General Information

GENERAL

SPECIFICATIONS

Description		Specifications (2.0 DOHC)	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		82mm (3.2283in)	
Stroke		93.5mm (3.6811in)	
Total displacement		1,975 cc (120.5 cu.in)	
Compression ratio		10.1 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens (ATDC)	11°	
	Closes (ABDC)	59°	
Exhaust valve	Opens (BBDC)	42°	
	Closes (ATDC)	6°	
Cylinder head			
Flatness of gasket surface		Less than 0.03mm (0.0012in)	0.06mm (0.0024in)
Flatness of manifold mounting surface	Intake	Less than 0.15mm (0.0059in)	0.30mm (0.0118in)
	Exhaust	Less than 0.15mm (0.0059in)	0.30mm (0.0118in)
Valve guide hole diameter (Intake, Exhaut)	STD	11.000 ~ 11.018mm (0.4331 ~ 0.4338in)	
	0.05 OS	11.050 ~ 11.068mm (0.4350 ~ 0.4357in)	
	0.25 OS	11.250 ~ 11.268mm (0.4429 ~ 0.4436in)	
	0.50 OS	11.500 ~ 11.518mm (0.4528 ~ 0.4535in)	
Intake valve seat ring hole diameter	STD	33.000 ~ 33.025mm (1.2992 ~ 1.3002in)	
	0.3 OS	33.300 ~ 33.325mm (1.3110 ~ 1.3120in)	
	0.6 OS	33.600 ~ 33.625mm (1.3228 ~ 1.3238in)	
Exhaust valve seat rin-g hole diameter	STD	28.500 ~ 28.521mm (1.1220 ~ 1.1229in)	
	0.3 OS	28.800 ~ 28.821mm (1.1339 ~ 1.1347in)	
	0.6 OS	29.100 ~ 29.121mm (1.1457 ~ 1.1465in)	
Camshaft			
Cam height (With CVVT)	Intake	44.518 ~ 44.718mm (1.7527 ~ 1.7605in)	
	Exhaust	44.418 ~ 44.618mm (1.7487 ~ 1.7566in)	
Cam height (Without CVVT)	Intake	44.720mm ~ 44.920mm (1.7606 ~ 1.7685in)	
	Exhaust	44.620mm ~ 44.820mm (1.7567 ~ 1.7646in)	

Description		Specifications (2.0 DOHC)	Limit
Journal outer Diameter (Intake, Exhaust)		27.964 ~ 27.980mm (1.1009 ~ 1.1016in)	
Bearing oil clearance		0.02 ~ 0.061mm (0.0008 ~ 0.0024in)	0.1mm (0.0039in)
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)	
Valve			
Valve length	Intake	114.34mm (4.5016in)	
	Exhaust	116.8mm (4.5984in)	
Stem outer diameter	Intake	5.965 ~ 5.980mm (0.2348 ~ 0.2354in)	
	Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in)	
Face angle		45˚ ~ 45˚ 30'	
Thickness of Valve head (margin)	Intake	1.15mm (0.0453in)	0.8mm (0.0315in)
	Exhaust	1.35mm (0.0531in)	1.0mm (0.0394in)
Valve stem to Valve guide clearance	Intake	0.020 ~ 0.050mm (0.0008 ~ 0.0020in)	0.10mm (0.0039in)
	Exhaust	0.035 ~ 0.065mm (0.0014 ~ 0.0026in)	0.13mm (0.0051in)
Valve guide			
Length	Intake	45.8 ~ 46.2mm (1.8031 ~ 1.8189in)	
	Exhaust	54.3 ~ 54.6mm (2.1378 ~ 2.1496in)	
Valve seat			
Width of seat contact	Intake	1.1 ~ 1.5mm (0.0433 ~ 0.0591in)	
	Exhaust	1.3 ~ 1.7mm (0.0512 ~ 0.0669in)	
Seat angle	Intake	45˚ ~ 45˚ 30'	
	Exhaust	45˚ ~ 45˚ 30'	
Valve spring			
Free length		48.86mm (1.9236in)	
Load		18.8±0.9kg/39.0mm(41.4±2.0 lb/1.5354in)	
		41.0±1.5kg/30.5mm(90.4±3.3 lb/1.2008in)	
Out of squareness		Less than 1.5˚	3˚
Valve clearance			
Cold (20℃ ± 5℃) (68˚F ± 9˚F)	Intake	0.20mm (0.0079in)	0.12~0.28mm (0.0047~0.0110in)
	Exhaust	0.28mm (0.0110in)	0.20~0.38mm (0.0079~0.0150in)
Cylinder block			
Cylinder bore		82.00 ~ 82.03mm (3.2283 ~ 3.2295in)	
Flatness of gasket surface		Total : Less than 0.05mm (0.0020in) Bore to bore : Less than 0.03mm (0.0012in)	
Piston			

Description		Specifications (2.0 DOHC)	Limit
Piston outer diameter		81.970 ~ 82.000mm (3.2272 ~ 3.2283in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	
	Oil ring groove	2.51 ~ 2.53mm (0.0988 ~ 0.0996in)	
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1mm (0.0039in)
	No. 2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1mm (0.0039in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	0.2mm (0.0079in)
End gap	No. 1 ring	0..23 ~ 0.38mm (0.0091 ~ 0.0150in)	1.0mm (0.0394in)
	No. 2 ring	0.33 ~ 0.48mm (0.0130 ~ 0.0189in)	1.0mm (0.0394in)
	Oil ring	0.20 ~ 0.60mm (0.0079 ~ 0.0236in)	1.0mm (0.0394in)
Piston pin			
Piston pin outer diameter		20.001 ~ 20.006mm (0.7874 ~ 0.7876in)	
Piston pin hole inner diameter		20.016 ~ 20.021mm (0.7880 ~ 0.7882in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		19.974 ~ 19.985mm (0.7864 ~ 0.7868in)	
Connecting rod small end hole clearance		-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)	
Piston pin press-in load		350~1,350 kg (772~2,976 lb)	
Connecting rod			
Connecting rod big end inner diameter		48.000 ~ 48.018mm (1.8898 ~ 1.8905in)	
Connecting rod bearing oil clearance		0.024 ~ 0.044mm (0.0009 ~ 0.0017in)	
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.4mm (0.0157in)
Crankshaft			
Main journal outer diameter		56.942 ~ 56.962mm (2.2418 ~ 2.2426in)	
Pin journal outer diameter		44.946 ~ 44.966mm (1.7695 ~ 1.7703in)	
Main bearing oil clearance		0.028 ~ 0.048mm (0.0011 ~ 0.0019in)	0.1mm (0.0039in)
End play		0.06 ~ 0.260mm (0.0024 ~ 0.0102in)	0.3mm (0.0118in)
Flywheel			
Runout		0.1mm (0.0039in)	0.13mm (0.0051in)
Oil pump			
Side clearance	Inner rotor	0.040 ~ 0.085mm (0.0016 ~ 0.0033in)	
	Outer rotor	0.040 ~ 0.090mm (0.0016 ~ 0.0035in)	
Body clearance		0.120 ~ 0.185mm (0.0047 ~ 0.0073in)	

Description		Specifications (2.0 DOHC)	Limit
Relief valve opening pressure		490±49.0kpa (5±0.5kg/cm², 71±7.1psi)	
Relief spring	Free length	43.8mm (1.7244in)	
	Load	3.7±0.4kg/40.1mm (8.2±0.9 lb/1.5787in) 9.7±0.4kg/34.3mm (21.4±0.9 lb/1.3504in)	
Engine oil			
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)
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		6.0 L (6.34 US qt, 5.28 Imp qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82±1.5℃(179.6±2.7°F)	
	Pull opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm², 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20℃ (68°F)	2.45±0.14 kΩ	
	80℃ (176°F)	0.3222 kΩ	

TIGHTENING TORQUE

Item	Quantity	Tightening torque		
		N.m	kgf.m	lbf.ft
Cylinder block				
Engine support (front) bracket bolt	3	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Engine support (rear) bracket bolt	2	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Engine support bracket stay plate bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Engine mounting				
Engine mounting bracket and body fixing bolt	3	49.0 ~63.7	5.0 ~6.5	36.2.9 ~47.0
Engine mounting insulator and engine mounting support bracket fixing nut	1	58.8 ~78.5	6.0 ~8.0	43.4 ~57.9
Engine mounting support bracket and engine support bracket fixing bolt	1	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Engine mounting support bracket and engine support bracket fixing nut	2	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Transaxle mounting bracket and body fixing bolt	4	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Transaxle mounting insulator and transaxle support bracket fixing bolt	1	88.3 ~107.9	9.0 ~11.0	65.1 ~79.6
Front roll stopper bracket and sub frame fixing bolt	3	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Front roll stopper insulator and front roll stopper support bracket fixing bolt,nut	1	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Rear roll stopper bracket and sub frame fixing bolt	3	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Rear roll stopper insulator and rear roll stopper support bracket fixing bolt,nut	1	49.0 ~63.7	5.0 ~6.5	36.2 ~47.0
Main moving system				
Connecting rod cap nut	8	49.0 ~52.0	5.0 ~5.3	36.2 ~38.3
Crankshaft main bearing cap bolt	10	(27.5~31.4) + (60° ~64°)	(2.8~3.2) + (60°~ 64°)	(20.3~23.1) + (60° ~64°)
Flywheel bolt (M/T)	6	117.7 ~127.5	12.0 ~13.0	86.8 ~94.0
Drive plate bolt (A/T)	6	117.7 ~127.5	12.0 ~13.0	86.8 ~94.0
Timing belt				
Timing belt upper cover bolt	4	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
Timing belt lower cover bolt	5	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
Timing belt under cover bolt	3	9.8 ~11.8	1.0 ~1.2	7.2 ~8.7
Crankshaft pulley bolt	1	166.7 ~176.5	17.0 ~18.0	123.0 ~130.2
Camshaft sprocket bolt	1	98.1 ~117.7	10.0 ~12.0	72.3 ~86.8

Item	Quantity	Tightening torque		
		N.m	kgf.m	lbf.ft
Timing belt auto tensioner bolt	1	22.6 ~28.4	2.3 ~2.9	16.6 ~21.0
Timing belt idler bolt	1	42.2 ~53.9	4.3 ~5.5	31.1 ~39.8
Cylinder head				
Engine cover bolt	5	3.9 ~5.9	0.4 ~0.6	2.9 ~4.3
Cylinder head cover bolt	12	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
Camshaft bearing cap bolt	22	13.7 ~14.7	1.4 ~1.5	10.1 ~10.8
Exhaust camshaft and CVVT assembly fixing bolt	1	64.7 ~76.5	6.6 ~7.8	47.7 ~56.4
Timing chain auto tensioner bolt	2	7.8 ~9.8	0.8 ~1.0	5.8 ~7.2
OCV(oil control valve) bolt	1	9.8 ~11.8	1.0 ~1.2	7.2 ~8.7
OCV(oil control valve) filter	1	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
Cylinder head bolt (10 X 99)	8	(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 bolt (12 X 151)	2	(27.5~31.4) + (60° ~65°) + (60°~65°)	(2.8~3.2) + (60°~ 65°) + (60°~65°)	(20.3~33.1) + (60° ~65°) + (60°~65°)
Cooling system				
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (8 X 20)	1	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump bolt (8 X 35)	2	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump and alternator brace fixing bolt (8 X 45)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Alternator brace and cylinder block fixing bolt	2	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Thermostat housing bolt	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Thermostat housing nut	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water temperature sensor	1	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Water inlet fitting nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Front case bolt (8 X 20)	4	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 25)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 38)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Front case bolt (8 X 45)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pan bolt (6 X 16)	15	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (6 X 50)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (6 X 118)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

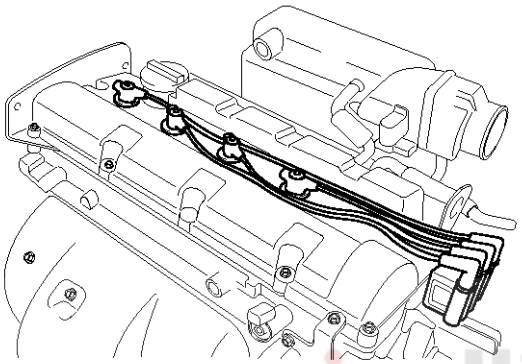
Item	Quantity	Tightening torque		
		N.m	kgf.m	lbf.ft
Oil pan and transaxle fixing bolt	3	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oil pan drain bolt	1	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Oil screen bolt	2	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Intake and exhaust system				
Intake manifold and cylinder head fixing nut	9	15.7 ~ 22.6	1.6 ~ 2.3	11.6 ~ 16.6
Intake manifold stay bolt	4	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold and cylinder head fixing nut	9	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
O2 sensor to exhaust manifold	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Exhaust manifold heat cover and exhaust manifold fixing bolt	4	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Air cleaner assembly fixing bolt	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Throttle body and surge tank fixing bolt	4	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Exhaust manifold and front muffler fixing bolt	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Front muffler fixing clip bolt	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front muffler and center muffler fixing nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Center muffler and main muffler fixing nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

COMPRESSION PRESSURE INSPECTION

NOTICE

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

1. Start the engine and allow to warm up to operating temperature (about five minutes). Stop the engine.
2. Disconnect the ignition coil connectors and the spark plug cables.



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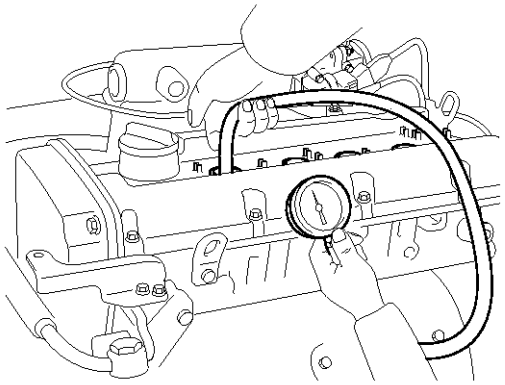
3. Remove the four spark plugs using a 16mm spark plug wrench.
4. Check the cylinder compression pressure.
   1) Insert a compression gauge into the spark plug hole.



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   2) Fully open the throttle.
   3) While cranking the engine, measure the compression pressure.

      NOTICE

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

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

      NOTICE

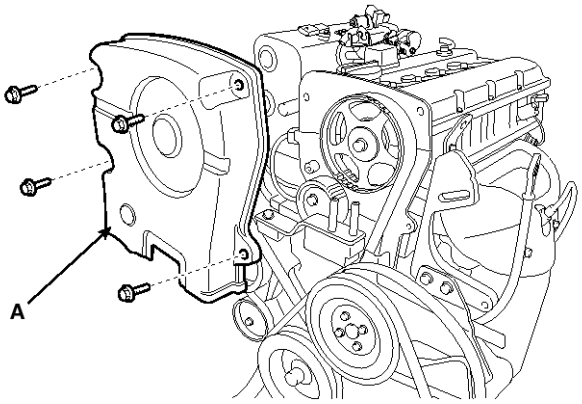
      This measurement must be done in as short a time as possible.

Compression pressure :
1,422kPa (14.5kg/cm², 206psi) (250~400 rpm)
Minimum pressure :
1,275kPa (13.0kg/cm², 185psi)
Difference between each cylinder :
98kPa (1.0kg/cm², 14psi) or less

   5) If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step (1) through (3) for cylinders with low compression.
      - 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 the spark plugs.
6. Connect the ignition coil connectors and the spark plug cables.

Timing Belt Tension Adjustment

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



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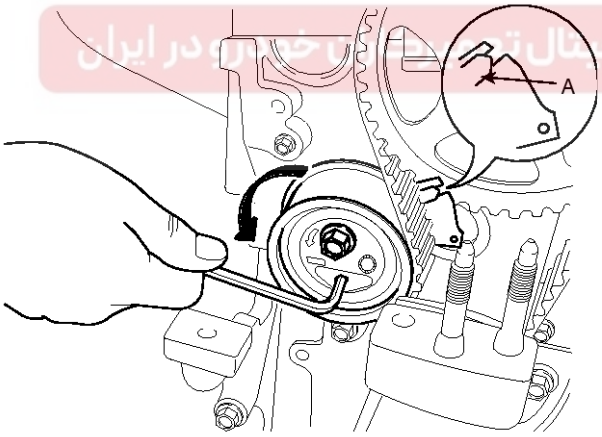
3. Slacker the tensioner bolt.

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)

4. 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.

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

Tightening torque

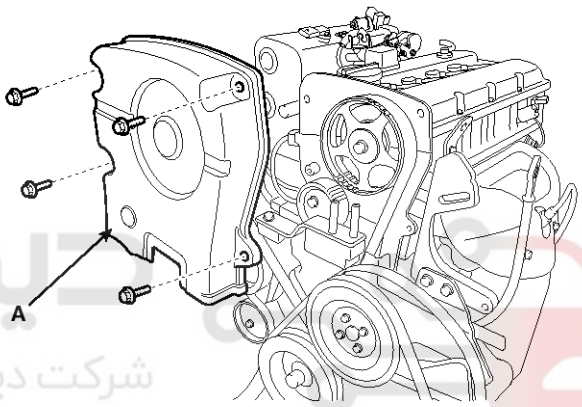
Tensioner bolt :

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

6. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
7. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
8. 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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9. Install RH front wheel.

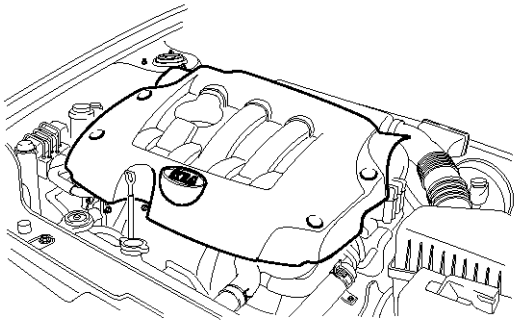
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

MLA(MECHNICAL LASH ADJUSTER)

NOTICE

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : (20℃ ± 5℃ [68℉ ± 9℉]) and cylinder head is installed on cylinder block.

1. Remove the engine cover.



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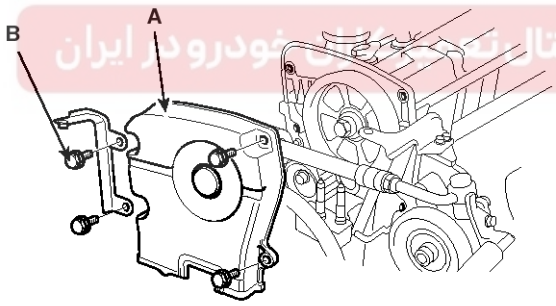
2. Remove the bolts(B) and timing belt upper cover(A).



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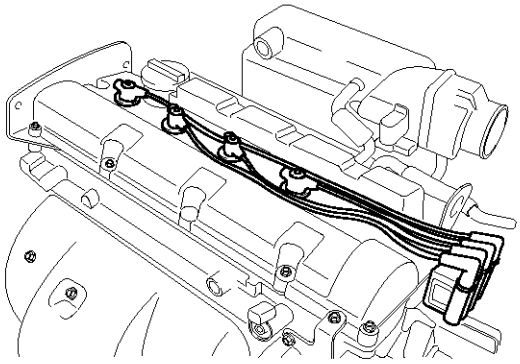
3. Remove the cylinder head cover.
   1) Disconnect the spark plug cables and do not pull on the cable by force.

      NOTICE

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



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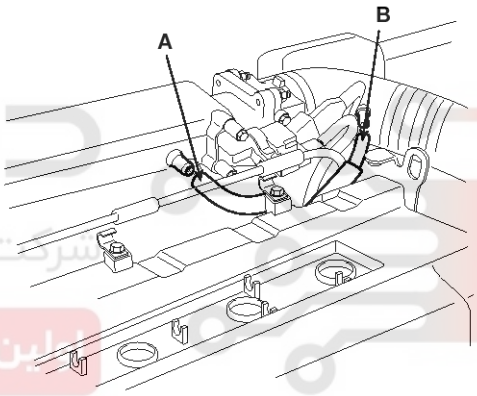
   2) Remove the PCV (Positive Crankcase Ventilation) hose(A) and the breather hose(B) from the cylinder head cover.



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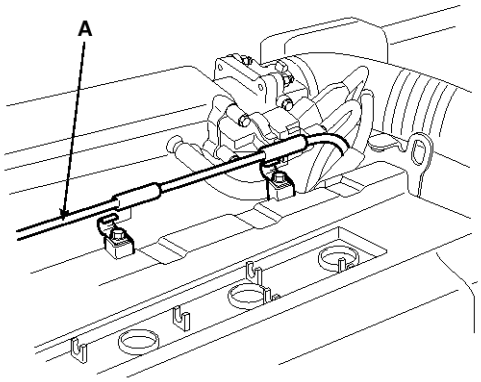
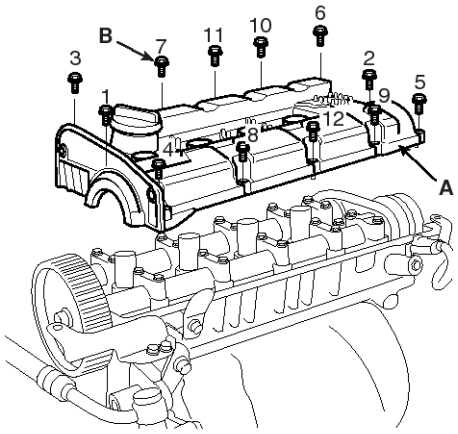
   3) Remove the accelerator cable(A) from the cylinder head cover.



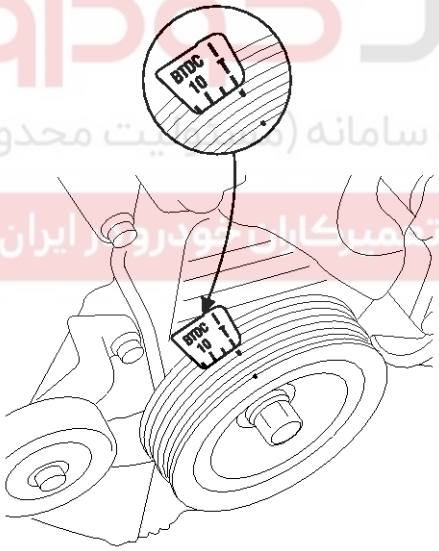
BCGE033A

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



ADIE002A

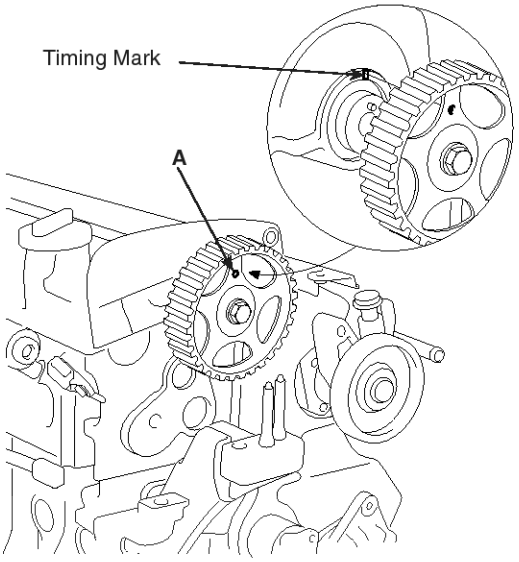
4. Set No. 1 cylinder to TDC/compression.
   1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



ECKD106A

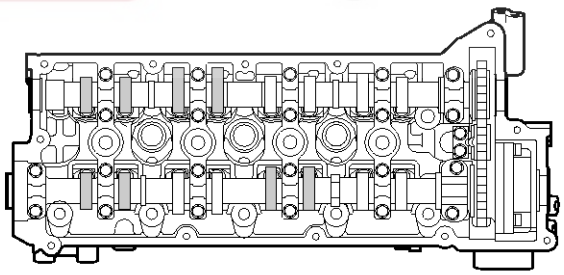
2) Check that the hole of the camshaft timing pulley(A) is aligned with the timing mark of the bearing cap.

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



BCGE001A

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



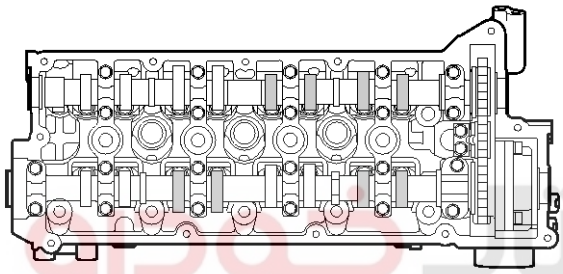
EDKD888B

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

Valve clearance

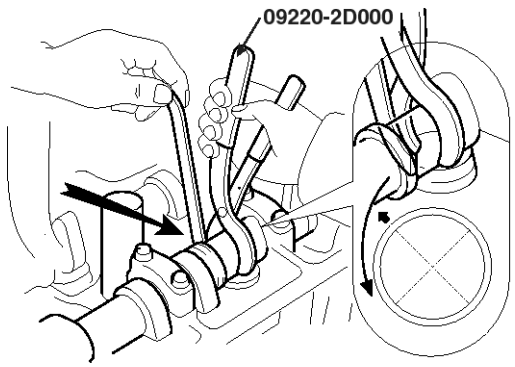
[Specification]
Engine coolant temperature : (20℃ ± 5℃[68°F ± 9°F])
Intake : 0.20mm (0.0079in)
Exhaust : 0.28mm (0.0110in)
[Limit]
Intake : 0.12 ~ 0.28mm (0.0047 ~ 0.0110in)
Exhaust : 0.20 ~ 0.38mm (0.0079 ~ 0.0150in)

2) Turn the crankshaft pulley one revolution (360°) and align the groove with the timing mark "T" of lower timing belt cover.
3) Check only valves indicated as shown. [No. 4 cylinder : TDC/compression]. Measure the valve clearance. (See procedure step (1))



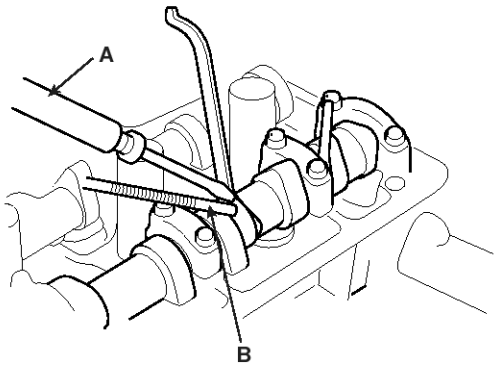
EDKD888C

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.



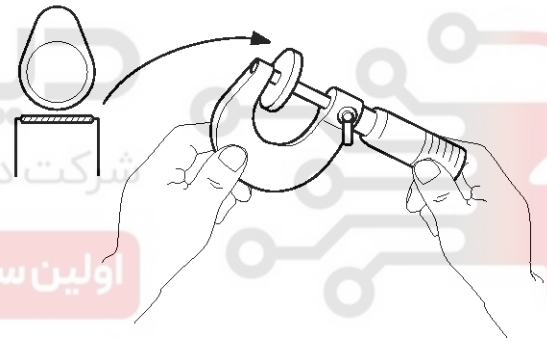
EDKB889B

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



EDKB889C

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



EDKB889D

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

Valve clearance
(Engine coolant temperature : 20℃ ± 5℃[68°F ± 9°F])
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)]

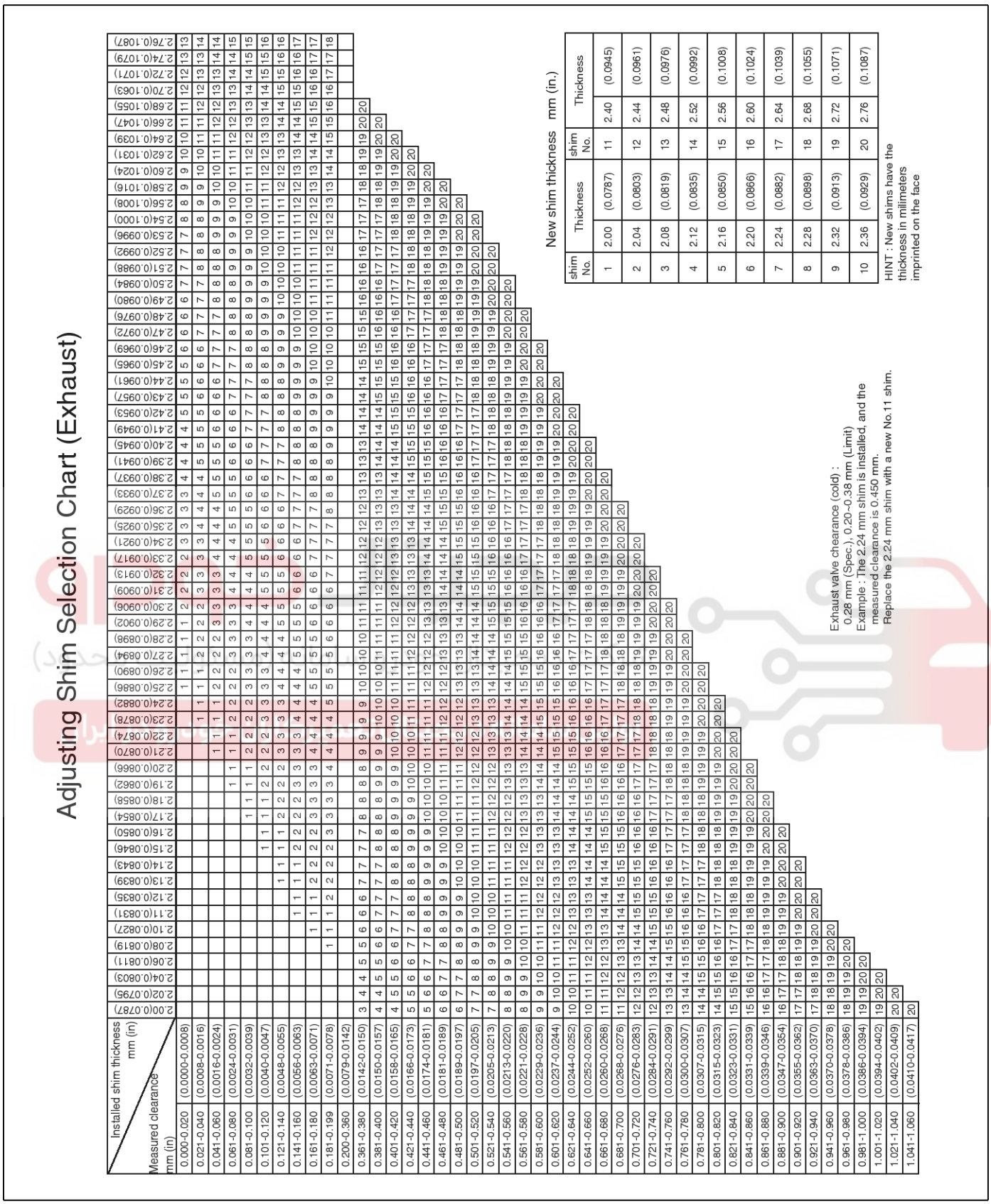
6) Select a new shim with a thickness as close as possible to the calculated value. (Refer to the Adjusting shim selection chart)

NOTICE

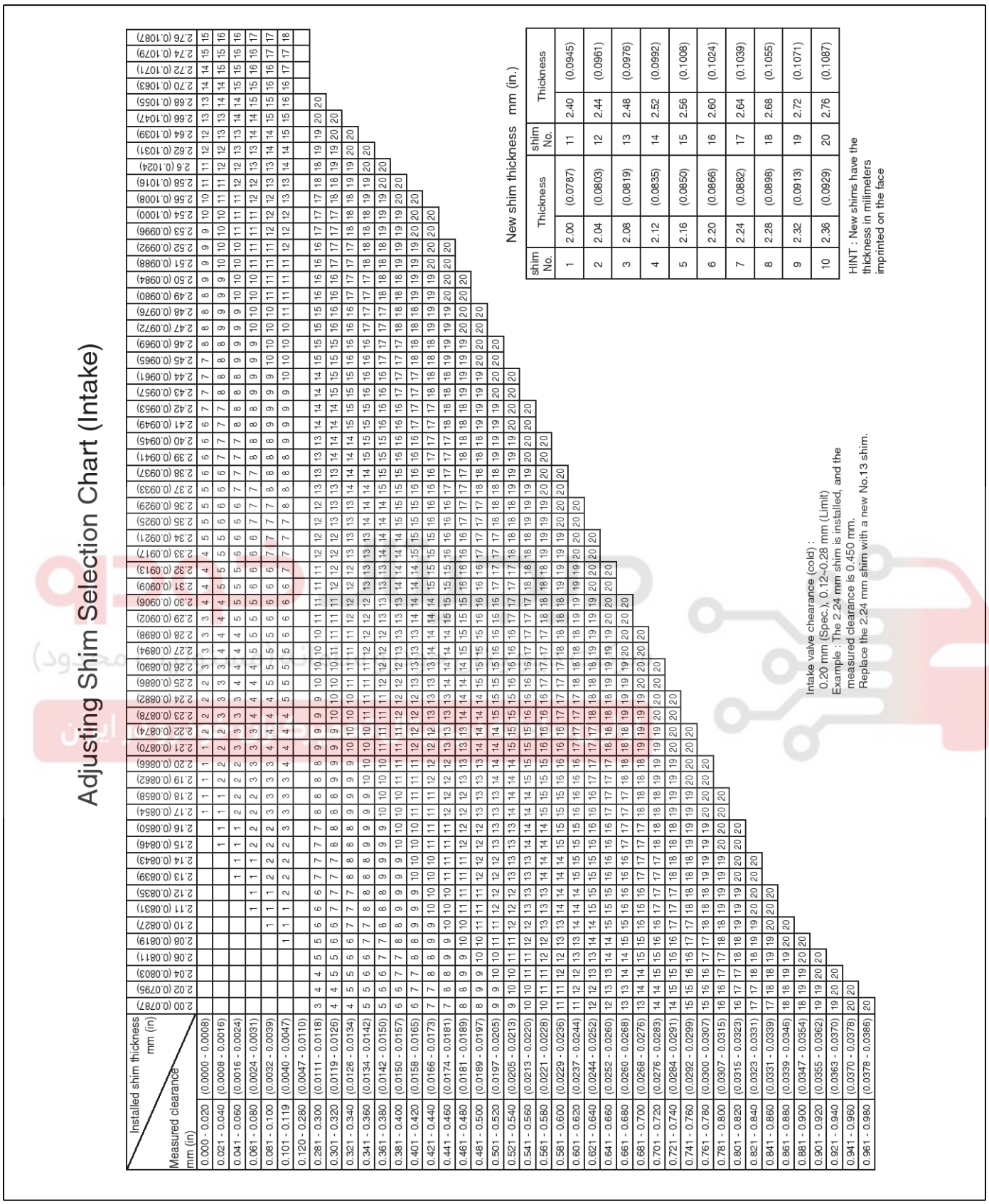
Shims are available in 20 size increments of 0.04mm (0.0016in) from 2.00mm (0.0787in) to 2.76mm (0.1087in)

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℃ ± 5℃[68°F ± 9°F])
[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)



BCGE002A



BCGE003A

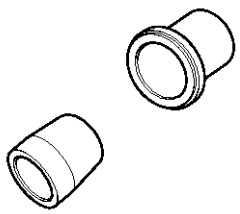
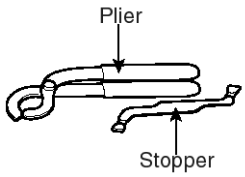
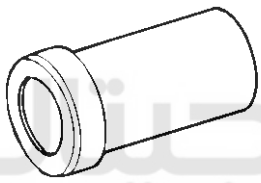
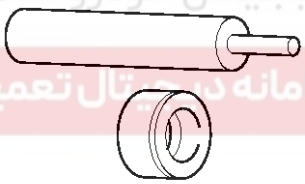
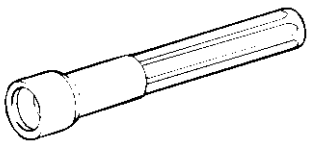
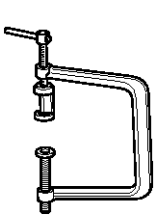
TROUBLESHOOTING

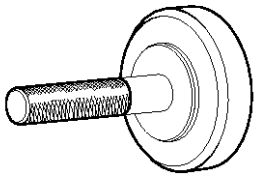
Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression.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

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

Symptom	Suspect area	Remedy
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 bearing bore.
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	Remove spark plugs and check for fluid. Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

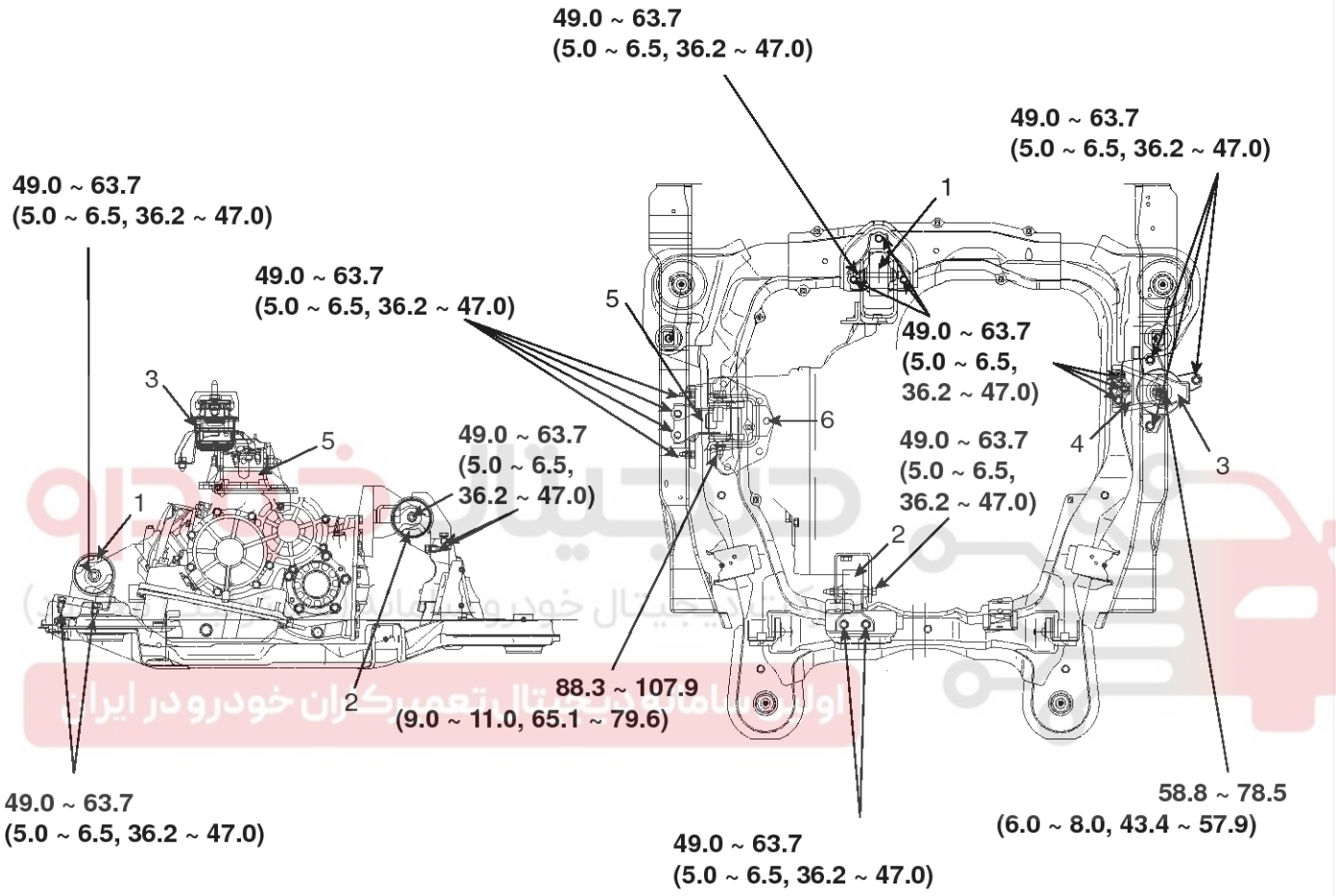
SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-23100)		Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)		Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100A/B)		Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor (09222-28000) Valve spring compressor adaptor (09222-28100)		Removal and installation of the intake or exhaust valve

Tool (Number and name)	Illustration	Use
Crankshaft rear oil seal installer (09231-23200, 09231-H1100)		Installation of the crankshaft rear oil seal

Engine And Transaxle Assembly

COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

1. Front roll stopper
2. Rear roll stopper
3. Engine mounting bracket
4. Engine mounting support bracket
5. Transaxle mounting bracket
6. Transaxle support bracket

LDIF009A

REMOVAL

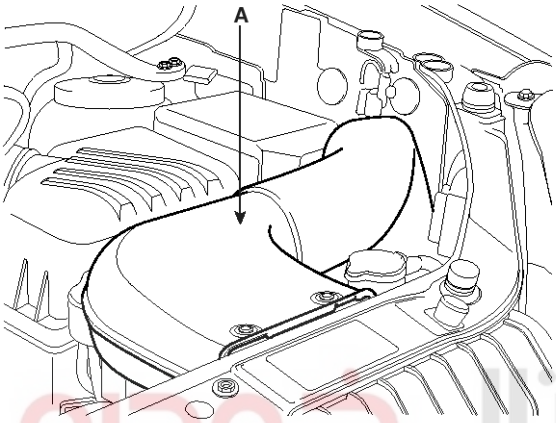
CAUTION

- **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.*

1. Remove the air duct(A).

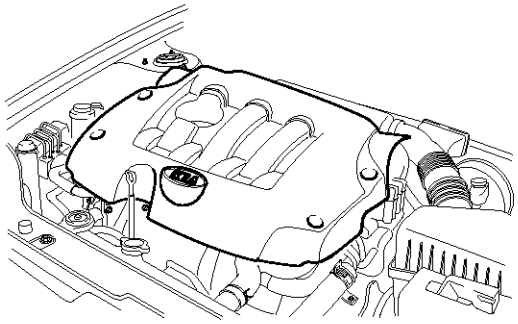


LDIF003A

2. Disconnect the battery terminals(A) and remove the battery.

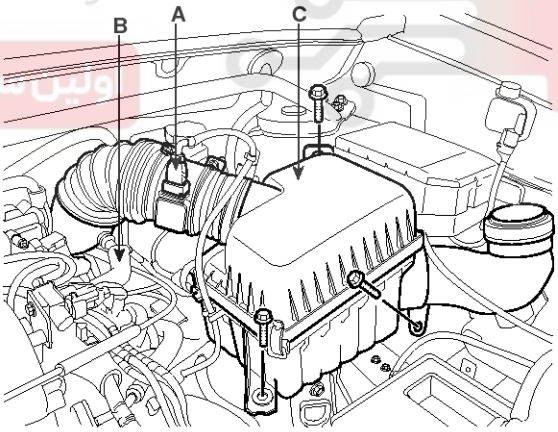
ADIE004A

3. Remove the engine cover.



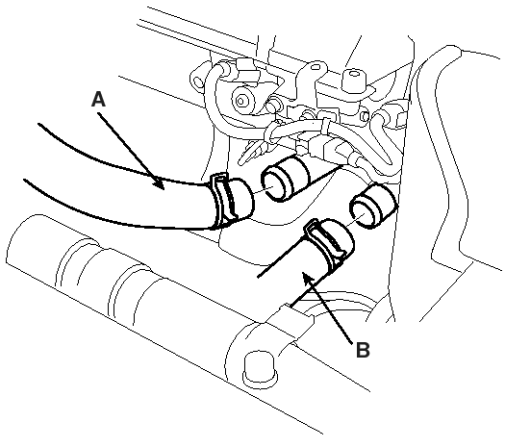
ADIE001A

4. Drain the engine coolant. (Refer to EMA-90)
   Remove the radiator cap to speed draining.
5. Remove the intake air hose and air cleaner assembly.
   1) Disconnect the AFS(Air Flow Sensor) connector(A).
   2) Disconnect the breather hose(B) from intake air hose.
   3) Remove the intake air hose and air cleaner assembly(C).



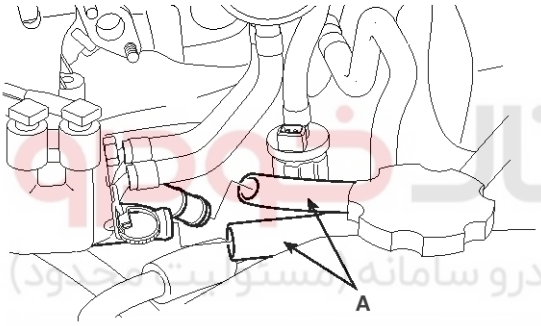
LDIF008A

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



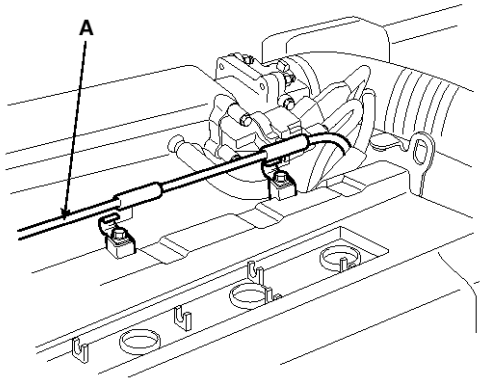
ADIE007A

7. Remove the heater hose(A).



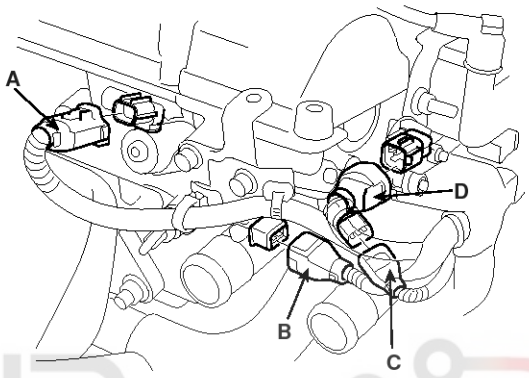
ECKD202A

8. Remove the accelerator cable(A).



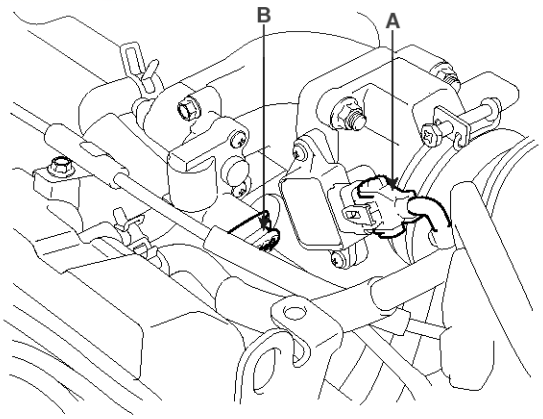
BCGE033A

9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   1) Disconnect the OCV(Oil Control Valve) connector(A).
   2) Disconnect the oil temperature sensor connector(B).
   3) Disconnect the ECT(Engine Coolant Temperature) sensor connector(C).
   4) Disconnect the ignition coil connector(D).



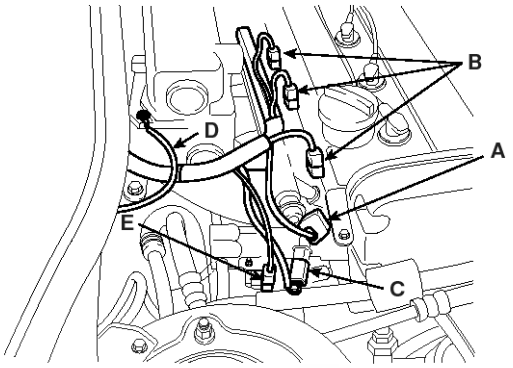
ECKD203A

   5) Disconnect the TPS(Throttle Position Sensor) Connector(A).
   6) Disconnect the ISA(Idle Speed Actuator) connector(B).



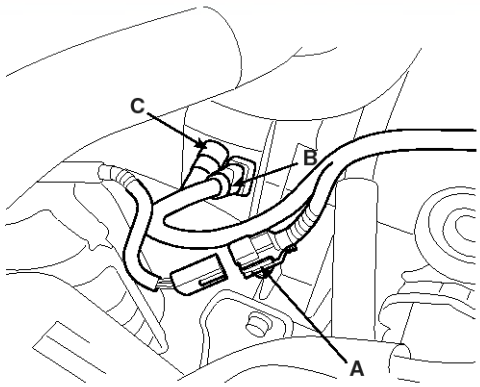
EDQF197A

7) Disconnect the CMP(Camshaft Position Sensor) connector(A).
8) Disconnect the four fuel injector connectors(B).
9) Disconnect the knock sensor connector(C).
10) Disconnect the ground cables(D) from the intake manifold and vehicle's body.
11) Disconnect the air conditioner compressor switch(E).



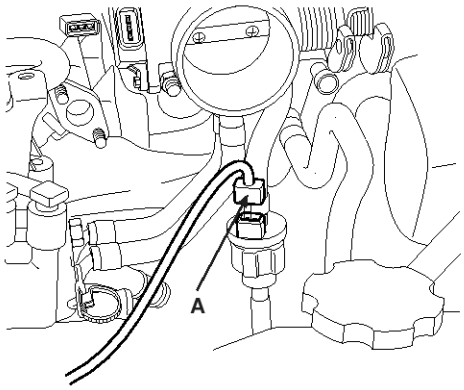
ADIE008A

12) Disconnect the front heated oxygen sensor connector(A).
13) Disconnect the CKP(Crankshaft Position Sensor) connector(B).
14) Disconnect the oil pressure switch connector(C).



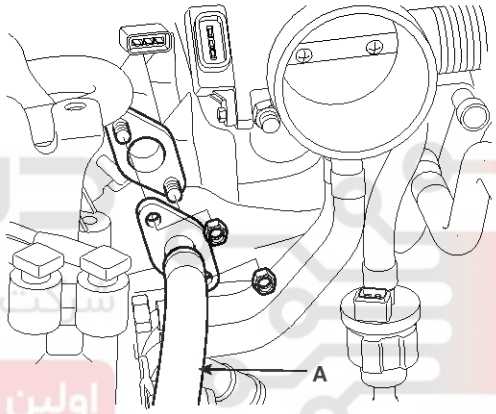
ACGE056A

15) Disconnect the PCSV (Purge Control Solenoid Valve) connector(A).



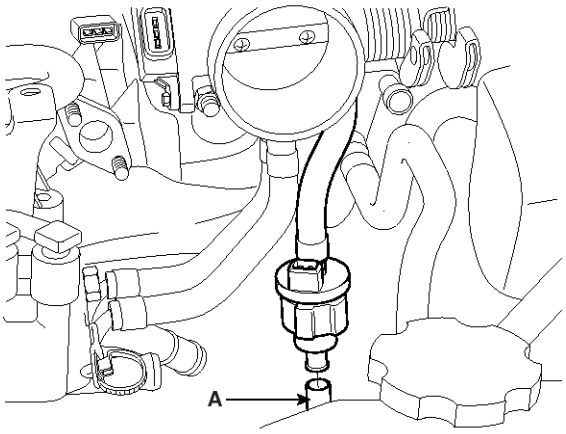
ECKD207A

10. Disconnect the fuel inlet hose(A) of the delivery pipe side.



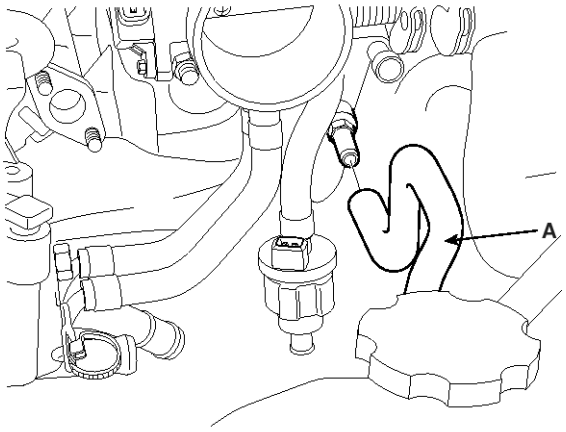
LDIF005A

11. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



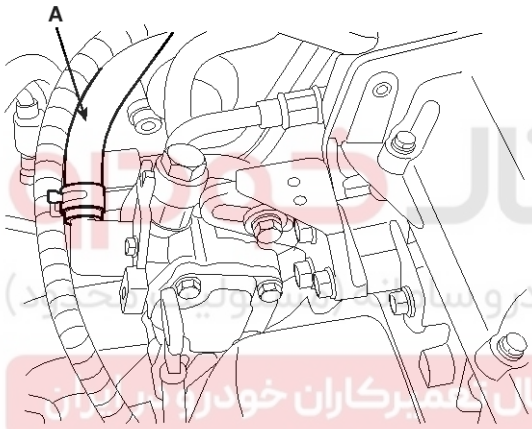
LDIF006A

12. Remove the brake booster vacuum hose(A).



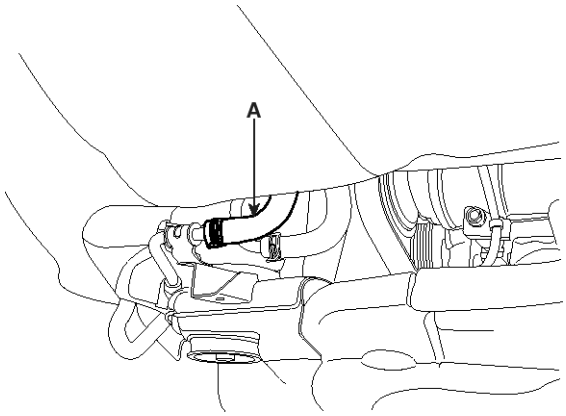
LDIF007A

13. Remove the power steering oil hose(A) from the power steering pump.



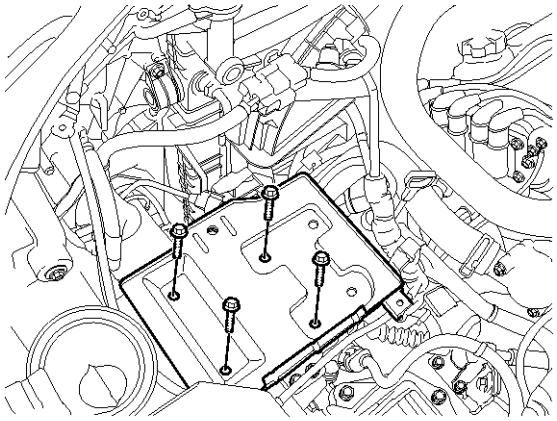
ADIE011A

14. Remove the power steering lower oil hose(A).

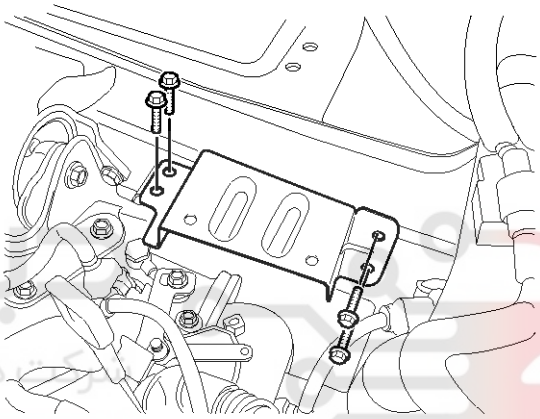


ADIE035A

15. Remove the battery tray bracket.

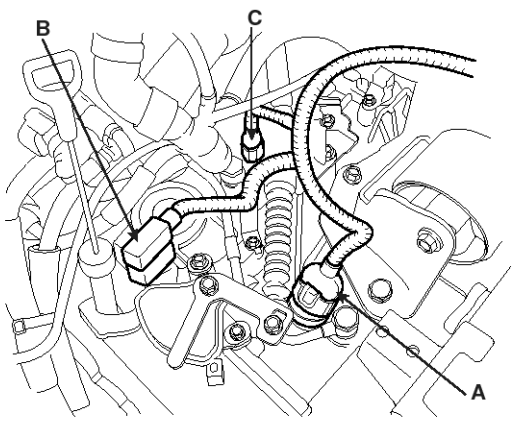


LDIF010A



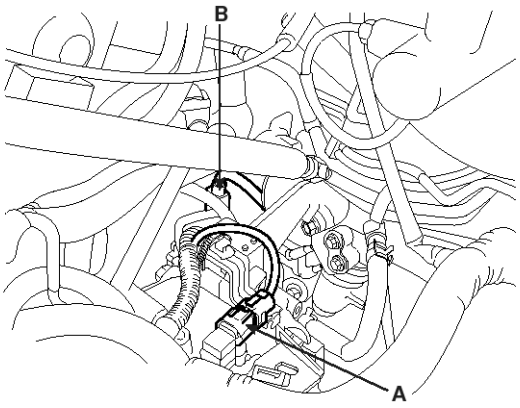
LDIF011A

16. Remove the transaxle wire harness connectors and control cable from transaxle(A/T).
    1) Disconnect the solenoid valve connector(A).
    2) Disconnect the transaxle range switch connector(B).
    3) Disconnect the input shaft speed sensor connector(C).



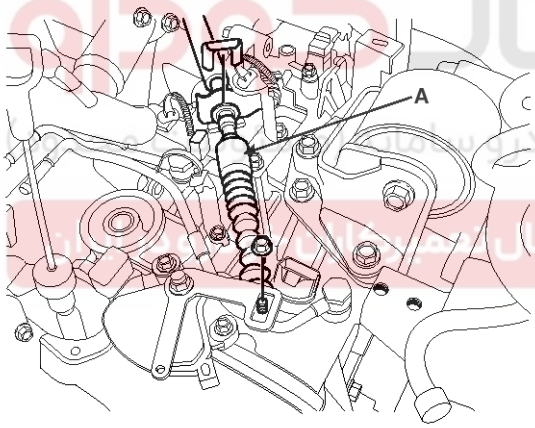
EDQF035A

4) Disconnect the output shaft speed sensor connector(A).
5) Disconnect the vehicle speed sensor connector(B).



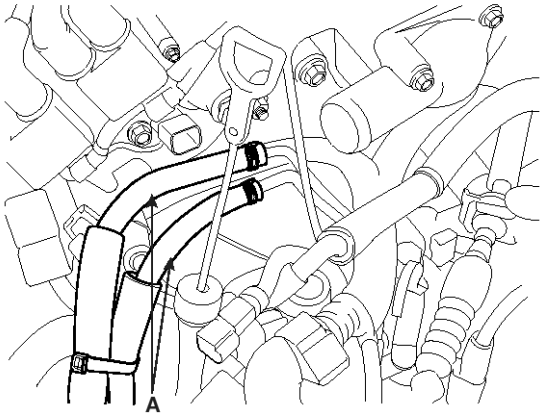
EDQF031A

6) Remove the control cable(A).



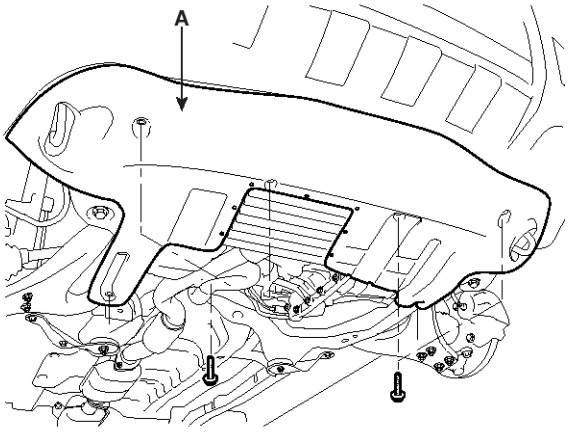
EDQF018A

17. Remove the transaxle oil cooler hose(A) (A/T).



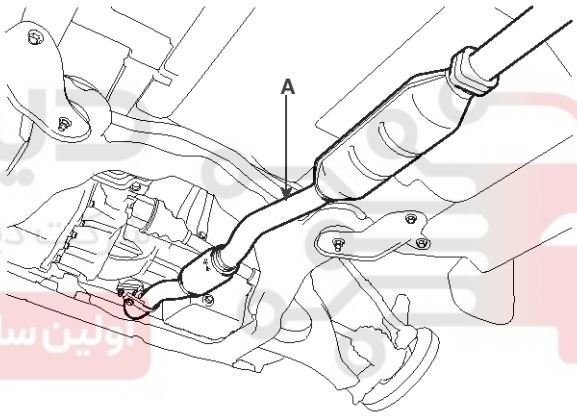
LDIF012A

18. Remove the under cover(A).



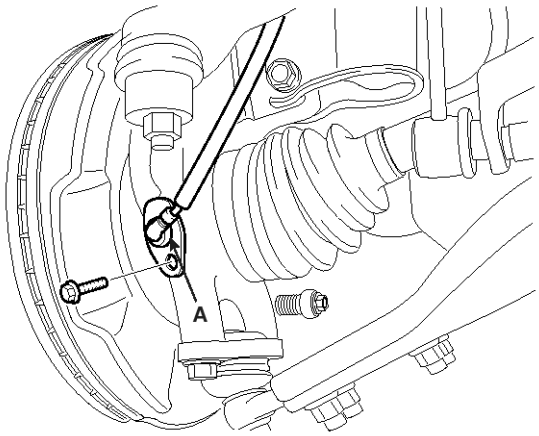
LDIF013A

19. Remove the front exhaust pipe(A).



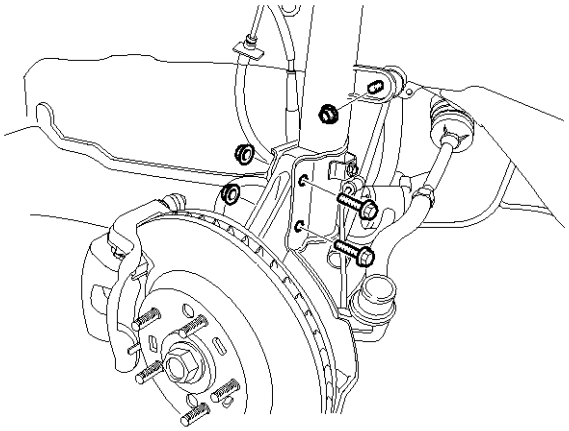
LDIF014A

20. Disconnect the ABS wheel speed sensor(A) from both front knuckle. (See DS group - front axle)



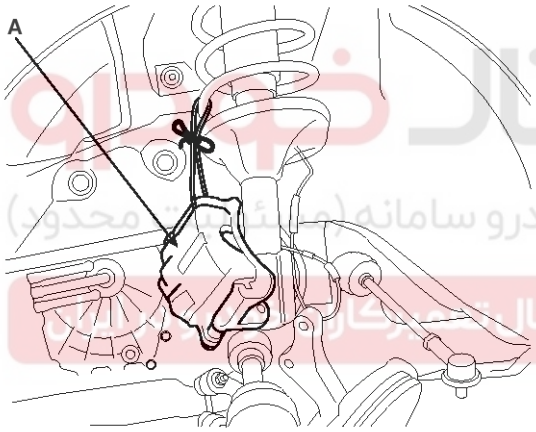
LDIF015A

21. Remove the front strut lower mounting bolts and nuts. (See SS griup - front strut)



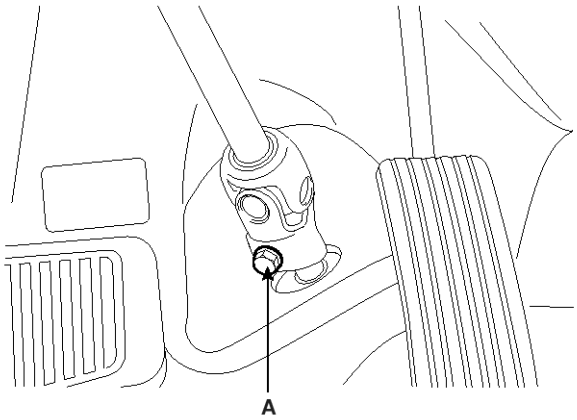
LDIF016A

22. Remove the caliper and hang the caliper assembly(A).



LDIF017A

23. Remove the steering u-joint mounting bolt(A). (See ST group - steering)

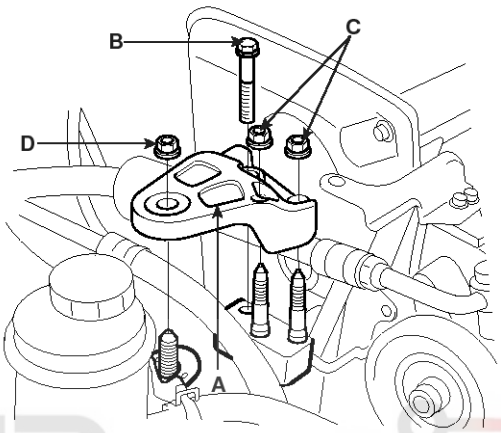


LDIF018A

24. Install the jack for supporting engine and transaxle assembly.

25. Remove the engine mounting bracket(A).

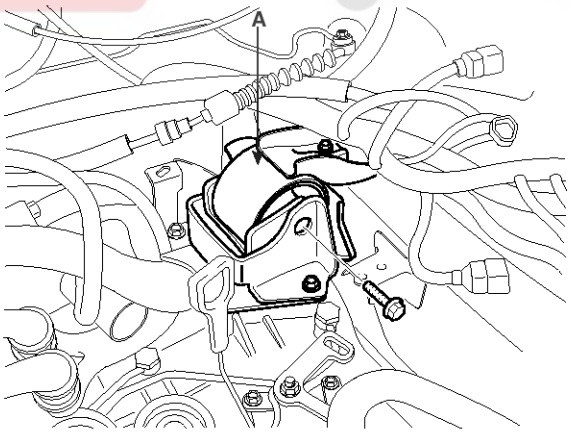
Tightening torque
Nut(D) : 58.8 ~ 78.5N.m (6.0 ~ 8.0 kgf.m, 43.4 ~ 57.9lbf.ft)
Bolt(B), Nut(C) : 49.0 ~ 63.7N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0lbf.ft)



LDIF019A

26. Remove the transaxle mounting bracket(A).

Tightening torque
Bolt(B) : 88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.61lbf.ft)

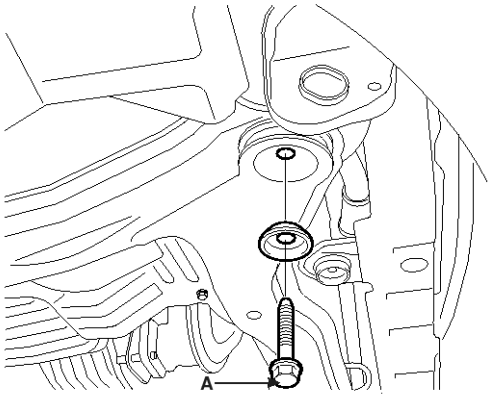


LDIF020A

27. Remove the sub frame mounting bolts and nuts.

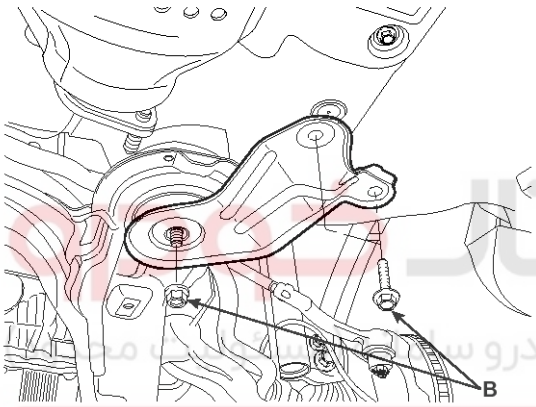
Tightening torque
Bolt(A) : 156.9 ~ 176.5N.m (16.0 ~ 18.0 kgf.m, 115.7 ~ 130.2 lbf.ft)
Bolt, Nut(B) : 68.6 ~ 88.3N.m (7.0 ~ 9.0 kgf.m, 50.6 ~ 65.1lbf.ft)

■ Front



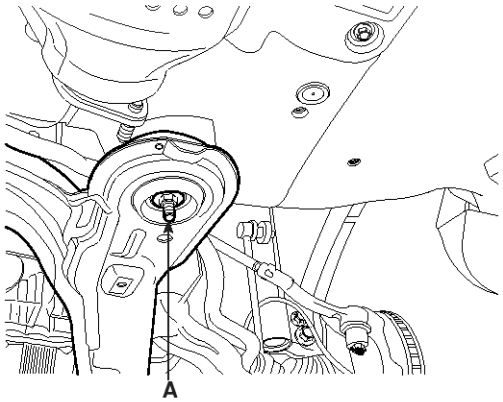
ADIE012A

■ Rear



ADIE023A

■ Rear



ADIE024A

28. Remove the engine and transaxle assembly by lifting vehicle.

⚠CAUTION

When remove the engine and transaxle assembly, be careful not to damage any surrounding parts or body components.

INSTALLATION

Installation is in the reverse order of removal.

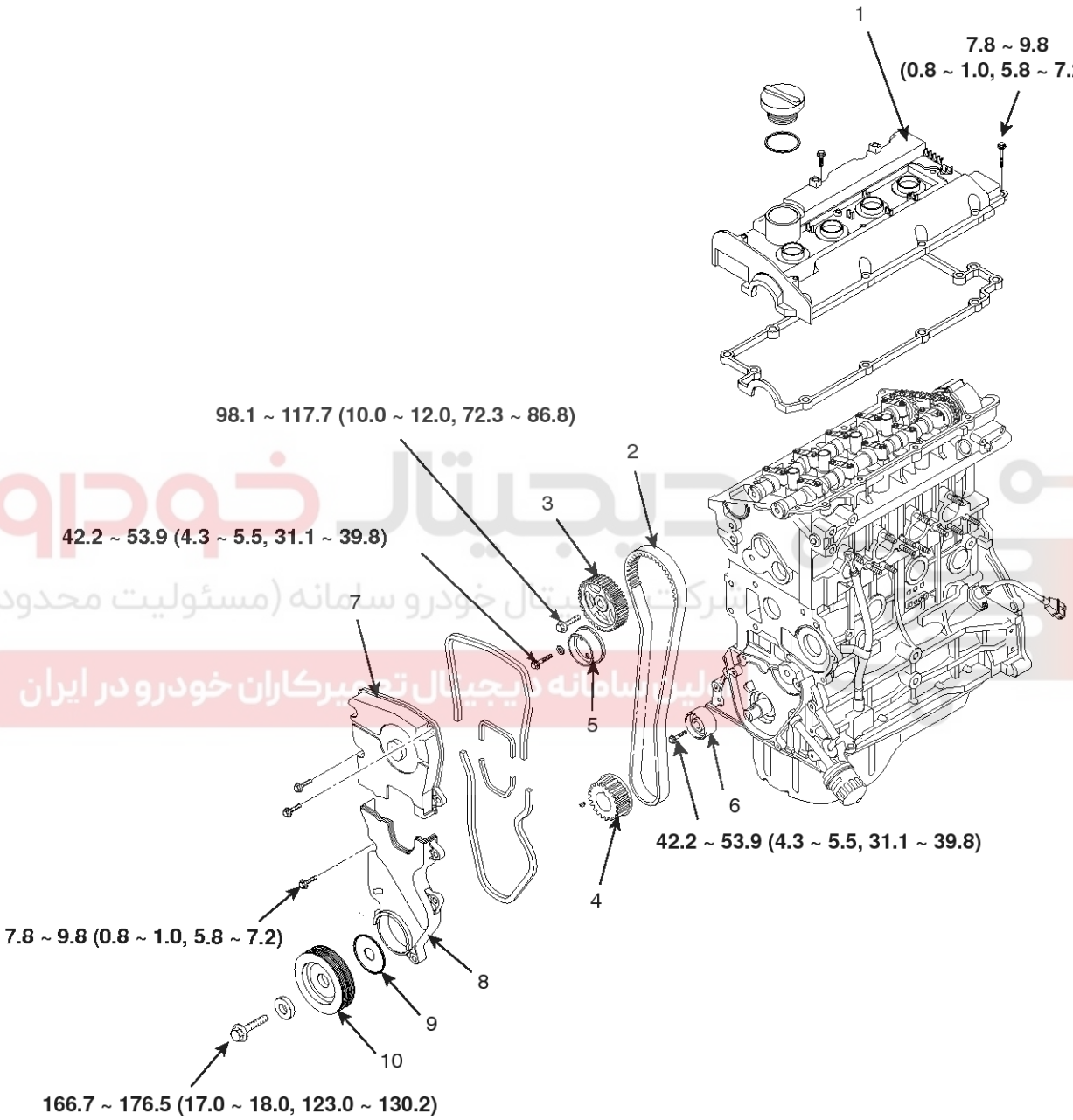
Perform the following :

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.
- Place the heater control knob on "HOT" positon.
- Bleed air from the cooling system
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put the radiator cap on tightly, then run the engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  - After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

Timing System

Timing Belt

COMPONENT



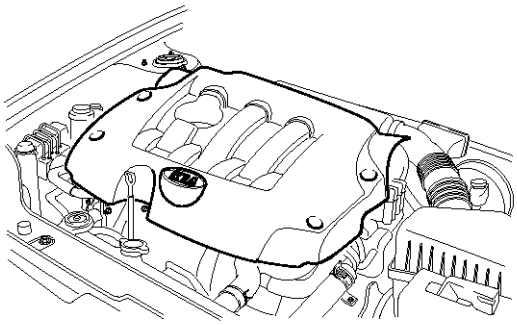
TORQUE : N.m (kgf.m, lbf.ft)

1. Cylinder cover
2. Timing belt
3. Cam shaft sprocket
4. Crank shaft sprocket
5. Tensioner
6. Idler
7. Timing belt upper cover
8. Timing belt lower cover
9. Flange
10. Crank shaft pulley

REMOVAL

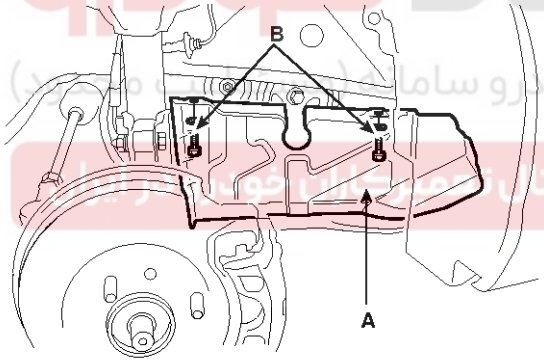
Engine removal is not required for this procedure.

1. Remove the engine cover.



ADIE001A

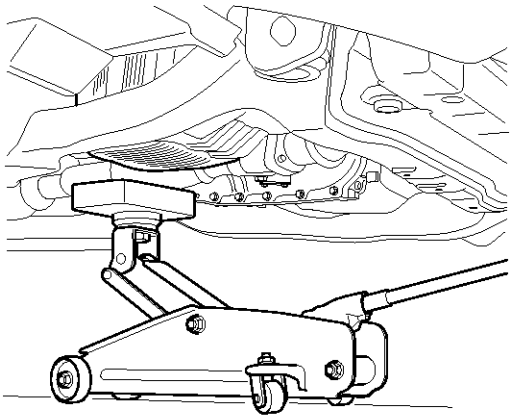
2. Remove the RH front wheel.
3. Remove the 2 bolts(B) and RH side cover(A).



KXDSE16A

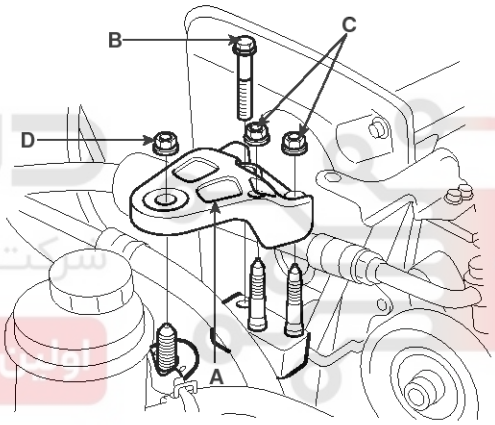
4. Remove the engine mounting support bracket.
   1) Set the jack to the engine oil pan.

LDIF028A



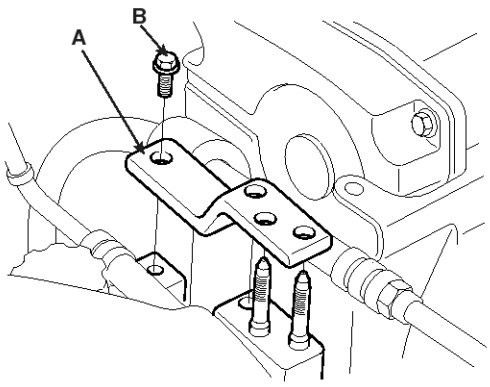
LDIF001A

   2) Remove the bolt(B), nuts(C,D) and engine mounting support bracket(A).



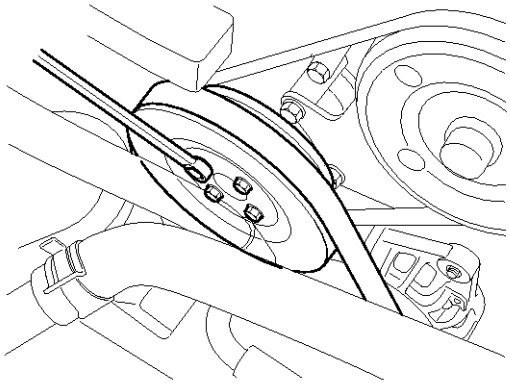
LDIF002A

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



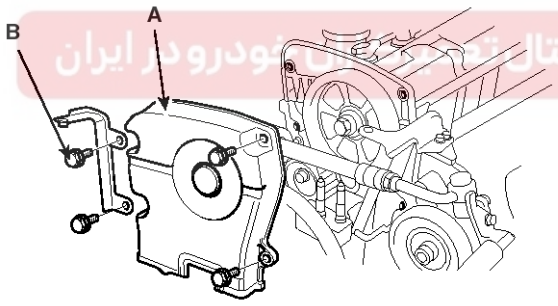
ECKD104A

5. Temporarily loosen the water pump pulley bolts.



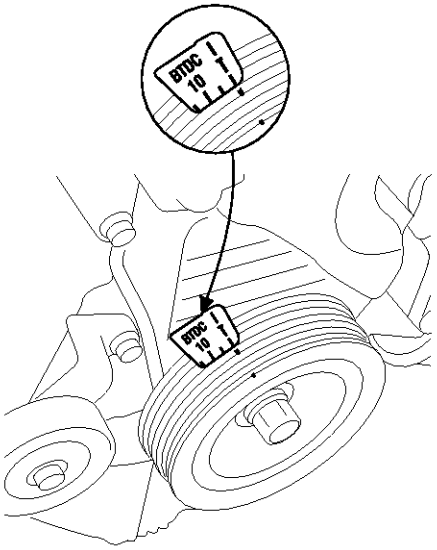
ECKD104B

6. Remove the alternator drive belt. (See EE group - alternator)
7. Remove the air conditioner compressor drive belt. (See HA group - air conditioner compressor)
8. Remove the power steering pump drive belt. (See ST group - power steering pump)
9. Remove the 4 bolts and water pump pulley.
10. Remove the 4 bolts(B) and timing belt upper cover(A).

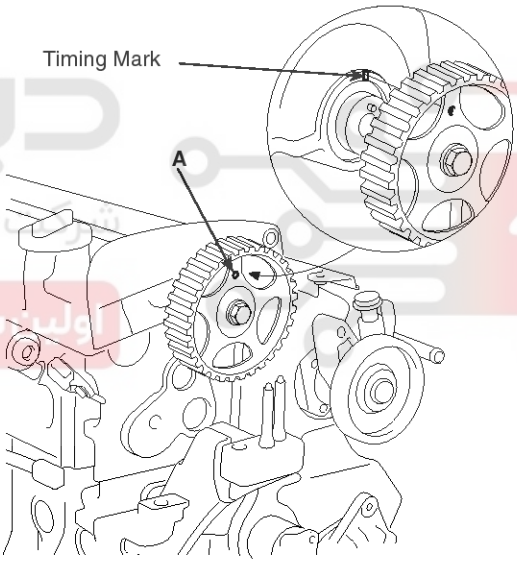


ECKD105A

11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover. (No.1 cylinder compression TDC position)

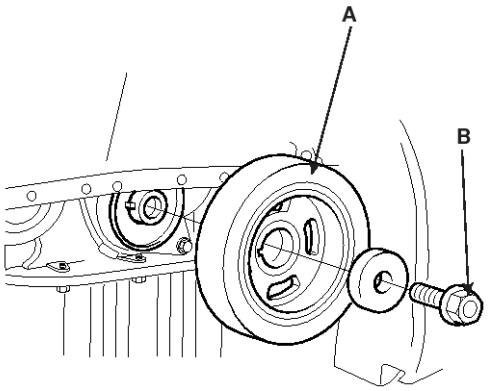


ECKD106A



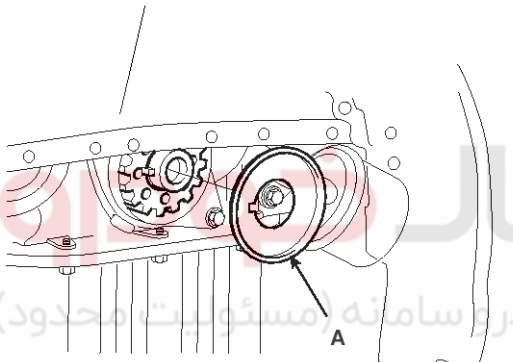
BCGE001A

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



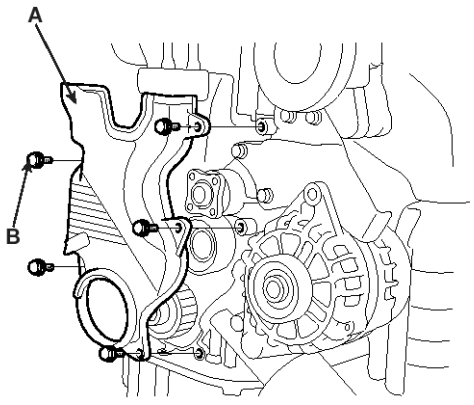
ECKD107A

13. Remove the crankshaft flange(A).



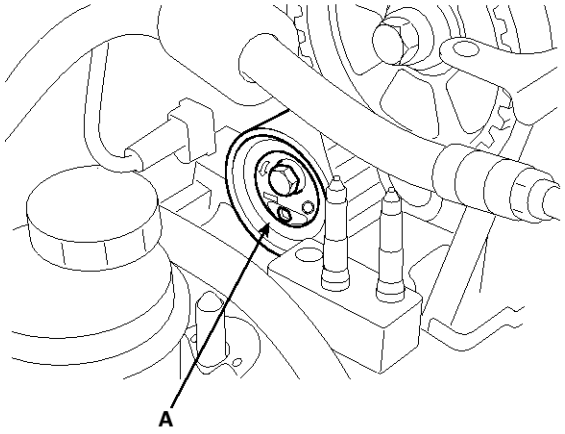
ECKD108A

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

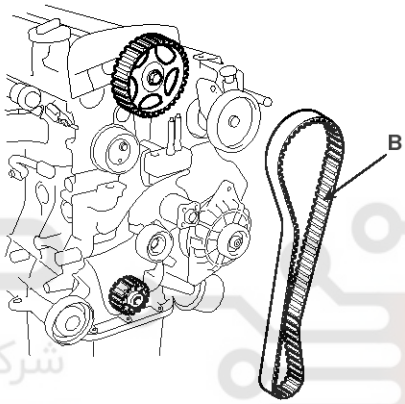


ECKD108B

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



SHDM16316L

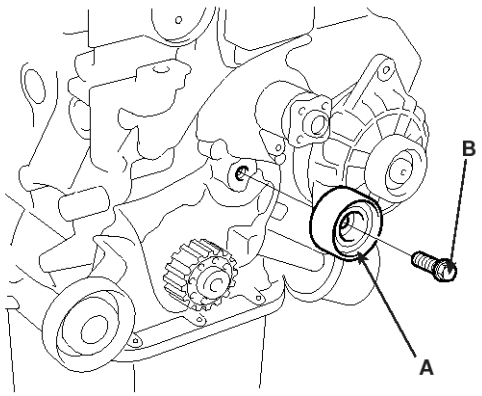


ECKD109B

NOTICE

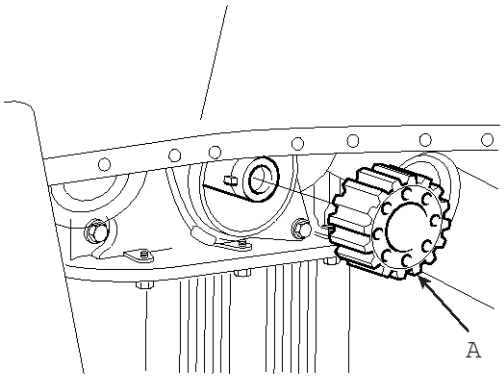
If the timing belt is going to be reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

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



ECKD109C

17. Remove the crankshaft sprocket(A).



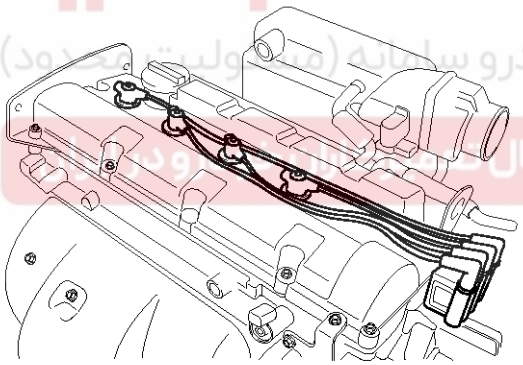
ECKD110A

18. Remove the cylinder head cover.

1) Disconnect the spark plug cables and do not pull on the cable by force.

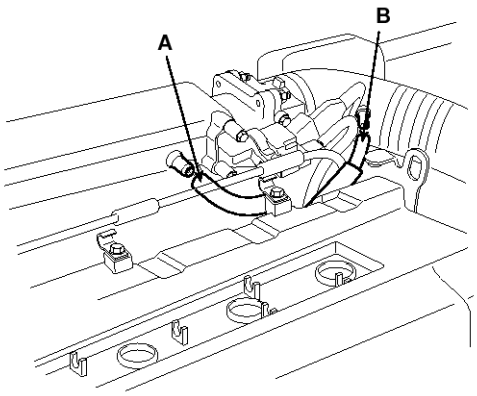
NOTICE

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



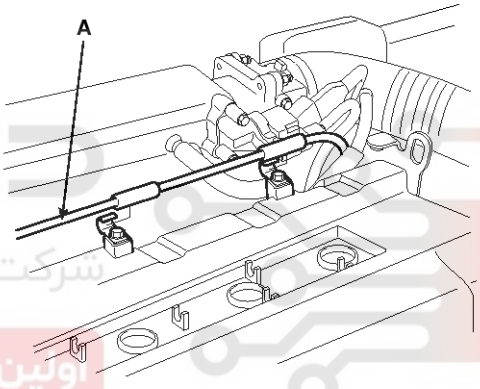
ACGE002A

2) Remove the PCV (Positive Crankcase Ventilation) hose(A) and the breather hose(B) from the cylinder head cover.



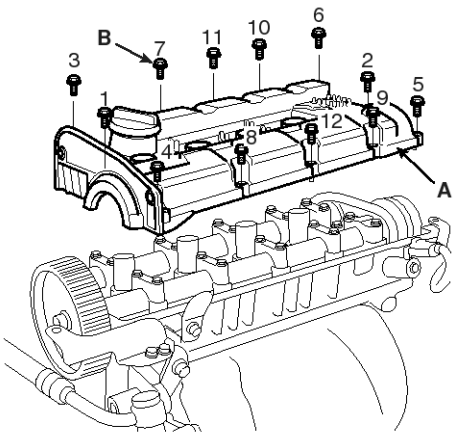
BCGE032A

3) Remove the accelerator cable(A) from the cylinder head cover.



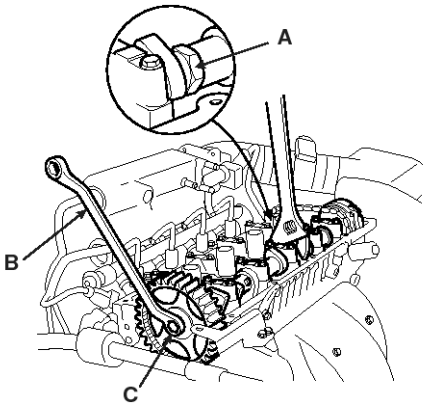
BCGE033A

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



ADIE002A

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



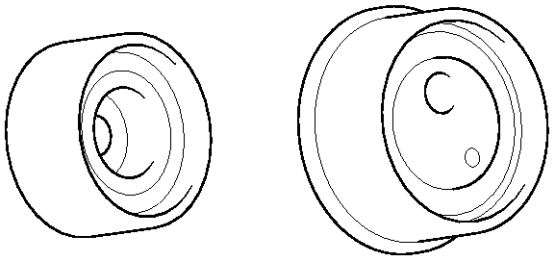
BCGE005A

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

INSPECTION

SPROCKETS, TENSIONER, IDLER

1. Check the camshaft sprocket, 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.

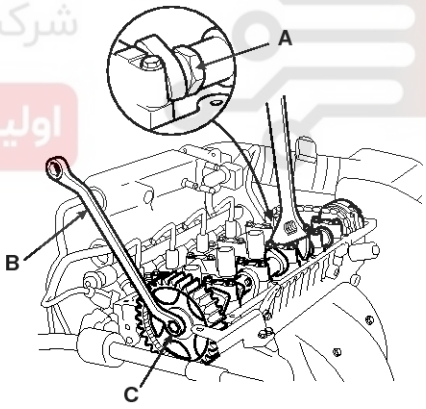
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the carefully. If any damage is found, replace the belt.

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

INSTALLATION

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

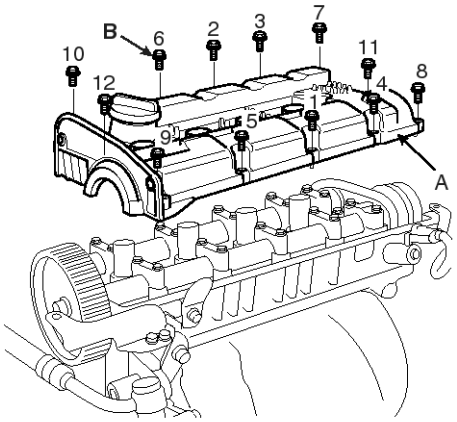
Tightening torque :
98.1 ~ 117.7N.m (10 ~ 12kgf.m, 72.3 ~ 86.8lbf.ft)



BCGE005A

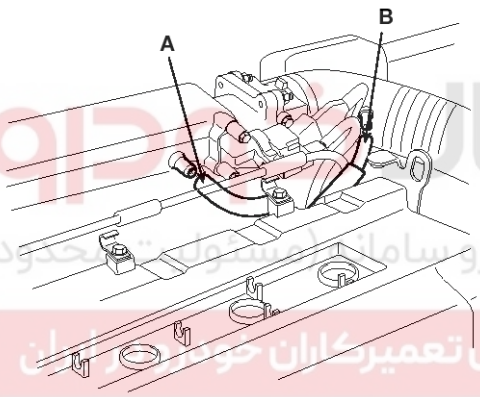
2. Install the cylinder head cover.
   1) Install the cylinder head cover(A) and bolts(B).

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



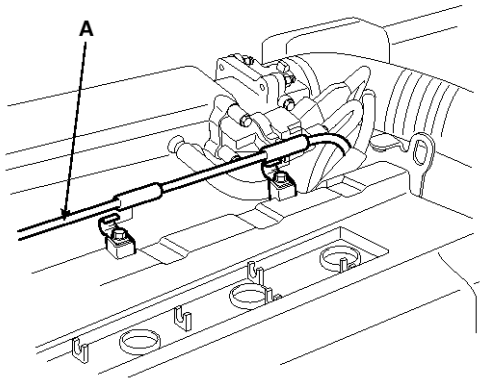
ADIE003A

2) Install the PCV(Positive Crankcase Ventilation) hose(A) and breather hose(B) to the cylinder head cover.



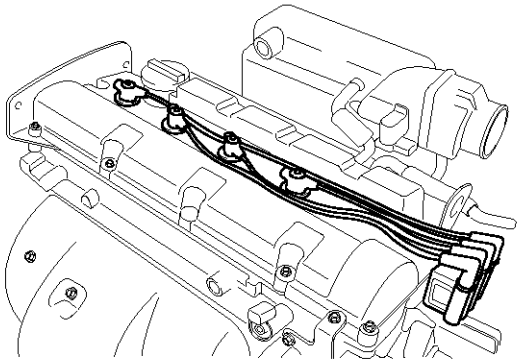
BCGE032A

3) Install the accelerator cable(A) to the cylinder head cover.



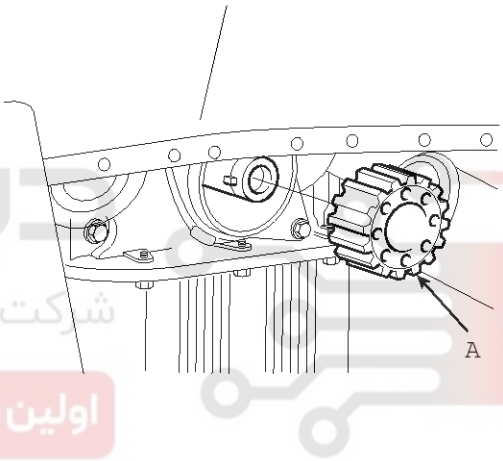
BCGE033A

4) Install the spark plug cables.



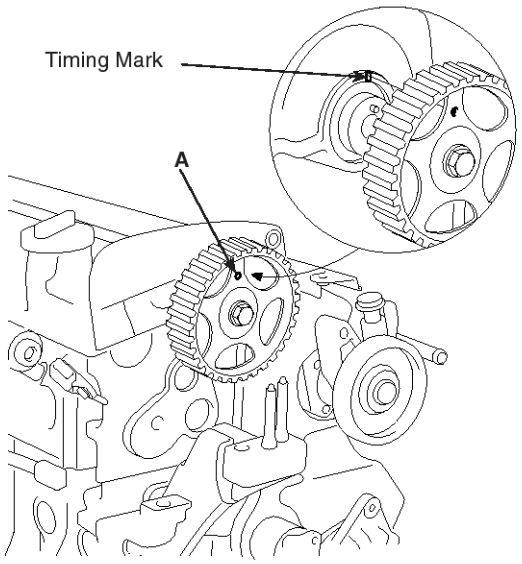
ACGE002A

3. Install the crankshaft sprocket(A).

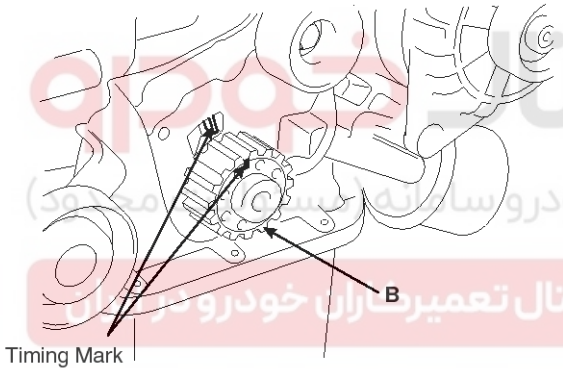


ECKD110A

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.



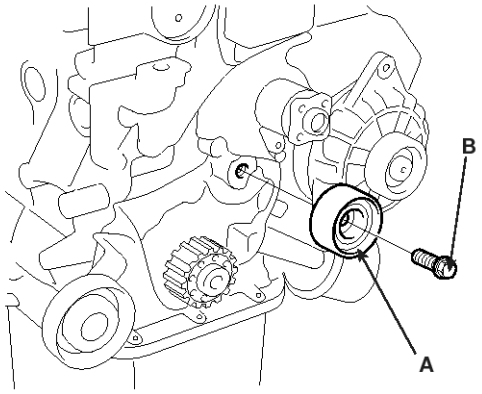
BCGE001A



BCGE006A

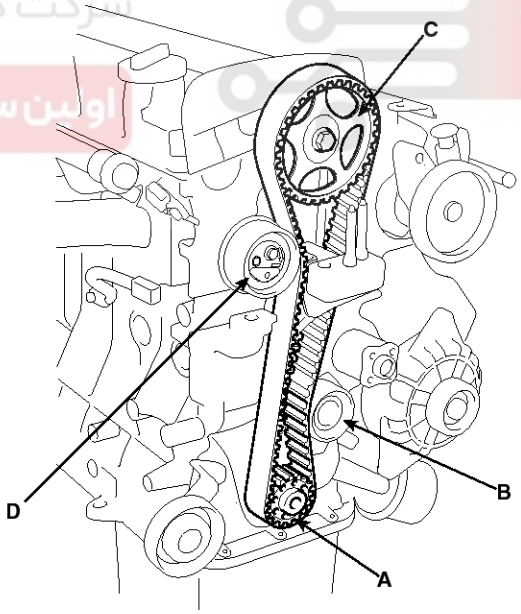
5. Install the idler pulley(A) and tighten the bolt(B) to the specified torque.

Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lbf.ft)



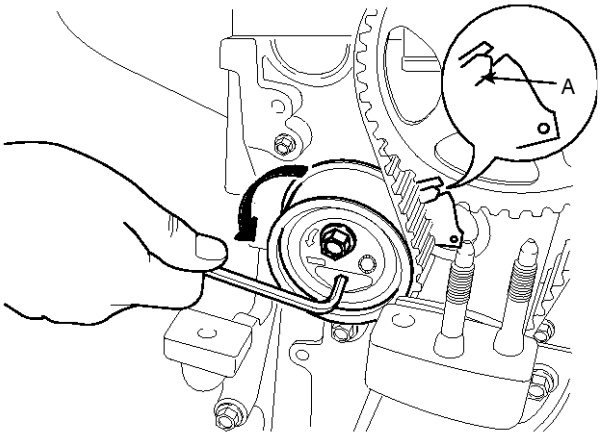
ECKD109C

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

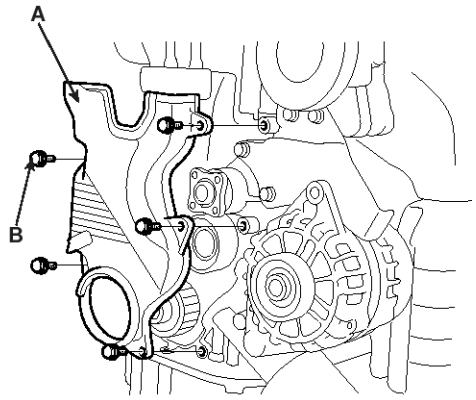
⚠CAUTION
Do not rotate the adjuster clockwise.
It will result in auto tensioner's functional problem.

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 5bolts(B).

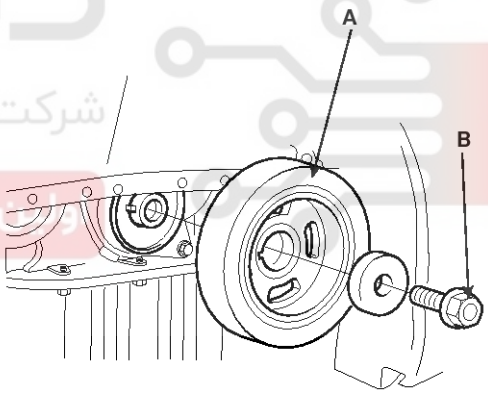
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



ECKD108B

15. Install the flange and crankshaft pulley(A), and then tighten crankshaft pulley bolt(B).
    Make sure that the crankshaft sprocket pin fits into the small hole in the pulley.

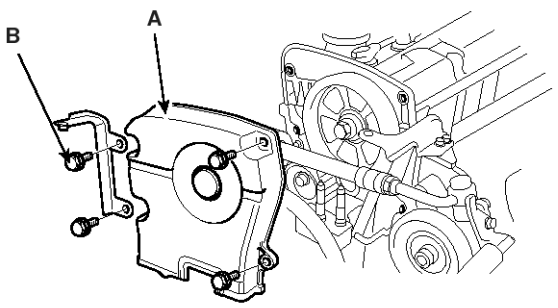
Tightening torque :
166.7 ~ 176.5N.m (17 ~ 18kgf.m, 123.0 ~ 130.2lbf.ft)



ECKD107A

16. Install the timing belt upper cover(A) with 4 bolts(B).

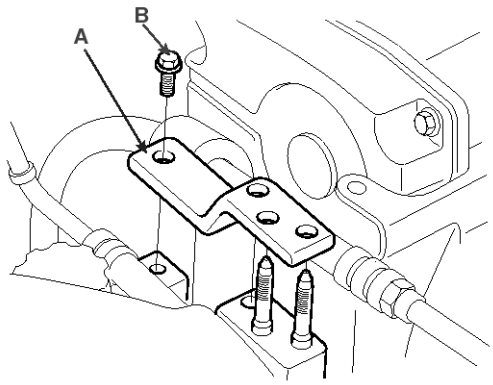
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



ECKD105A

17. Install the water pump pulley and 4 bolts.
18. Install the power steering pump drive belt. (See ST group - power steering pump)
19. Install the air conditioner compressor drive belt. (See HA group - air conditioner compressor)
20. Install the alternator drive belt. (See EE group - alternator)
21. Tighten the bolts of water pump pulley.
22. Install the engine mounting support bracket.
    1) Install the engine mounting support bracket stay plate(A) with bolt(B).

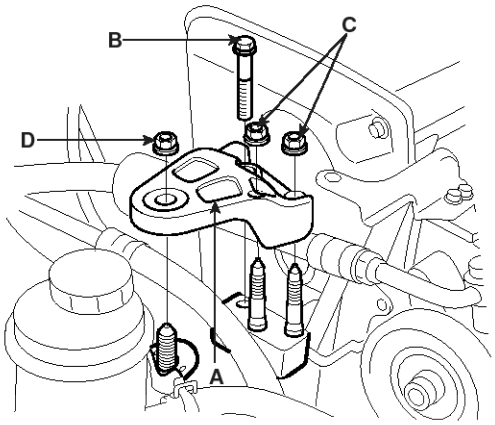
Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lbf.ft)



ECKD104A

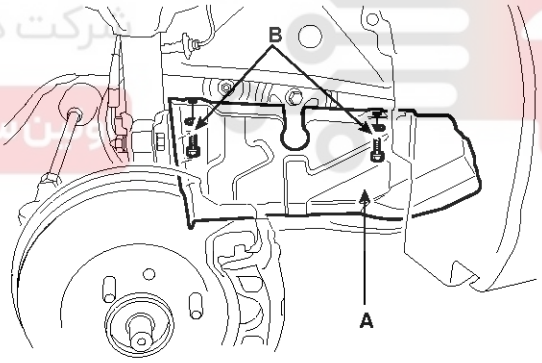
    2) Install the engine mounting support bracket(A) with nuts(C,D) and bolt(B).

Tightening torque :
Nut(D) : 58.8 ~ 78.5N.m (6.0 ~ 8.0kgf.m, 43.4 ~ 57.9lbf.ft)
Nut(C) and bolt(B) : 49.0 ~ 63.7N.m
(5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lbf.ft)



LDIF002A

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



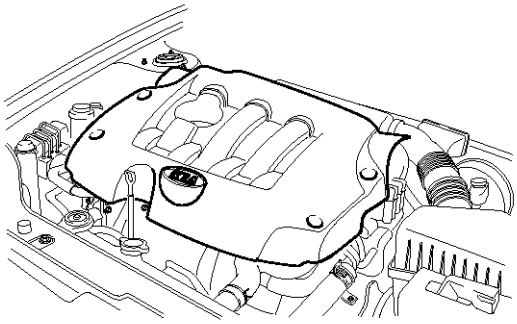
KXDSE16A

24. Install the RH front wheel.

Tightening torque :
88.3 ~ 98.N.m (9.0 ~ 10.0kgf.m, 65.1 ~ 72.3lbf.ft)

25. Install the engine cover with bolts.

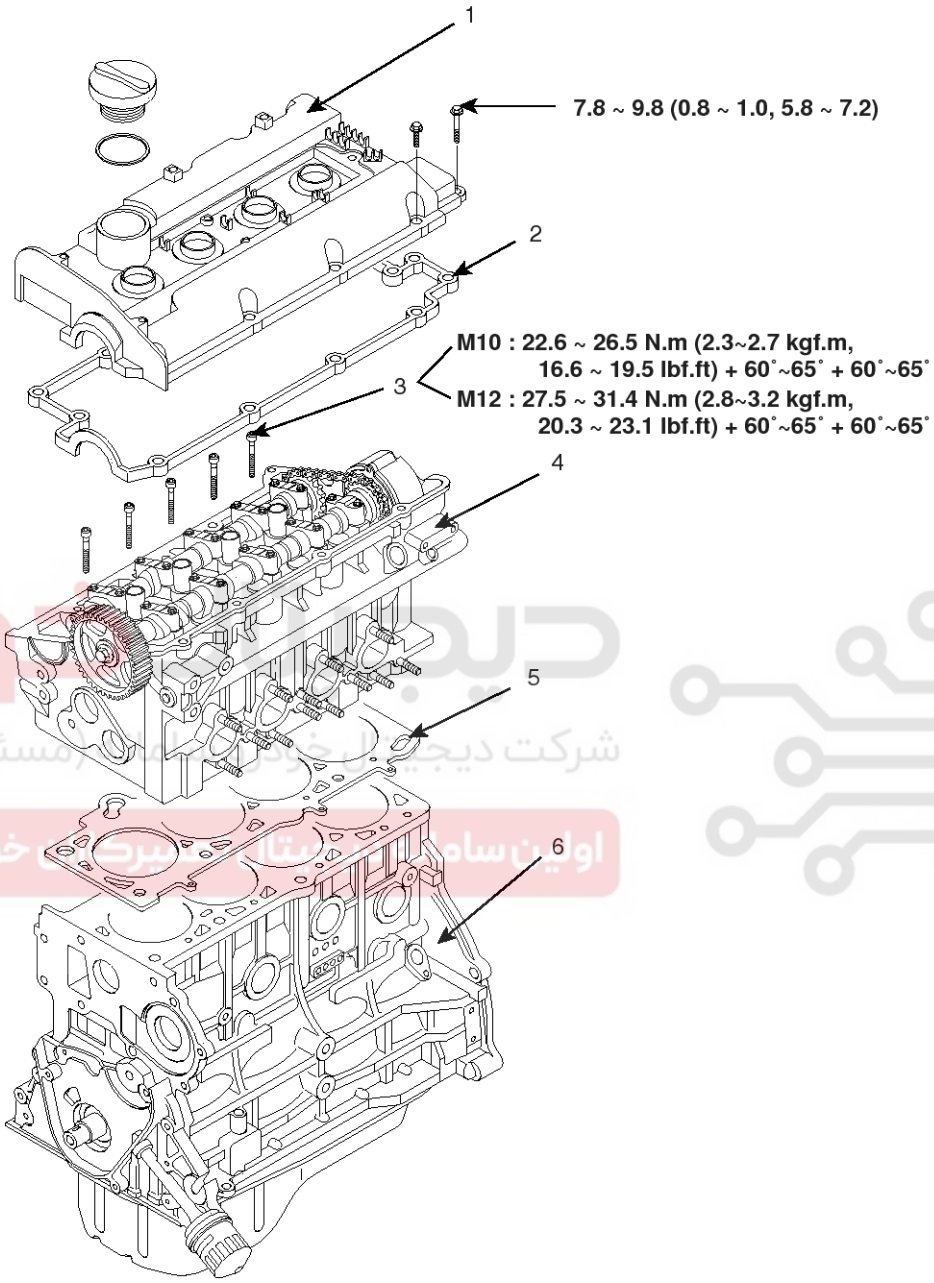
Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lbf.ft)



ADIE001A

Cylinder Head Assembly

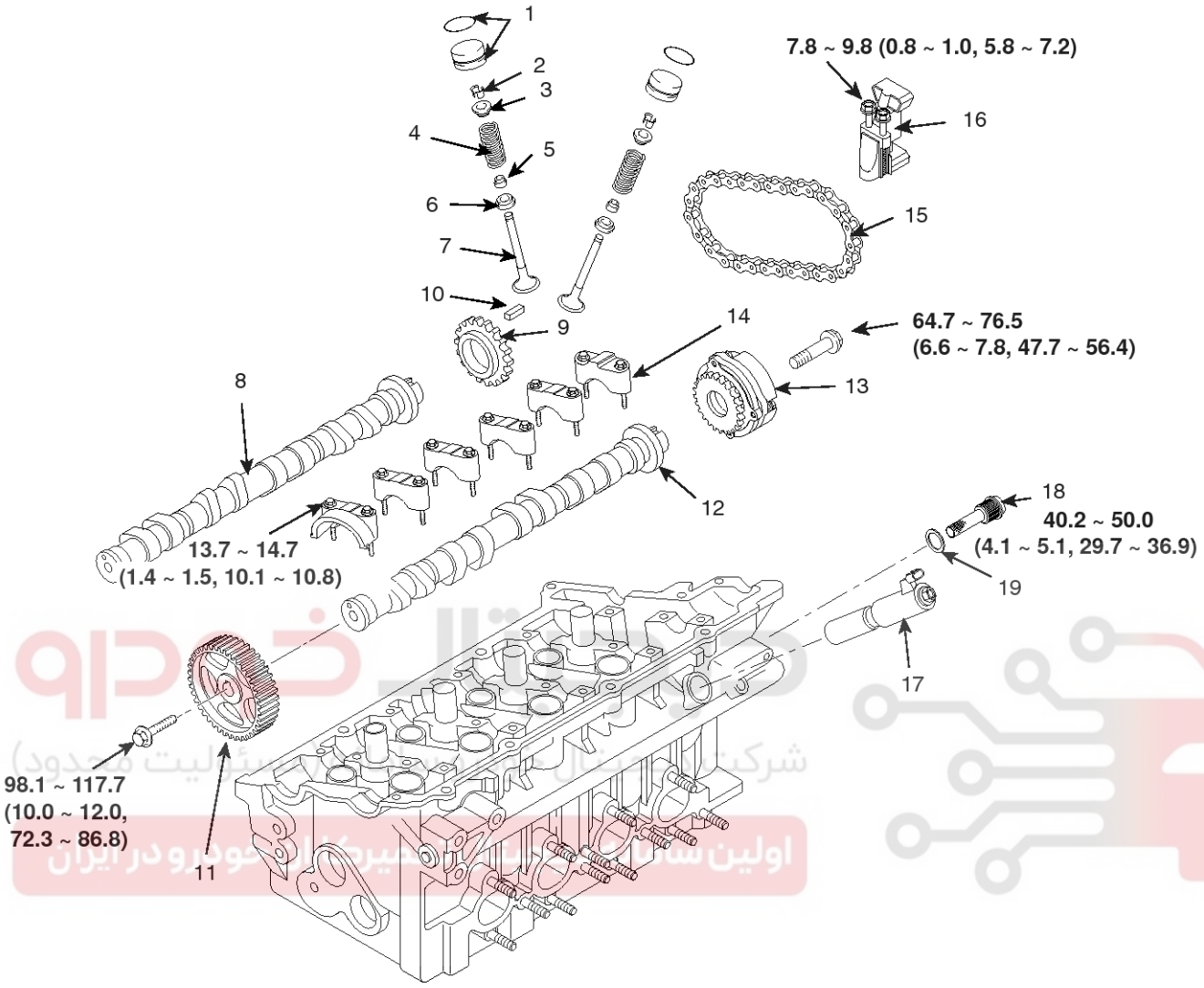
COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

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

LDIF029A



TORQUE : N.m (kgf.m, lbf.ft)

1. MLA (Mechanical Lash Adjuster)
2. Retainer lock
3. Retainer
4. Valve spring
5. Stem seal
6. Spring seat
7. Valve
8. Intake camshaft
9. Chain sprocket
10. Key
11. Camshaft sprocket
12. Exhaust camshaft
13. CVVT (Continuously Variable Valve Timing) assembly
14. Camshaft bearing cap
15. Timing chain
16. Auto tentioner
17. OCV (Oil Control Valve)
18. OCV (Oil Control Valve) filter
19. Washer

LDIF030A

REMOVAL

Engine removal is not required for this procedure.

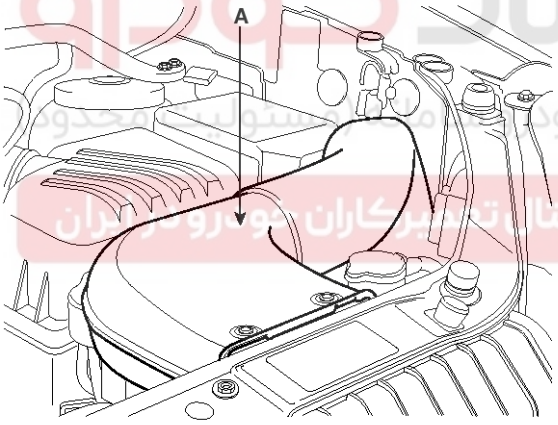
CAUTION

- **Use Fender cover 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

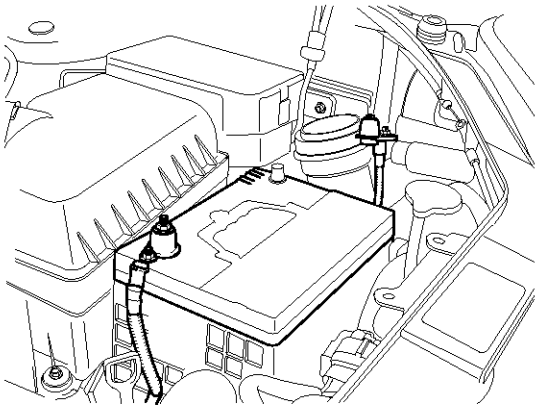
- *Mark all wiring and hoses to avoid misconnection.*
- *Inspect the timing belt before removing the cylinder head.*
- *Turn the crankshaft pulley so that the No. 1 piston is at top dead center.*

1. Remove the air duct(A).



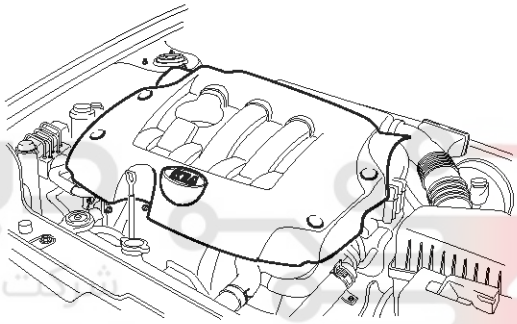
LDIF003A

2. Disconnect the terminals(A) from battery.



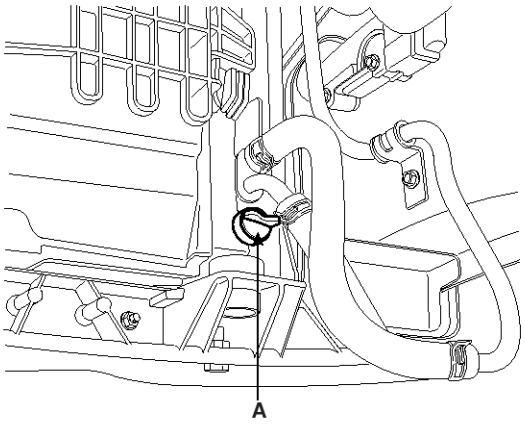
ADIE004A

3. Remove the engine cover.



ADIE001A

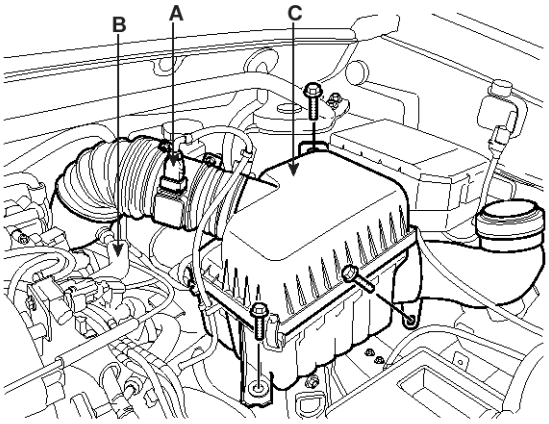
4. Drain the engine coolant. (Refer to EMA-90)
   Remove the radiator cap to speed draining.



LDIF004A

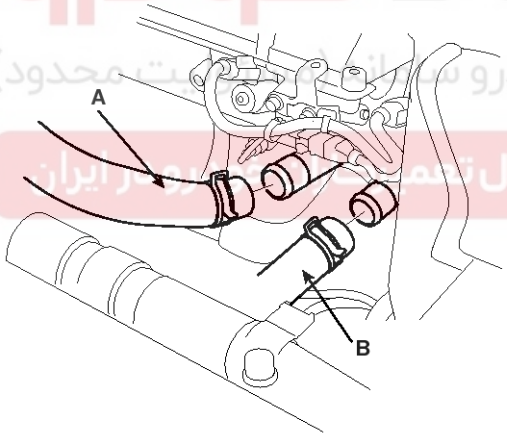
5. Remove the intake air hose and air cleaner assembly.

1) Disconnect the AFS(Air Flow Sensor) connector(A).
2) Disconnect the breather hose(B) from intake air hose.
3) Remove the intake air hose and air cleaner assembly(C).



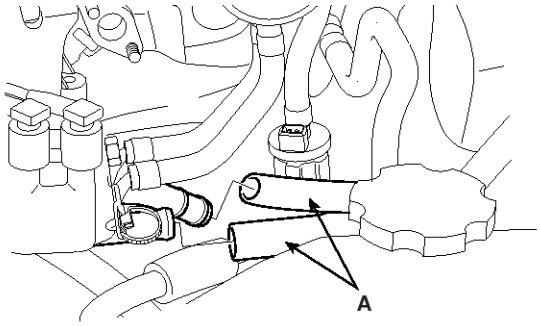
ADIE006A

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



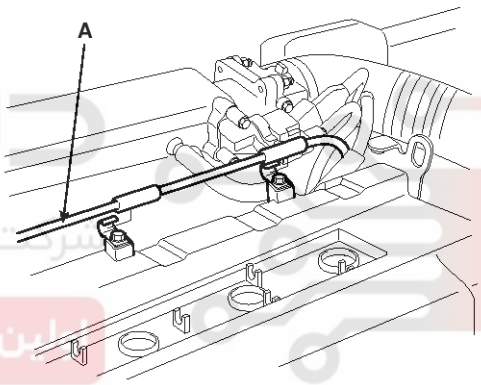
ADIE007A

7. Remove the heater hoses(A).



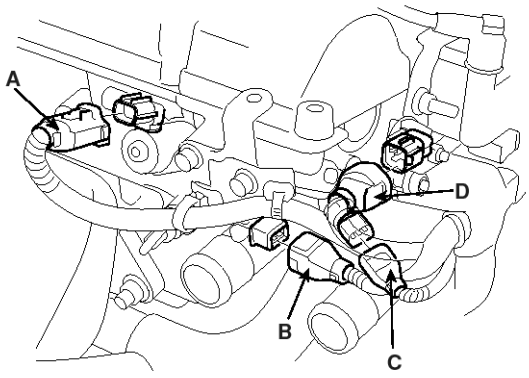
ECKD202A

8. Remove the accelerator cable(A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.



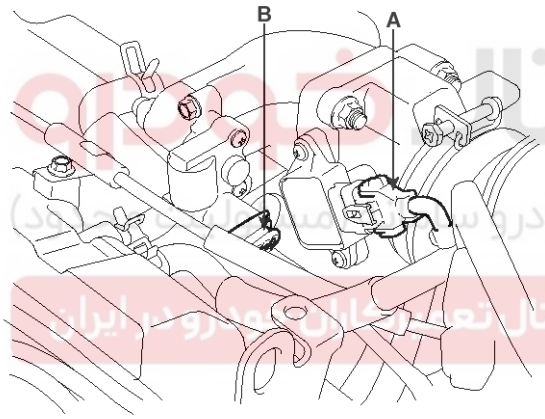
BCGE033A

9. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
   1) Disconnect the OCV (Oil Control Valve) connector(A).
   2) Disconnect the oil temperature sensor connector(B).
   3) Disconnect the ECT (Engine Coolant Temperature) sensor connector(C).
   4) Disconnect the ignition coil connector(D).



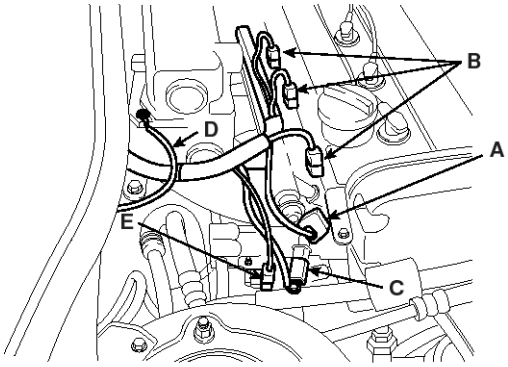
ECKD203A

5) Disconnect the TPS (Throttle Position Sensor) connector(A).
6) Disconnect the ISA (Idle Speed Actuator) connector(B).



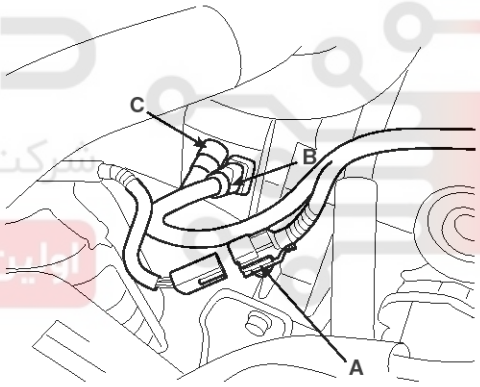
EDQF197A

7) Disconnect the CMP (Camshaft Position Sensor) connector(A).
8) Disconnect the four injector connectors(B).
9) Disconnect the knock sensor connector(C).
10) Disconnect the ground cables (D) from the intake manifold.
11) Disconnect the air conditioner compressor switch connector(E).



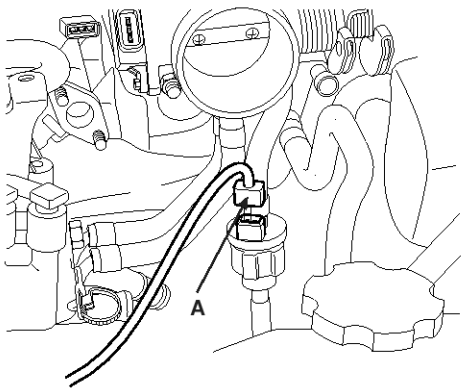
ADIE008A

12) Disconnect the front heated oxygen sensor connector(A).
13) Disconnect the CKP(Crankshaft Position Sensor) connector(B).
14) Disconnect the oil pressure switch connector(C).



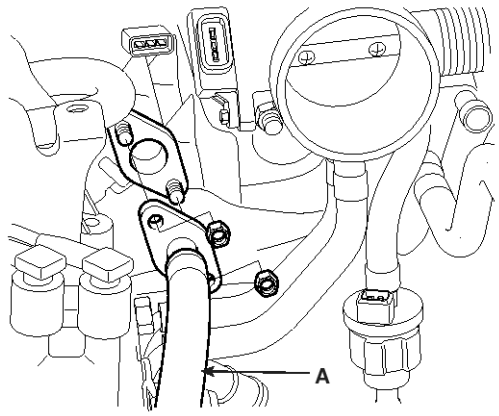
ACGE056A

15) Disconnect the PCSV (Purge Control Solenoid Valve) connector(A).



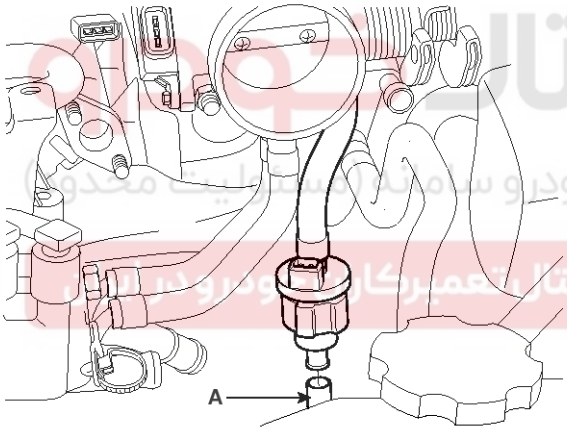
ECKD207A

10. Disconnect the fuel inlet hose(A) of the delivery pipe side.



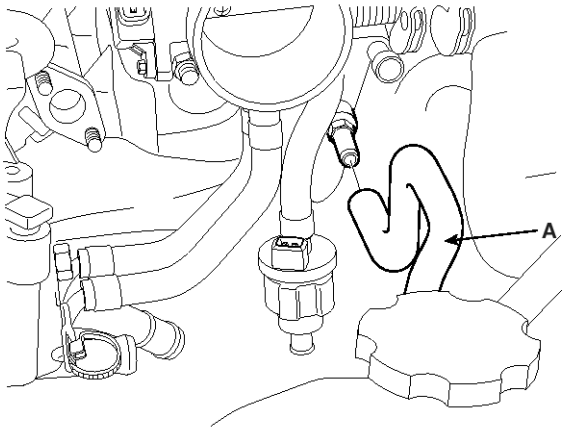
LDIF005A

11. Disconnect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



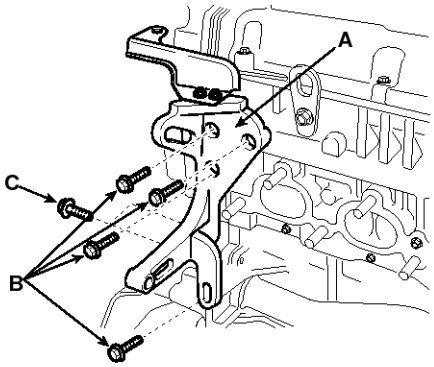
LDIF006A

12. Remove the brake booster vacuum hose(A).



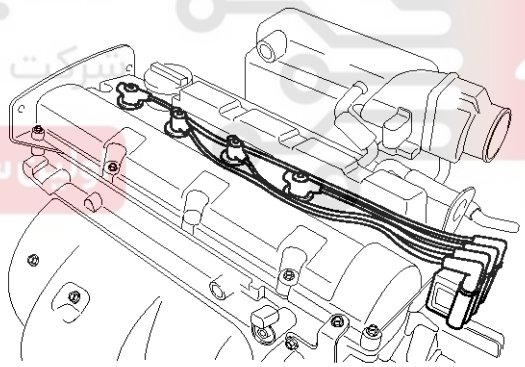
LDIF007A

13. Remove the power steering pump drive belt.
14. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
15. Remove the bolts(B, C) and power steering pump bracket(A).



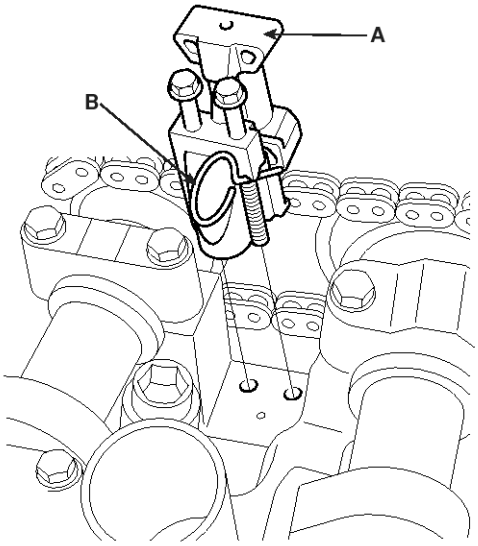
ACGE008A

16. Remove the spark plug cables.



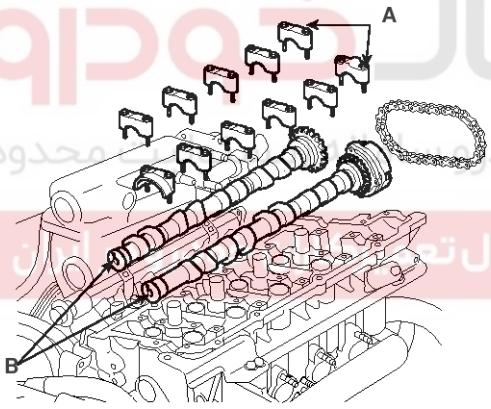
ACGE002A

17. Remove the exhaust manifold. (Refer to EMA-113)
18. Remove the intake manifold. (Refer to EMA-110)
19. Remove the timing belt. (Refer to EMA-27 ~ 29, step 2 ~ 15)
20. Remove the PCV(Positive Crankcase Ventilation) hose.
21. Remove the cylinder head cover. (Refer to EMA-30, step 18)
22. Remove the camshaft sprocket. (Refer to EMA-31, step 19)
23. Insert a stopper pin or other device into timing chain auto tensioner and remove the auto tensioner.



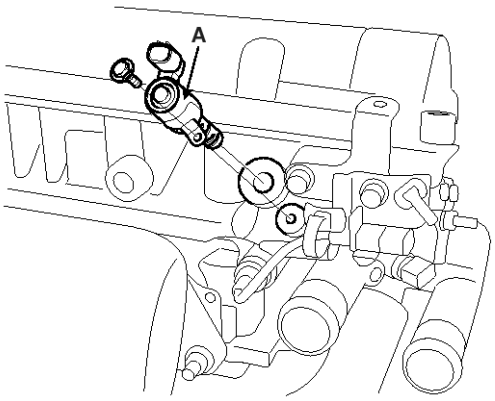
ECKD212A

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



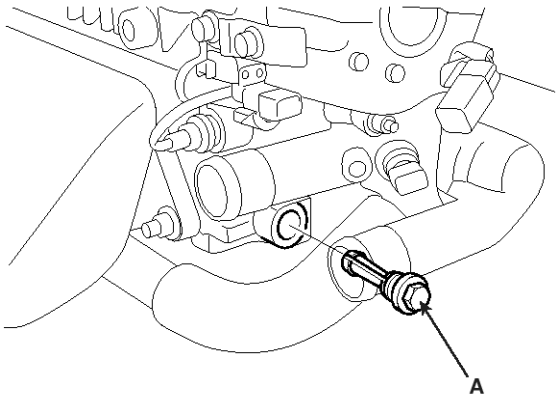
ECKD213A

25. Remove the OCV(Oil Control Valve)(A).



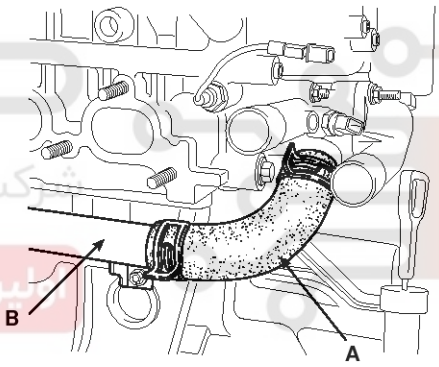
ECKD214A

26. Remove the OCV(Oil Control Valve) filter(A).



ECKD215A

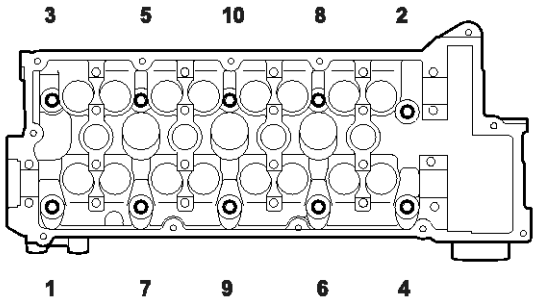
27. Remove the water hose(A) from water pipe(B).



ACGE009A

28. 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.

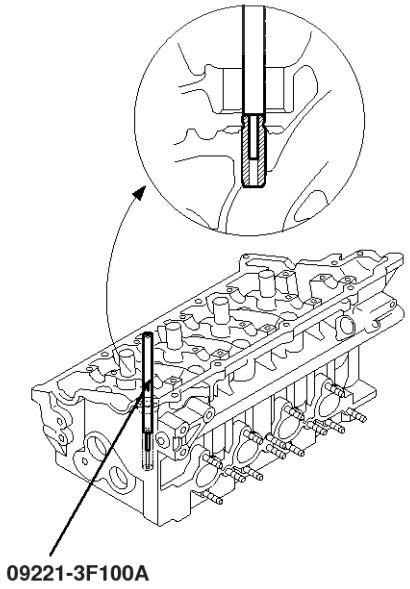
2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

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

REPLACEMENT

VALVE GUIDE

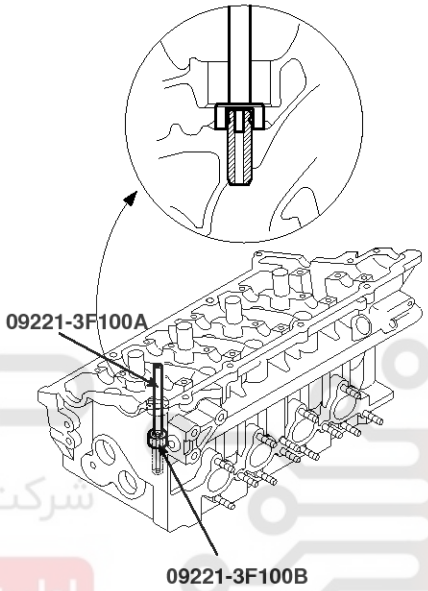
1. Using the SST(09221 - 3F100A), withdraw the old valve guide toward the bottom of cylinder head.



ECKD900A

2. Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.
3. Using the SST (09221 - 3F100 A/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.

Valve guide length
Intake : 45.8 ~ 46.2mm (1.8031 ~ 1.8189in)
Exhaust : 54.3 ~ 54.7mm (2.1378 ~ 2.1535in)



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.

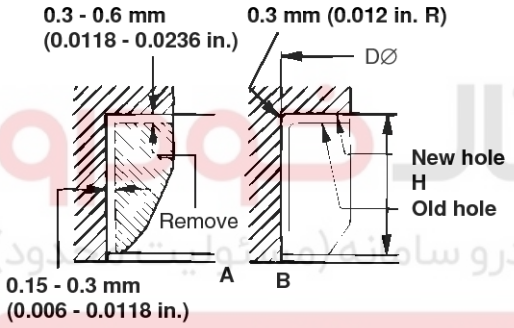
4. After the valve guide is press-fitted, insert a new valve and check for proper stem-to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

VALVE GUIDE OVERSIZE

Item	Oversize [mm (in)]	Size mark	Valve guide hole inner diameter [mm (in)]	Valve guide outer diameter [mm (in)]	Valve guide protrusion height [mm (in)]
Valve guide	STD	-	11.000 ~ 11.018 (0.4331 ~ 0.4338)	11.040 ~ 11.050 (0.4346 ~ 0.4350)	14.000 (0.5512)
	0.05 (0.002) OS	5	11.050 ~ 11.068 (0.4350 ~ 0.4357)	11.090 ~ 11.100 (0.4366 ~ 0.4370)	
	0.25 (0.010) OS	25	11.250 ~ 11.268 (0.4429 ~ 0.4436)	11.290 ~ 11.300 (0.4445 ~ 0.4449)	
	0.50 (0.020) OS	50	11.500 ~ 11.518 (0.4528 ~ 0.4535)	11.540 ~ 11.550 (0.4543 ~ 0.4547)	

VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



ECA9281F

2. Enlarge the seat ring hole of cylinder head so that matches the specified cylinder head hole inner diameter of new valve seat ring.
3. Heat the cylinder head to about 250℃(480˚F) and press-fit an oversize seat ring for the cylinder head hole size.
4. Using lapping compound, lap the valve to the new seat.

VALVE SEAT RING OVERSIZE

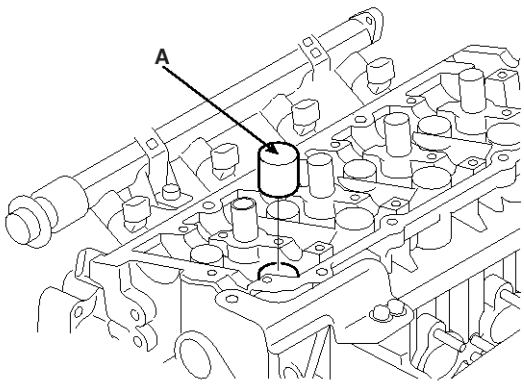
Item	Over size mm(in.)	Size mark	Seat ring hole inner diameter [mm(in)]	Seat ring outer diameter [mm(in)]	Seat ring height [mm(in)]
Intake valve seat ring	STD	-	33.000 ~ 33.025 (1.2992 ~ 1.3002)	33.090 ~ 33.105 (1.3028 ~ 1.3033)	7.200 ~ 7.400 (0.2835 ~ 0.2913)
	0.3(0.012) OS	30	33.300 ~ 33.325 (1.3110 ~ 1.3120)	33.390 ~ 33.405 (1.3146 ~ 1.3152)	7.500 ~ 7.700 (0.2953 ~ 0.3031)
	0.6(0.024) OS	60	33.600 ~ 33.625 (1.3228 ~ 1.3238)	33.690 ~ 33.705 (1.3264 ~ 1.3270)	7.800 ~ 8.000 (0.3071 ~ 0.3150)
Exhaust valve seat ring	STD	-	28.500 ~ 28.521 (1.1220 ~ 1.1229)	28.590 ~ 28.605 (1.1256 ~ 1.1262)	7.600 ~ 7.800 (0.3110 ~ 0.3189)
	0.3(0.012) OS	30	28.800 ~ 28.821 (1.1339 ~ 1.1347)	28.890 ~ 28.905 (1.1374 ~ 1.1380)	7.900 ~ 8.100 (0.3110 ~ 0.3189)
	0.6(0.024) OS	60	29.100 ~ 29.121 (1.1457 ~ 1.1465)	29.190 ~ 29.205 (1.1492 ~ 1.1498)	8.200 ~ 8.400 (0.3228 ~ 0.3307)

DISASSEMBLY

NOTICE

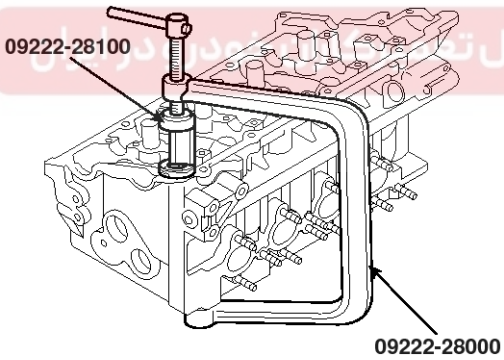
Identify MLA(Mechanical Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the MLAs(A).



ECKD217A

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



ECKD218A

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

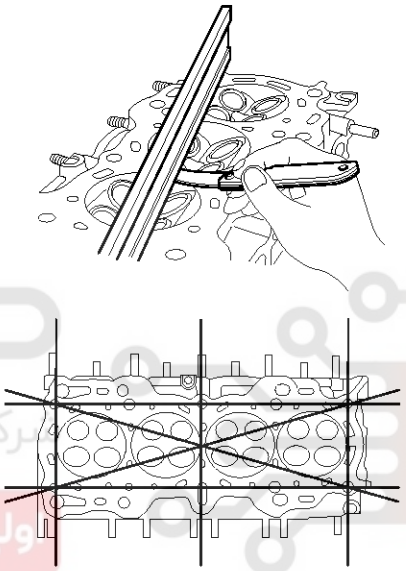
INSPECTION

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 (0.0012in)
Limit : 0.05mm (0.0020in)
Flatness of manifold mating surface
Standard : Less than 0.15mm (0.0059in)
Limit : 0.30mm (0.0118in)



ECKD001H

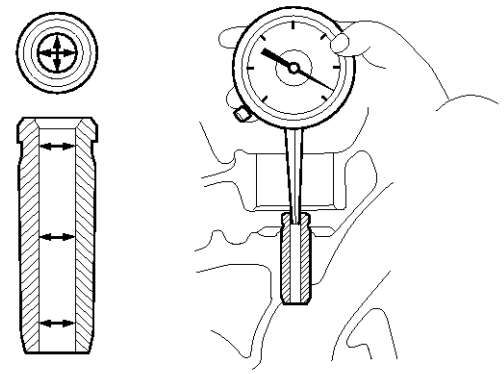
2. Inspect for cracks.

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

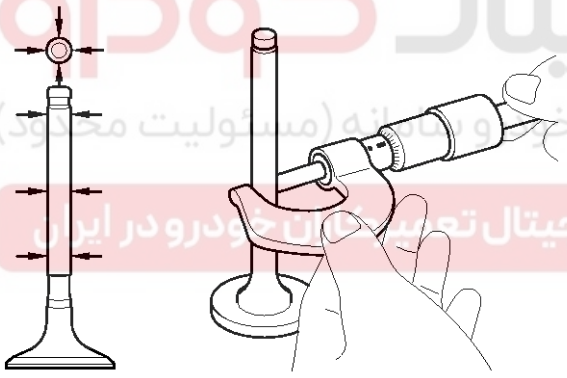
Valve guide inner diameter :
6.000 ~ 6.015mm (0.2362 ~ 0.2368in)



ECKD219A

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

Valve stem outer diameter
Intake : 5.965 ~ 5.980mm (0.2348 ~ 0.2354in)
Exhaust : 5.950 ~ 5.965mm (0.2343 ~ 0.2348in)



ECKD220A

3) Subtract the valve stem outer diameter measurement from the valve guide innner diameter measurement.

Valve stem- to-guide clearance
Standard
Intake : 0.020 ~ 0.050mm (0.0008 ~ 0.0020in)
Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in)
Limit
Intake : 0.10mm (0.0039in)
Exhaust : 0.13mm (0.0051in)

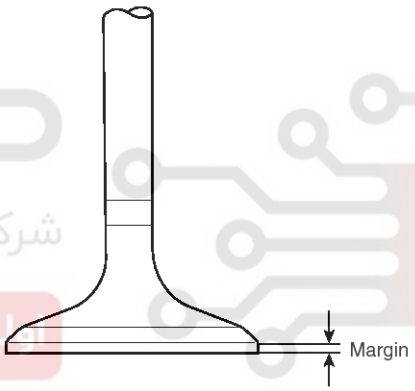
If the clearance is greater than maximum, replace the valve and valve guide.

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

      If the valve face is damaged or 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 : 1.15mm (0.0453in)
Exhaust : 1.35mm (0.0531in)
Limit
Intake : 0.8mm (0.0315in)
Exhaust : 1.0mm (0.0394in)

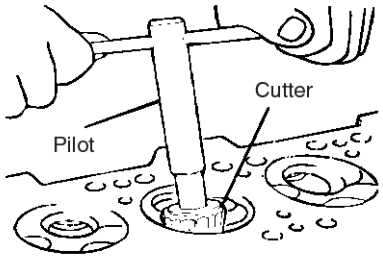


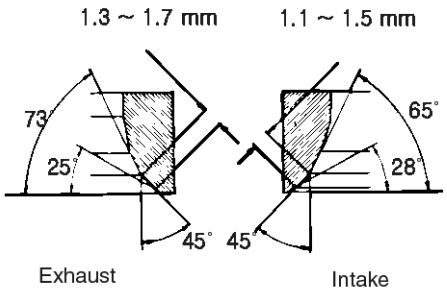
ECKD221A

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

      If the valve stem tip is worn, replace the valve.
3. Inspect the valve seats.
   1) Check the valve seat for evidence of overheating and improper contact with the valve face.

      Replace the seat if necessary.
   2) Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.
   3) 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.

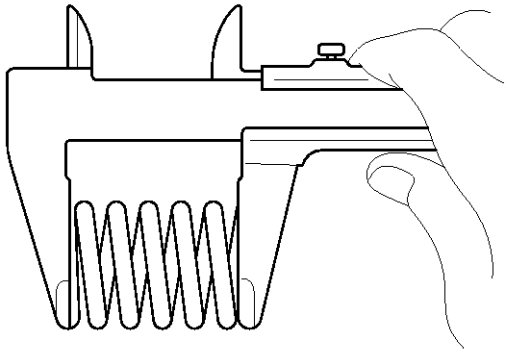




BCGE009A

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

Valve spring
Standard
Free height : 48.86mm (1.9236in)
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 : Less than 1.5°
Limit
Out of square : 3°



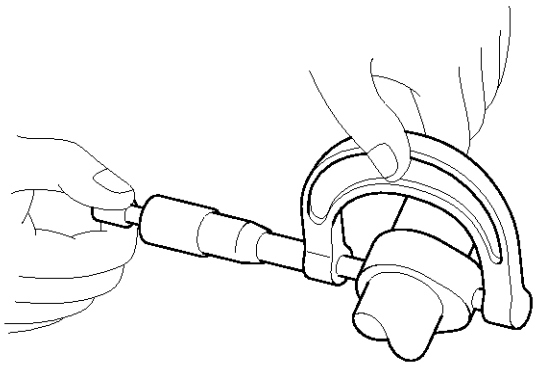
ECKD222A

If the loads is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect the cam lobes.
   Using a micrometer, measure the cam lobe height.

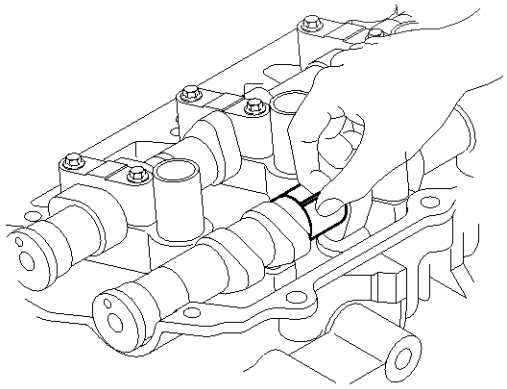
Cam height
Intake : 44.518 ~ 44.718mm (1.7527 ~ 1.7605in)
Exhaust : 44.418 ~ 44.618mm (1.7487 ~ 1.7566in)



ECKD223A

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

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



ECKD224A

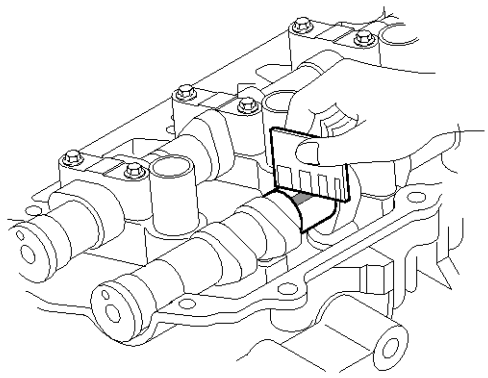
   4) Install the bearing caps and tighten the bolts with specified torque. (Refer to EMA-55, step 6)

      ⚠CAUTION
      Do not turn the camshaft.

   5) Remove the bearing caps.

6) Measure the plastigage at its widest point.

Bearing oil clearance
Standard : 0.020 ~ 0.061mm (0.0008 ~ 0.0024in)
Limit : 0.1mm (0.0039in)



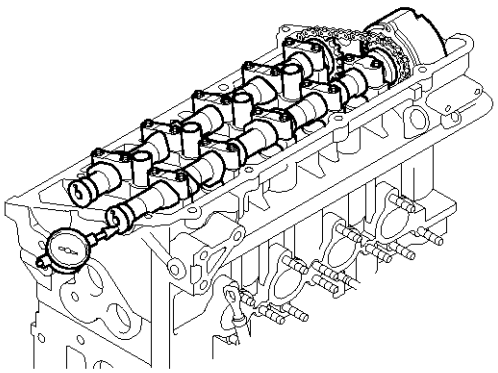
ECKD225A

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 the camshaft end play.
   1) Install the camshafts. (Refer to EMA-55, step 6)
   2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)



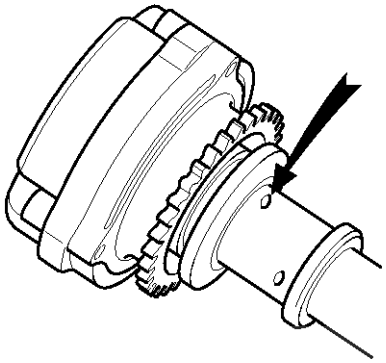
ECKD226A

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(Continuous Variable Valve Timing) ASSEMBLY

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

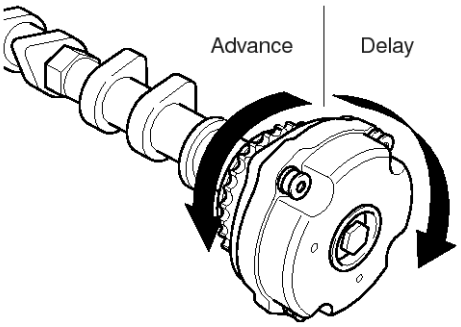


EDKD270B

3) To release the CVVT lock pin, wrap some tape around the tip of an air pressure adapter and apply low air pressure(about 14 psi) to the exposed camshaft port.

NOTICE
Wrap a shop towel or rag around the CVVT because residual oil may leak out of the unit when applying air pressure.

4) With low air pressure applied, turn the CVVT to the ADVANCE direction as indicated in the illustration.
   - With the low air pressure applied, the CVVT should turn to the ADVANCE side.
   - If too much air leaks when applying the low air pressure, the CVVT lock pin may not release and the CVVT may not turn.



BCGE010A

5) Allow the CVVT assembly to move in the ADVANCE and DELAY directions to ensure there is no binding and that it moves freely.

Standard : Movable smoothly in the range about 20˚

6) Turn the CVVT by hand and make sure it locks in the maximum delay angle position.

REASSEMBLY

NOTICE

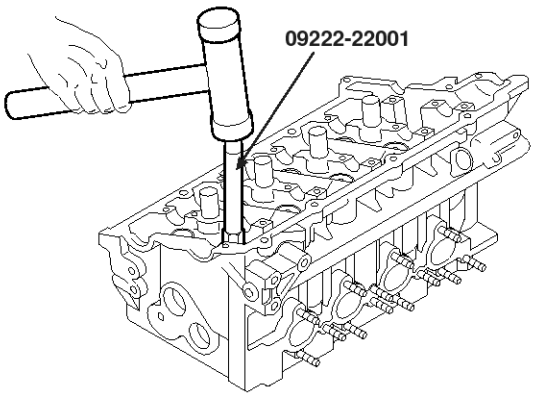
- *Thoroughly clean all parts to be assembled.*
- *Before installing the parts, apply fresh engine oil to all sliding and rotating surface.*
- *Replace oil seals with new ones.*

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

      NOTICE

      Do not reuse old valve stem oil seals.

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



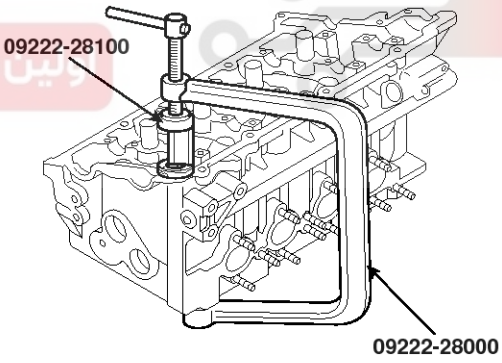
ECKD229A

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

   NOTICE

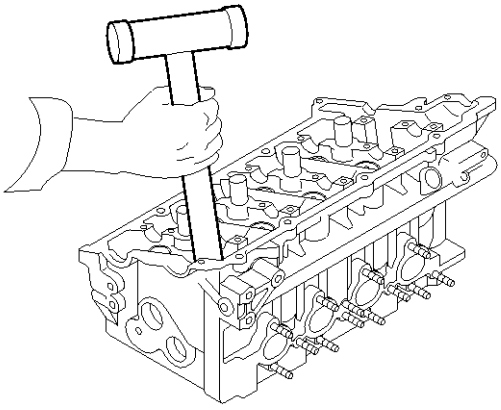
   Place the valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

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.



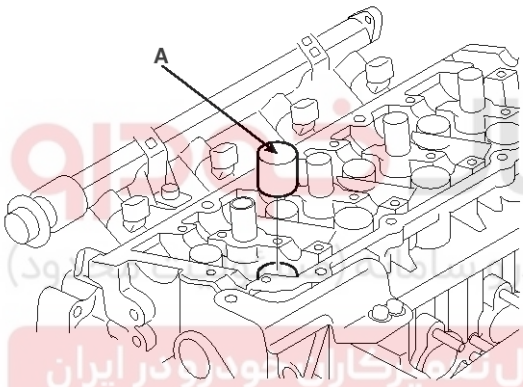
ECKD218A

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 the MLA(Mechanical Lash Adjuster)s.
   Check that the MLA rotates smoothly by hand.



ECKD217A

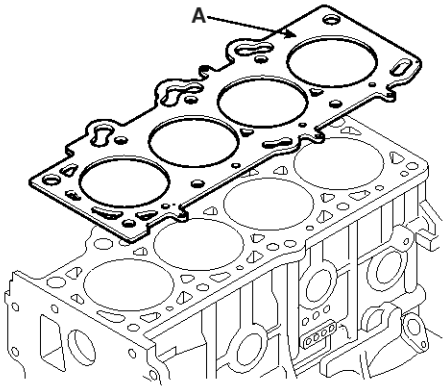
INSTALLATION

NOTICE

- *Thoroughly clean all parts to be assembled.*
- *Always use a new cylinder 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.

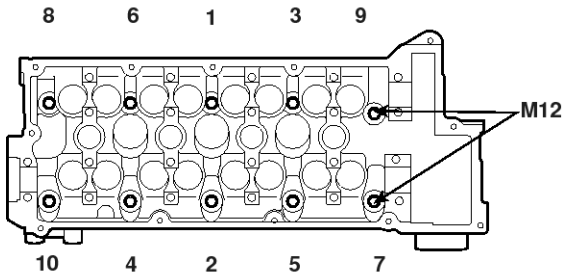
   NOTICE
   Be careful of the installation direction.



ECKD231A

2. Place the cylinder head onto the block carefully in order to prevent damaging the gasket. If the gasket is damaged, fluid leakage could occur.
3. Install the 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.

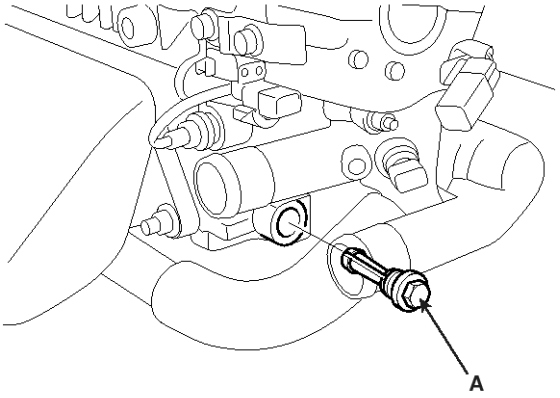
Tightening torque :
M10: 22.6~26.5N.m (2.3~2.7kgf.m, 16.6~19.5lbf.ft)+60°~65° + 60°~65°
M12: 27.5~31.4N.m (2.8~3.2kgf.m, 20.3~23.1lbf.ft)+60°~65° + 60°~65°



ECKD232A

4. Install the OCV(Oil Control Valve) filter(A).

Tightening torque :
40.2 ~ 50.0N.m (4.1 ~ 5.1kgf.m, 29.7 ~ 36.9lbf.ft)



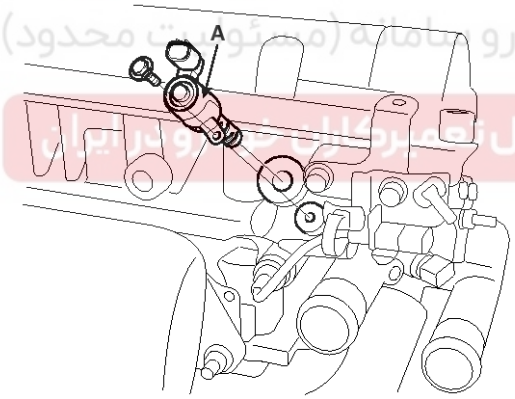
ECKD215A

NOTICE

- *Always use a new OCV(Oil Control Valve) filter gasket.*
- *Keep the OCV filter clean.*

5. Install the OCV(Oil Control Valve)(A).

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

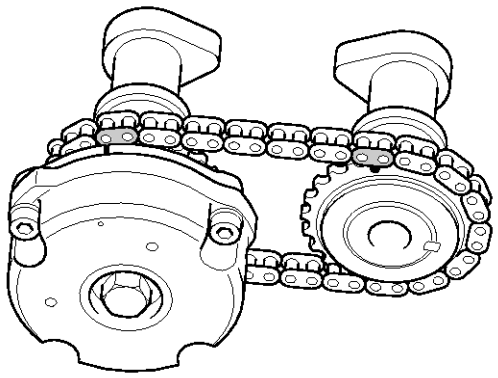


ECKD214A

CAUTION

- **Do not reuse the OCV(Oil Control Valve) when dropped.**
- **Keep the OCV clean.**
- **Do not hold the OCV(Oil Control Valve) sleeve during servicing.**
- **When the OCV is installed on the engine, be careful not to rotate the engine while holding the yoke.**

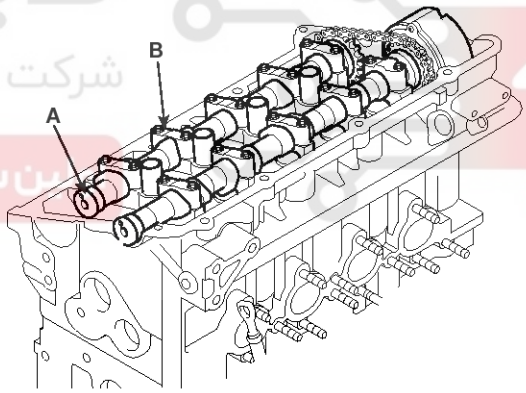
6. Install the camshafts.
   1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



ECKD233A

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

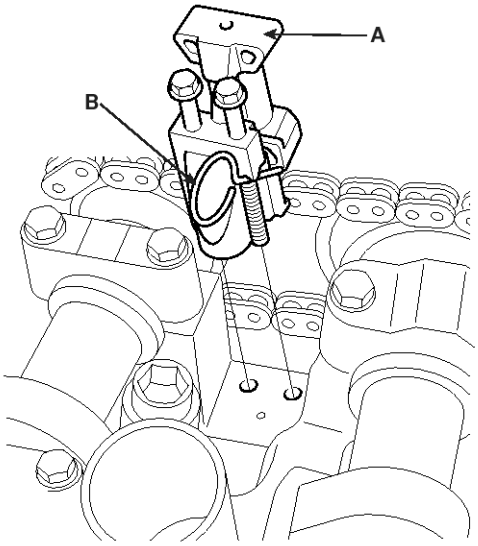
Tightening torque :
13.7 ~ 14.7N.m (1.4 ~ 1.5kgf.m, 10.1 ~ 10.8lbf.ft)



ECKD234A

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

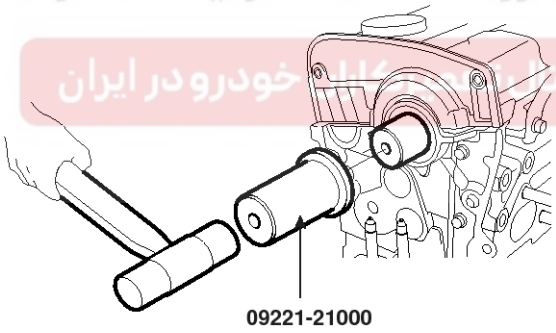
Tightening torque :
7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lbf.ft)



ECKD212A

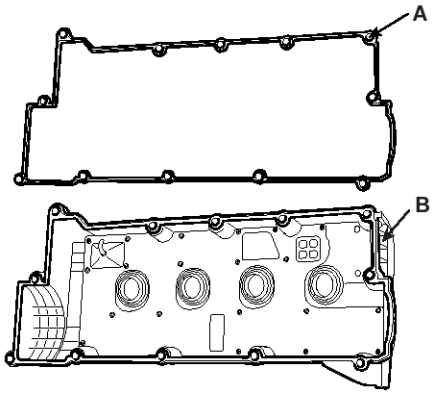
4) Remove the auto tentioner stopper pin(B).

7. Check and adjust valve clearance. (Refer to EMA-14 ~ 19)
8. Using the SST (09221 - 21000), install the camshaft bearing oil seal.



ECKD235A

9. Install the camshaft sprocket. (Refer to EMA-32, step 1)
10. Install the cylinder head cover.
    1) Install the cylinder head cover gasket(A) in the groove of the cylinder head cover(B).

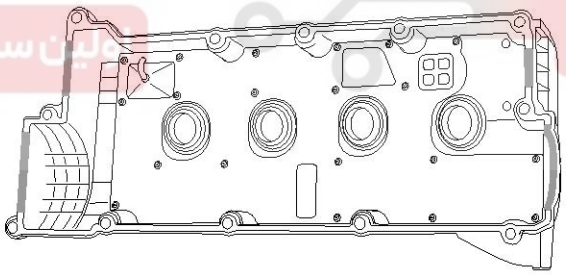


ECKD236A

NOTICE

- *Before installing the cylinder head cover gasket, thoroughly clean the cylinder head cover and the groove.*
- *When installing, make sure the cylinder 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.



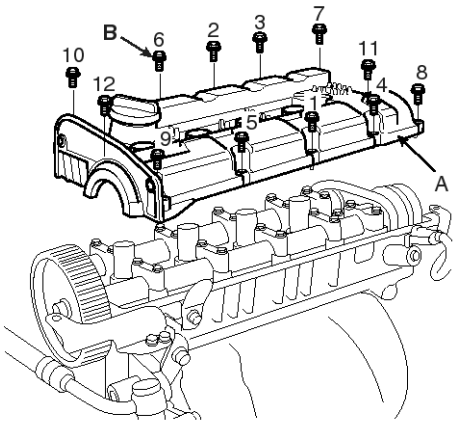
ECKD237A

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.*

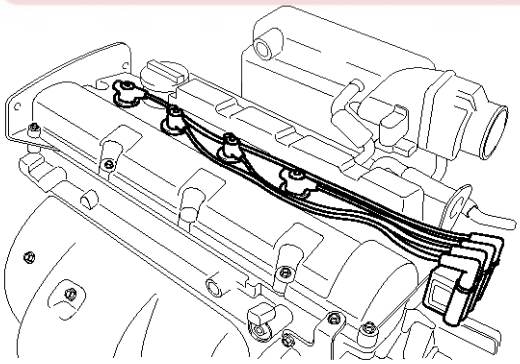
3) Install the cylinder head cover(A) with the 12 bolts(B). Uniformly tighten the bolts in several passes.

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



ADIE003A

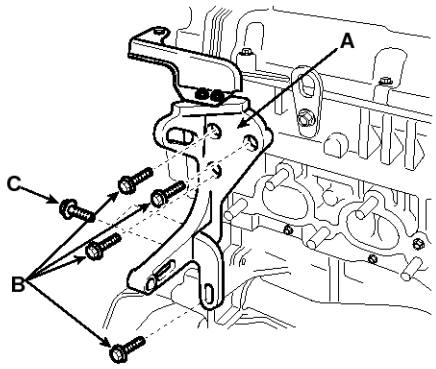
11. Install the PCV(Positive Crankcase Ventilation) hose. (Refer to EMA-33, step 2))
12. Install the timing belt. (Refer to EMA-33 ~ 37, step 4 ~ 21)
13. Install the intake manifold. (Refer to EMA-110)
14. Install the exhaust manifold. (Refer to EMA-113)
15. Install the spark plug cables.



ACGE002A

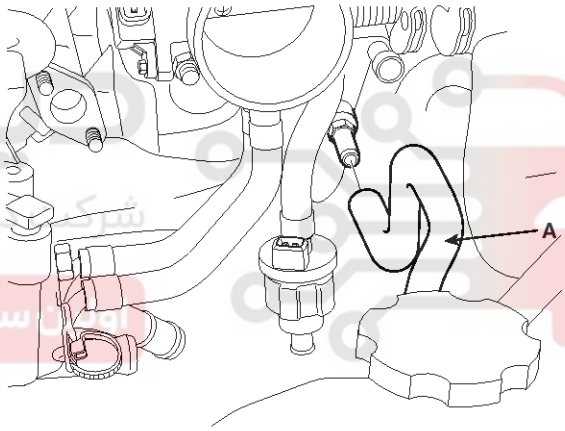
16. Install the power steering pump bracket(A) and bolts(B, C).

Tightening torque :
Bolt (B) : 34.3 ~ 49.0N.m (3.5~ 5.0kgf.m, 25.3 ~ 36.2lbf.ft)
Bolt (C) : 11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lbf.ft)



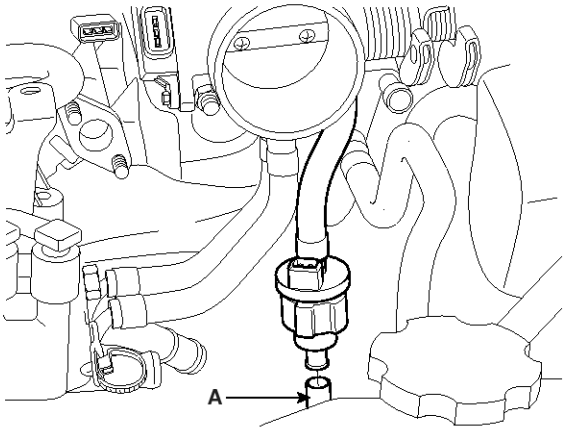
ACGE008A

17. Install the power steering pump. (See ST group - power steering pump)
18. Install the accelerator cable.
19. Install the brake booster hose(A).



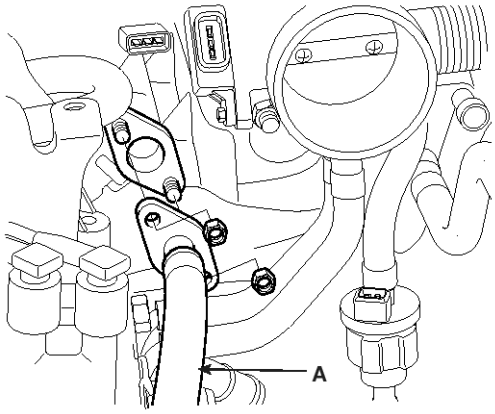
LDIF007A

20. Connect the hose(A) of the PCSV (Purge Control Solenoid Valve) side.



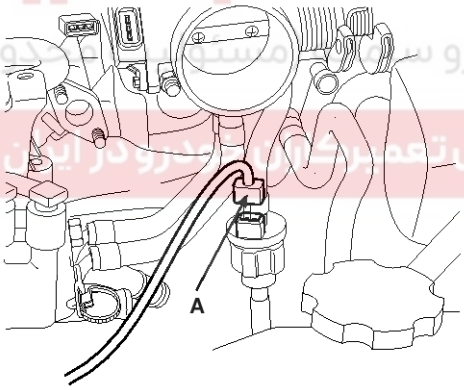
LDIF006A

21. Connect the fuel inlet hose(A) of the delivery pipe side.



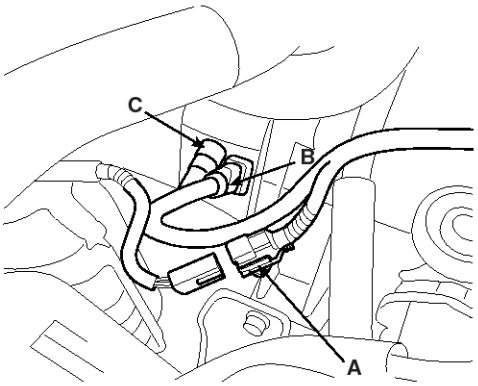
LDIF005A

22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
    1) Connect the PCSV(Purge Control Solenoid Valve) connector(A).



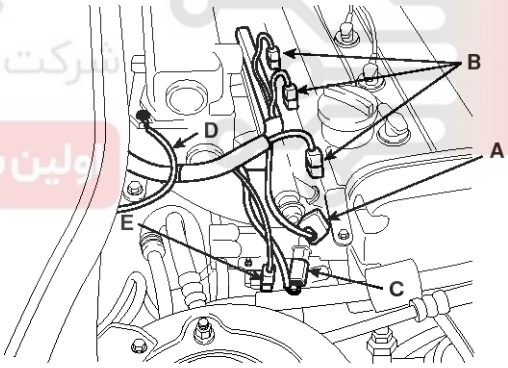
ECKD207A

    2) Connect the front heated oxygen sensor connector (A).
    3) Connect the CKP(Crankshaft Position Sensor) connector(B).
    4) Connect the oil pressure switch connector(C).



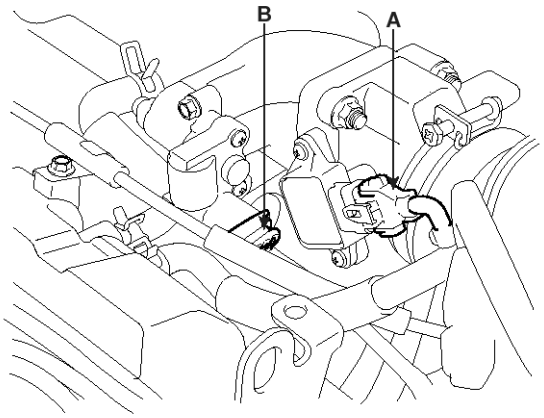
ACGE056A

    5) Connect the air conditioner compressor switch connector(E).
    6) Connect the ground cables(D) to intake manifold.
    7) Connect the knock sensor connector(C).
    8) Connect the fuel injector connectors(B).
    9) Connect the CMP(Camshaft position sensor) connector(A).



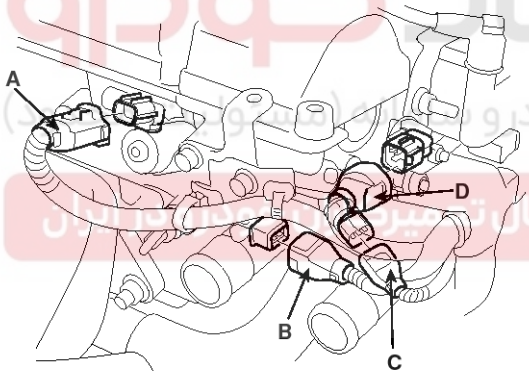
ADIE008A

    10) Connect the ISA(Idle Speed Actuator) connector(B).
    11) Connect the TPS (Throttle Position Sensor) connector (A).



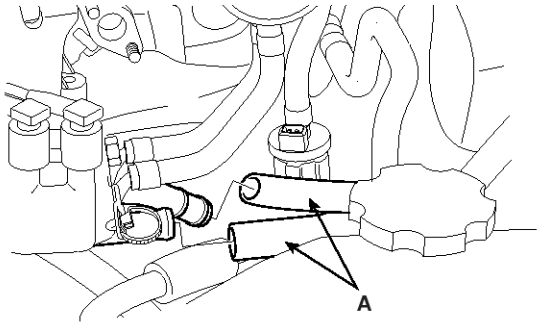
EDQF197A

12) Connect the ignition coil connector(D).
13) Connect the ECT (Engine Coolant Temperature) connector(C).
14) Connect the oil temperature sensor connector(B).
15) Connect the OCV(Oil Control Valve) connector(A).



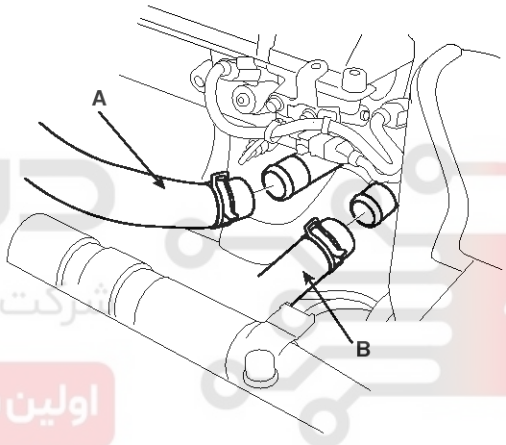
ECKD203A

23. Install the heater hose(A).



ECKD202A

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

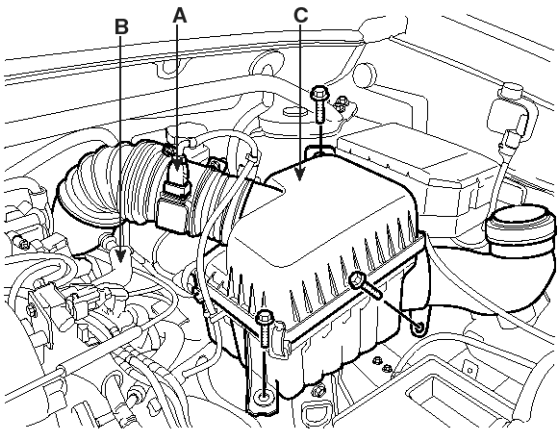


ADIE007A

25. Install the intake air hose and air cleaner assembly.
    1) Install the intake air hose, air cleaner assembly(C) and bolts.

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

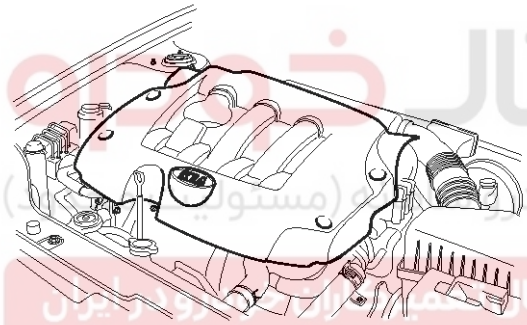
    2) Install the breather hose(B) to intake air hose.
    3) Connect the AFS(Air Flow Sensor) connector(A).



LDIF008A

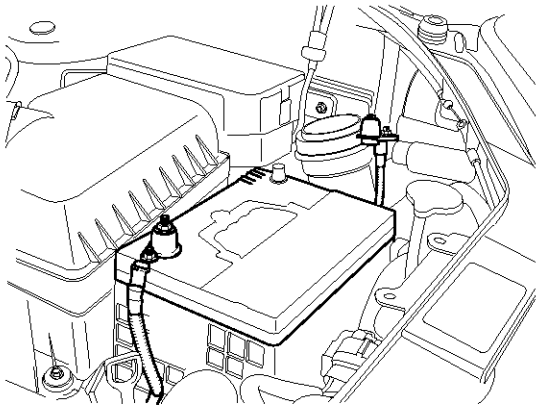
26. Install the engine cover.

Tightening torque :
3.9 ~ 5.9N.m (0.4 ~ 0.6kgf.m, 2.9 ~ 4.3lbf.ft)



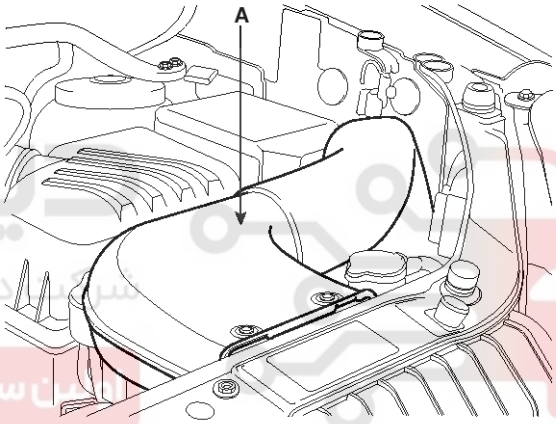
ADIE001A

27. Reconnect the battery terminals(A).



ADIE004A

28. Install the air duct(A).

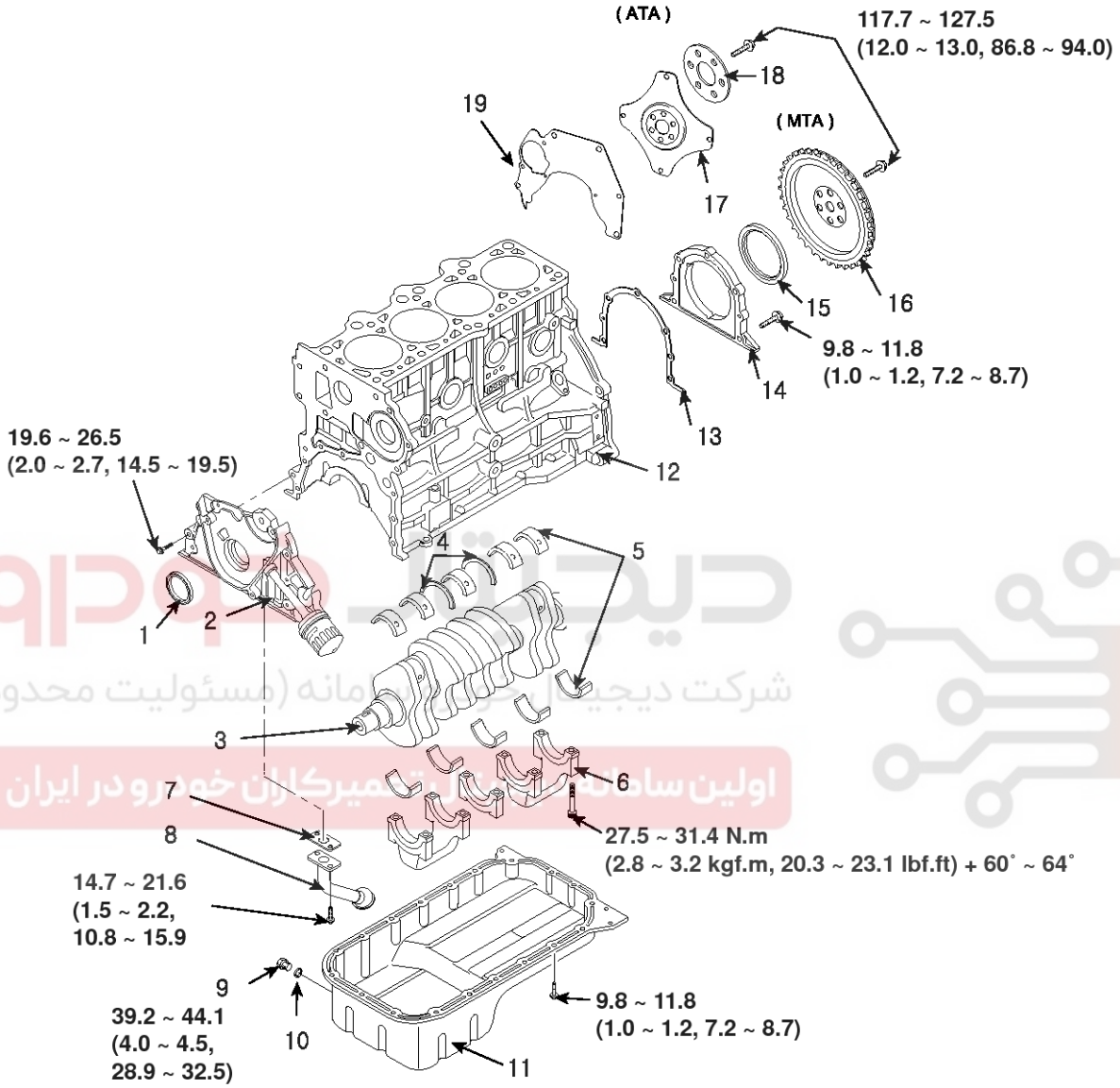


LDIF003A

29. Fill with engine coolant.
30. Start the engine and check for leaks.
31. Recheck engine coolant level and oil level.

Cylinder Block

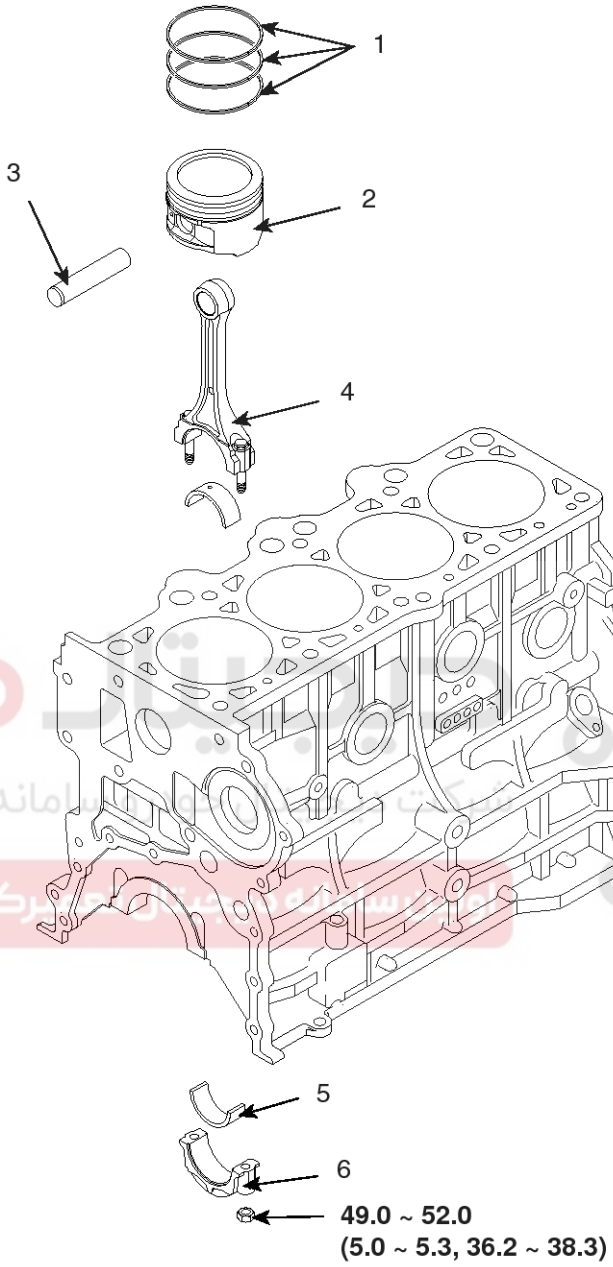
COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

1. Oil seal
2. Front case
3. Crank shaft
4. Thrust bearing
5. Main bearing
6. main bearing cap
7. Gasket
8. Oil screen
9. Drain plug
10. Gasket
11. Oil pan
12. Cylinder block
13. Gasket
14. Rear oil seal case
15. Oil seal
16. Fly wheel
17. Drive plate
18. Washer
19. Rear plate

LDIF031A



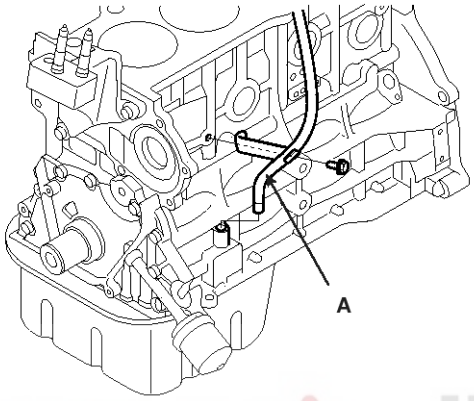
TORQUE : N.m (kgf.m, lbf.ft)

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

LDIF032A

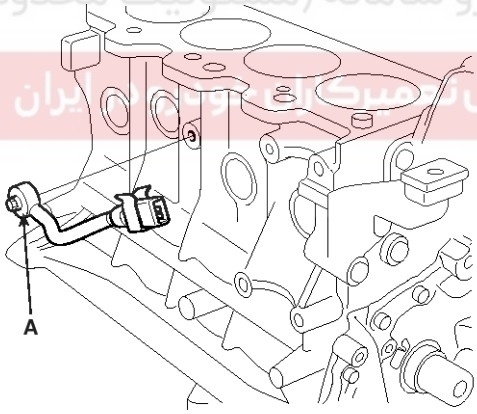
DISASSEMBLY

1. M/T : Remove the fly wheel.
2. A/T : Remove the drive plate.
3. Install the engine block onto an engine stand for disassembly.
4. Remove the timing belt. (Refer to EMA-27)
5. Remove the cylinder head. (Refer to EMA-40)
6. Remove the oil level gauge tube(A).



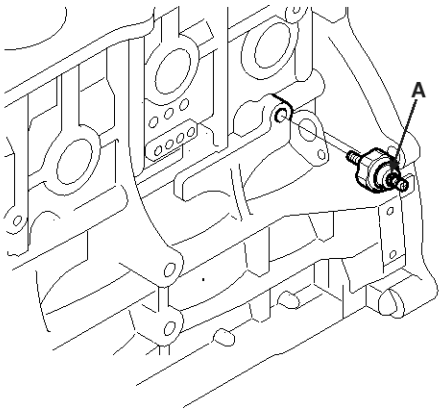
ECKD301A

7. Remove the knock sensor(A).



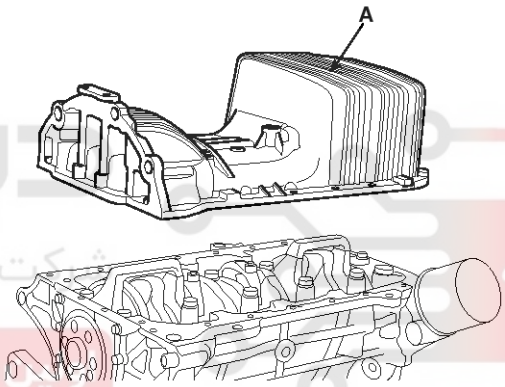
ECKD302A

8. Remove the oil pressure switch(A).



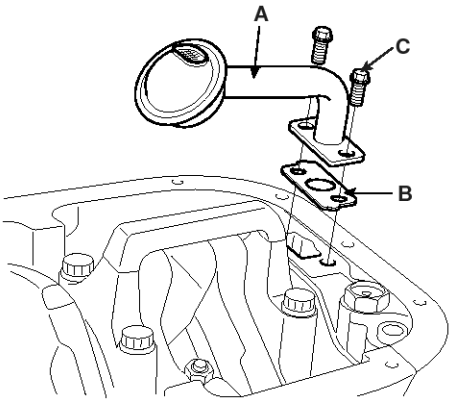
ECKD303A

9. Remove the water pump. (Refer to EMA-92)
10. Remove the oil pan(A).



ECKD304A

11. Remove the oil screen.
    Remove the 2bolts(C), oil screen(A) and gasket(B).



ECKD305A

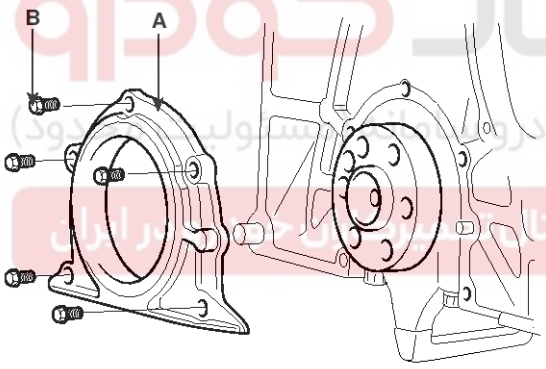
12. Check the connecting rod end play. (Refer to EMA-74, step 1)
13. Remove the connecting rod caps and check oil clearance. (Refer to EMA-74, step 2)
14. Remove the piston and connecting rod assemblies.
    1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
    2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTICE

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

15. Remove the front case. (Refer to EMA-104, step 8 ~ 9)
16. Remove the rear oil seal case.

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

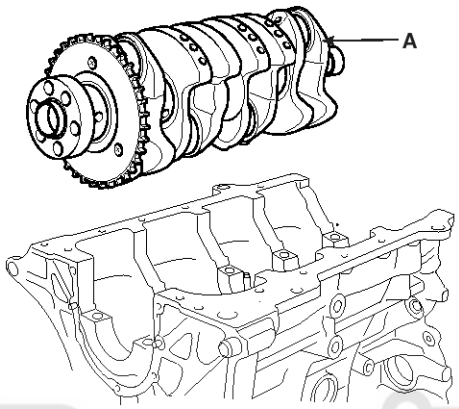


ECKD306A

17. Remove the crankshaft bearing cap and check oil clearance. (Refer to EMA-76, step 4)
18. Check the crankshaft end play. (Refer to EMA-78, step 5)
19. Lift the crankshaft(A) out of the engine, being careful not to damage journals.

NOTICE

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

NOTICE

Arrange the piston rings in the correct order only.

22. Remove the connecting rod from the piston.

    Using a press, remove the piston pin from piston.

    (Press-in load : 350 ~ 1,350kg(772~2,976lb)

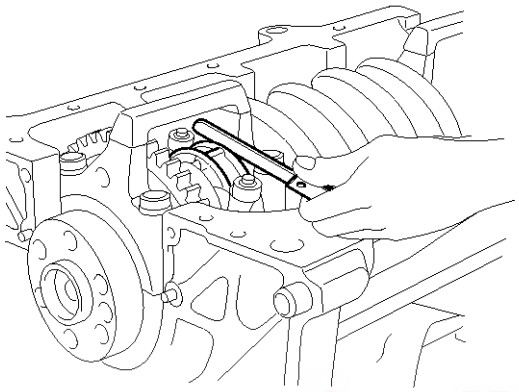
INSPECTION

CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

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

End play
Standard : 0.1 ~ 0.25mm (0.0039 ~ 0.0098in)
Maximum : 0.4mm (0.0157in)



ECKD308A

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

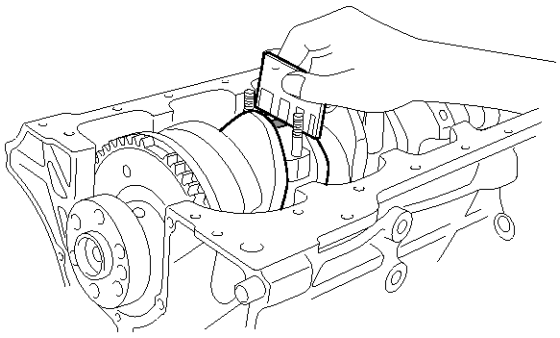
2. Check the connecting rod bearing oil clearance.
   1) Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
   2) Remove the 2 connecting rod cap nuts.
   3) Remove the connecting rod cap and lower bearing.
   4) Clean the crankshaft pin journal and bearing.
   5) Place a plastigage across the crankshaft pin journal.
   6) Reinstall the lower bearing and cap, and tighten the nuts.

Tightening torque :
49.0 ~ 52.0N.m (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lbf.ft)

NOTICE
Do not turn the crankshaft.

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

Standard oil clearance
0.024 ~ 0.044mm (0.0009 ~ 0.0017in)



ECKD309A

   9) If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to connecting rod bearing selection table)

      Recheck the oil clearance.

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

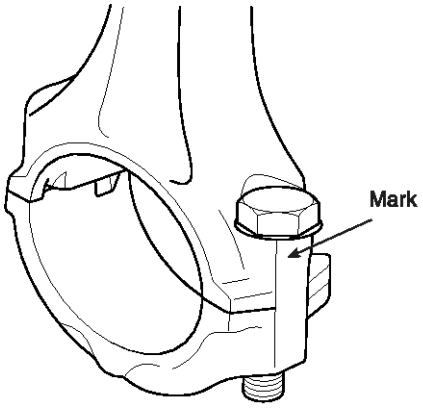
   10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to connecting rod bearing selection table)

      Recheck the oil clearance.

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 alignment marks are unreadable because of an accumulation of grease or grime, don't clean with a wire or abrasive cleaner. Clean only with correct cleaning solvent or detergent.

Connecting rod mark location

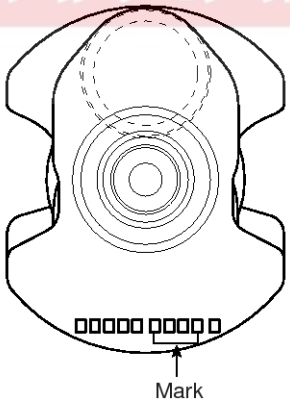


LDIF021A

Discrimination of connecting rod

Mark	Connecting rod big-end inner diameter
A	48.000 ~ 48.006mm (1.8898 ~ 1.8900in)
B	48.006 ~ 48.012mm (1.8900 ~ 1.8902in)
C	48.012 ~ 48.018mm (1.8902 ~ 1.8905in)

Crankshaft pin journal mark location

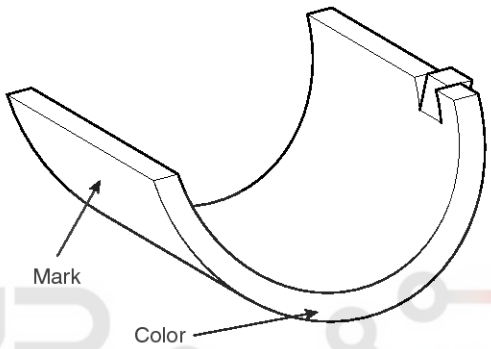


BCGE015A

Discrimination of crankshaft pin journal

Mark	Crankshaft pin journalouter diameter
1	44.960 ~ 44.966mm (1.7701 ~ 1.7703in)
2	44.952 ~ 44.960mm (1.7698 ~ 1.7701in)
3	44.946 ~ 44.952mm (1.7695 ~ 1.7698in)

Connecting rod bearing mark location



BCGE017A

Discrimination of connecting rod bearing

Mark	Color	Connecting rod bearing thickness
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) Select the bearing by using selection table.

Connecting rod bearing selection table

		Connecting rod mark		
		A (White)	B (None)	C (Yellow)
Crank shaft pin journal mark	1 (Yellow)	D (Yellow)	C (Green)	B (None)
	2 (None)	C (Green)	B (None)	A (Black)
	3 (White)	B (None)	A (Black)	AA (Blue)

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

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

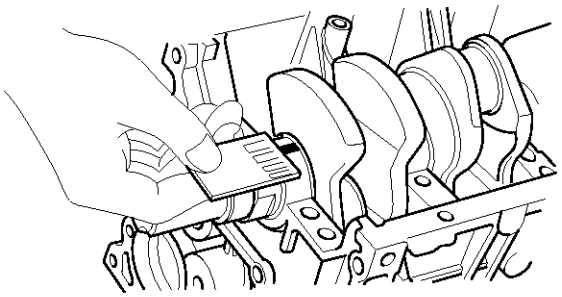
4. Check the crankshaft bearing oil clearance.
   1) To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
   2) Clean each main journal and lower bearing with a clean shop towel.
   3) Place one strip of plastigage across each main journal.
   4) Reinstall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

Tightening torque : 27.5 ~ 31.4N.m
(2.8 ~3.2kgf.m, 20.3 ~ 23.1lbf.ft)+60˚~ 64˚

NOTICE
Do not turn the crankshaft.

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

Standard oil clearance :
0.028 ~ 0.048mm (0.0011 ~ 0.0019in)



ECKD001I

6) If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to EMA-78, step 8))
   Recheck the oil clearance.

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

7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing.
   (Refer to EMA-78, step 8))
   Recheck the oil clearance.

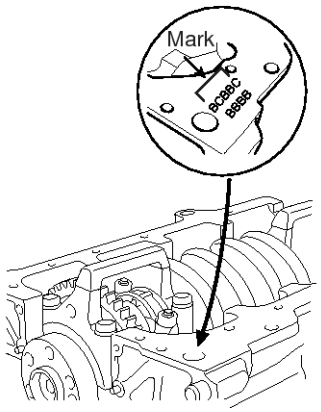
NOTICE
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION
If the alignment marks are unreadable because of accumulation of grease or grime, don't clean with a wire or abrasive cleaner. Clean only with correct cleaning solvent or detergent.

Cylinder block crankshaft journal 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 letters stamped on the crank (marks for main journal size), to choose the correct bearings.

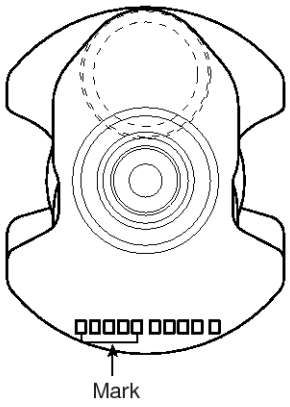


BCGE027A

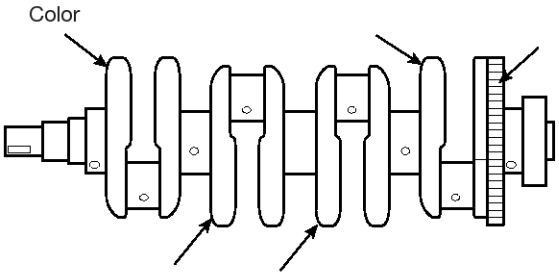
Discrimination of cylinder block crankshaft journal bore

Mark	Cylinder block crankshaft journal boreinner diameter
A	61.000 ~ 61.006mm (2.4016 ~ 2.4018in)
B	61.006 ~ 61.012mm (2.4018 ~ 2.4020in)
C	61.012 ~ 61.018mm (2.4020 ~ 2.4023in)

Crankshaft main journal mark location



BCGE028A

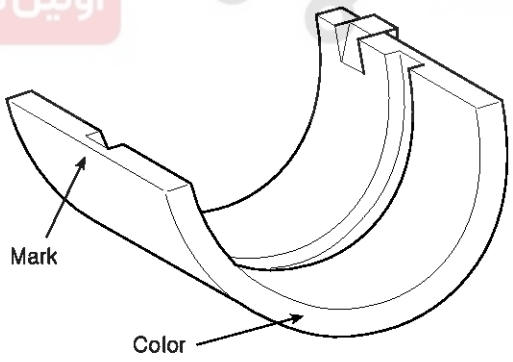


BCGE029A

Discrimination of crankshaft main journal

Mark	Color	Crankshaft main journal outer diameter
1	Yellow	56.956 ~ 56.962mm (2.2424 ~ 2.2426in)
2	None	56.948 ~ 56.956mm (2.2420 ~ 2.2424in)
3	White	56.942 ~ 56.948mm (2.2418 ~ 2.2420in)

Crankshaft main bearing mark location



BCGE030A

Discrimination of crankshaft main bearing

Mark	Color	Crankshaft main bearing thickness
AA	Blue	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)
A	Black	2.011 ~ 2.014mm (0.0792 ~ 0.0793in)
B	None	2.008 ~ 2.011mm (0.0791 ~ 0.0792in)
C	Green	2.005 ~ 2.008mm (0.0789 ~ 0.0791in)
D	Yellow	2.002 ~ 2.005mm (0.0788 ~ 0.0789in)

8) Select the bearing by using selection table.

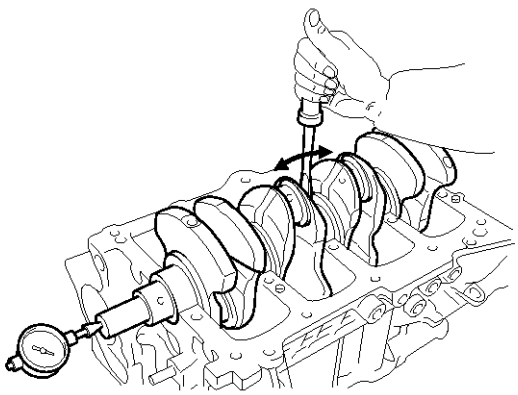
Crankshaft main bearing selection table

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

5. Check the crankshaft end play.

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

End play
Standard: 0.06 ~ 0.26mm (0.0024 ~ 0.0102in)
Limit : 0.30mm (0.0118in)



ECKD001B

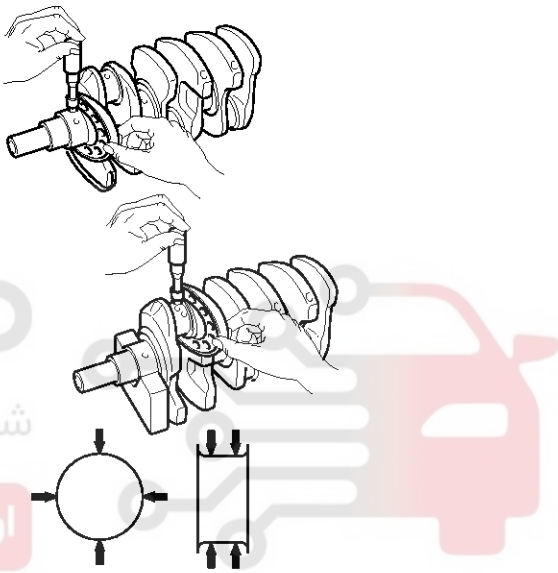
If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness :
2.44 ~ 2.77mm (0.0961 ~ 0.0972in)

6. Inspect the crankshaft main journals and pin journals.

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

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



ECKD001E

CYLINDER BLOCK

1. Remove the gasket material.

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

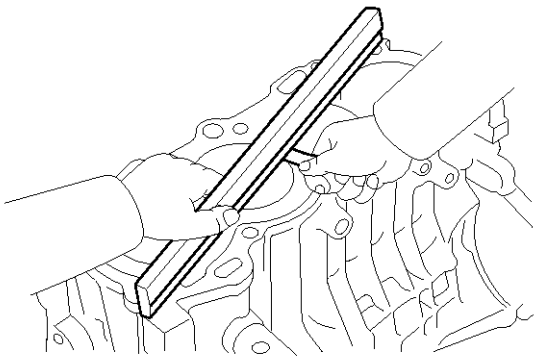
2. Clean the cylinder block.

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

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

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

Flatness of cylinder block gasket surface
Total : Less than 0.05mm (0.0020in)
Bore to bore : Less than 0.03mm (0.0012in)



ECKD001L

4. Inspect the cylinder bore.

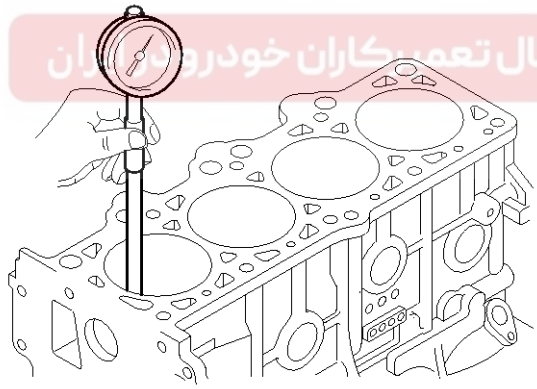
   Visually check the cylinder for vertical scratchs.

   If deep scratchs are present, replace the cylinder block.

5. Inspect the cylinder bore diameter.

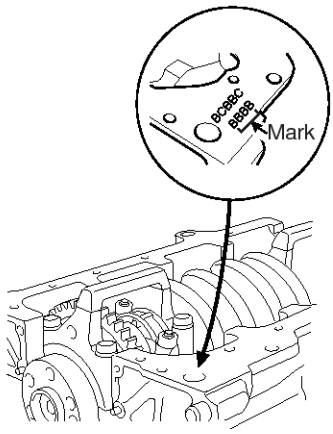
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

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



ECKD318A

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

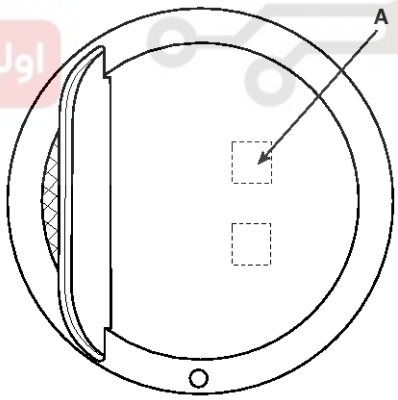


BCGE031A

Discrimination of cylinder bore size

Mark	Cylinder bore inner diameter
A	82.00 ~ 82.01mm (3.2283 ~ 3.2287in)
B	82.01 ~ 82.02mm (3.2287 ~ 3.2291in)
C	82.02 ~ 82.03mm (3.2291 ~ 3.2295in)

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



ECKD320B

Discrimination of piston outer diameter

Mark	Piston outer diameter
A	81.97 ~ 81.98mm (3.2272 ~ 3.2276in)
None	81.98 ~ 81.99mm (3.2276 ~ 3.2279in)
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)

8. Select the piston related to cylinder bore class.

Piston-to-cylinder clearance :
0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

Boring cylinder

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

   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(Outer Diameter), calculate the new bore size.

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

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

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

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

Standard : 0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

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

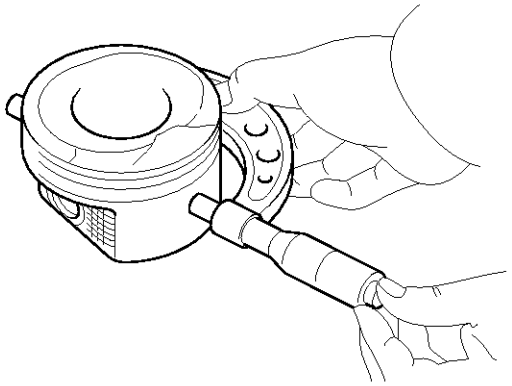
PISTON AND PISTON RINGS

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

   NOTICE
   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47mm (1.85in) from top land of the piston.

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



ECKD001D

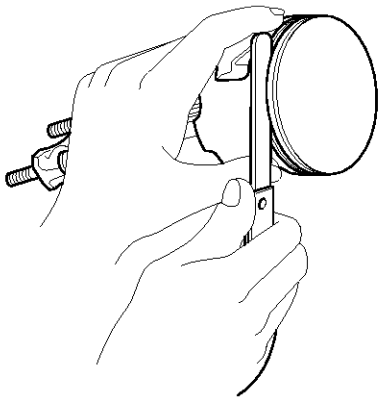
3. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

Piston-to-cylinder clearance :
0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance
No.1 : 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)
No. 2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059in)
Limit
No.1 : 0.1mm (0.0039in)
No.2 : 0.1mm (0.0039in)
Oil ring : 0.2mm (0.0079in)



ECKD001G

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

5. Inspect the piston ring end gap.

   To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston rings. If the gap is too large, recheck the cylinder bore inner diameter. If the bore is over the service limit, the cylinder block must be rebored. (Refer to EMA-80)

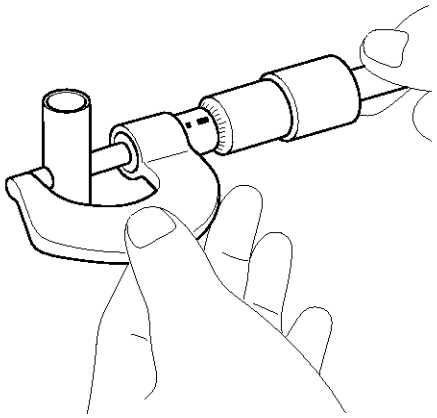
Piston ring end gap
Standard
No.1 : 0.23 ~ 0.38mm (0.0091 ~ 0.0150in)
No.2 : 0.33 ~ 0.48mm (0.0130 ~ 0.0189in)
Oil ring : 0.20 ~ 0.60mm(0.0079 ~ 0.0236in)
Limit
No.1, 2, oil ring : 1.0mm(0.039in)

ECKD001K

PISTON PINS

1. Measure the outer diameter of piston pin.

Piston pin diameter :
20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



ECKD001Z

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

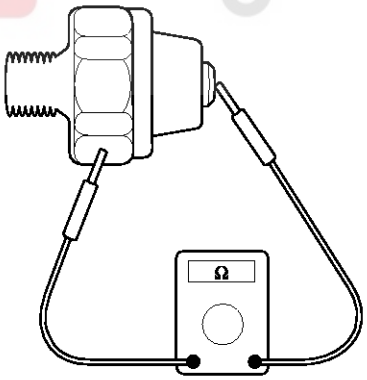
Piston pin-to-piston clearance :
0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

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

Piston pin-to-connecting rod interference :
-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

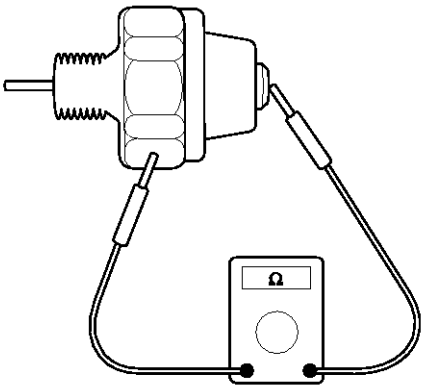
OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter. If there is no continuity, replace the oil pressure switch.



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.



ECKD001Y

3. If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) is applied through the oil hole, the switch is operating properly.

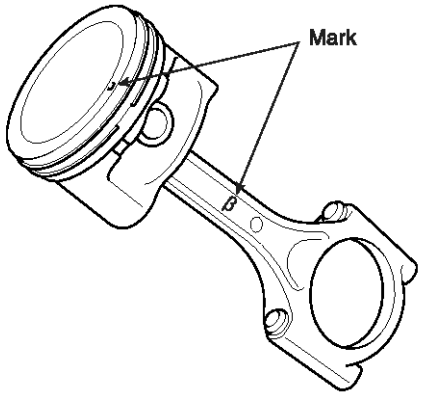
   Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

REASSEMBLY

NOTICE

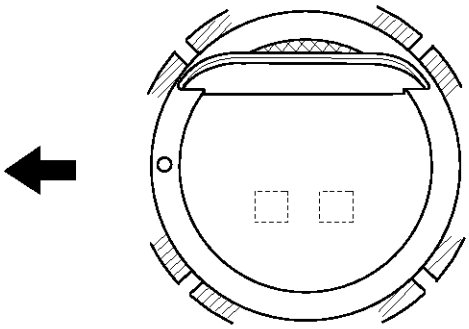
- *Thoroughly clean all parts to assembled.*
- *Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.*
- *Replace all gaskets, O-rings and oil seals with new parts.*

1. Assemble the 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.



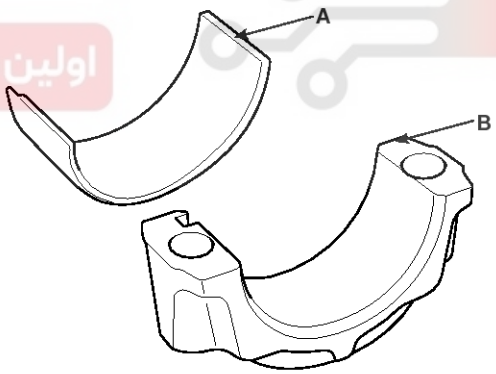
LDIF022A

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



ECKD321A

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



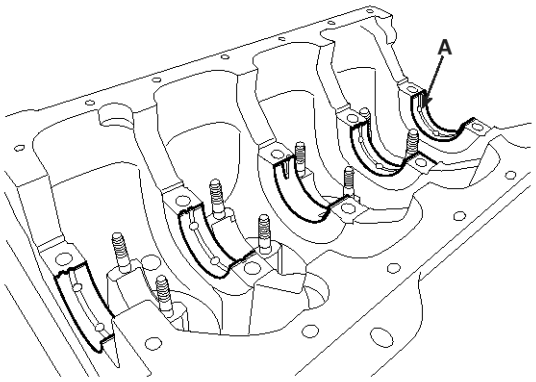
ECKD322A

4. Install the crankshaft 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).



ECKD323A

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

5. Install the thrust bearings.

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

ECKD324A

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

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.*

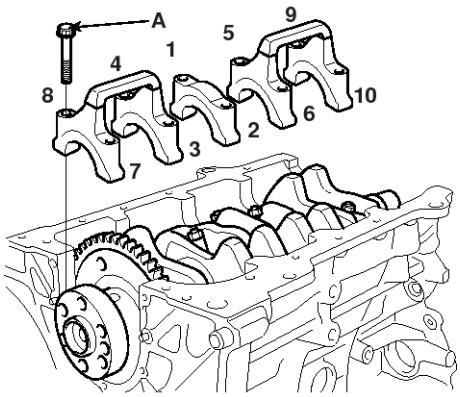
1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

2) Install and uniformly tighten the 10 bearing cap bolts(A), in several passes, in the sequence shown.

Tightening torque : 27.5 ~ 31.4N.m
(2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lbf.ft) + 60°~ 64°

CAUTION

Always use new main bearing cap bolts.



ECKD325A

3) Check that the crankshaft turns smoothly.

9. Check the crankshaft end play. (Refer to EMA-78, step 5)
10. Install the piston and connecting rod assemblies.

NOTICE

Before installing the piston, 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 rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

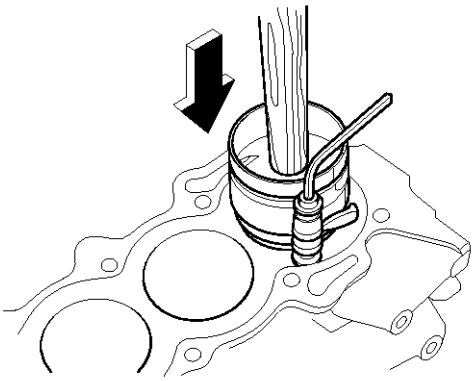
3) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

4) Apply engine oil to the bolt threads. install the rod caps with bearings, and tighten the nuts.

Tightening torque :
49.0 ~ 52.0N.m (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lbf.ft)

NOTICE

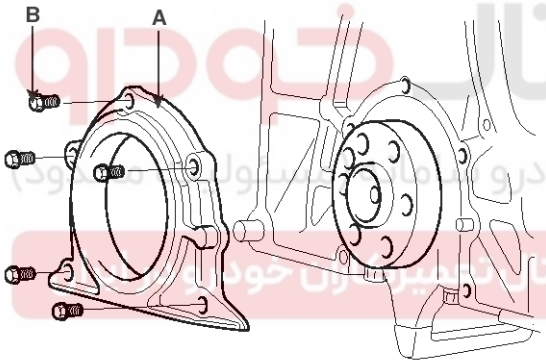
Maintain downward force on the ring compressor to prevent the rings from expending before entering the cylinder bore.



ECKD001F

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

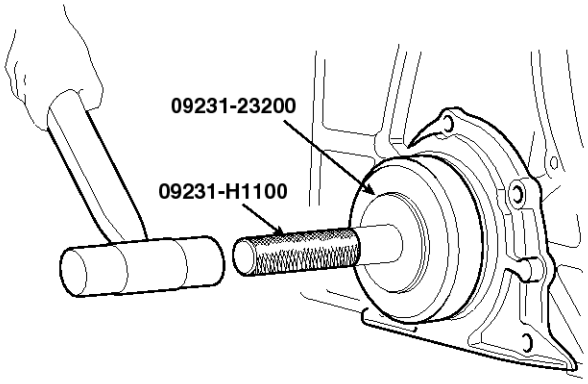
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lbf.ft)



ECKD306A

NOTICE
Check that the mating surfaces are clean and dry.

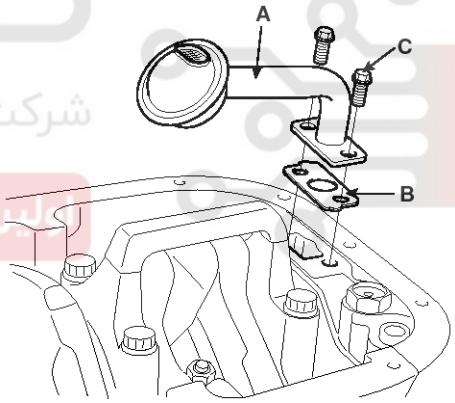
12. Install the rear oil seal.
    1) Apply engine oil to a new oil seal lip.
    2) Using the SST(09231-23200, 09231-H1100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



SAMM19103N

13. Install the front case. (Refer to EMA-106, step 1 ~ 5)
14. Install the oil screen.
    Install a new gasket(B) and oil screen(A) with 2 bolts(C).

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lbf.ft)



ECKD305A

15. Install the 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 liquid gasket.

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

Liquid gasket : MS 721-40A or equivalent

NOTICE
- *To prevent leakage of oil, apply liquid gasket*

to the inner threads of the bolt holes.

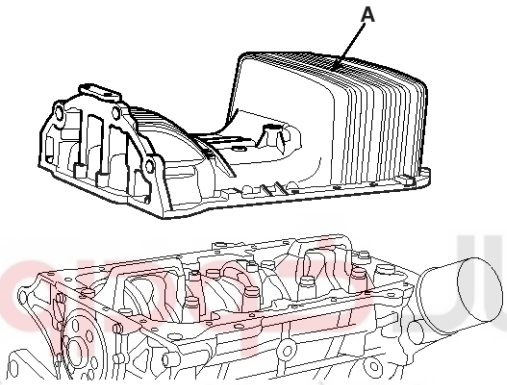
- *Do not install the parts if five minutes or more have elapsed since applying the liquid gasket.*

  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(A) with the bolts.

Uniformly tighten the bolts in several passes.

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



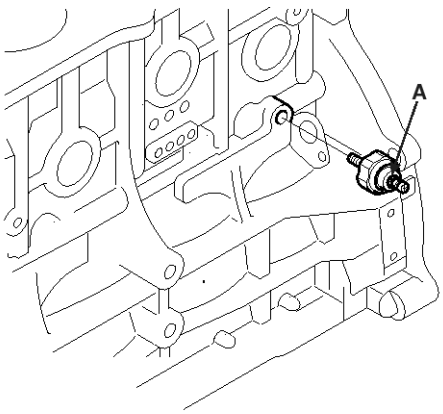
ECKD304A

16. Install the water pump. (Refer to EMA-96)
17. Install the oil pressure switch.
    1) Apply adhesive to 2 or 3 threads.

Adhesive : MS 721-39(B) or equivalent.

    2) Install the oil pressure switch(A).

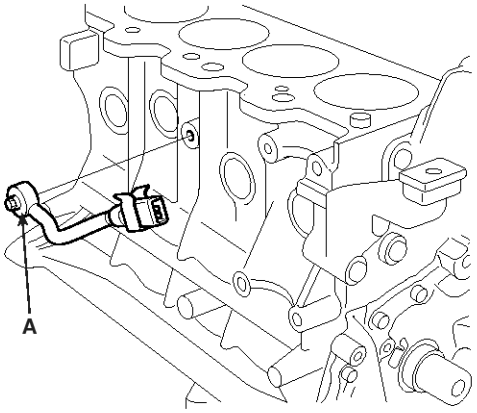
Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lbf.ft)



ECKD303A

18. Install the knock sensor(A).

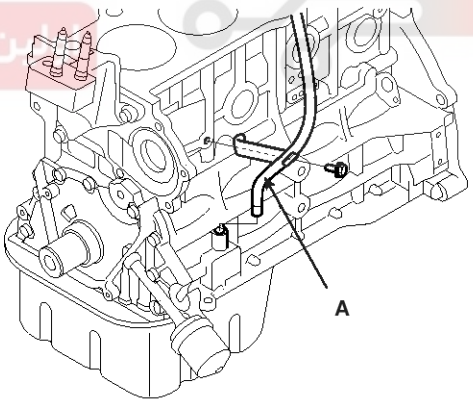
Tightening torque :
16.7 ~ 26.5N.m (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lbf.ft)



ECKD302A

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

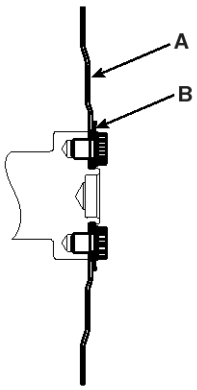
Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lbf.ft)



ECKD301A

20. Install the cylinder head. (Refer to EMA-54)
21. Install the timing belt. (Refer to EMA-32)
22. Remove the engine stand.
23. A/T : install the drive plate(A) and washer(B).

Tightening torque :
117.7 ~ 127.5N.m (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lbf.ft)



ACGE018A

24. M/T : install the fly wheel.

Tightening torque :
117.7 ~ 127.5N.m (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lbf.ft)

Cooling System

ENGINE COOLANT REFILLING AND BLEEDING

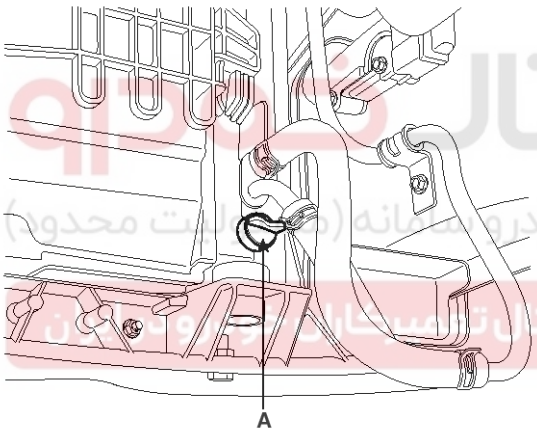
WARNING

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

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 the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.



LDIF023A

4. Tighten the radiator drain plug(A) 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. Fill fluid mixture with coolant and water slowly through the radiator cap. Gently squeeze the upper/lower hoses of the radiator so as to bleed air easily.

   NOTICE

   - *Use only genuine antifreeze/coolant.*
   - *For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant 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. Start tart the engine and allow coolant to circulates.

   When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
8. Repeat 7 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
11. Stop the engine and allow coolant to cool.
12. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

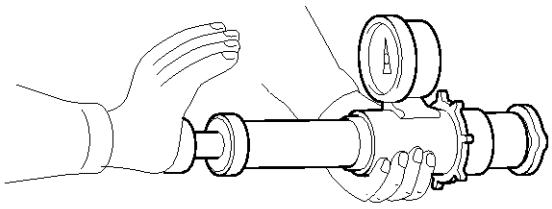
    NOTICE

    Recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

Coolant capacity : 6.0 liters (6.34 US qt, 5.28 Imp qt)

RADIATOR CAP TESTING

1. Remove the radiator cap, wet its seal with engine coolant, then install it on pressure tester.

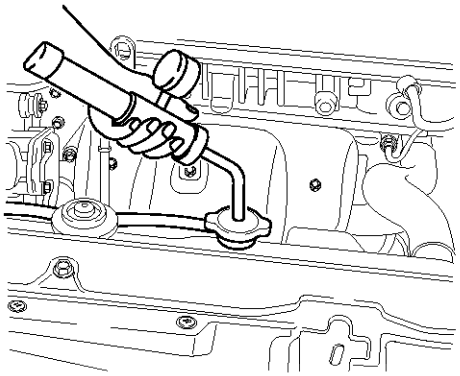


ECKD501X

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.

RADIATOR LEAKAGE TEST

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).



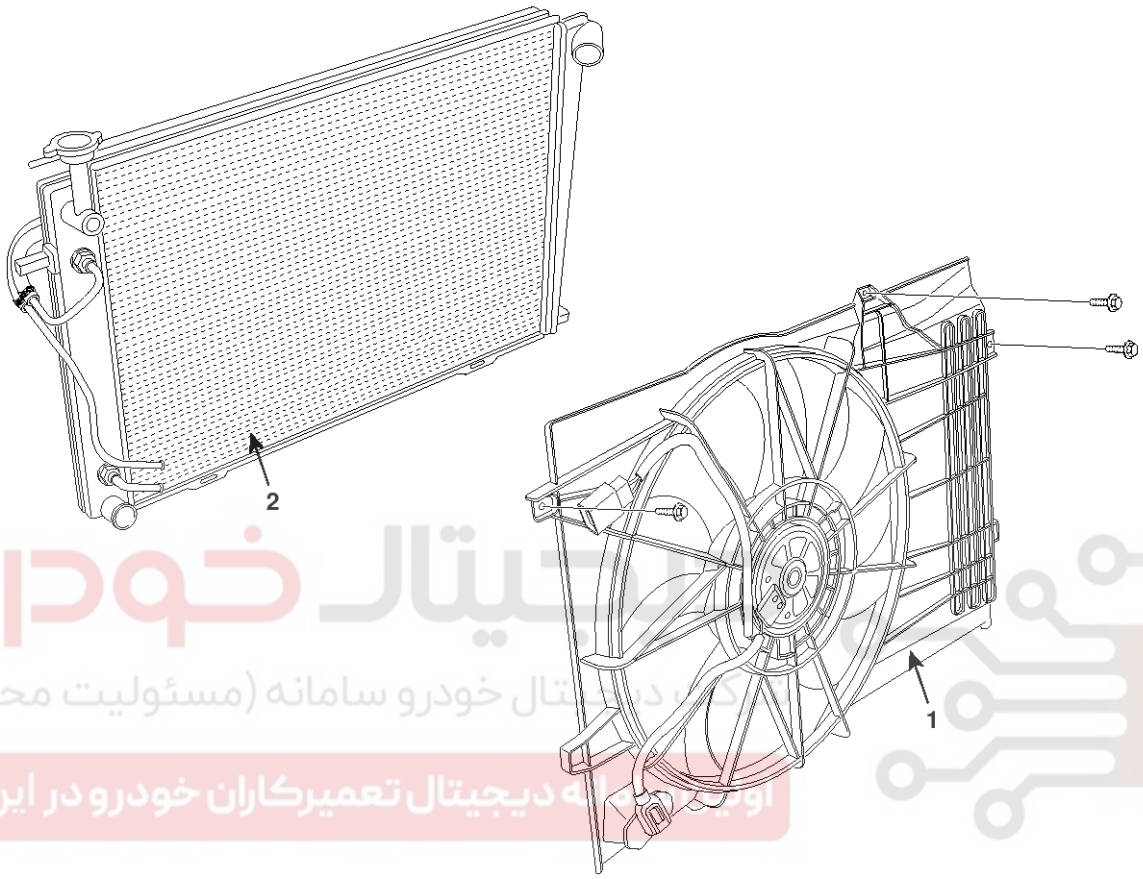
ACGE020A

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

NOTICE

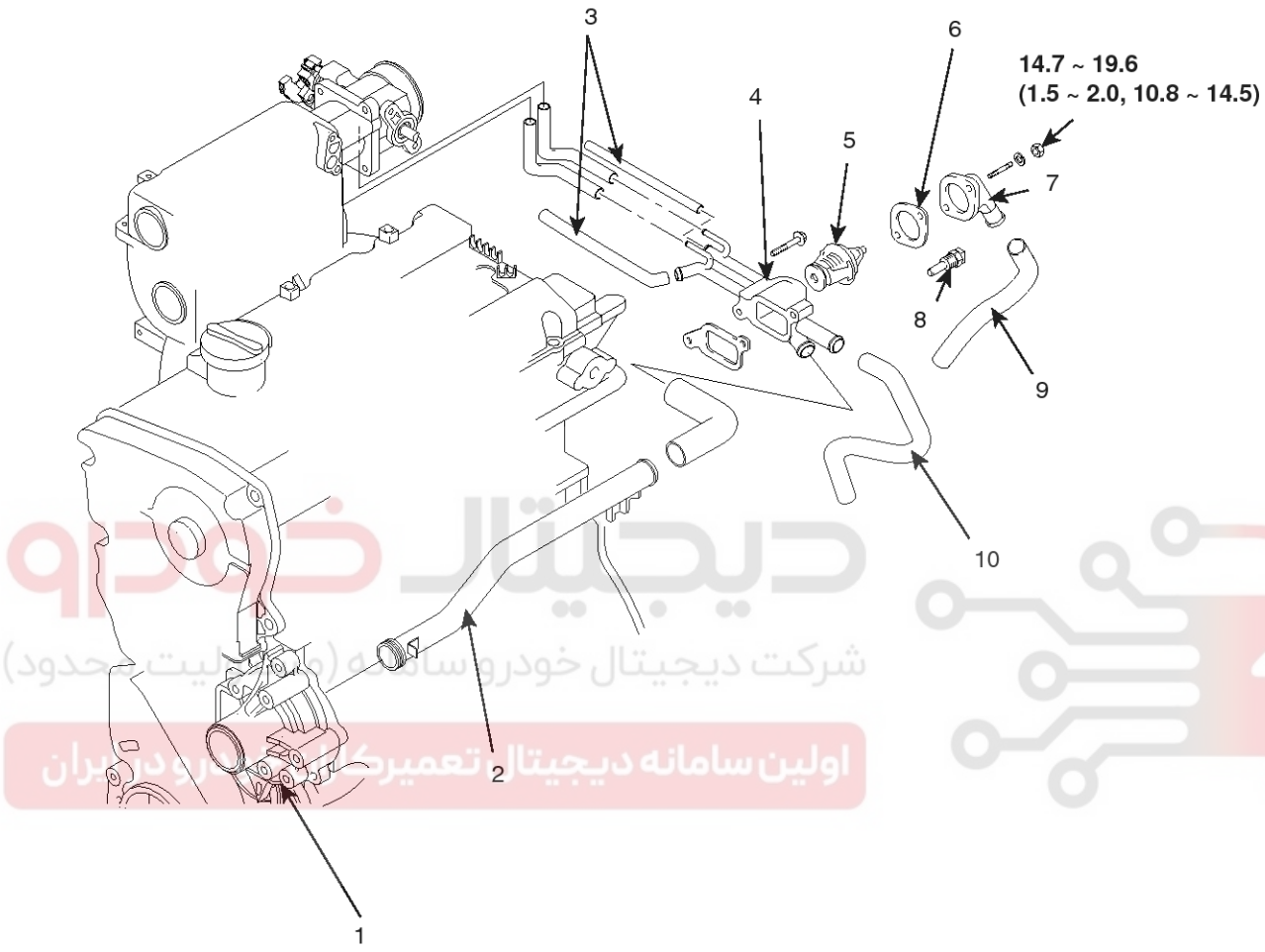
Check for engine oil in the coolant and/or coolant in the engine oil.

COMPONENT



1. Cooling fan & Condenser fan assembly
2. Radiator

LDIF025A



TORQUE : N.m (kgf.m, lbf.ft)

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

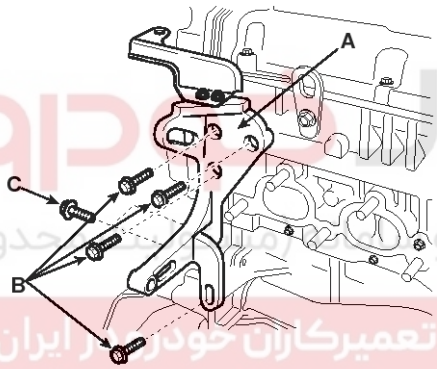
LDIF033A

REMOVAL

WATER PUMP

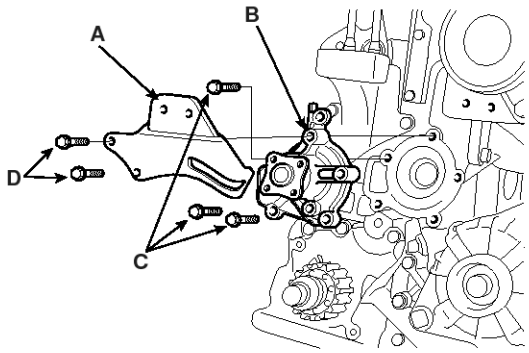
1. Drain the engine coolant.

   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 the drive belts.
3. Remove the timing belt. (Refer to EMA-27)
4. Remove the timing belt idler.
5. Remove the power steering pump and use a wire to secure the pump to the vehicle so that it is out of the way.
6. Remove the bolts(B, C) and power steering pump bracket(A).



ACGE008A

7. Remove the alternator. (See EE group - alternator)
8. Remove the water pump.
   1) Remove the 2 bolts(D) and alternator brace(A).
   2) Remove the 3 bolts(C) and remove the water pump(B) and gasket.

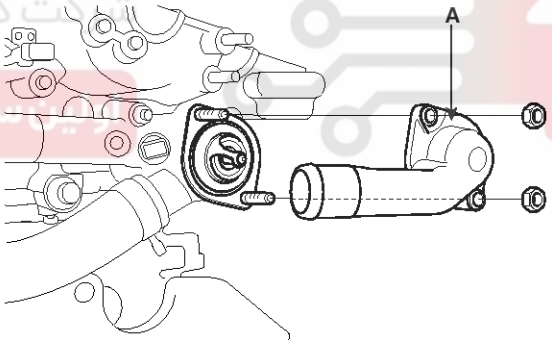


ACGE068A

THERMOSTAT

NOTICE
Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

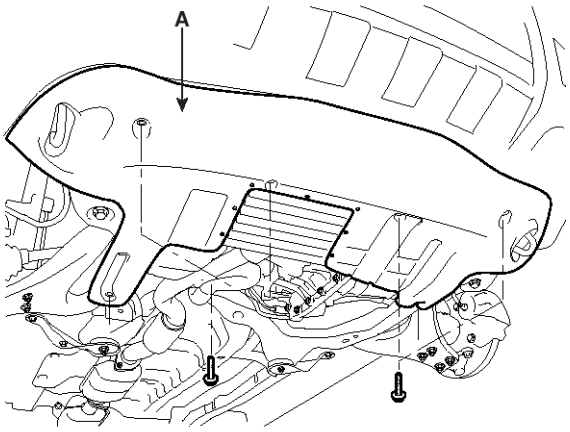
1. Drain the engine coolant so its level is below thermostat.
2. Remove the water inlet fitting(A), gasket and thermostat.



ECKD501B

RADIATOR

1. Remove the under cover(A).

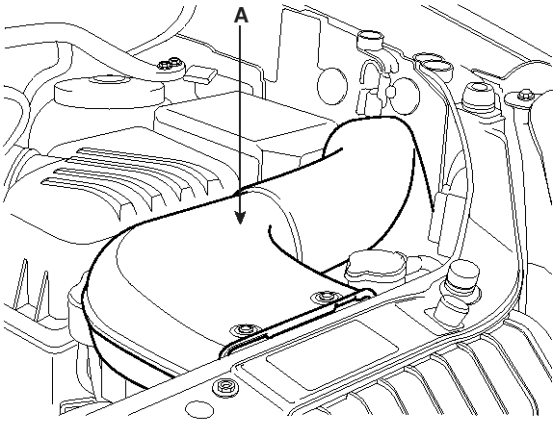


LDIF013A

2. Drain the engine coolant. Remove the radiator cap to speed draining.

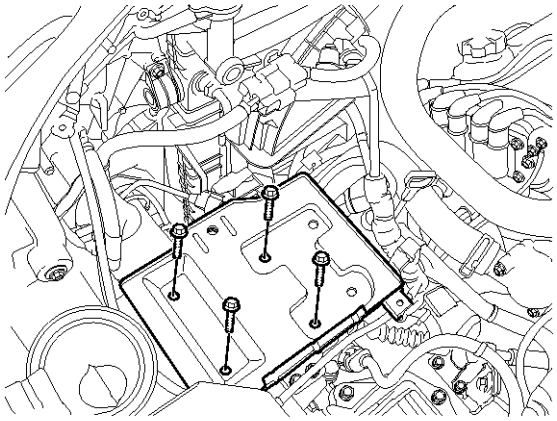
LDIF023A

3. Remove the air duct(A).



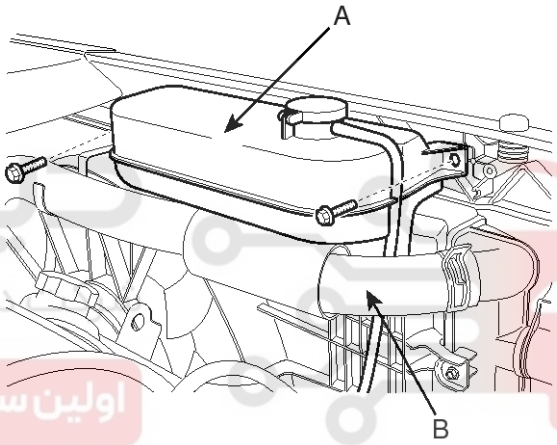
LDIF003A

4. Remove the battery and tray.



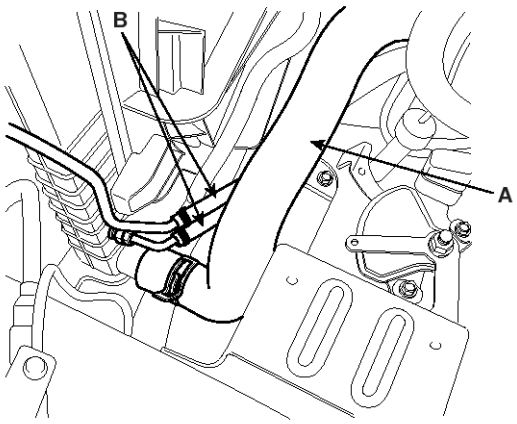
LDIF010A

5. Remove the coolant reservoir tank(A).
6. Remove the radiator upper hose(B).



ADIE014A

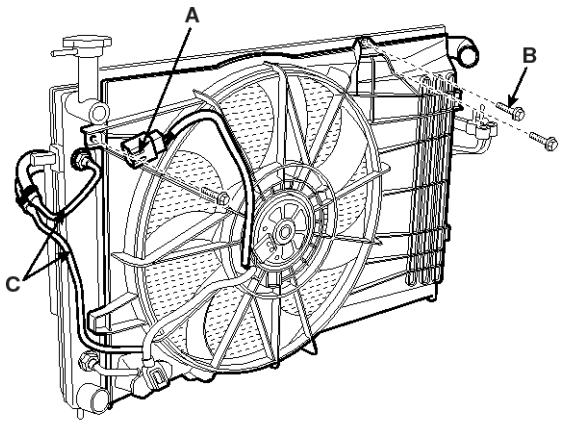
7. Remove the radiator lower hose(A).
8. Remove the ATF oil cooler hose(B).



ACIE180A

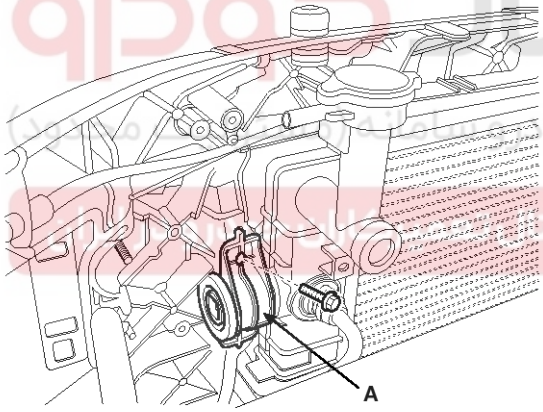
9. Remove the cooling fan motor connector(A).

10. Remove the cooling fan motor assembly mounting bolt(B).
11. Remove the ATF oil cooler pipe(C).

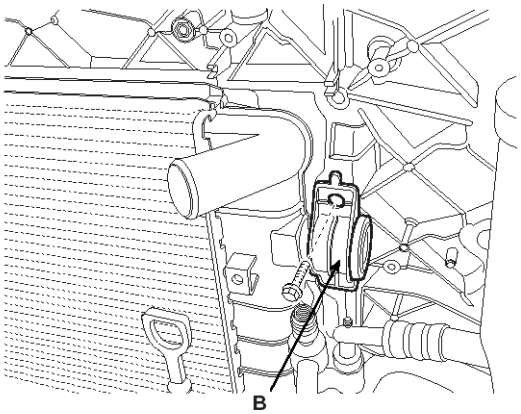


ACIE181A

12. Remove the cooling fan motor assembly with pulling it from the radiator.
13. Remove the radiator bracket(A, B).

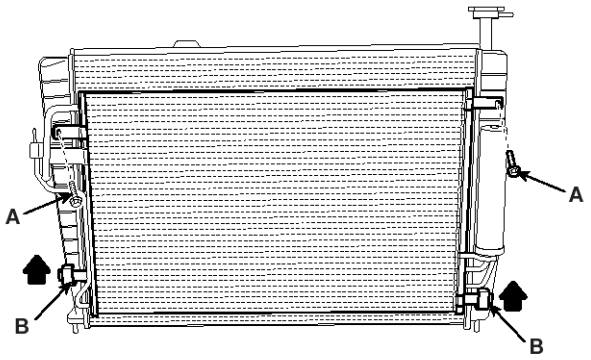


ACIE182A



ACIE183A

14. Remove the condenser mounting bolt(A).
15. Remove the condenser bracket(B) with pulling the condenser from the radiator.



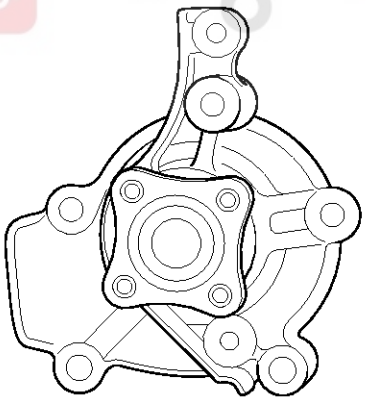
ACIE184A

16. Remove the radiator from engine room.

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

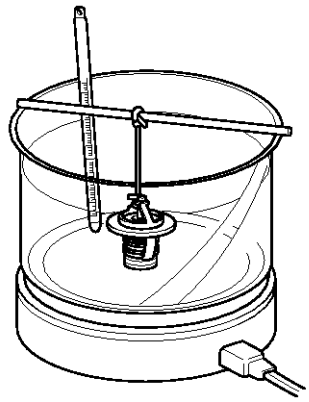
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

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±1.5℃ (179.6±2.7˚F)
Full opening temperature : 95℃ (203˚F)

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℃ (203˚F)

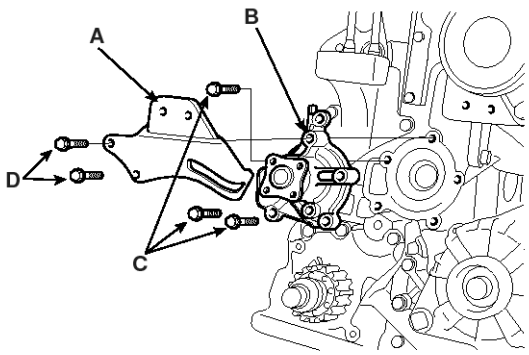
If the valve lift is not as specified, replace the thermostat.

INSTALLATION

WATER PUMP

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

Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lbf.ft)



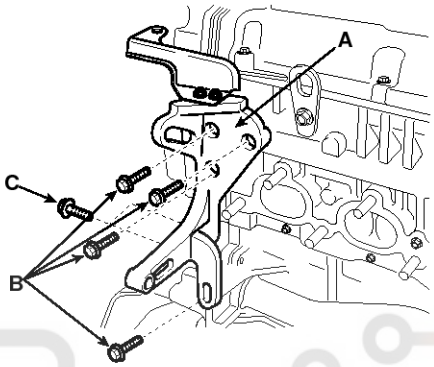
ACGE068A

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

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lbf.ft)

2. Install the power steering pump bracket(A) and bolts(B, C).

Tightening torque :
Bolts(B) : 34.3 ~ 49.0N.m (3.5 ~ 5.0kgf.m, 25.3 ~ 36.2lbf.ft)
Bolts(C) : 14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lbf.ft)



ACGE008A

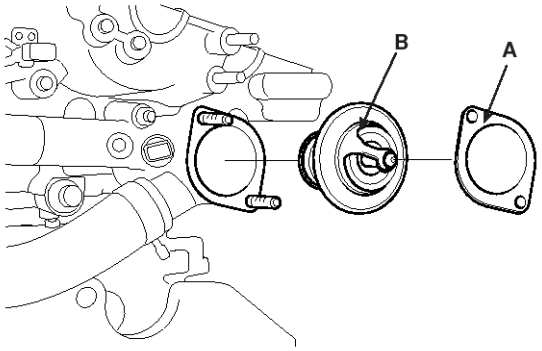
3. Install the alternator. (See EE group - alternator)
4. Install the power steering pump. (See ST group - power steering pump)
5. Install the timing belt idler.
6. Install the timing belt. (Refer to EMA-32)
7. Install the water pump pulley.
8. Install the drive belts.
9. Tighten the water pump pulley bolts.

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

10. Fill with engine coolant.
11. Start engine and check for leaks.
12. Recheck engine coolant level.

THERMOSTAT

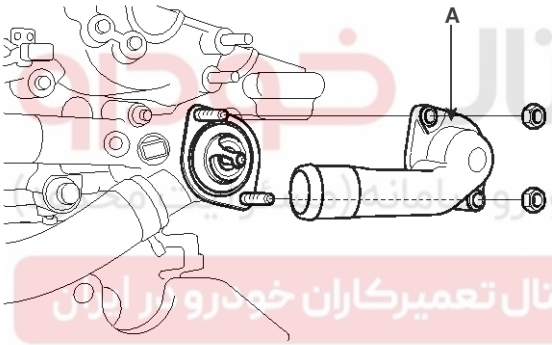
1. Place the thermostat in thermostat housing.
   1) Install the thermostat(B) with the jiggle valve upward.
   2) Install a new gasket(A) to the thermostat(B).



ECKD510A

2. Install the water inlet fitting(A).

Tightening torque :
14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lbf.ft)



ECKD501B

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

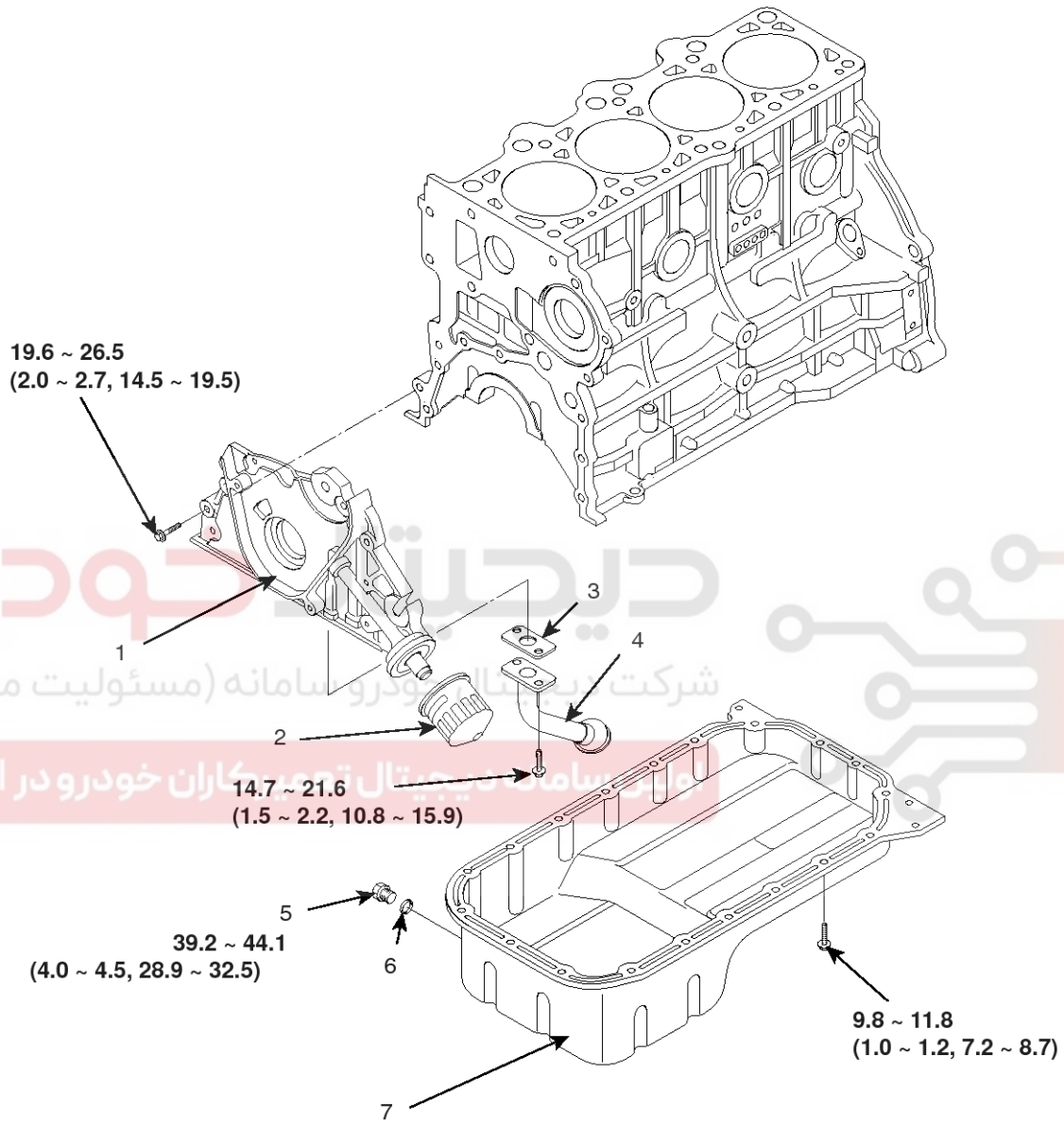
RADIATOR

1. Install the cooling fan onto the radiator.
2. Install the radiator onto the air conditioner condenser on the vehicle.

   The next installation procedures are in the reverse order of radiator removal.
3. Connect the fan motor connector.
4. Install the upper and lower radiator hoses, and ATF cooler hoses.
5. Fill with engine coolant.
6. Start engine and check for leaks.

Lubrication System

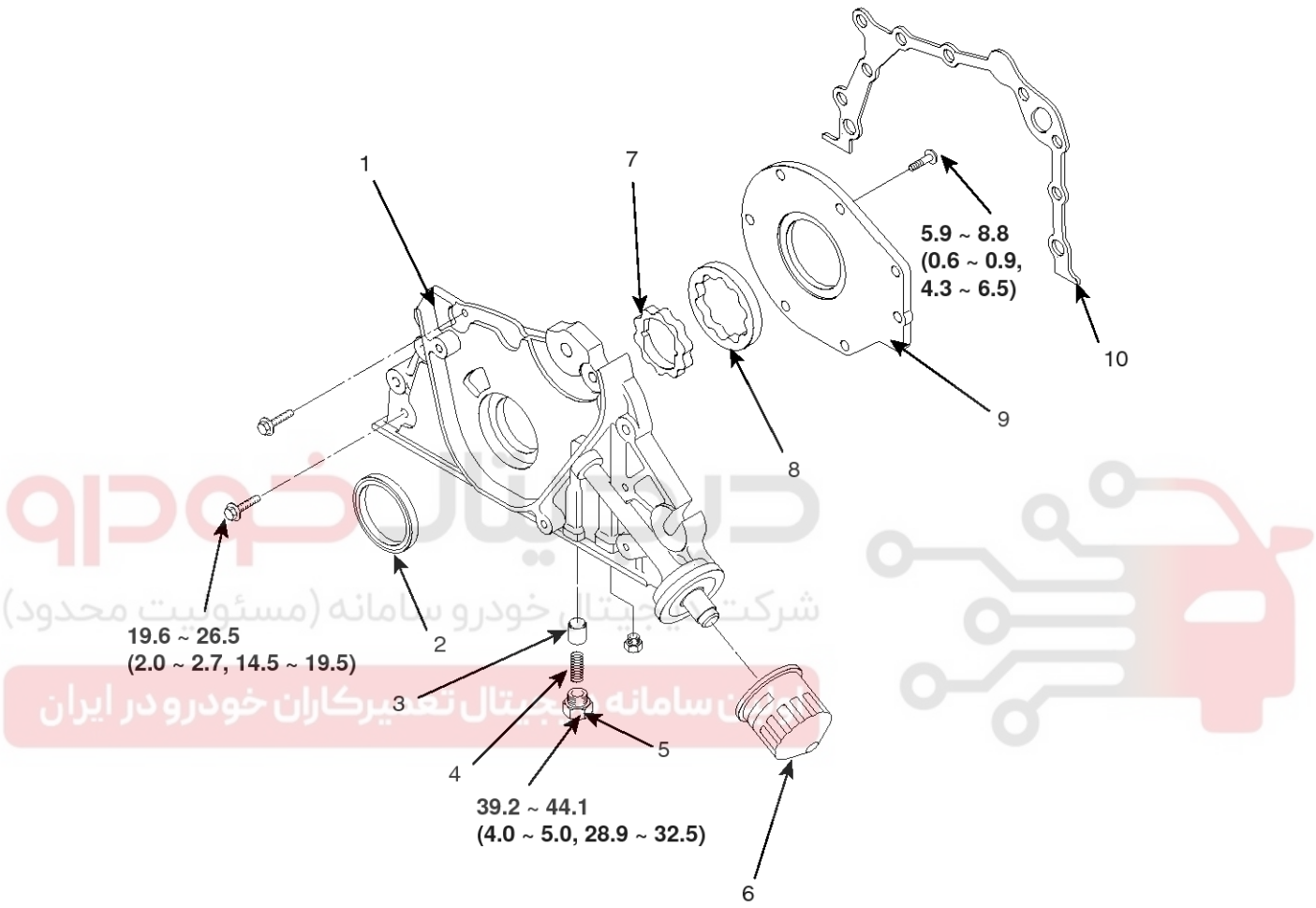
COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

1. Front case
2. Filter
3. Gasket
4. Oil screen
5. Drain plug
6. Gasket
7. Oil pan

LDIF034A



TORQUE : N.m (kgf.m, lbf.ft)

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

LDIF035A

OIL AND FILTER REPLACEMENT

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 the engine oil.
   1) Remove the oil filler cap.
   2) Remove the oil drain plug, and drain the oil into a container.
2. Replace the oil filter.
   1) Remove the oil filter.
   2) Check and clean the oil filter installation surface.
   3) Check the part number of the new oil filter is as same as old one.
   4) Apply clean engine oil to the gasket of a new oil filter.
   5) Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
   6) Tighten it an additional 3/4 turn.
3. Refill with engine oil.
   1) 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 ~ 32.5lbf.ft)

   2) Fill with fresh engine oil.

Capacity
Total : 4.1 L (4.33 US qt, 3.60 Imp qt)
Oil pan : 3.7 L (3.91 US qt, 3.26 Imp qt)
Drain and refill including oil filter : 4.0 L (4.23 US qt, 3.52 Imp qt)

   3) Install the oil filler cap.
4. Start engine and check for oil leaks.
5. Recheck the engine oil level.

INSPECTION

1. Check the engine oil quality.

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

   If the quality is visibly poor, replace the oil.
2. Check the engine oil level.

   After warming up the engine for five minutes, stop the engine and check the oil leverl. The level should be between the "L" and "F" marks on the dipstick.

   If low, check for oil leakage and add oil up to the "F" mark on the dipstick.

NOTICE

Do not fill with engine oil above the "F" mark.

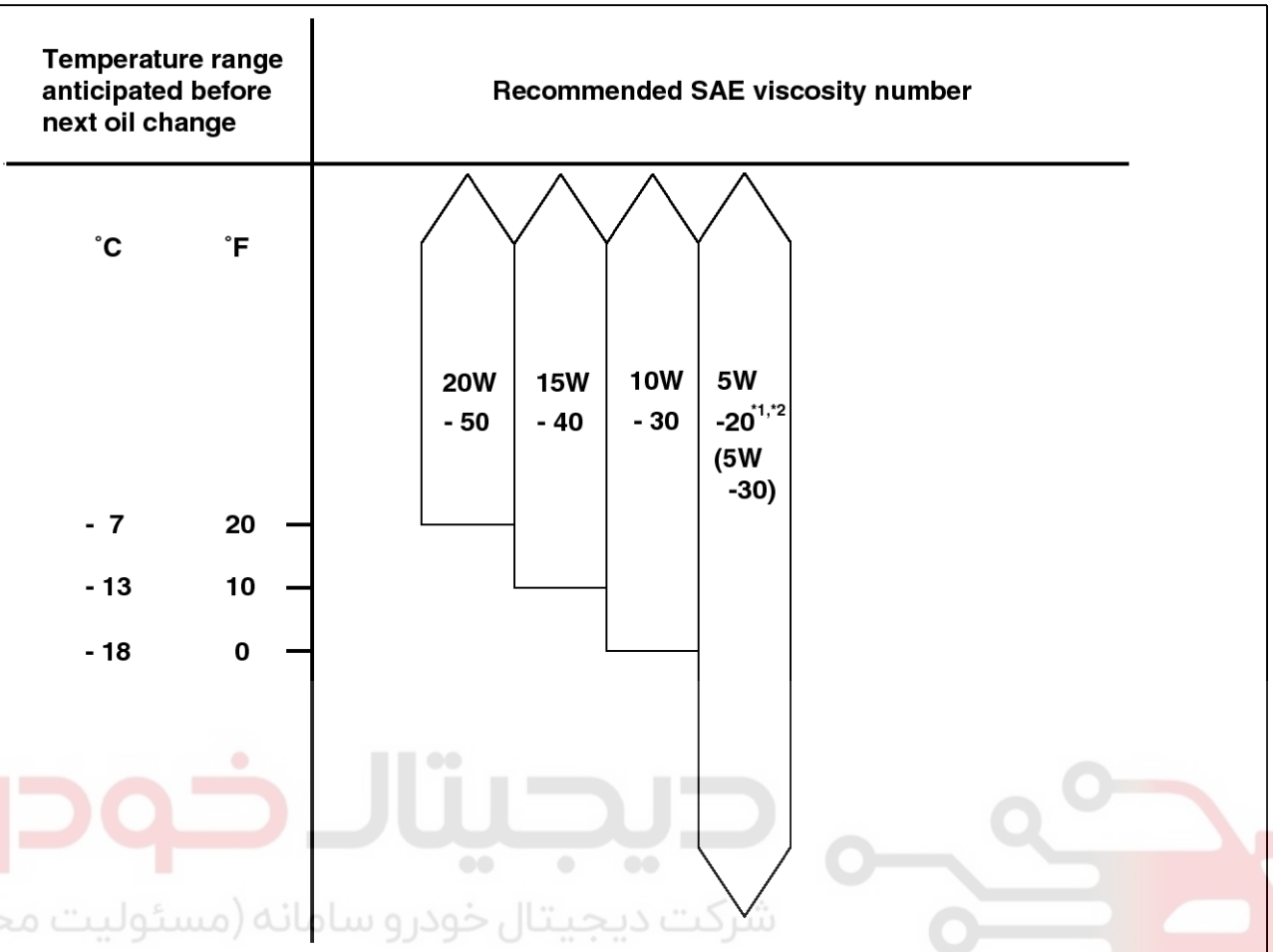
Selection Of Engine Oil

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 / GF4 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.
*2 In Middle East, do not use the engine oil of viscosity grade SAE 5W-20.

SAMM29103L

NOTICE

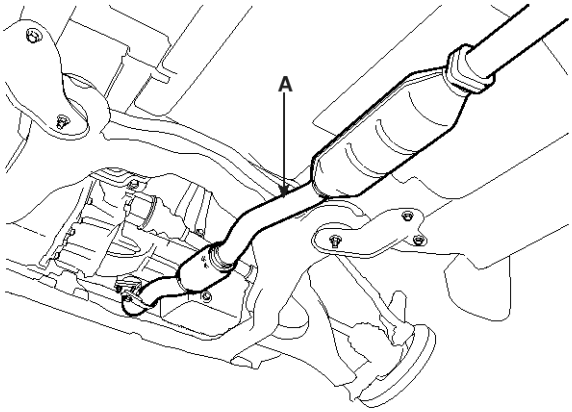
For best performance and maximum protection of all types of operation, select only those lubricants which :

1. *Satisfy the requirement of the API or ILSAC classification.*
2. *Have proper SAE grade number for expected ambient temperature range.*
3. *Lubricants that do not have both an SAE grade number and API or ILSAC service classification on the container should not be used.*

REMOVAL

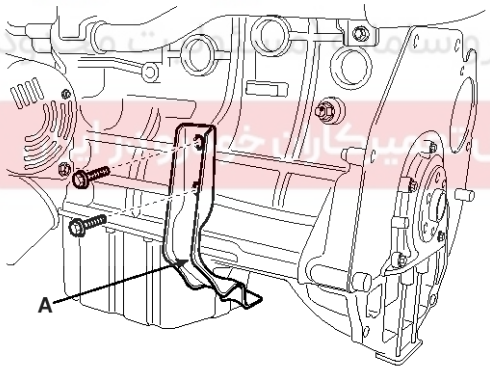
OIL PAN

1. Drain the engine oil.
2. Disconnect the rear oxygen sensor connector.
3. Remove the front muffler(A).



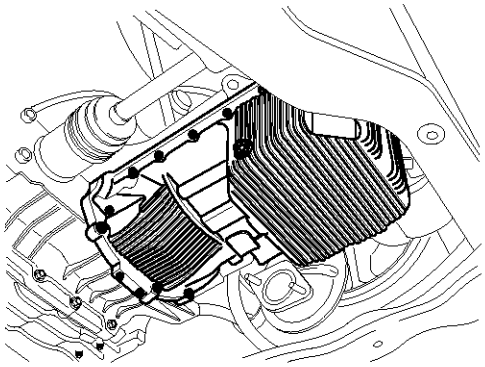
EDQF192A

4. Remove the exhaust manifold. (Refer to EMA-113)
5. Remove the front muffler bracket(A).



ACGE027A

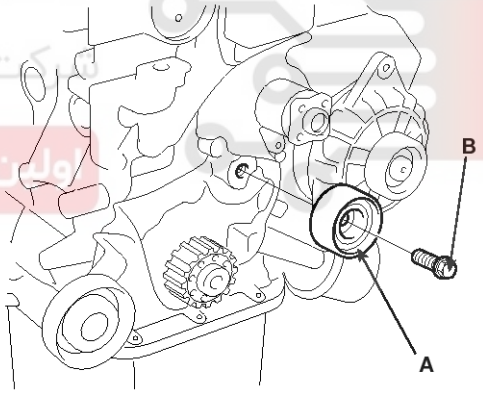
6. Remove the oil pan.



ACGE028A

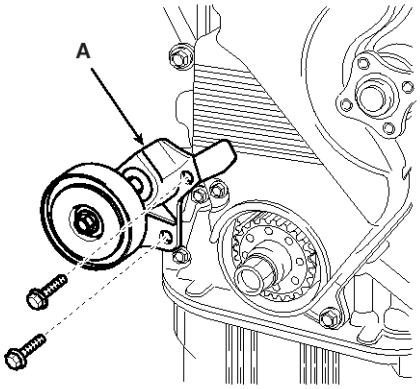
OIL PUMP

1. Drain the engine oil.
2. Remove the drive belts.
3. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.
4. Remove the timing belt. (Refer to EMA-27)
5. Remove the bolt(B) and timing belt idler(A).



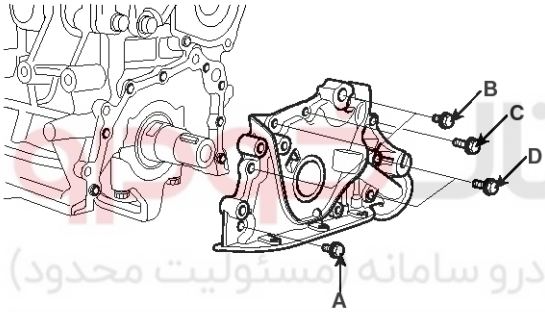
ECKD109C

6. Remove the oil pan and oil screen.
7. Remove the alternator. (Sed EE group - alternator)
8. Remove the air conditioner compressor tensioner bracket(A).



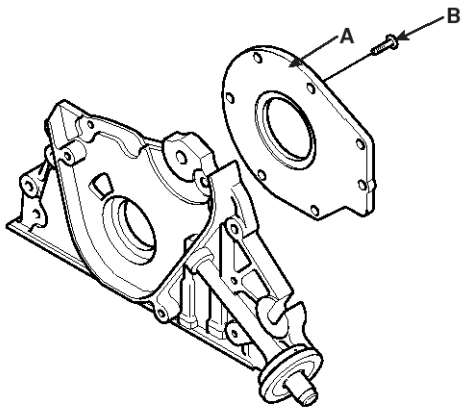
ACGE029A

9. Remove the bolts(A, B, C, D) and front case.



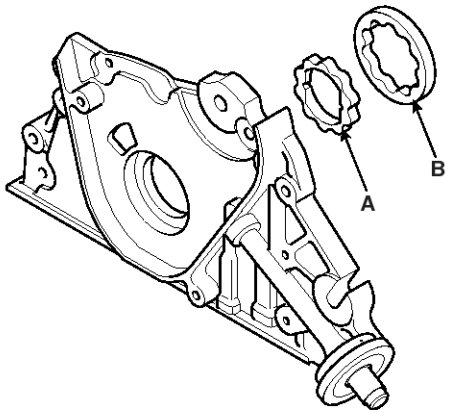
ECKD411A

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



ECKD401A

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

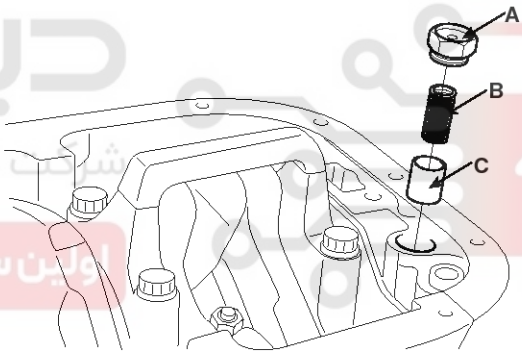


ECKD402A

DISASSEMBLY

RELIEF PLUNGER

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



ECKD403A

INSPECTION

1. Inspect the relief plunger.

   Coat the plunger 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 the relief valve spring.

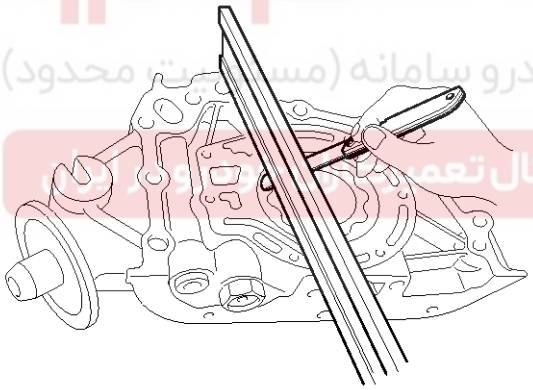
   Inspect for distorted or broken relief valve spring.

Standard value
Free height : 43.8mm (1.724in)
Load : 3.7±0.4kg/40.1mm (8.2±0.9 lb/1.579in)
9.7±0.4kg/34.3mm (21.4±0.9 lb/1.350in)

3. Inspect the rotor side clearance.

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

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



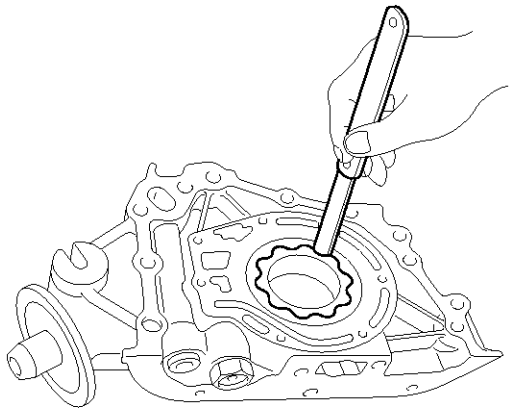
ECKD404A

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

4. Inspect the rotor tip clearance.

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

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



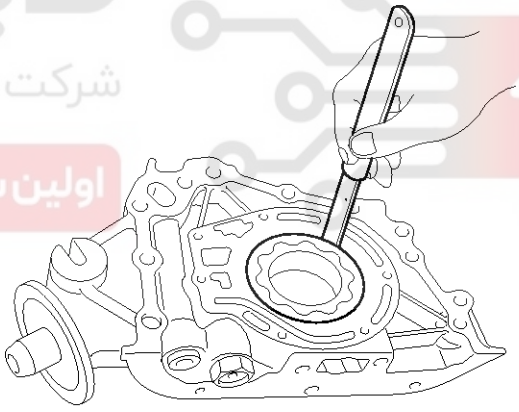
ECKD405A

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

5. Inspect the rotor body clearance.

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

Body clearance
0.120 ~ 0.185mm (0.0047 ~ 0.0073in)



ECKD406A

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

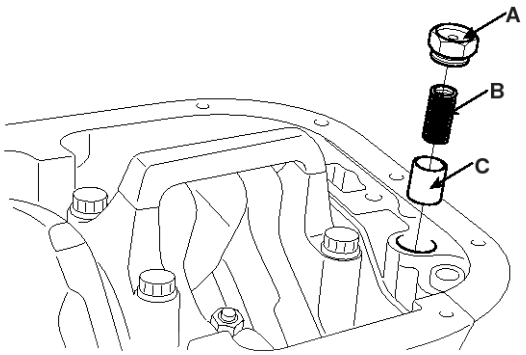
REASSEMBLY

RELIEF PLUNGER

1. Install the 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 ~ 36.2lbf.ft)



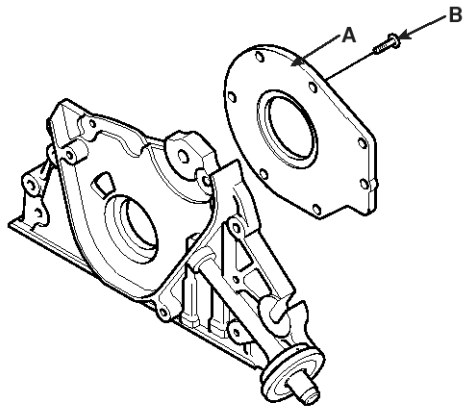
ECKD403A

INSTALLATION

OIL PUMP

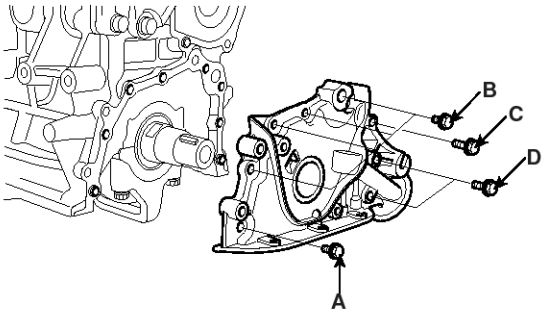
1. Install the oil pump.
   1) Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
   2) Install the oil pump cover(A) to front case with the 7 screws(B).

Tightening torque :
5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lbf.ft)



ECKD401A

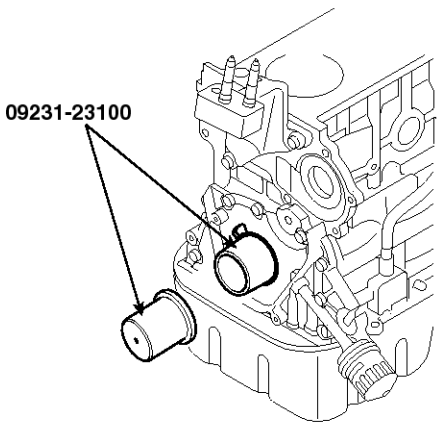
2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.
   1) Place a new front case gasket on the cylinder block.
   2) Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft.
   3) When the pump is in place, clean any excess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



ECKD411A

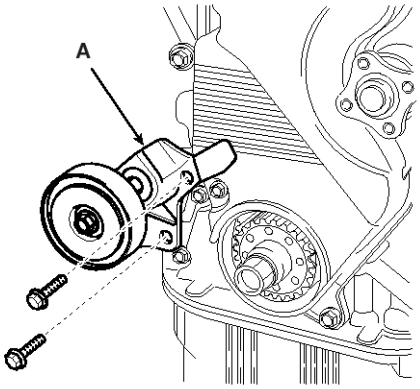
Bolt length
(A) : 25mm (0.984in), (B) : 30mm (1.181in)
(C) : 38mm (1.496in), (D) : 45mm (1.772in)
Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lbf.ft)

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



SAMM19104N

6. Install the air conditioner compressor tensioner bracket (A).



ACGE029A

7. Install the alternator. (See EE group - alternator)
8. Install the oil screen.

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lbf.ft)

9. Install the oil pan.

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

NOTICE
Clean the oil pan gasket mating surfaces.

10. Install the timing belt idler.

Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lbf.ft)

11. Install the timing belt (Refer to EMA-32)
12. Install the drive belts.
13. Fill with engine oil.

OIL PAN

1. Install the 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 liquid gasket.

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

Liquid gasket : MS 721-40A or equivalent

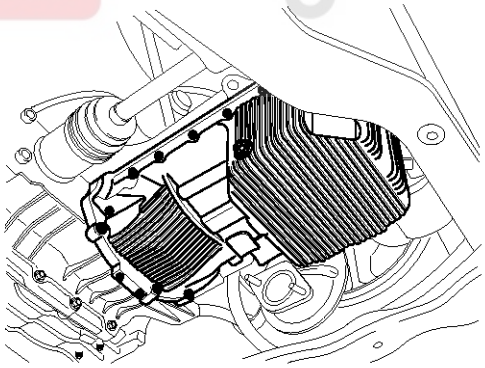
NOTICE
- *To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.*
- *Do not install the parts if five minutes or more have elapsed since applying the liquid gasket.*

  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 bolts.

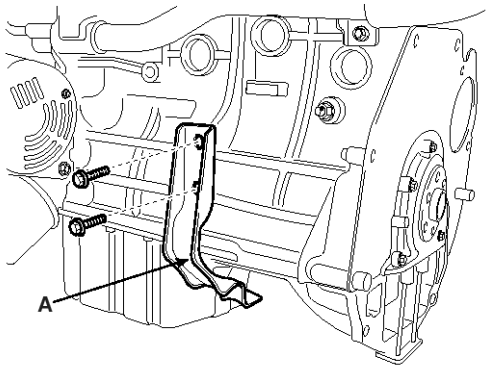
      Uniformly tighten the bolts in several passes.

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



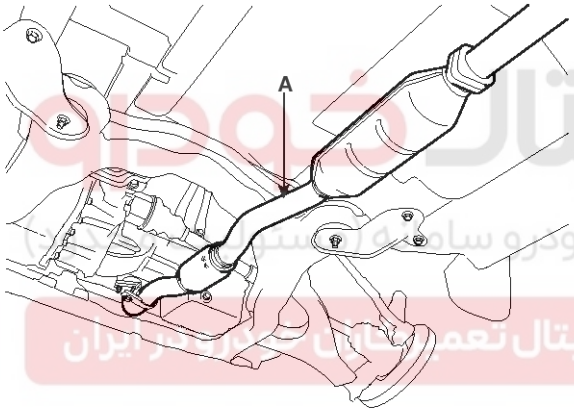
ACGE028A

2. Install the front muffler bracket(A).



ACGE027A

3. Install the exhaust manifold. (Refer to EMA-113)
4. Install the front muffler(A).



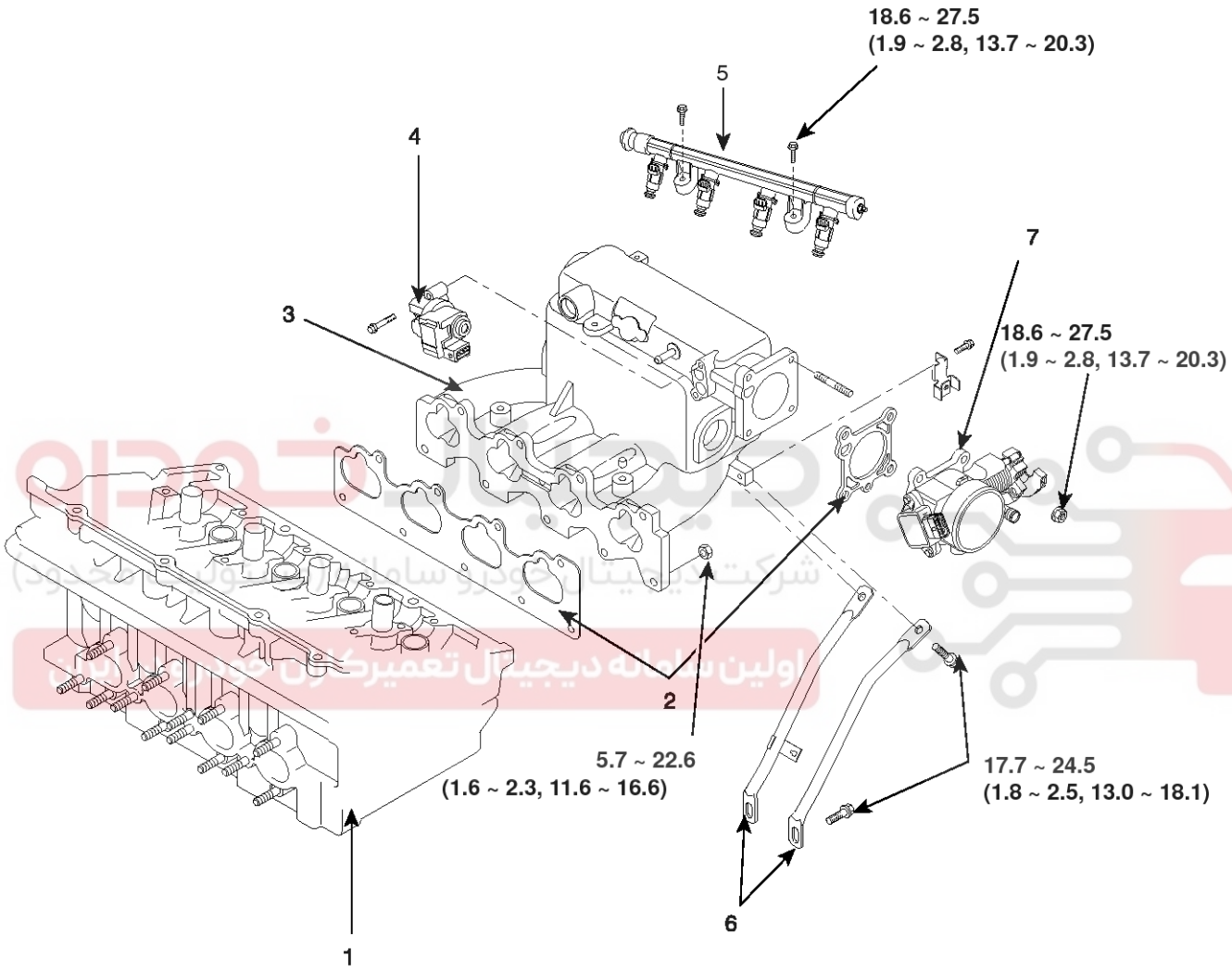
EDQF192A

5. Connect the rear oxygen sensor connector.
6. Fill with engine oil

Intake And Exhaust System

Intake Manifold

COMPONENT



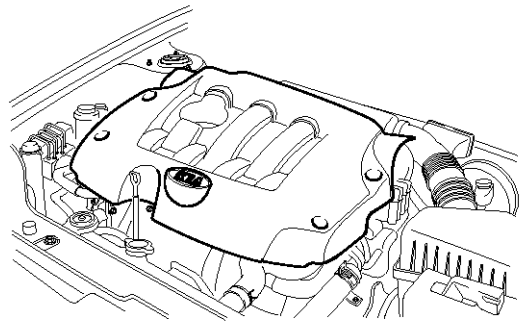
TORQUE : N.m (kgf.m, lbf.ft)

1. Cylinder head
2. Gasket
3. Intake manifold
4. I.S.A (Idle Speed Actuator)
5. Delivery pipe assembly
6. Intake manifold stay
7. Throttle body

LDIF036A

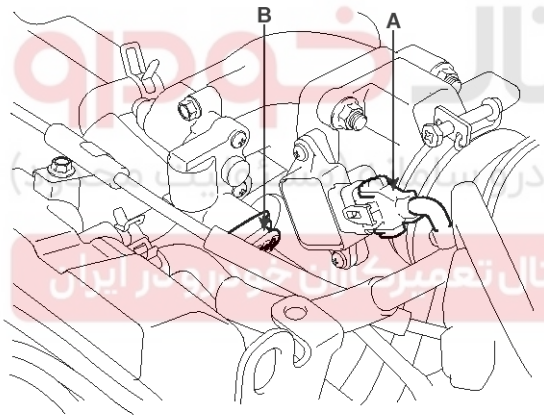
REMOVAL

1. Remove the engine cover.



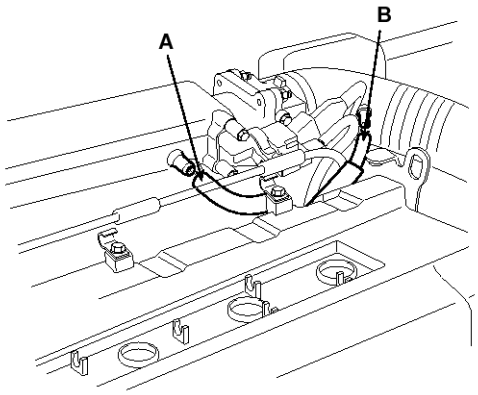
ADIE001A

2. Disconnect the TPS(Throttle Position Sensor) connector(A) and ISA(Idle Speed Actuator) connector(B).



EDQF197A

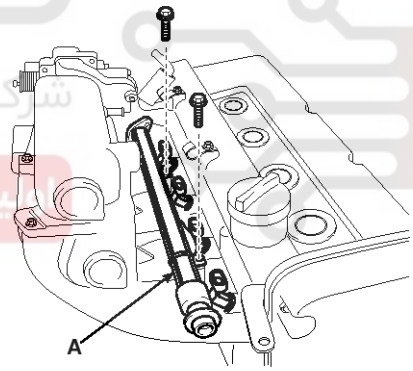
3. Disconnect the PCV(Positive Crankcase Ventilation) hose(A) and breather hose(B).



BCGE032A

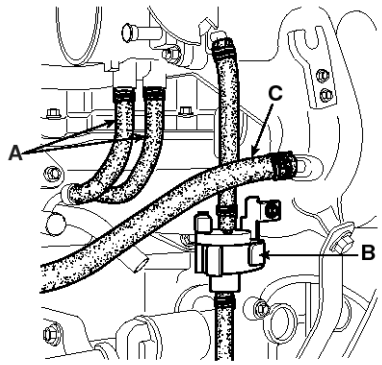
4. Remove the accelerator cable.
5. Remove the delivery pipe(A).

Tightening torque :
18.6 ~ 27.5N.m (1.9 ~ 2.8kgf.m, 13.7 ~ 20.3lbf.ft)



ACGE030A

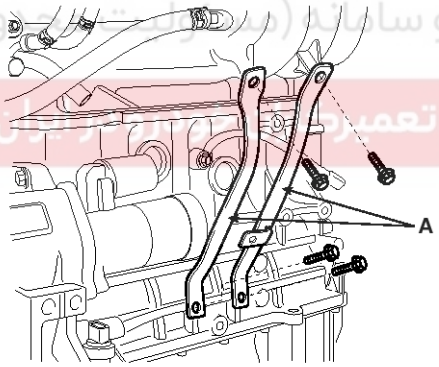
6. Remove the heater hose(A), PCSV(Purge Control Solenoid Valve)(B) and the brake vacuum hose(C) from throttle body and intake manifold.



ACGE031A

7. Remove the air conditioner compressor. (Refer to HA Gr.)
8. Remove the intake manifold stay(A).

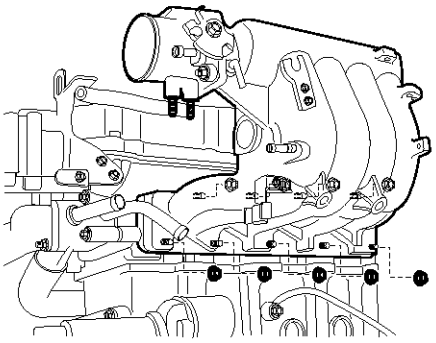
Tightening torque :
17.7 ~ 24.5N-m (1.8 ~ 2.5kg-m, 13.0 ~ 18.1lb-ft)



ACGE032A

9. Remove the intake manifold.

Tightening torque :
15.7 ~ 22.6N-m (1.6 ~ 2.3kg-m, 11.6 ~ 16.6lb-ft)

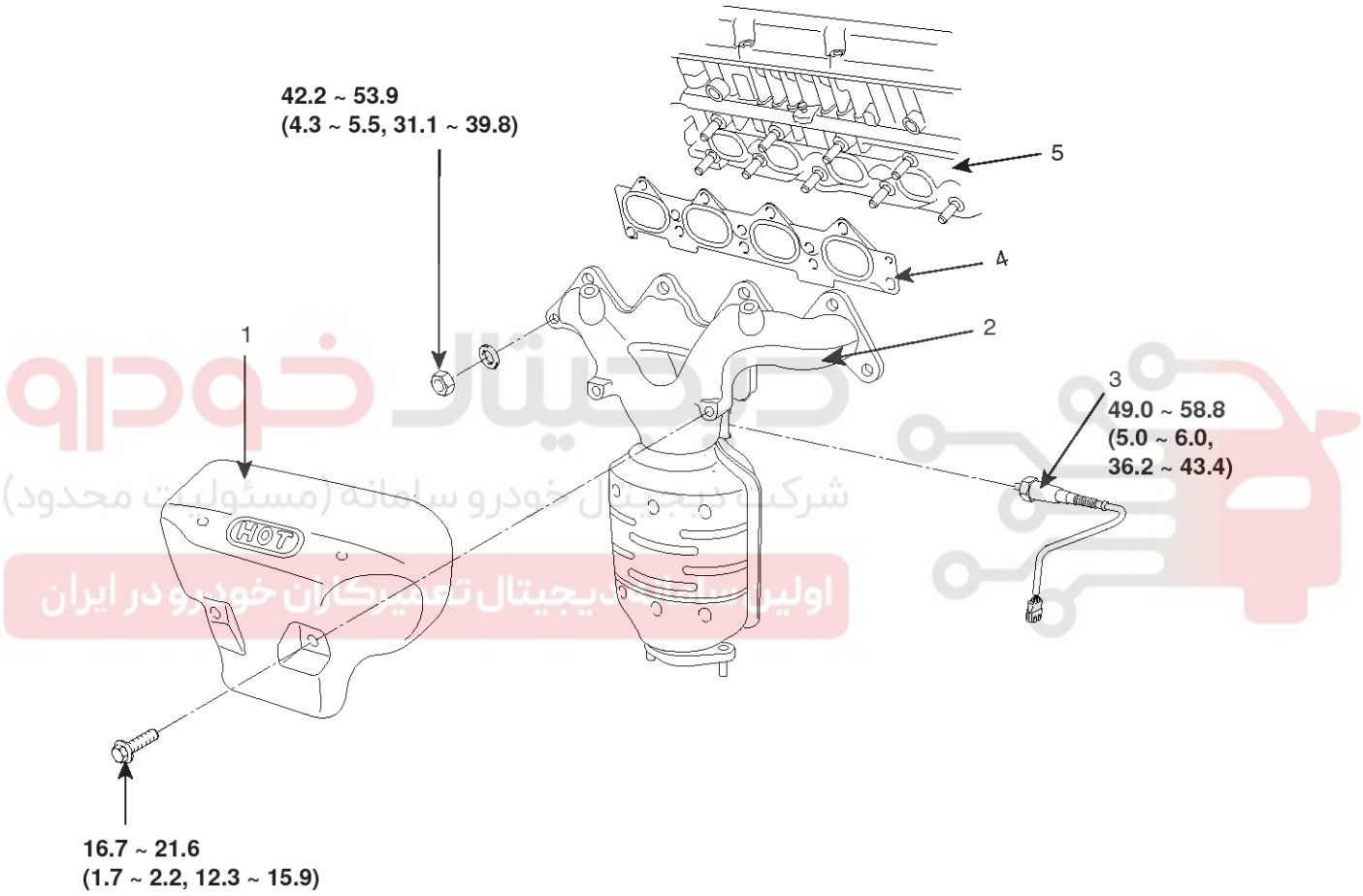


ACGE033A

10. Installation is in the reverse order of removal with new gasket.

Exhaust Manifold

COMPONENT



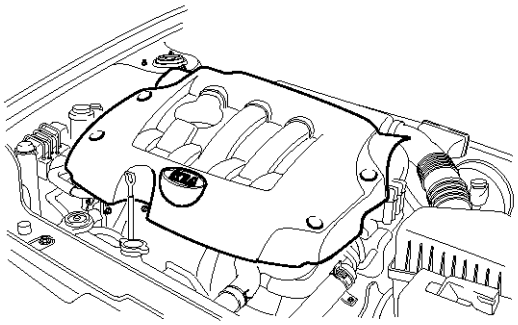
TORQUE : N.m (kgf.m, lbf.ft)

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

LDIF026A

REMOVAL

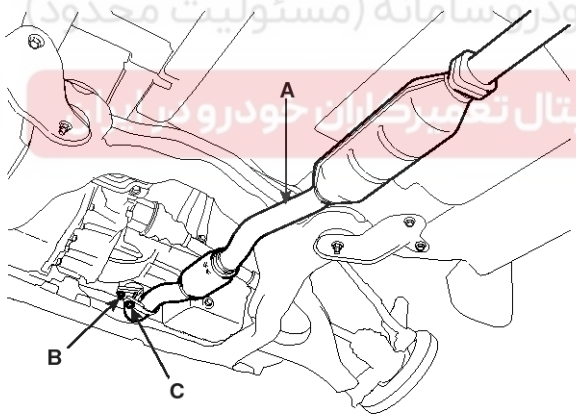
1. Remove the engine cover.



ADIE001A

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

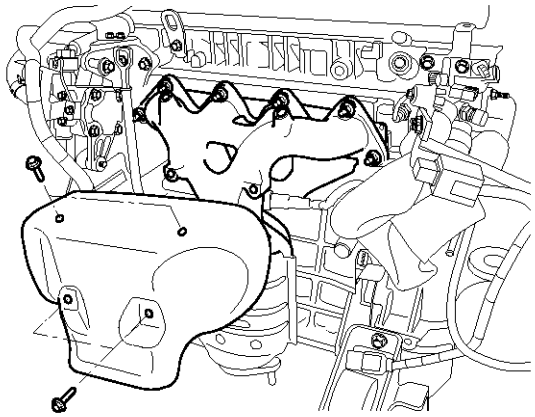
Tightening torque :
Nut (B) : 39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lbf.ft)
Bolt (C) : 29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lbf.ft)



ADIE036A

4. Remove the heat protector.

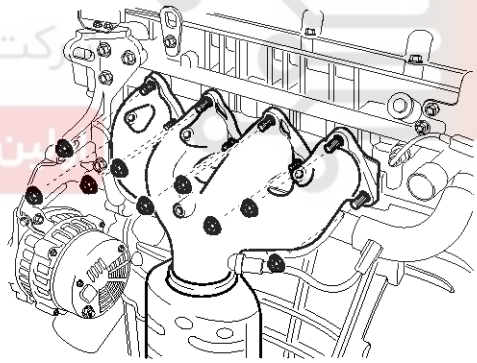
Tightening torque :
16.7 ~ 21.6N.m (1.7 ~ 2.2kgf.m, 12.3 ~ 15.9lbf.ft)



EDQF195A

5. Remove the exhaust manifold and catalytic converter assembly.

Tightening torque :
42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lbf.ft)

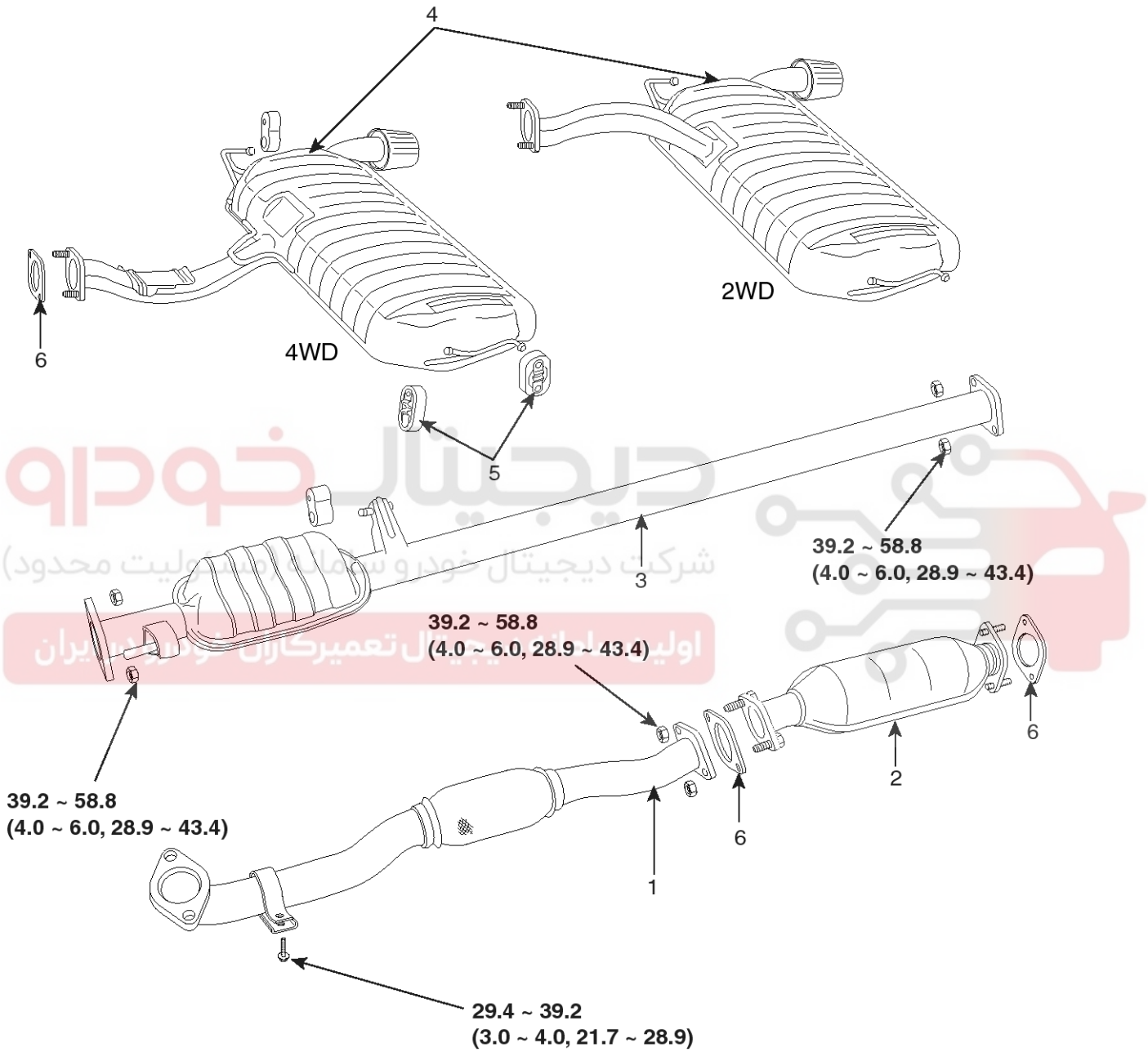


ACGE035A

6. Installation is in the reverse order of removal

Front Exhaust Pipe

COMPONENT



TORQUE : N.m (kgf.m, lbf.ft)

1. Front muffler
2. Catalytic converter
3. Center muffler
4. Main muffler
5. Rubber hanger
6. Gasket

LDIF027A