0.04 mm (0.0008-0.0016 in.)

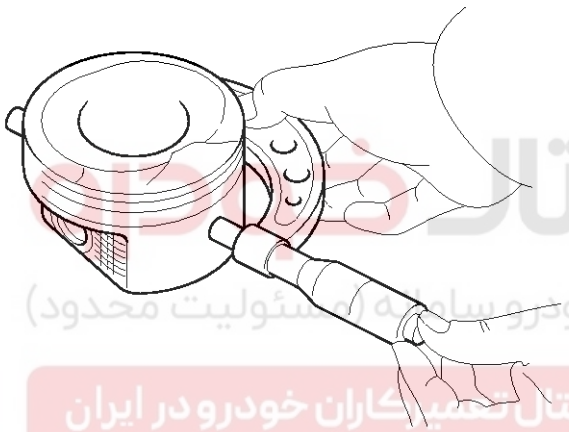
NOTICE
When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

Piston And Rings

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

   NOTICE
   Do not use a wire brush.
2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Standard diameter
81.97 ~ 82.00mm (3.2272 ~ 3.2283in)



ECKD001D

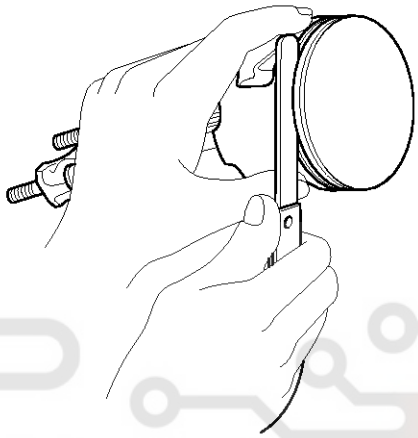
3. Calculate the difference between the cylinder bore diameter and the piston diameter.

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 the ring groove.

Piston ring side clearance
No. 1 : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)
No. 2 : 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in)
Oil ring : 0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in)
Limit
No. 1 : 0.1mm (0.004in)
No. 2 : 0.1mm (0.004in)
Oil ring : 0.2 mm (0.0079 in)



ECKD001G

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

5. Inspect piston ring end gap.

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

Piston ring end gap

Standard

No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138 in)

No. 2 : 0.37 ~ 0.52mm (0.0146 ~ 0.0205 in)

Oil ring : 0.20 ~ 0.60 mm (0.0079 ~ 0.0236 in)

Limit

No. 1, 2, oil ring : 1.0mm (0.039in)

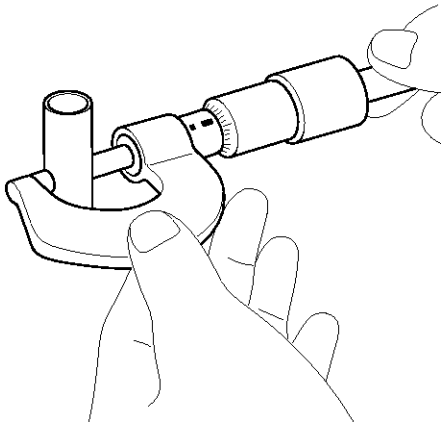
ECKD001K

Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter

20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



ECKD001Z

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

Piston pin-to-piston clearance

0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

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

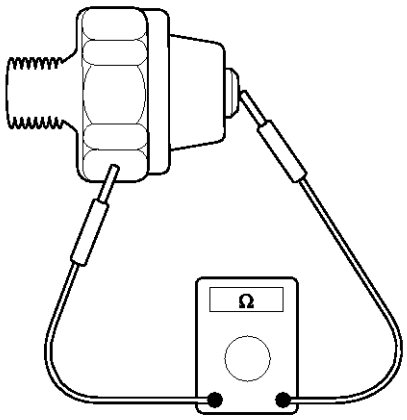
Piston pin-to-connecting rod interference

-0.032 ~ -0.016mm (-0.0013 ~ -0.00006in)

Oip Pressure Switch

1. Check the continuity between the terminal and the body with an ohmmeter.

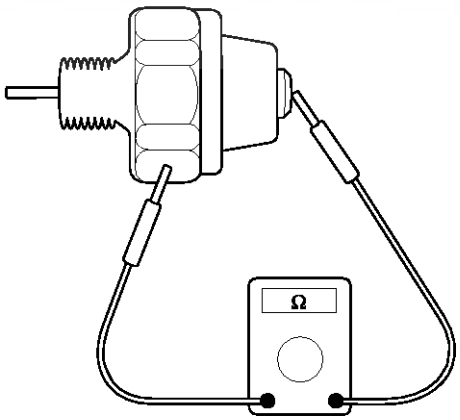
   If there is no continuity, replace the oil pressure switch.



ECKD001W

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

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



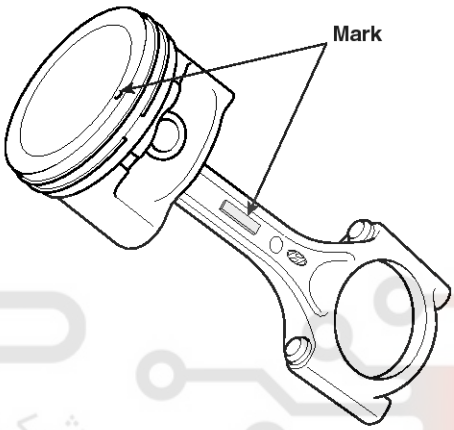
ECKD001Y

Reassembly

NOTICE

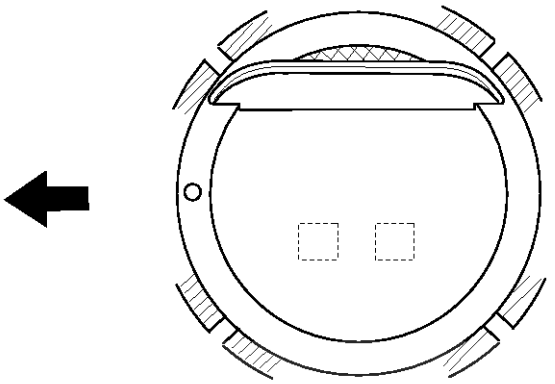
- *Thoroughly clean all parts to assembled.*
- *Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.*
- *Replace all gaskets, O-rings and oil seals with new parts.*

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



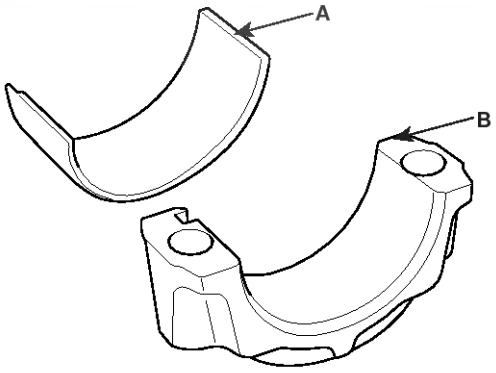
ECKD320A

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



ECKD321A

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



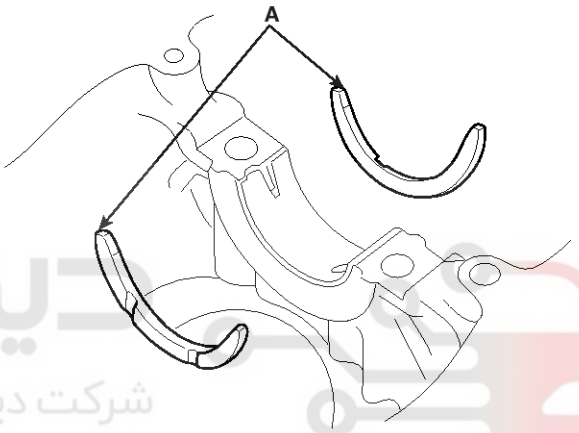
ECKD322A

4. Install main bearings.

   NOTICE

   Upper 1,2,4,5 bearings have an oil groove of oil holes; Lower bearings do not.
   1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).
   2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
5. Install thrust bearings.

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



ECKD324A

6. Place crankshaft on the cylinder block.
7. Place main bearing caps on cylinder block.

8. Install main bearing cap bolts.

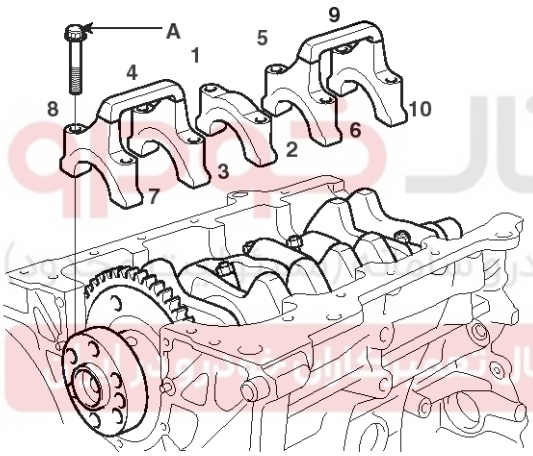
NOTICE

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

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

Tightening torque
27.5 ~ 31.4Nm (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft) + 60 ~ 64°

CAUTION
Always use new main bearing cap bolts.



ECHE200A

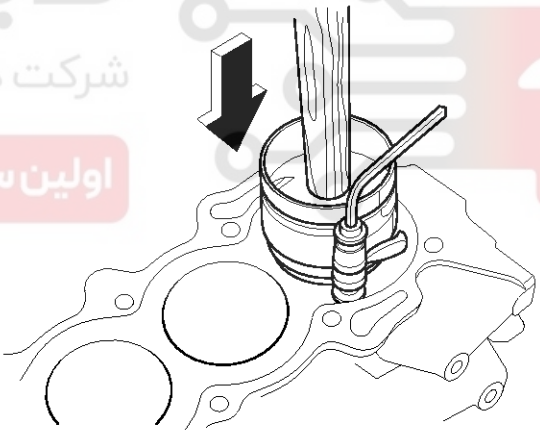
3) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.
10. Install piston and connecting rod assemblies.

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

1) Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts : 50 ~ 53Nm (5.0 ~ 5.3kgf.m, 36.9 ~ 39lb-ft)

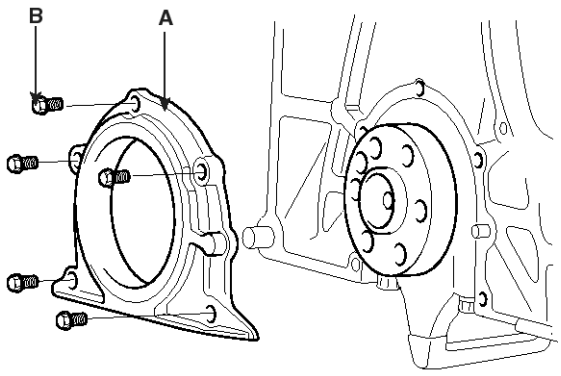
NOTICE
Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



ECKD001F

11. Install a new gasket and rear oil seal case (A) with 5 bolts (B).

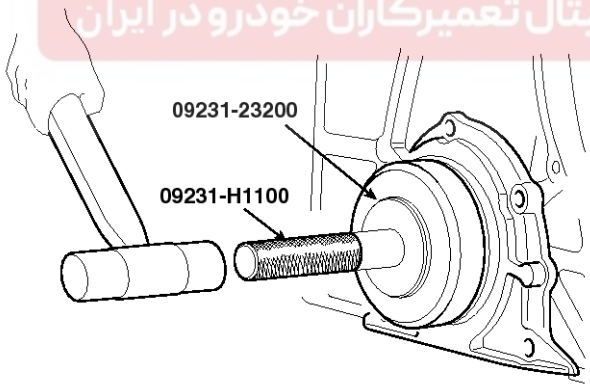
Tightening torque
9.8 ~ 11.8Nm (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



ECKD306A

NOTICE
Check that the mating surfaces are clean and dry.

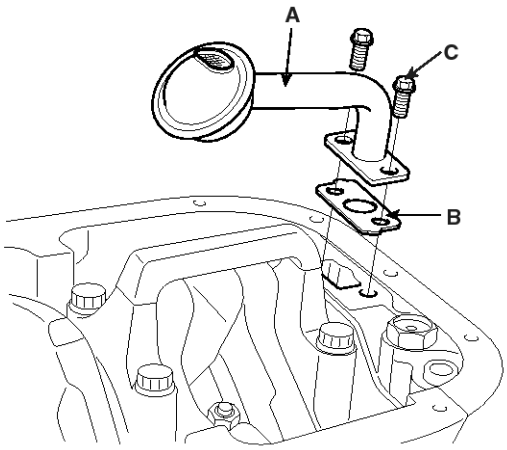
12. Install rear oil seal.
    1) Apply engine oil to a new oil seal lip.
    2) Using SST(09231-23200, 09231-H1100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



SAMM19103N

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

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



ECKD305A

15. Install oil pan.
    1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

    NOTICE
    Check that the mating surfaces are clean and dry before applying liqued gasket.

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

    Use liquid gasket 'TB 1217H' or equivalent.

    NOTICE
    - *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.*

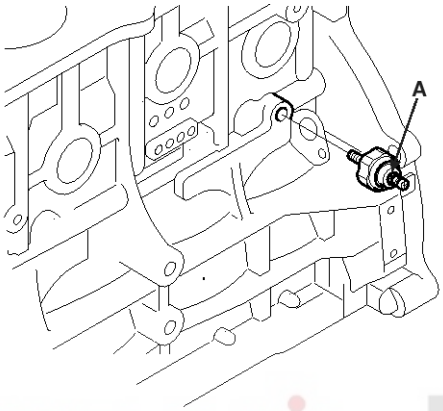
    3) Install the oil pan with the 19 bolts.

    Uniformly tighten the bolts in several passes.

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

16. Install water pump. (Refer to Cooling system in this group)
17. Install oil pressure sensor.
    1) Apply adhesive to 2 or 3 threads.
       Adhesive : Three bond 2310/2350 or equivalent.
    2) Install the oil pressure sensor (A).

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



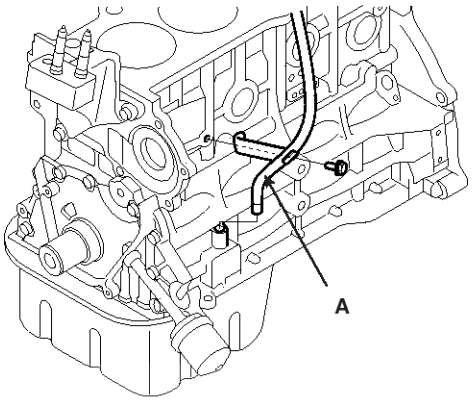
ECKD303A

18. Install knock sensor.

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

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

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



ECKD301A

20. Install cylinder head. (Refer to Cylinder head in this group)
21. Install timing belt. (Refer to Timing system in this group)
22. Remove engine stand.
23. A/T : Install drive plate.

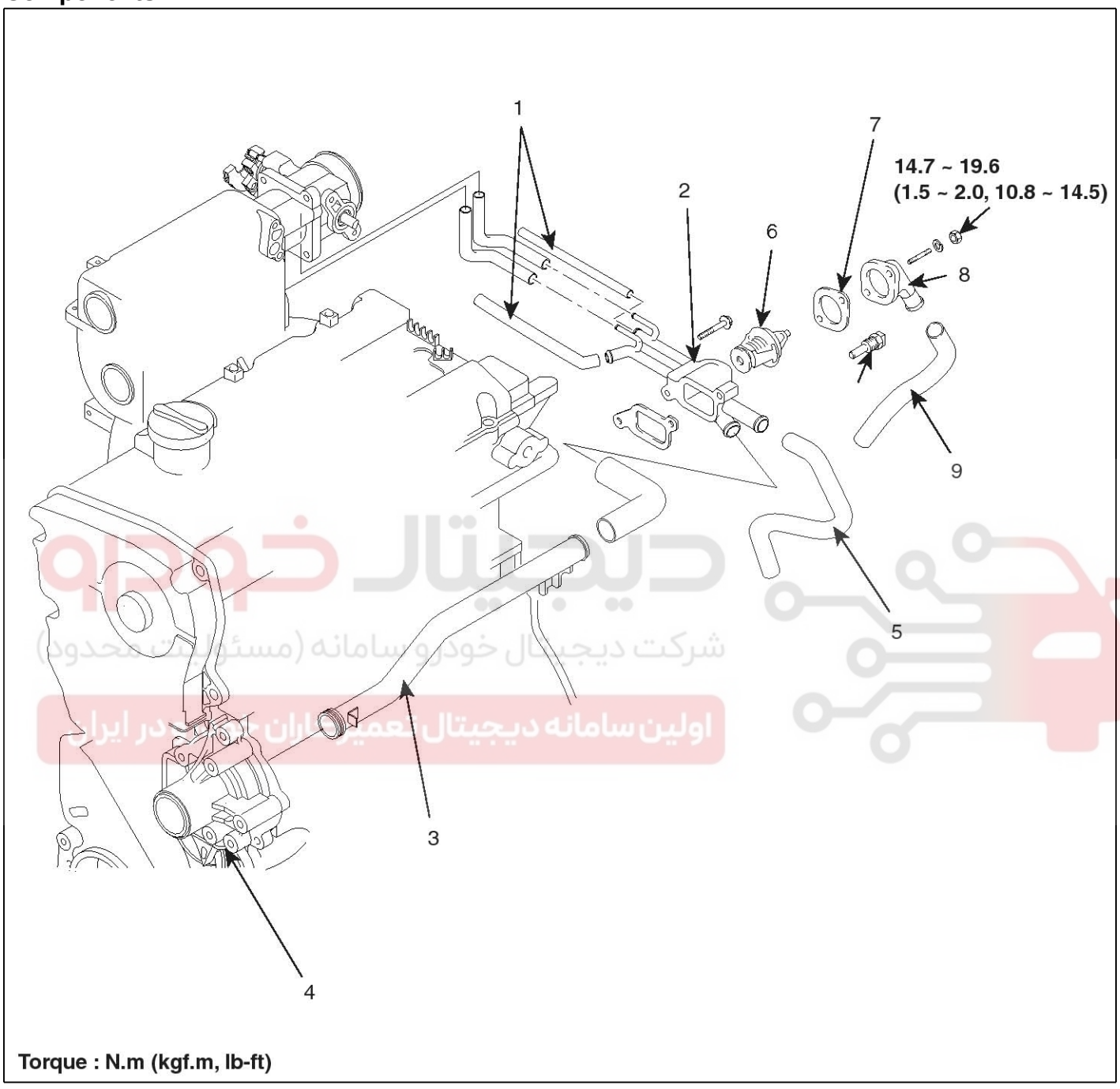
Tightening torque
117.7 ~ 127.5Nm (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)

24. M/T : Install flywheel.

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

Cooling System

Components



SFDM18015L

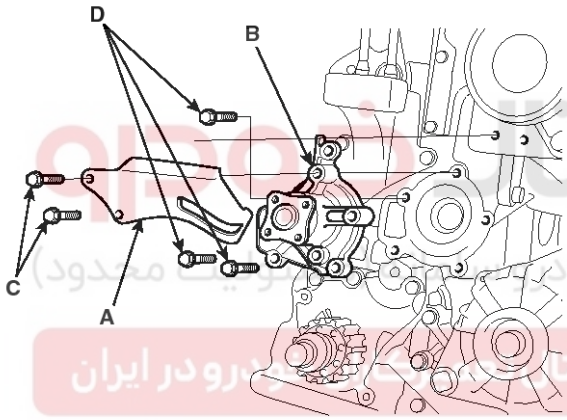
1. Heater hoses
2. Thermostat housing
3. Coolant inlet pipe
4. Water pump
5. Radiator upper hose
6. Thermostat
7. Gasket
8. Coolant inlet fitting
9. Radiator lower hose

Removal

Water Pump

1. Drain the engine coolant.

   WARNING
   System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.
2. Remove drive belts.
3. Remove the timing belt and the timing belt idler. (Refer to Timing system in this group)
4. Remove the water pump.
   1) Remove the 4 bolts and pump pulley.
   2) Remove the 2 bolts(C), then remove the alternator brace (A).
   3) Remove the water pump (B) and gasket.

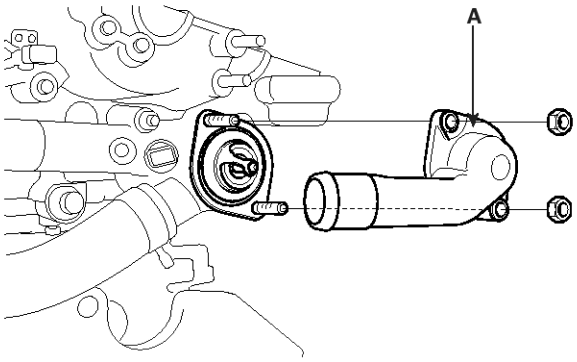


SFDM18003L

Thermostat

NOTICE
Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

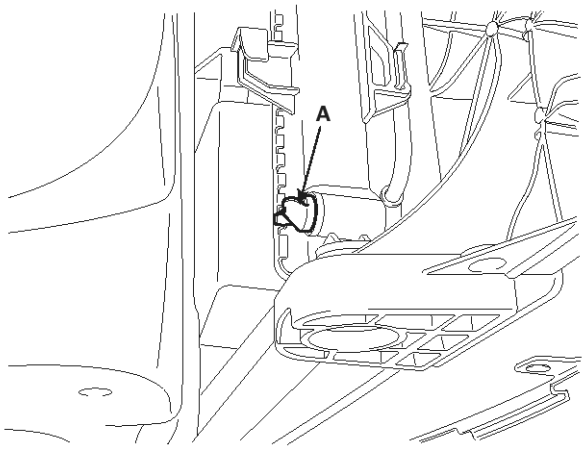
1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet (A), gasket and thermostat.



ECKD501B

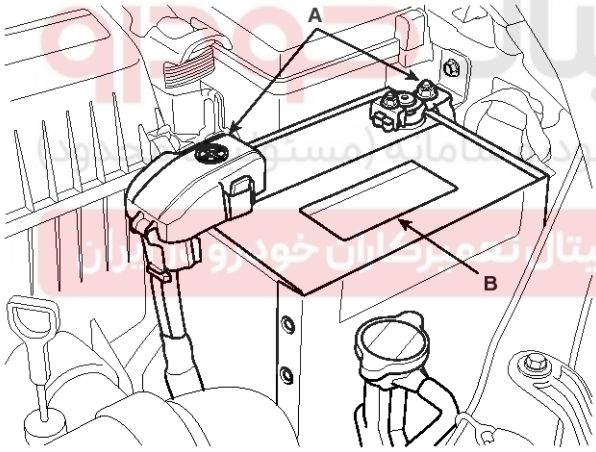
Radiator

1. Remove the radiator cap to speed draining.
2. Loosen the radiator drain plug (A) and drain engine coolant.



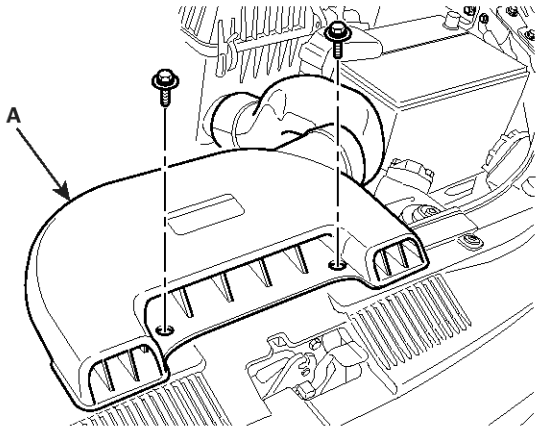
SEDM17003L

3. Disconnect the terminals(A) and remove the battery(B).



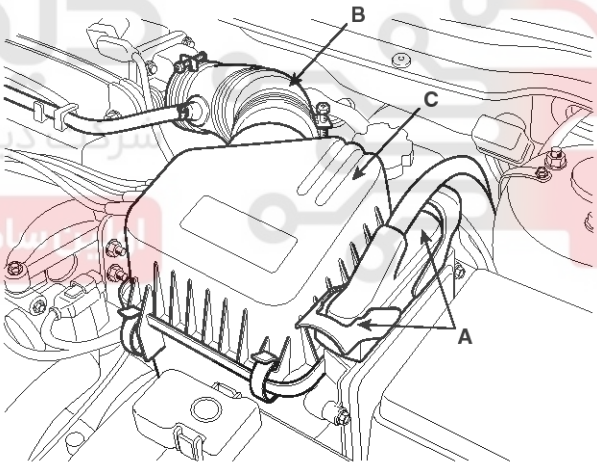
SHDM16004L

4. Remove the air duct (A).



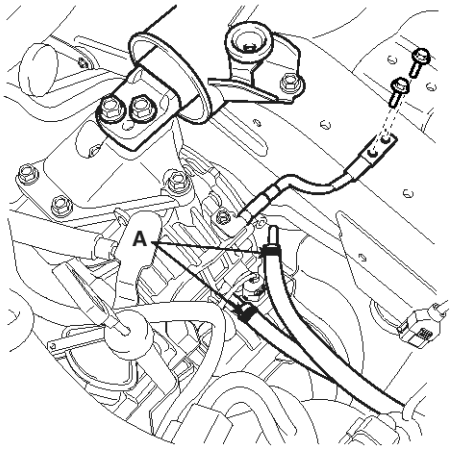
SFDM38001L

5. Remove the air cleaner assembly.
   1) Disconnect the power train module (PCM) connector (A).
   2) Disconnect the intake hose (B).
   3) Remove the air cleaner assembly (C).



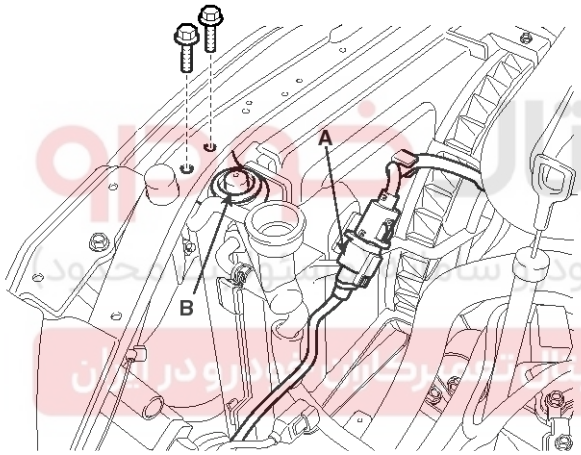
SEDM17004L

6. Disconnect the auto transaxle fluid (ATF) hose (A).



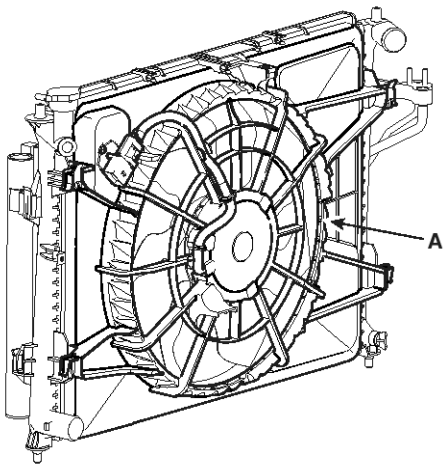
SEDM17006L

7. Disconnect the fan motor connector (A) and remove the radiator mounting bracket (B).



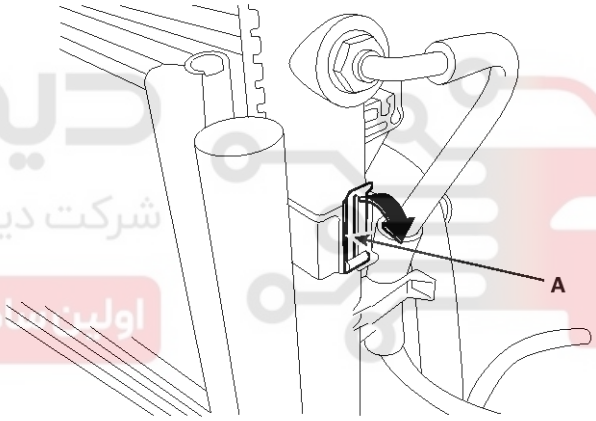
SEDM17011L

8. Remove the blower assembly(A).



SEDM17400L

9. After pulling back the condenser fixing bracket(A), remove the radiator assembly.

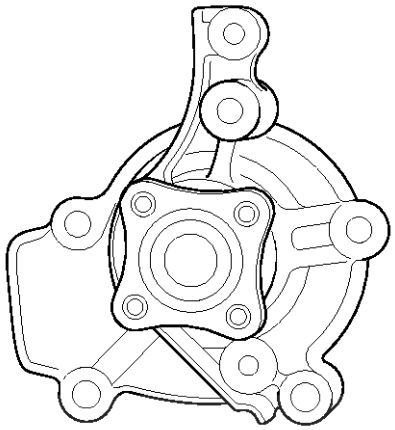


SHDEM6103D

Inspection

Water Pump

1. Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.



ECKD503A

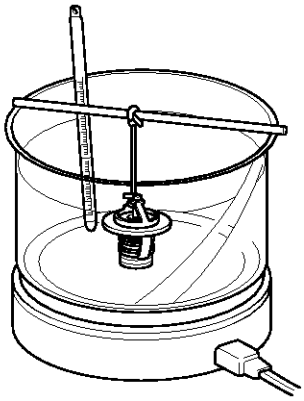
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly

NOTICE

A small amount of "weeping" from the bleed hole is normal.

Thermostat

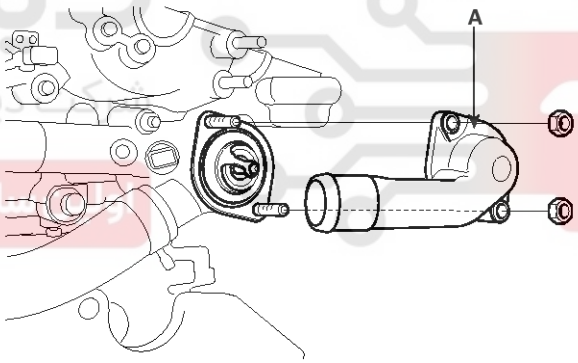
1. Immerse the thermostat in water and gradually heat the water.



ECKD503B

2. Check the valve opening temperature.

Valve opening temperature : 82 ˚C(177 ˚F)
Full opening temperature : 95 ˚C(205 ˚F)



ECKD501B

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

3. Check the valve lift.

Valve lift : 8mm(0.3in.) or more at 95 ˚C(205 ˚F)

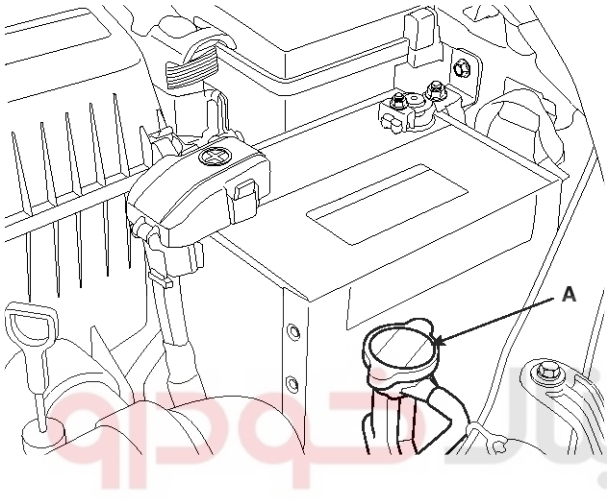
If the valve lift is not as specified, replace the thermostat.

Engine Coolant Refilling and Bleeding

CAUTION

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap (A).



SHDM16322L

3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Mix the recommended antifreeze with water at the ratio of five to five(coolant 5 : water 5) in a clean container.

   NOTICE

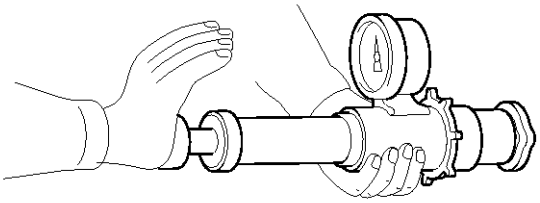
   - *Use only genuine antifreese/coolant.*
   - *For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.*
   - *Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.*

   CAUTION

   - **Do not mix different brands of antifreeze/coolants.**
   - **Do not use additional rust inhibitors or anti-rust products; they may not be compatible with the coolant.**
7. Pour coolant into the radiator up to base of the filler neck, and install the radiator cap loosely.
8. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).
9. Turn off the engine. Check the level in the radiator, add coolant if needed.
10. Put the radiatir cap on tightly, then run the engine again and check for leaks.

Cap Testing

1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.

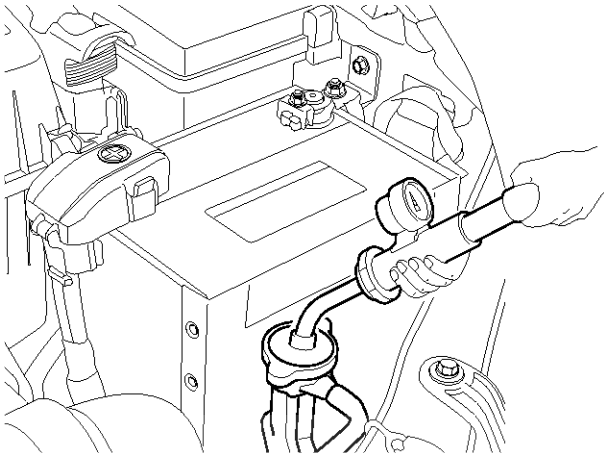


ECKD501X

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

Testing

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
2. Apply a pressure tester to the radiator and apply a pressure of 93.16 ~ 122.58kpa(0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)



SHDM16323L

3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTICE

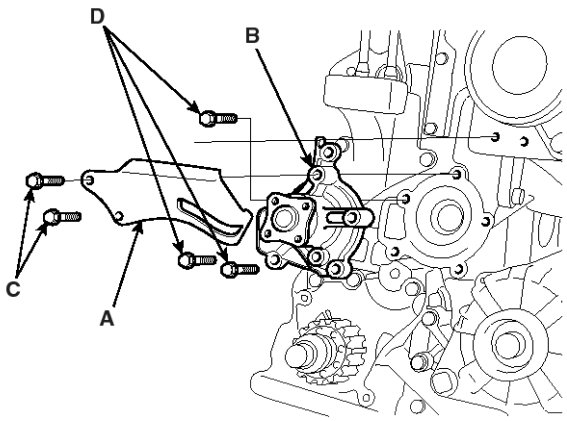
Check for engine oil in the coolant and/or coolant in the engine oil.

Installation

Water Pump

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

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



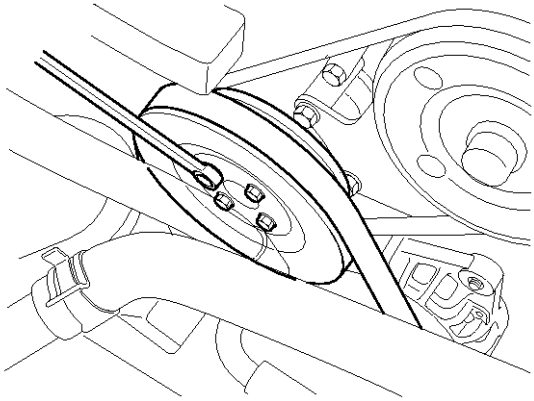
SFDM18003L

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

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

   3) Install the 4 bolts and pump pulley.

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

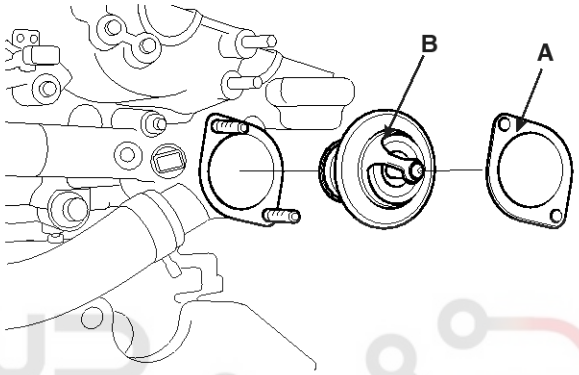


ECKD104B

2. Install the timing belt idler and the timing belt. (Refer to Timing system in this group)
3. Install drive belts.
4. Fill with engine coolant.
5. Start engine and check for leaks.
6. Recheck engine coolant level.

Thermostat

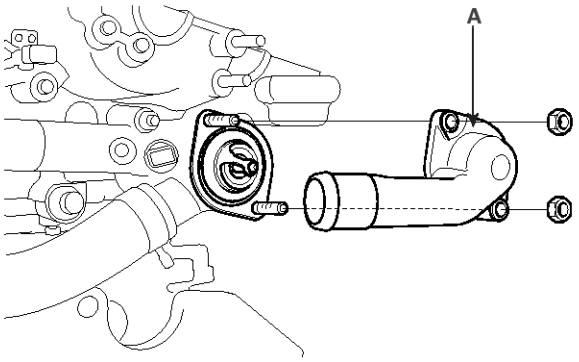
1. Place thermostat in thermostat housing.
   1) Install the thermostat with the jiggle valve upward.
   2) Install a new gasket (A) to the thermostat (B).



ECKD510A

2. Install water inlet (A).

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



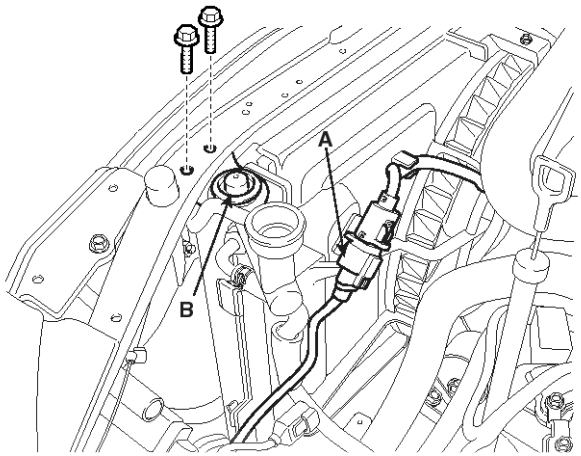
ECKD501B

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

Radiator

1. Install the radiator.
2. Connect the fan motor connector (A) and install the radiator mounting bracket (B).

Tightening torque
8.8 ~ 10.8Nm (0.9 ~ 1.1kgf.m, 6.5 ~ 7.9lb-ft)

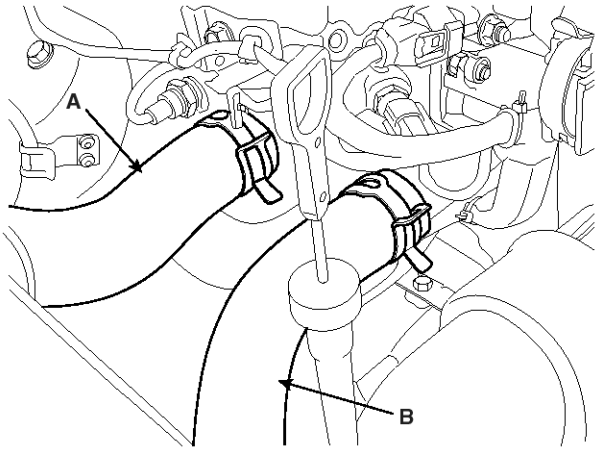


SEDM17011L

3. Connect the auto transaxle fluid (ATF) hoses (A).

SEDM17006L

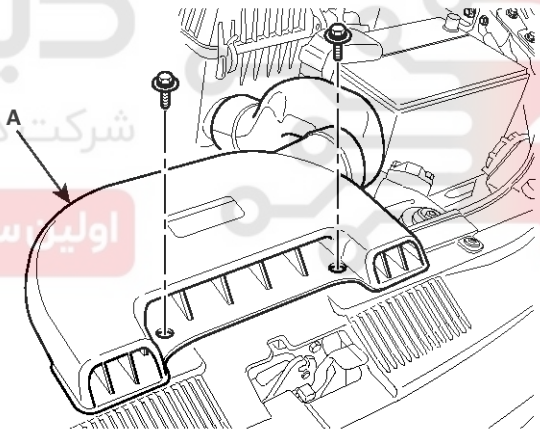
4. Install the upper radiator hose (A) and lower radiator hose (B).



SHDM16006L

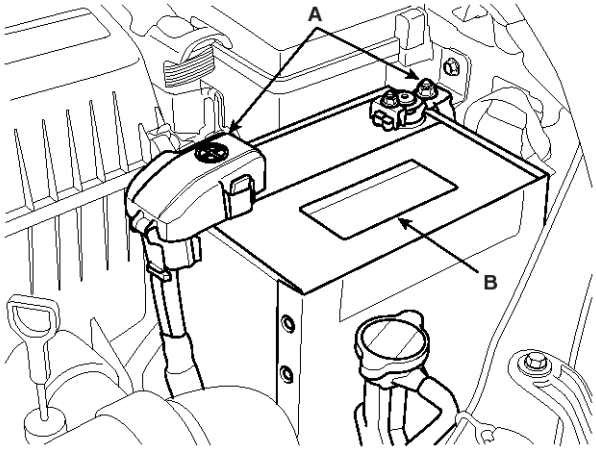
5. Install air cleaner assembly.
6. Install the air duct (A).

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



SFDM38001L

7. Install battery (B) and connect teminal (A).

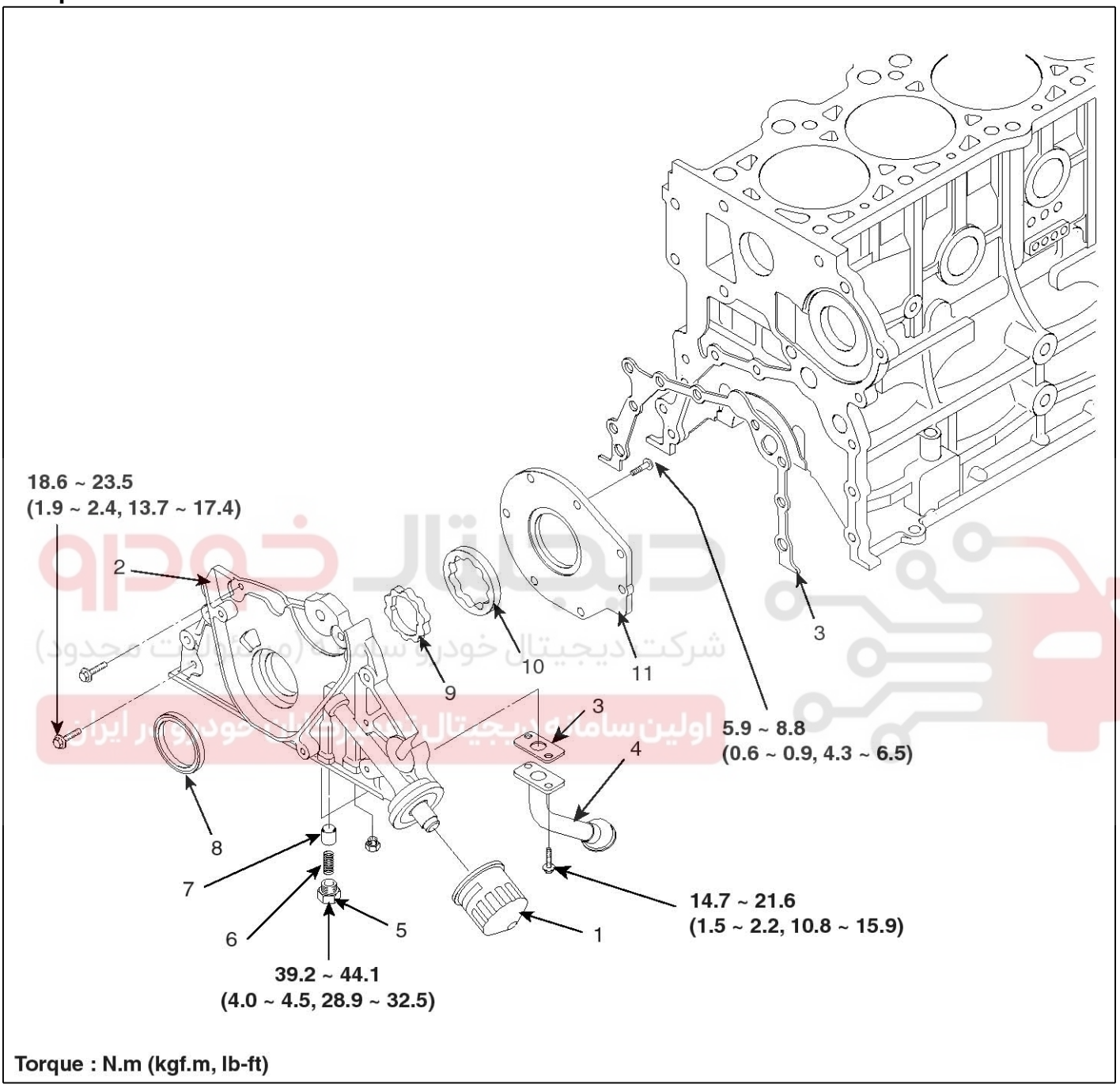


SHDM16004L

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

Lubrication System

Components

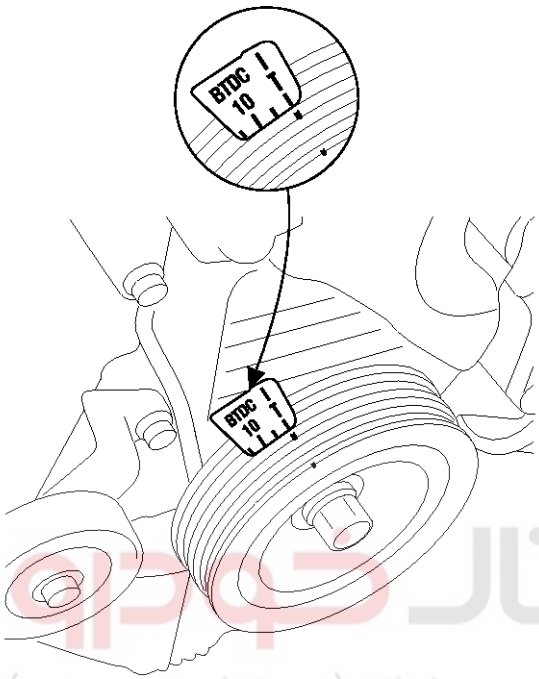


SFDM18016L

1. Filter
2. Front case
3. Gasket
4. Oil screen
5. Plug
6. Relief spring
7. Relief plunger
8. Oil seal
9. Inner rotor
10. Outer rotor
11. Pump cover

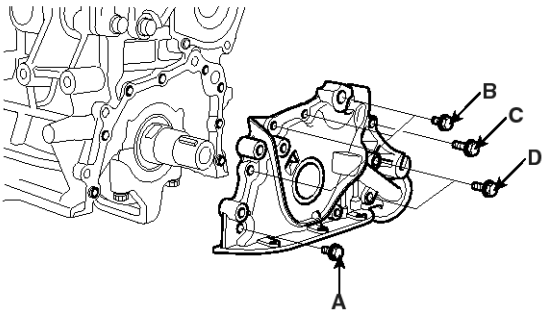
Removal

1. Drain engine oil.
2. Remove the drive belts.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.



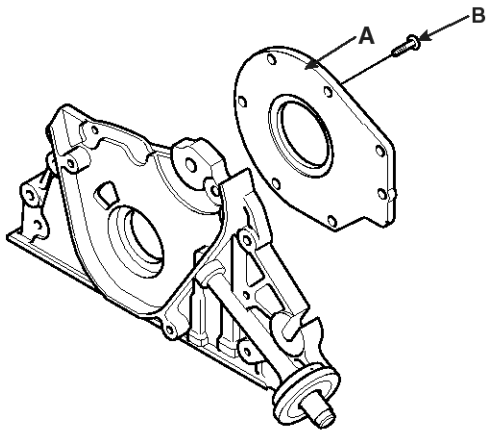
ECKD106A

4. Remove the timing belt. (Refer to Timing system in this group)
5. Remove the oil pan and oil screen.
6. Remove the front case.



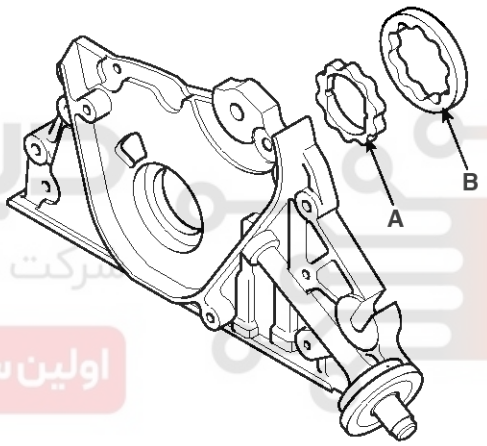
ECKD411A

1) Remove the screws (B) from the pump housing, then separate the housing and cover (A).



ECKD401A

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



ECKD402A

Oil And Filter

⚠CAUTION

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

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

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

   b. Fill with fresh engine oil

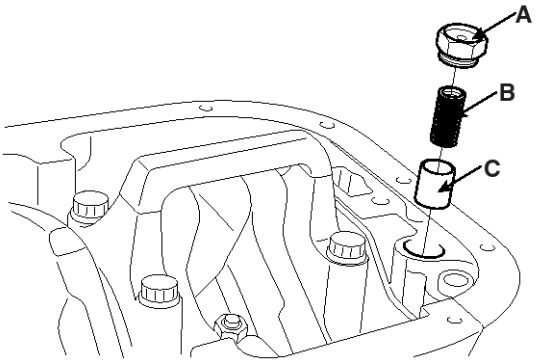
Capacity :
Total : 4.1L (4.33US qts, 3.60Imp qts)
Oil pan : 3.7L (3.91US qts, 3.26Imp qts)
Drain and refill including oil filter : 4.0L (4.23US qts, 3.25Imp qts)

   c. Install the oil filter cap.
4. Start engine and check for oil leaks.
5. Recheck engine oil level.

Disassembly

1. Remove the relief plunger.

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



ECKD403A

Inspection

1. Inspect relief plunger.

   Coat the valve with engine oil and check that it falls smoothly into the plunger hole by its own weight.

   If it does not, replace the relief plunger. If necessary, replace the front case.

2. Inspect relief valve spring.

   Inspect for distorted or broken relief valve spring.

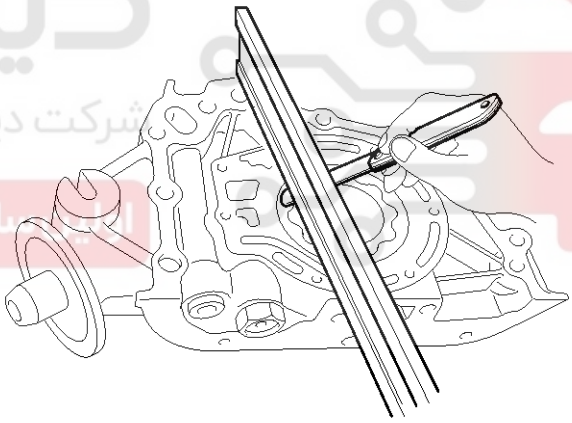
Standard value

Free height : 43.8mm (1.724 in.)
Load : 3.7kg/40.1mm (8.14 lb/1.579 in.)

3. Inspect rotor side clearance.

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

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



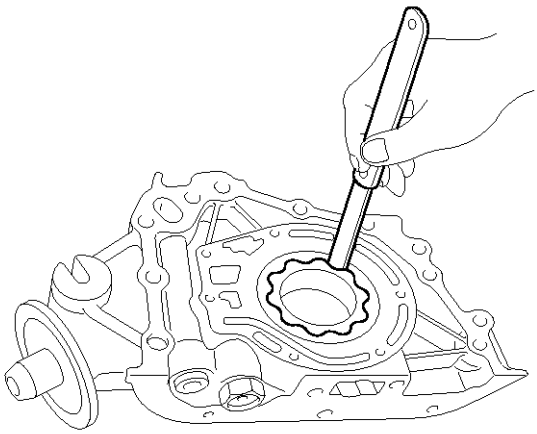
ECKD404A

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

4. Inspect rotor tip clearance.

   Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

Tip clearance
0.025 ~ 0.069 mm(0.0010 ~ 0.0027 in.)



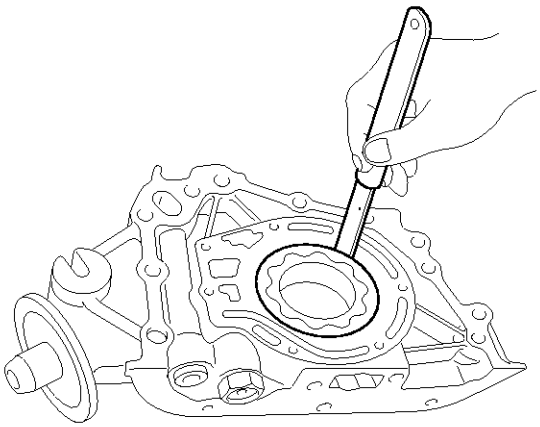
ECKD405A

If the tip clearance is greater than maximum, replace the rotor as a set.

5. Inspect rotor body clearance.

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

Body clearance
0.12 ~ 0.185 mm(0.0047 ~ 0.0073 in.)



ECKD406A

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

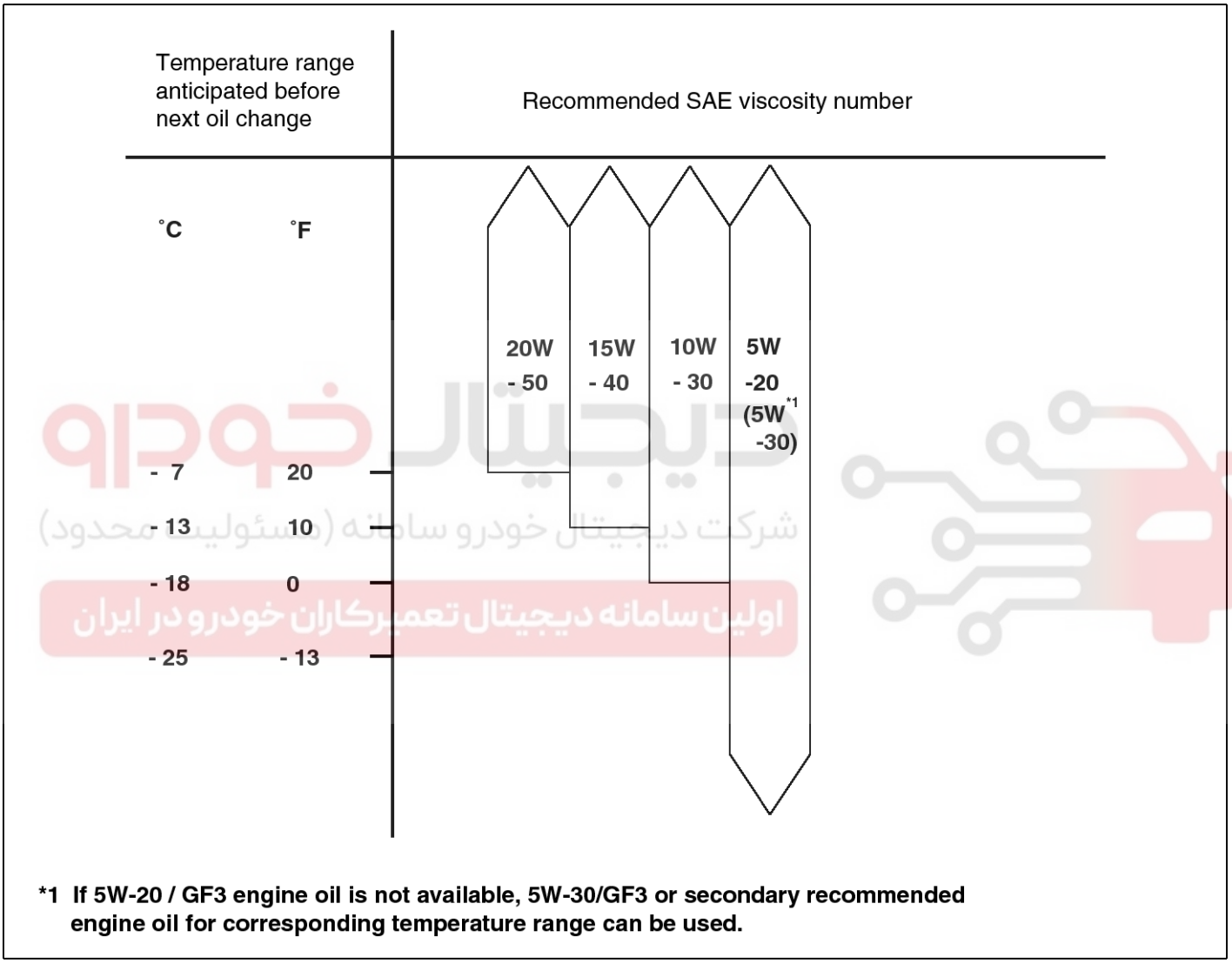
Selection Of Engine Oil

Recommendation (except Middle East) : 5W-20/GF4&SM (If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.)

API classification : SL, SM or above

ILSAC classification : GF3, GF4 or above

SAE viscosity grade : Refer to the recommended SAE viscosity number.



***1 If 5W-20 / GF3 engine oil is not available, 5W-30/GF3 or secondary recommended engine oil for corresponding temperature range can be used.**

SHDM16307L

NOTICE

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

1. *Satisfy the requirement of the API or ILSAC classification.*
2. *Have proper SAE grade number for expected ambient temperature range.*

Lubricants that do not have both an SAE grade number and API or ILSAC service classification on the container should not be used.

Engine Oil

1. Check engine oil quality.

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

   If the quality is visibly poor, replace the oil.

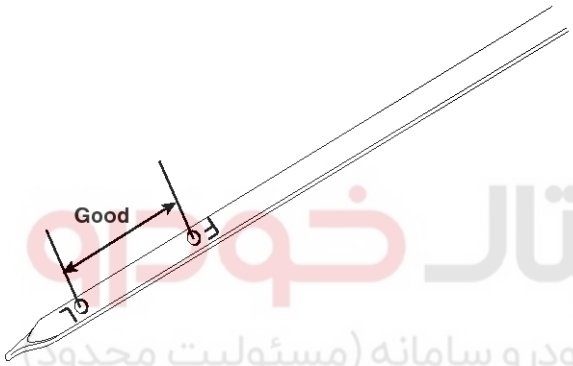
2. Check engine oil level.

   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the “L” and “F” marks on the dipstick.

   If low, check for leakage and add oil up to the “F” mark.

NOTICE

Do not fill with engine oil above the “F” mark.



SBLEM6027L

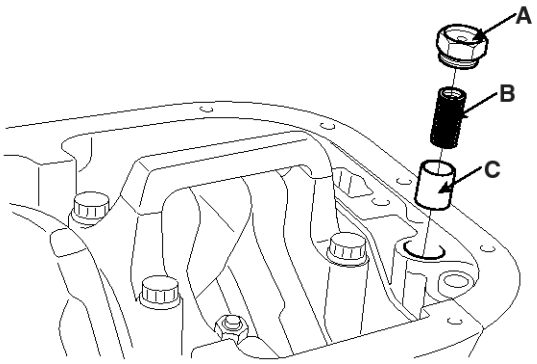
Reassembly

1. Install relief plunger.

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

Tightening torque

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

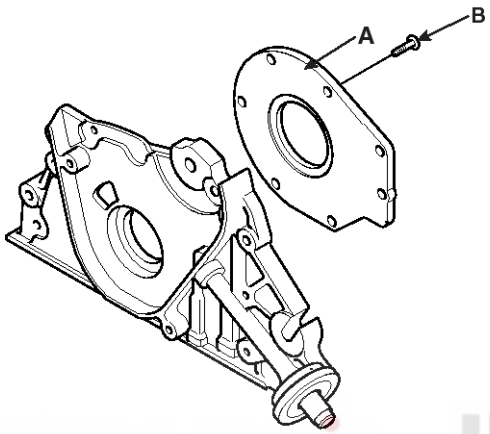


ECKD403A

Installation

1. Install oil pump.
   1) Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
   2) Install the oil pump cover (A) to front case with the 7 screws(B).

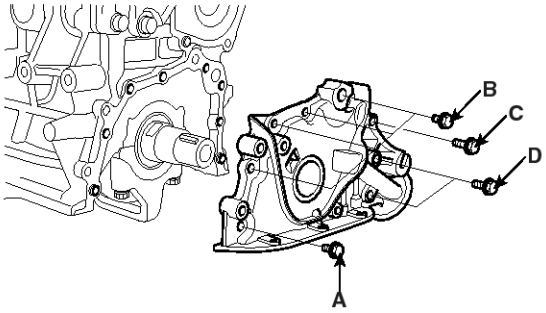
Tightenig torque
5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lb-ft)



ECKD401A

2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.

   Place a new front case gasket on the cylinder block. Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft. When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.

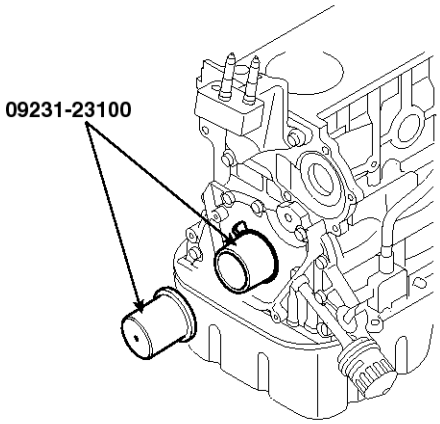


ECKD411A

Bolt length
(A) : 0.98 in (25mm)
(B) : 0.787 in (20mm)
(C) : 1.496 in (38mm)
(D) : 1.771 in (45mm)

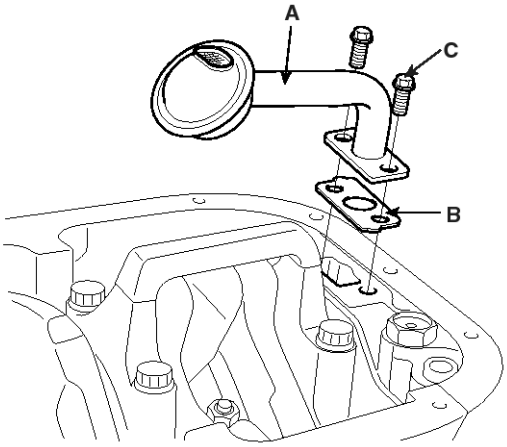
Tightening torque :
18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4 lb-ft)

4. Apply a light coat of oil to the seal lip.
5. Using the SST(09231-23100), install the oil seal.



SAMM19104N

6. Install the oil screen(A) with a new gasker (B).



ECKD305A

7. Install oil pan.
   1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

      NOTICE

      Check that the mating surfaces are clean and dry before applying liqued gasket.

   2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.
      Use liquid gasket 'TB 1217H' or equivalent.

      NOTICE

      - *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.*

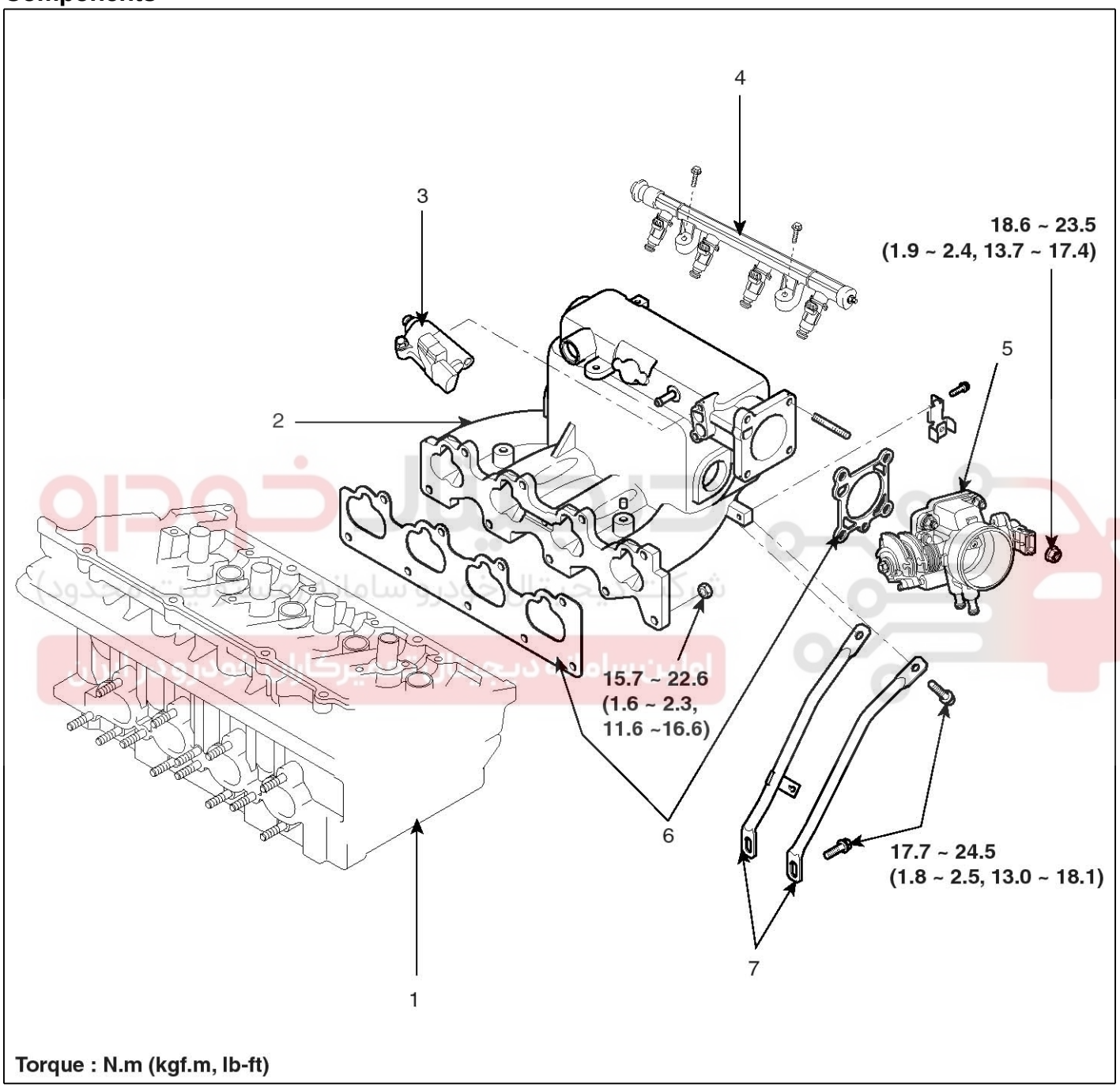
   3) Install the oil pan with the 19 bolts.
      Uniformly tighten the bolts in several passes.

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

Intake And Exhaust System

Intake Manifold

Components



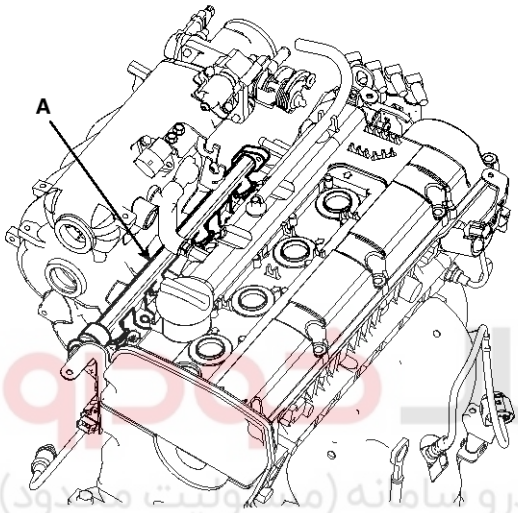
SFDM18017L

1. Cylinder head
2. Intake manifold
3. Idle speed actuator(ISA)
4. Delivery pipe assembly
5. Throttle body assembly
6. Gasket
7. Intake manifold stay

Removal

1. Removal the engine cover.
2. Disconnect the throttle position sensor(TPS) and the idle speed actuator(ISA) connectors.
3. Disconnect the positive crankcase ventilation(PCV) hose and the breather hose.
4. Disconnect the accelerator cable.
5. Remove the delivery pipe(A).

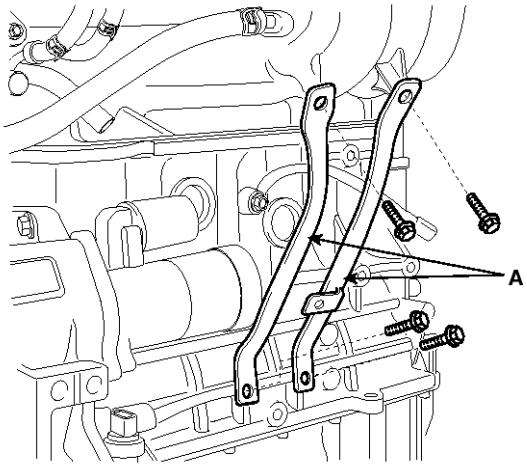
Tightening torque
18.6 ~ 23.5Nm (1.9 ~ 2.4kgf.m, 13.7 ~ 17.3lb-ft)



SHDM16303D

6. Disconnect the pulge control solenoid valve(PCSV) hose and the brake booster hose from the intake manifold and throttle body assembly.
7. Remove the intake manifold stay(A).

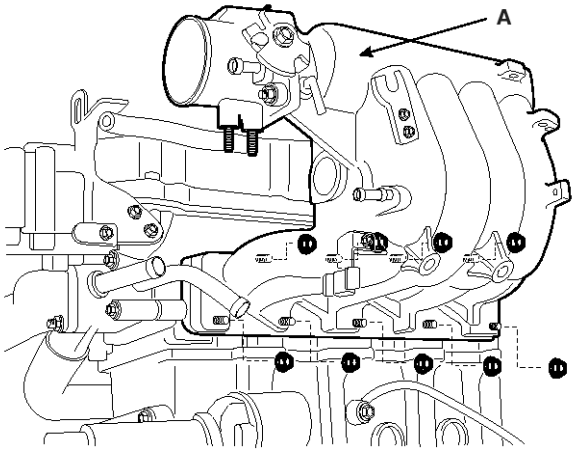
Tightening torque
17.7 ~ 24.5Nm (1.8 ~ 2.5kgf.m, 13.0 ~ 18.1lb-ft)



ACGE032A

8. Remove the intake manifold assembly(A).

Tightening torque
15.7 ~ 22.6Nm (1.6 ~ 2.3kgf.m, 11.6 ~ 16.6lb-ft)

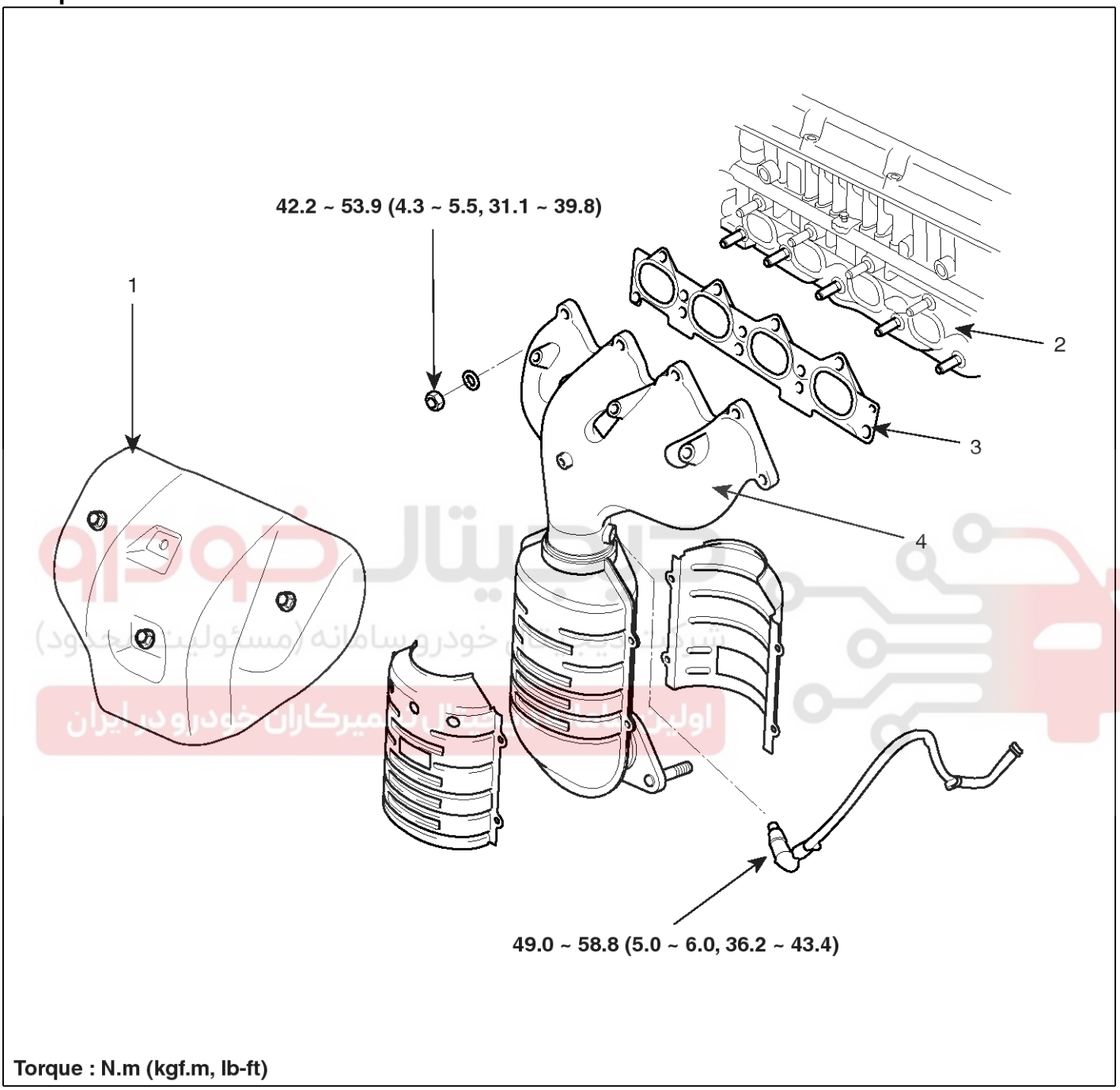


SHDM16215D

9. To install, reverse the removal procedure with new gaskets.

Exhaust Manifold

Components



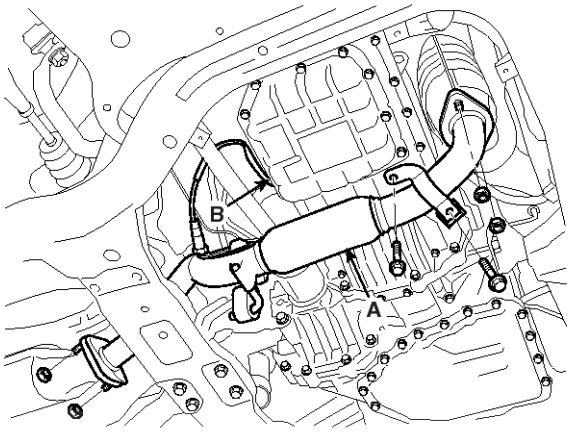
SFDM18018L

1. Heat protector
2. Cylinder Head
3. Gasket
4. Exhaust manifold
5. Front oxygen sensor

Removal

1. Remove the engine cover.
2. Disconnect the front oxygen sensor connector(B).
3. Remove the front muffler(A).

Tightening torque
39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



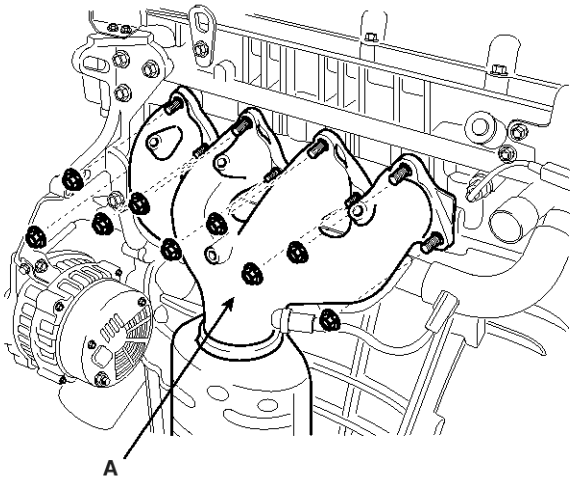
SFDM18002L

4. Remove the heat protector.

Tightening torque
16.7 ~ 21.5Nm (1.7 ~ 2.2kgf.m, 12.3 ~ 15.9lb-ft)

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

Tightening torque
42.1 ~ 53.9Nm (4.3 ~ 5.5kgf.m, 31.1 ~ 39.7lb-ft)



SHDM16216D

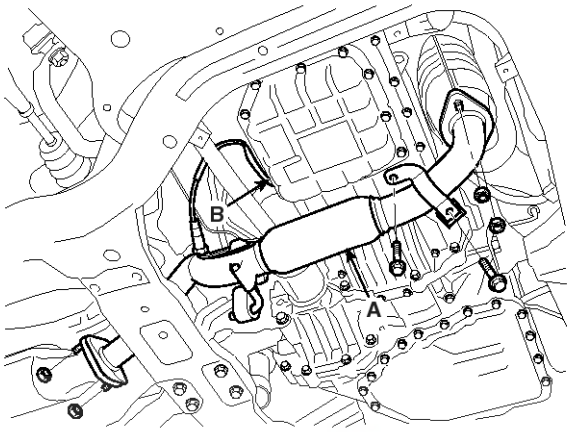
6. To install, reverse the removal procedure with new gasket.

Front Exhaust Pipe

Removal

1. Disconnect the front oxygen sensor connector(B).
2. Remove the front muffler(A).

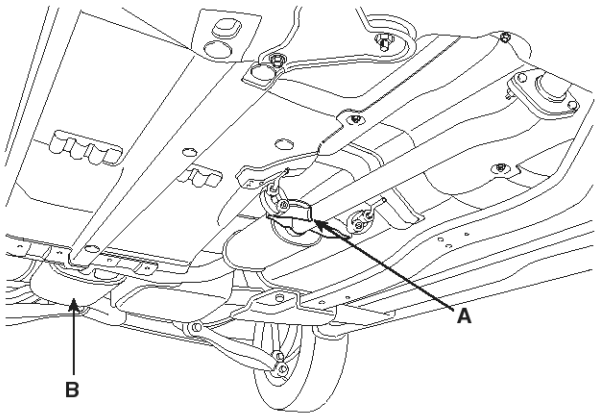
Tightening torque
39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



SFDM18002L

3. Remove the center muffler(A) and the main muffler(B).

Tightening torque
39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



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