ZPP 410 – Engine SOHC

GENERAL

SPECIFICATION EE2E7FA4

DESCRIPTION		SPECIFICATION (EPSILON 1.1)	LIMIT
General			
Type		In-line, SOHC	
Number of cylinders		4	
Bore		67mm (2.6378in)	
Stroke		73mm (2.8740in)	
Total displacement		1,086cc (66.3 cu.in)	
Compression ratio		10.0: 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens (BTDC)	5°	
	Closes (ABDC)	35°	
Exhaust valve	Opens (BBDC)	43°	
	Closes (ATDC)	5°	
Cylinder head			
Flatness of gasket surface		Less than 0.03mm (0.0012in)	0.10mm (0.0039in)
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	STD	10.000 ~ 10.015mm (0.3937 ~ 0.3943in)	
	0.05 OS	10.050 ~ 10.068mm (0.3957 ~ 0.3964in)	
	0.25 OS	10.250 ~ 10.268mm (0.4035 ~ 0.4043in)	
	0.50 OS	10.500 ~ 10.518mm (0.4134 ~ 0.4141in)	
Intake valve seat ring hole diameter	STD	24.000 ~ 24.021mm (0.9449 ~ 0.9457in)	
	0.3 OS	24.300 ~ 24.321mm (0.9567 ~ 0.9575in)	
	0.6 OS	24.600 ~ 24.621mm (0.9685 ~ 0.9693in)	
Exhaust valve seat ring hole diameter	STD	29.000 ~ 29.021mm (1.1417 ~ 1.1426in)	
	0.3 OS	29.300 ~ 29.321mm (1.1535 ~ 1.1544in)	
	0.6 OS	29.600 ~ 29.621mm (1.1654 ~ 1.1662in)	
Camshaft			
Cam height	Intake	33.941 ~ 34.141mm (1.3363 ~ 1.3441in)	
	Exhaust	34.055 ~ 34.255mm (1.3407 ~ 1.3486in)	
Journal outer Diameter		40.940 ~ 40.955mm (1.6118 ~ 1.6124in)	
Bearing oil clearance		0.045 ~ 0.085mm (0.0018 ~ 0.0033in)	
End play		0.07 ~ 0.19mm (0.0028 ~ 0.0075in)	
Rocker arm			
Rocker arm inner diameter		17.010 ~ 17.028mm (0.6697 ~ 0.6704in)	

DESCRIPTION		SPECIFICATION (EPSILON 1.1)	LIMIT
Rocker arm shaft outer diameter		16.985 ~ 16.998mm (0.6687 ~ 0.6692in)	
Valve			
Valve length	Intake	99.55mm (3.9193in)	
	Exhaust	99.05mm (3.8996in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2152 ~ 0.2157in)	
	Exhaust	5.430 ~ 5.450mm (0.2138 ~ 0.2146in)	
Face angle		45° ~ 45°30'	
Thickness of valve head (margin)	Intake	0.8mm (0.0315in)	0.50mm (0.019in)
	Exhaust	1.2mm (0.0472in)	0.90mm (0.035in)
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	
	Exhaust	0.050 ~ 0.082mm (0.0020 ~ 0.0032in)	
Valve guide			
Length	Intake	46.0mm (1.8110in)	
	Exhaust	48.0mm (1.8898in)	
Valve seat			
Width of seat contact	Intake	0.9 ~ 1.3mm (0.0354 ~ 0.0512in)	
	Exhaust	0.9 ~ 1.3mm (0.0354 ~ 0.0512in)	
Seat angle	Intake	43°30' ~ 44°	
	Valve spring	43°30' ~ 44°	
Valve spring			
Free length		40.50mm (1.5945in)	
Load		15.6±0.9kg/32.0mm (34.4±2.0lb/1.2598in)	
		33.3±1.8kg/24.5mm (73.4±4.0 lb/0.9646in)	
Out of squareness		Less than 1.5°	
Valve clearance			
Cold (20°C) [68°F] Only for reference	Intake	0.15 ~ 0.21mm (0.0059 ~ 0.0083in)	
	Exhaust	0.19 ~ 0.25mm (0.0075 ~ 0.0098in)	
Hot (80 ~ 95°C) [176 ~ 203°F]	Intake	0.22 ~ 0.28mm (0.0087 ~ 0.0110in)	
	Exhaust	0.27 ~ 0.33mm (0.0106 ~ 0.0130in)	
Cylinder block			
Cylinder bore		67.000 ~ 67.030mm (2.6378 ~ 2.6390in)	
Flatness of gasket surface		Less than 0.05mm (0.002in)	
Piston			
Piston outer diameter		66.970 ~ 67.000mm (2.6366 ~ 2.6378in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008-0.0016in)	
Ring groove width	No. 1 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	
	No. 2 ring groove	1.21 ~ 1.23mm (0.0476 ~ 0.0484in)	
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	
Piston ring			

DESCRIPTION		SPECIFICATION (EPSILON 1.1)	LIMIT
Side clearance	No. 1 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.10mm (0.0039in)
	No. 2 ring	0.02 ~ 0.06mm (0.0008 ~ 0.0024in)	0.10mm (0.0039in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	
End gap	No. 1 ring	0.15 ~ 0.30mm (0.0059 ~ 0.0118in)	
	No. 2 ring	0.30 ~ 0.50mm (0.0098 ~ 0.0157in)	
	Oil ring	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	
Piston pin			
Piston pin outer diameter		17.000 ~ 17.003mm (0.6693 ~ 0.6694in)	
Piston pin hole inner diameter		17.011 ~ 17.015mm (0.6697 ~ 0.6699in)	
Piston pin hole clearance		0.008 ~ 0.014mm (0.0003 ~ 0.0006in)	
Connecting rod small end hole inner diameter		16.974 ~ 16.985mm (0.6683 ~ 0.6687in)	
Connecting rod small end hole clearance		-0.029 ~ -0.015mm (-0.0006 ~ -0.0003in)	
Piston pin press-in load		500 ~ 1100kg (1102.3 ~ 2425.1lb)	
Connecting rod			
Connecting rod big end inner diameter		41.000 ~ 41.015mm (1.6142 ~ 1.6148in)	
Connecting rod bearing oil clearance		0.012 ~ 0.041mm (0.0005 ~ 0.0016in)	
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.40mm (0.0157in)
Crankshaft			
Main journal outer diameter		41.982 ~ 42.000mm (1.6528 ~ 1.6535in)	
Pin journal outer diameter		37.980 ~ 38.000mm (1.4953 ~ 1.4961in)	
Main bearing oil clearance		0.020 ~ 0.038mm (0.0008 ~ 0.0015in)	
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	
Flywheel			
Run out		0.13mm (0.0051in)	
Oil pump			
Side clearance	Inner rotor	0.040 ~ 0.095mm (0.0016 ~ 0.0037in)	
	Outer rotor	0.040 ~ 0.095mm (0.0016 ~ 0.0037in)	
Body clearance		0.100 ~ 0.181mm (0.0039 ~ 0.0071in)	
Relief valve opening pressure		490.33±49.03kpa (5±0.5kg/cm², 71.12±7.11psi)	
Relief spring	Free length	38.6mm (1.5197in)	
	Load	3.65±0.4kg/33mm (8.0±0.85 lb/1.2992in)	
Engine oil			
Oil quantity (Total)		3.3 L (3.49 US qt, 2.90 Imp qt)	
Oil quantity (Oil pan)		3.0 L (3.17 US qt, 2.64 Imp qt)	
Oil quantity (Oil filter)		0.3 L (0.32 US qt, 0.26 Imp qt)	
Oil quality		Above SG	
Oil pressure (Idle)		78.45kpa (0.8kg/cm², 11.38psi)	
Cooling method			

DESCRIPTION		SPECIFICATION (EPSILON 1.1)	LIMIT
Cooling system		Forced circulation with cooling fan	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5 °C (177±2.7°F)	
	Full 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		Thermistor type	
Resistance	20°C (68°F)	2.45±0.14 kΩ	
	80°C 176°F)	0.3222 kΩ	

TIGHTENING TORQUE

Item	Quentity	Tightening torque		
		N-m	kg-m	lb-ft
Cylinder block				
Engine support bracket bolt	3	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Engine mounting				
Engine mounting bracket and body fixing blot	2	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Engine mounting bracket and body fixing nut	1	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Engine mounting bracket and engine support bracket fixing bolt	1	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Engine mounting bracket and engine support bracket fixing nut	2	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Transaxle mounting bracket and body fixing bolt	3	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Transaxle mounting insulator and transaxle support bracket fixing bolt	2	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Rear roll stopper bracket and sub frame fixing bolt	1	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Rear roll stopper bracket and rear roll stopper support bracket bolt	1	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Main moving system				
Connecting rod bearing cap nut	8	19.6 ~ 22.6	2.0 ~ 2.3	14.5 ~ 16.6
Crankshaft main bearing cap bolt	10	49.0 ~ 53.9	5.0 ~ 5.5	36.2 ~ 39.8
Fly wheel bolt (M/T)	5	68.6 ~ 78.5	7.0 ~ 8.0	50.6 ~ 57.9
Drive plate bolt (A/T)	5	68.6 ~ 78.5	7.0 ~ 8.0	50.6 ~ 57.9
Timing belt				
Timing belt upper cover bolt (6×18)	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt upper cover bolt (6×10)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt lower cover bolt (6×18)	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	122.6 ~ 142.2	12.5 ~ 14.5	90.4 ~ 104.9
Camshaft sprocket bolt	1	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Timing belt tensioner bolt	1	21.6 ~ 29.4	2.2 ~ 3.0	15.9 ~ 21.7
Cylinder head				
Rocker cover bolt	6	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Rocker arm shaft bolt	5	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Camshaft thrust cap bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Cylinder head bolt	10	55.8 ~ 68.6	6.0 ~ 7.0	43.4 ~ 50.6
Cooling system				
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (6×18)	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (6×35)	1	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump and alternator brace fixing bolt (6×55)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump and alternator brace fixing bolt (8×22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5

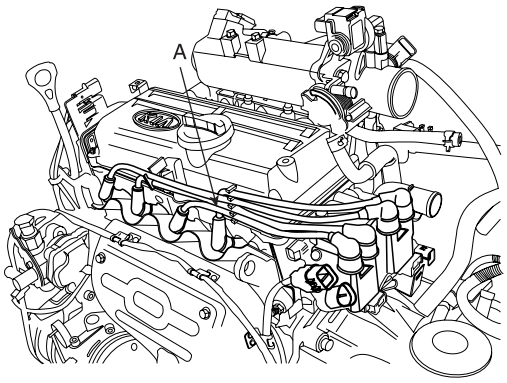
Item	Quentity	Tightening torque		
		N-m	kg-m	lb-ft
Water inlet pipe fixing bolt (8×25)	2	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water inlet pipe fixing bolt (6×22)	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Thermostat housing bolt (Water inlet fitting)	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water outlet fitting assembly bolt (8X25)	3	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Front case bolt (6×30)	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Front case bolt (6×18)	5	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Oil pan bolt	16	5.9 ~ 7.8	0.6 ~ 0.8	4.3 ~ 5.8
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 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	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold and cylinder head fixing bolt	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold stay bolt	2	17.7 ~ 24.5	1.8 ~ 2.5	14.5 ~ 19.5
Intake manifold bracket bolt and nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold and cylinder head fixing nut	9	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Oxygen sensor to exhaust manifold (FR)	1	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Oxygen sensor to exhaust manifold (RR)	1	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold heat protector and exhaust manifold fixing bolt	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Throttle body and surge tank fixing bolt and nut	4	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Exhaust manifold and front muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front muffler pipe and main muffler pipe clamp nut	1	17.7 ~ 27.5	1.8 ~ 2.8	13.0 ~ 20.3

COMPRESSION PRESSURE INSPECTION ED07C5CE

NOTE

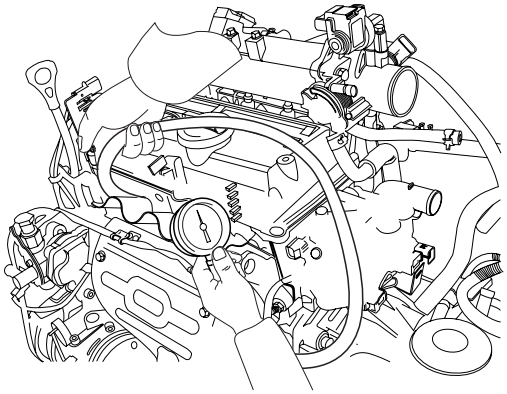
If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

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(A).



ACHE072A

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.



ACHE121A

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

NOTE

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

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

NOTE

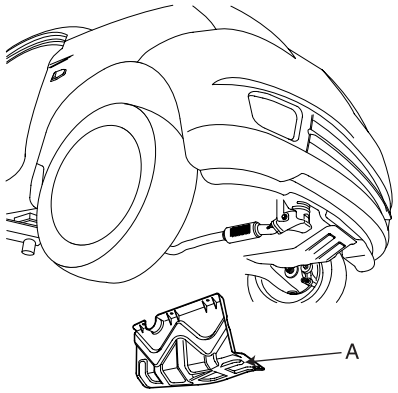
This measurement must be done in as short a time as possible.

Compression pressure: 1,520kPa (15.5kg/cm², 220psi) / 370rpm Minimum pressure: 1,373kPa (14.0kg/cm², 199psi) 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.

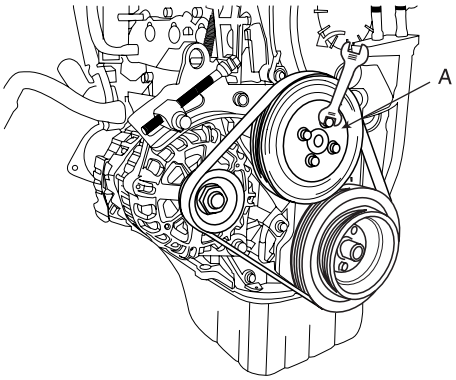
TIMING BELT TESION ADJUSTMENT

1. Remove the RH front wheel.
2. Remove the bolts and the RH under cover (A).



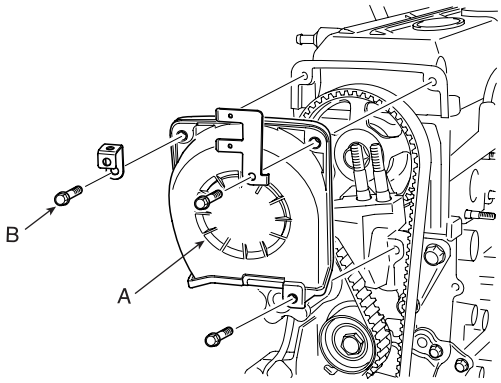
ACHE029A

3. Temporarily loosen the water pump pulley (A) bolts.



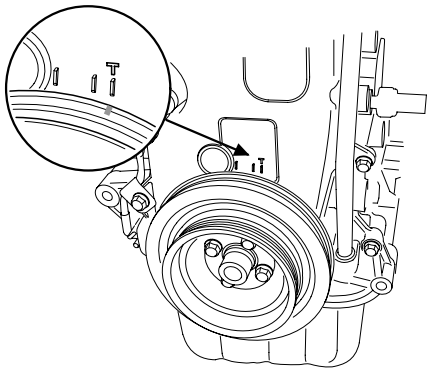
ACHE055A

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



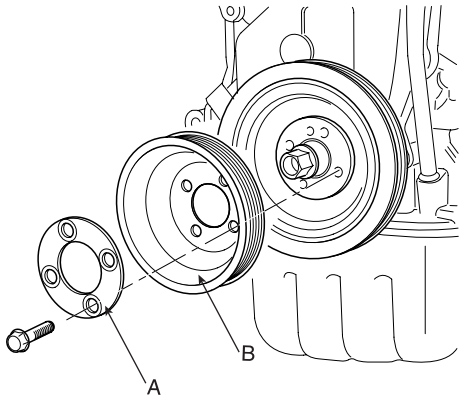
ACHE056A

9. Turn the crankshaft pulley and align its groove with timing mark "T" of the timing belt cover.



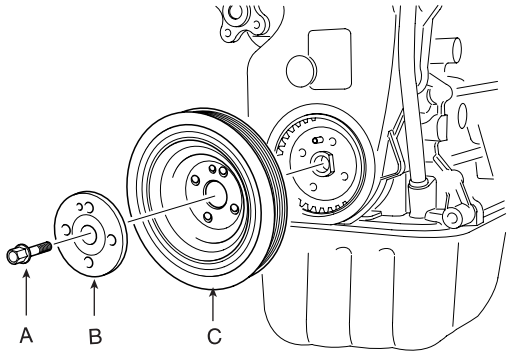
ACHE057A

10. Remove the drive belt pulley (B) and washer (A).



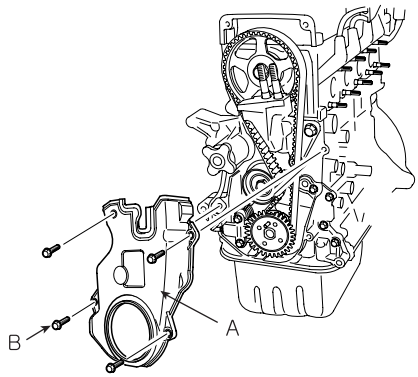
ACHE058A

11. After loosen the crankshaft pulley bolt (A), remove the crankshaft pulley(C) and washer (B).



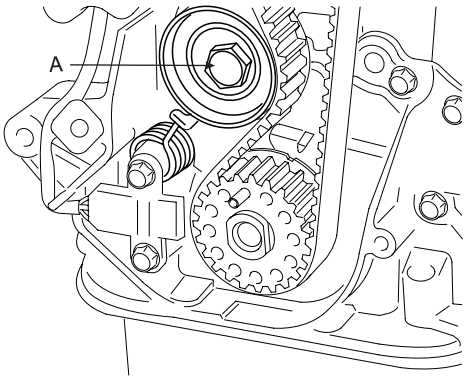
ACHE059A

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



ACHE060A

13. Apply spring tension to the timing belt by temporarily loosening the bolt (A) of the tensioner pulley.



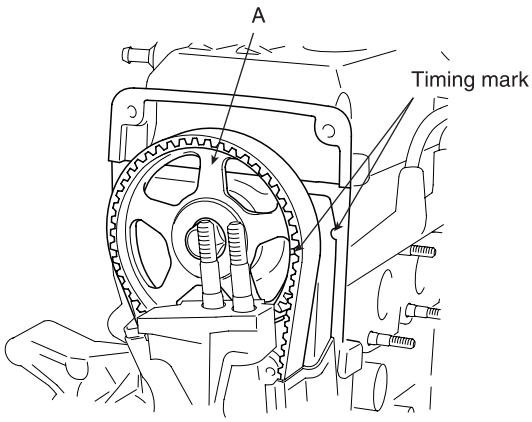
ACHE122A

14. Adjust the timing belt tension.

    1) Rotate crankshaft clock wise (view from the front) through angle equivalent to two teeth (15˚) of camshaft sprocket (A).

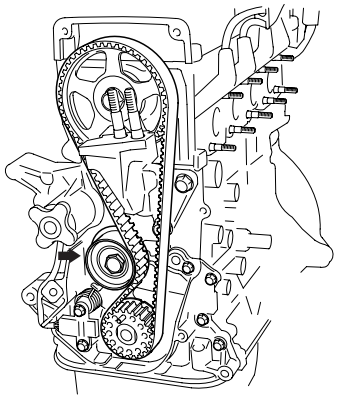
NOTE

It is procedure to give uniformly tension in the tension side of timing belt by setting exhaust rocker arm of the No. 2 cylinder on the cam.



LCHE001A

    2) Push the timing belt in the arrow direction and check the installation condition, and then apply spring tension to the timing belt.

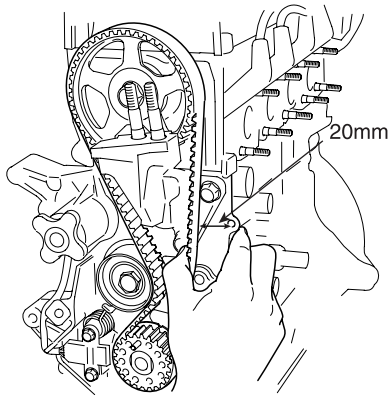


ACHE124A

    3) Tightening the tensioner bolt.

Tightening torque: 21.6 ~ 29.4Nm (2.2 ~ 3.0kg-m, 15.9 ~ 21.7lb-ft)

4) Recheck the belt tension.
Grasp the timing belt and the cylinder block as shown in the illustration, and then check that the interval between the timing belt and the mounting bolt hole is about 20mm (0.79 in).

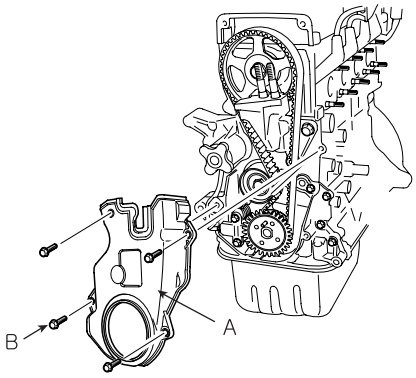


ACHE071A

15. Turn the crankshaft two turns in the operating direction (clockwise) and realign the crankshaft sprocket and camshaft sprocket timing marks.

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

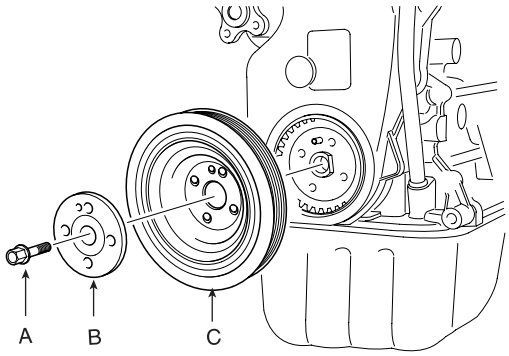
Tightening torque:
9.8 ~ 11.8Nm (1.0 ~ 1.2kg-m, 7.2 ~ 8.7lb-ft)



ACHE060A

17. Install the crankshaft pulley (C) and washer (B) with the bolt (A).

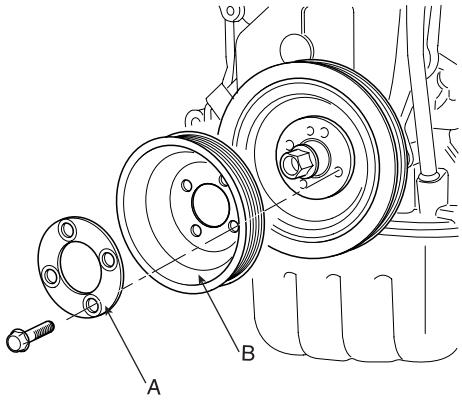
Tightening torque:
122.6 ~ 142.2Nm (12.5 ~ 14.5kg-m, 90.4 ~ 104.9lb-ft)



ACHE059A

18. Install the drive belt pulley (B) and washer (A) with bolts.

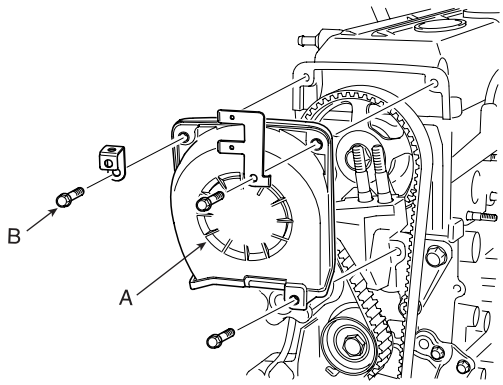
Tightening torque:
9.8 ~ 11.8Nm (1.0 ~ 1.2kg-m, 7.2 ~ 8.7lb-ft)



ACHE058A

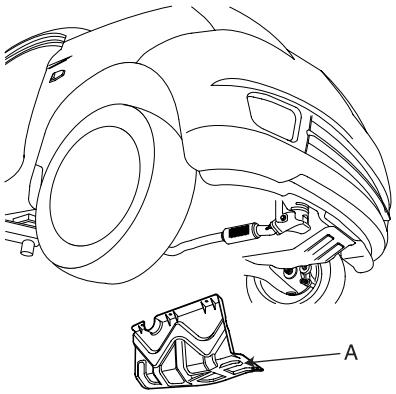
19. Install the timing belt upper cover (A) with bolts (B).

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



ACHE056A

20. Install the water pump pulley.
21. Install the power steering pump drive belt. (See ST group - power steering pump)
22. Install the air conditioner compressor drive belt. (See HA group - air conditioner compressor)
23. Install the alternator drive belt. (See EE group - alternator)
24. Tighten the water pump pulley bolts.
25. Install the RH under cover (A).



ACHE029A

26. Install the RH front wheel.

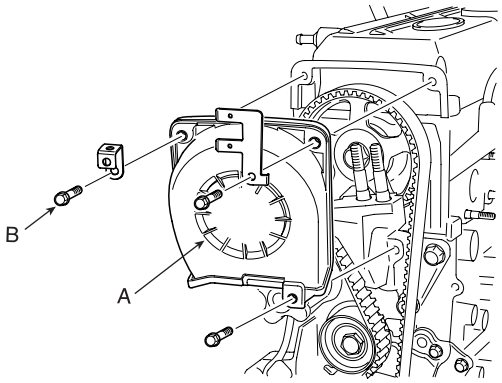
Tightening torque:
88.3 ~ 107.9Nm (9.0 ~ 11.0kg-m, 65.1 ~ 79.6lb-ft)

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

NOTE

Warm up the engine (80 ~ 95°C [176 ~ 203°F]), and then inspect and adjust the valve clearance with the cylinder head installed on the cylinder block.

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

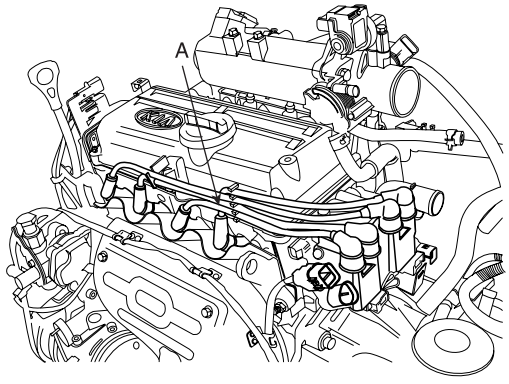


ACHE056A

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

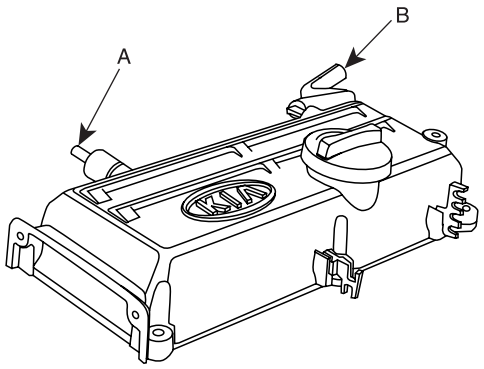
NOTE

Pulling or bending the cables may damage the conductor inside.



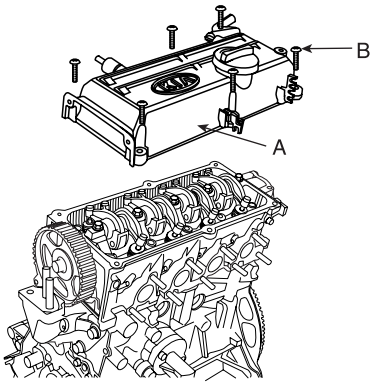
ACHE072A

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



ACHE125A

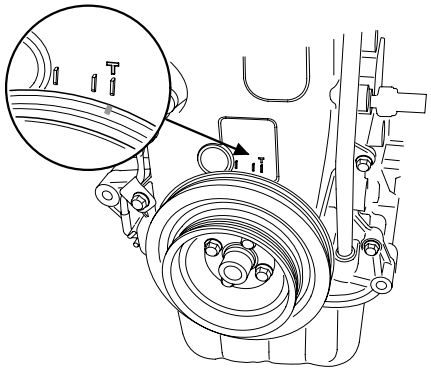
3) Remove the cylinder head cover bolts (B), and then remove the cover (A) and gasket.



ACHE077A

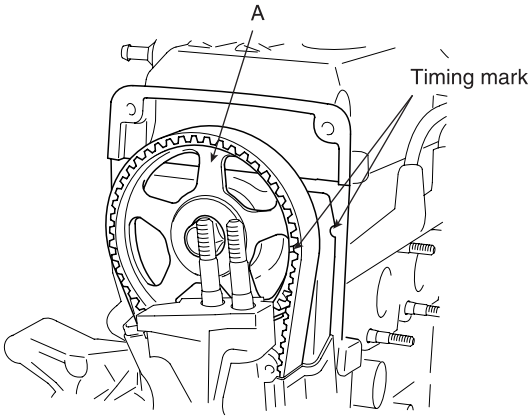
3. Set No. 1 cylinder to TDC/compression.

1) Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing belt cover.



ACHE057A

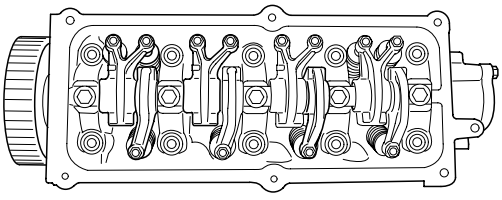
2) Check that timing mark of the camshaft sprocket (A) is aligned with the timing mark of the cylinder head.
If not, turn the crankshaft one revolution (360°).



LCHE001A

4. Inspection the valve clearance.

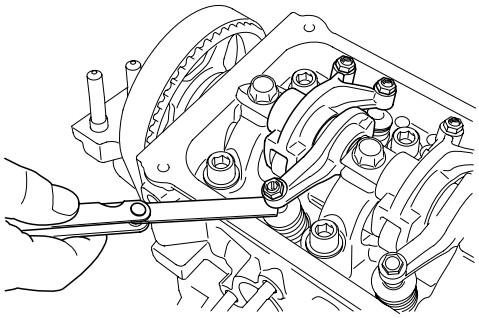
1) Check only the valve indicator as shown. [No. 1 cylinder: TDC/Compression]. Measure the valve clearance.



ACHE109A

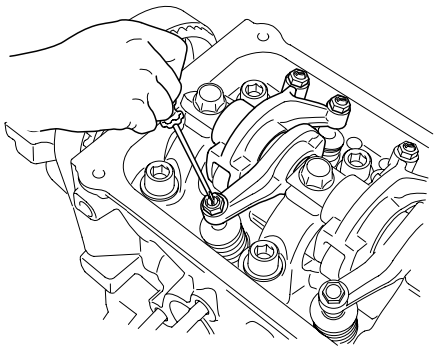
2) Using a thickness gauge, measure the clearance between the adjusting screw and the valve stem end.

Valve clearance
[Specification]
Engine coolant temperature : 80 ~ 95°C[176 ~ 203°F]
Intake: 0.22 ~ 0.28 mm (0.0087 ~ 0.0110in)
Exhaust: 0.27 ~ 0.33mm (0.0106 ~ 0.0130in)
[Reference data]
Engine coolant temperature : 20°C[68°F]
Intake: 0.15 ~ 21mm (0.0059 ~ 0.0083in)
Exhaust: 0.19 ~ 0.25mm (0.0075 ~ 0.0098in)



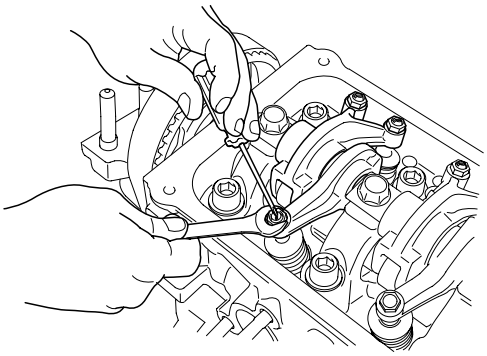
ACHE111A

3) Using the adjusting screw, adjust valve clearance by the specification value after loosen lock nut.



ACHE112A

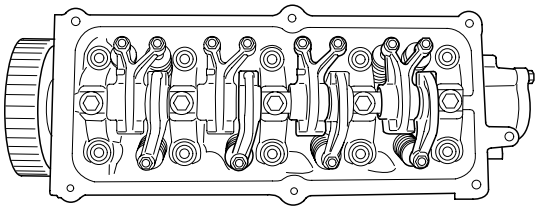
4) If the adjustment is completed, tighten the lock nut.



ACHE113A

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

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



ACHE110A

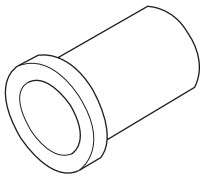
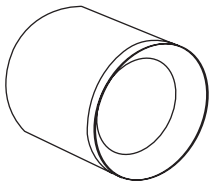
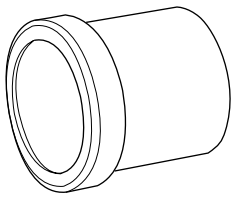
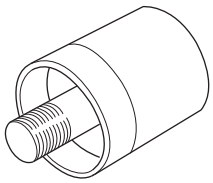
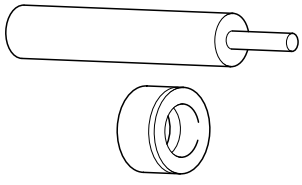
TROUBLESHOOTING ECBFBC4A

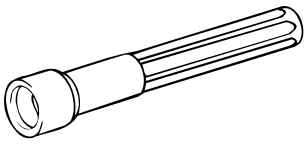
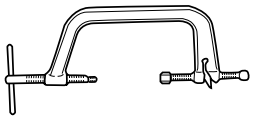
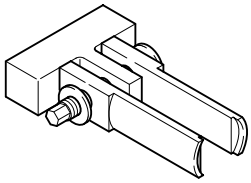
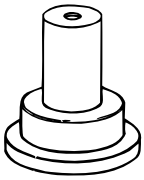
Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspection the cylinder for a loss of compression. 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 belt.	Replace the timing belt and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifers.
Engine misfire with coolant consumption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system . • Coolant consumption may or may not cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, 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)	Inspection 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.
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 belt and/or damage sprocket teeth.	Replace the timing belt and sprockets.
	Worn timing belt tensioner, if applicable.	Replace the timing belt 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, and then repair as required.

Symptom	Suspect area	Remedy
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.
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 journal. • The cylinder block crankshaft bearing bore.

Symptom	Suspect area	Remedy
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 belt and/or timing belt sporckets.	Inspect timing belt and sprockets. 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 ECA3834B

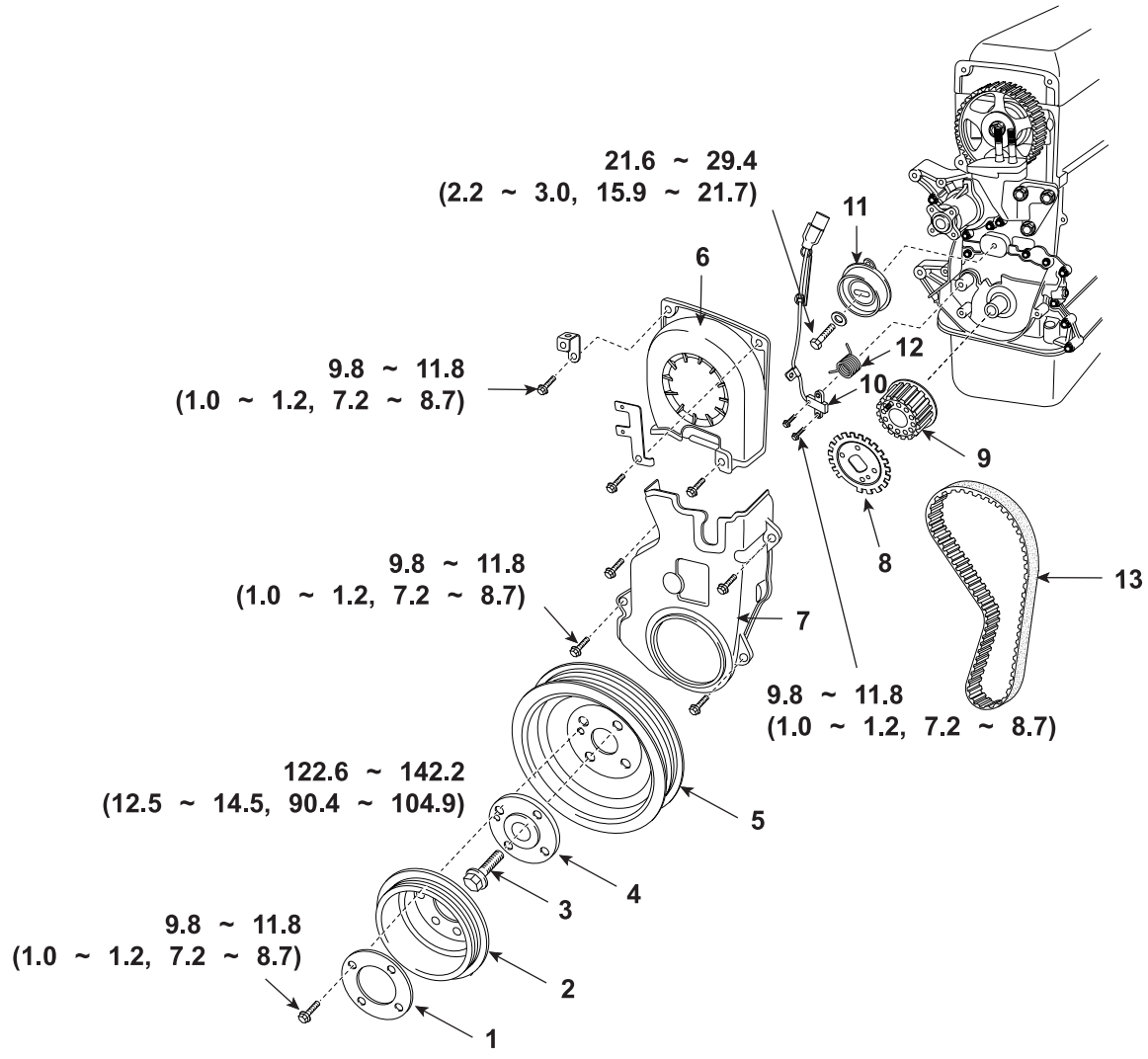
Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-22000)	 ACHE147A	Installation of the front oil seal (With 09231-22100)
Crankshaft front oil seal guide (09231-22100)	 ACHE148A	Installation of the front oil seal (With 09231-22000)
Camshaft oil seal installer (09221-21000)	 ACHE149A	Installation of the camshaft oil seal (With 09221-21100)
Camshaft oil seal guide (09221-21100)	 ACHE150A	Installation of the camshaft oil seal (With 09221-21000)
Valve guide remover and installer (09222-02100)	 ACHE154A	Removal and installation of the valve guide

Tool (Number and name)	Illustration	Use
Valve stem oil seal installer (09222-02000)	 ECKA010A	Installation of the valve stem oil seal
Valve spring lifer arm (0K993 120 001)	 ADBE118A	Removal and installation of the intake or exhaust valve
Valve spring lifter pivot (0K993 120 004)	 ADBE113A	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)	 EDDA005F	Installation of the crankshaft rear oil seal

TIMING SYSTEM

TIMING BELT

COMPONENT EBE8D8EE



TORQUE : N·m (kg·m, lb·ft)

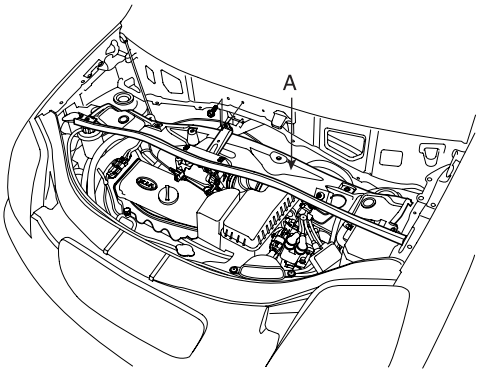
1. Drive belt pulley washer
2. Dive belt pulley
3. Crankshaft pulley bolt
4. Crankshaft pulley washer
5. Crankshaft pulley
6. Timing belt upper cover
7. Timing belt lower cover
8. Crankshaft position sensor target wheel
9. Crankshaft sprocket
10. Crankshaft position sensor
11. Timing belt tensioner
12. Timing belt tensioner spring
13. Timing belt

LCHE002A

REMOVAL E0157710

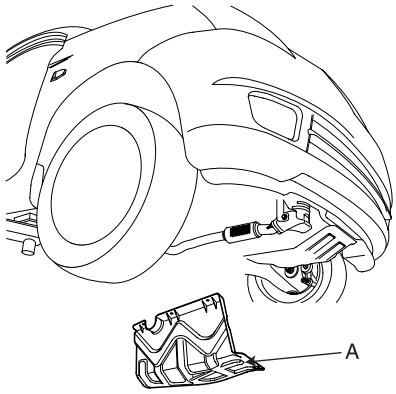
Engine removal is not required for this procedure.

1. Remove the cowl grill and the wiper motor. (See BE group - wiper motor)
2. Remove the cowl panel (A).



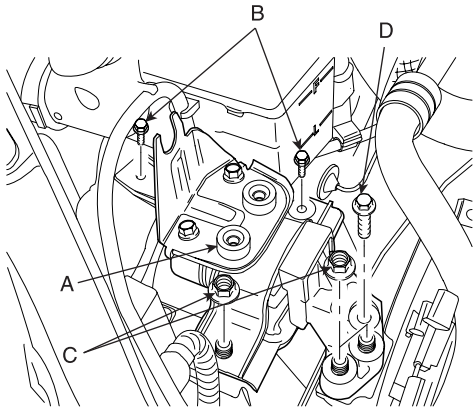
ACHE005A

3. Remove the RH front wheel.
4. Remove the bolts and RH under cover (A).



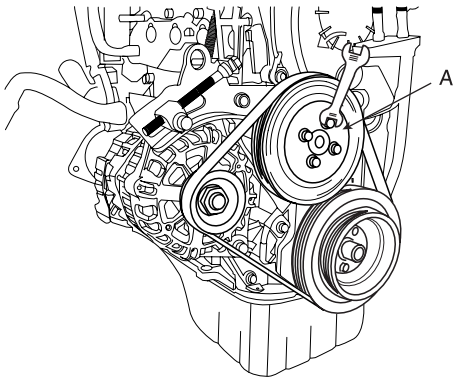
ACHE029A

5. Remove the engine mounting bracket.
   1) Install the engine hanger.
   2) Remove the bolt (B, D), nuts(C) and engine mounting bracket (A).



ACHE035A

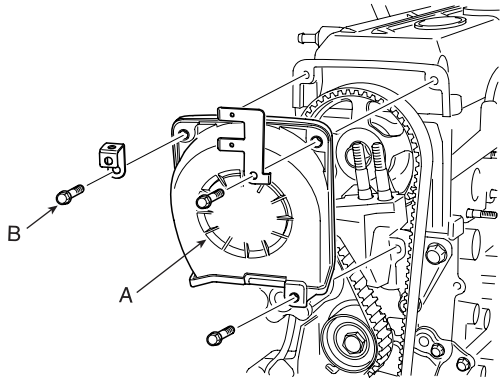
6. Temporarily loosen the water pump pulley (A) bolts.



ACHE055A

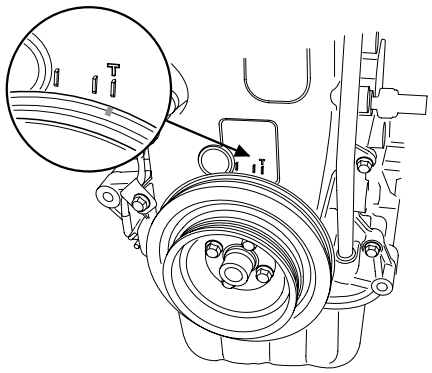
7. Remove alternator drive belt. (See EE group - alternator)
8. Remove air conditioner compressor drive belt. (See HA group - air conditioner compressor)
9. Remove power steering pump drive belt. (See ST group - power steering pump)
10. Remove the water pump pulley.

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



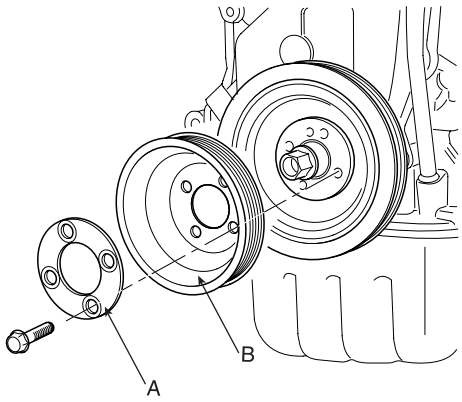
ACHE056A

12. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.



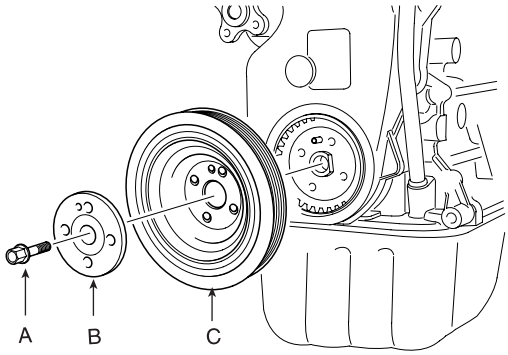
ACHE057A

13. Remove the drive belt pulley (B) and washer (A).



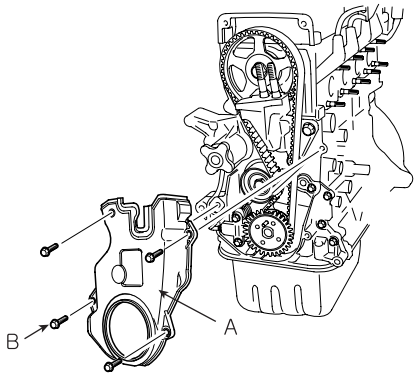
ACHE058A

14. Loosen the crankshaft pulley bolt (A), and then remove the crankshaft pulley(C) and washer (B).



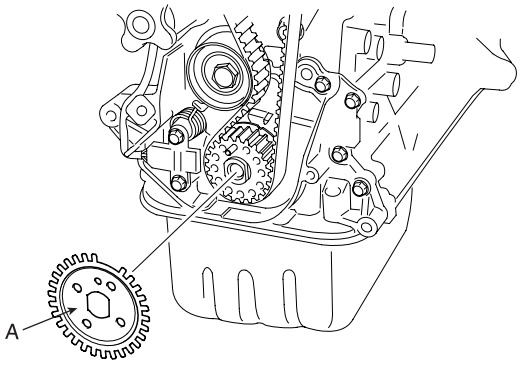
ACHE059A

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



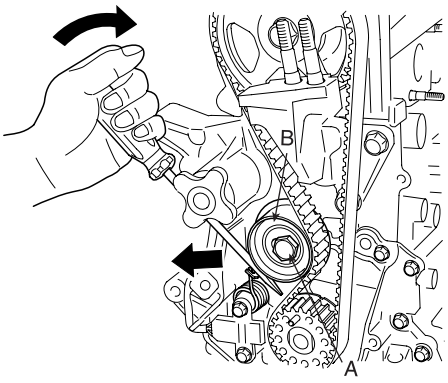
ACHE060A

16. Remove the crankshaft position sensor target wheel (A).



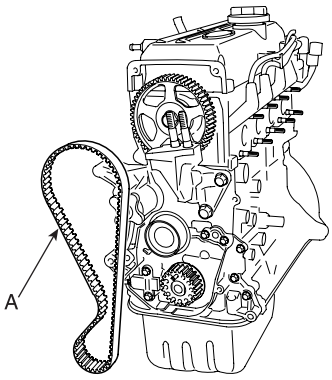
ACHE061A

17. Temporarily loosen the tensioner bolt (A).
    Release tension from the timing belt by pulling the tensioner (B) in the arrow direction, and then temporarily tighten the tensioner bolt (A).



ACHE062A

18. Remove the timing belt (A).

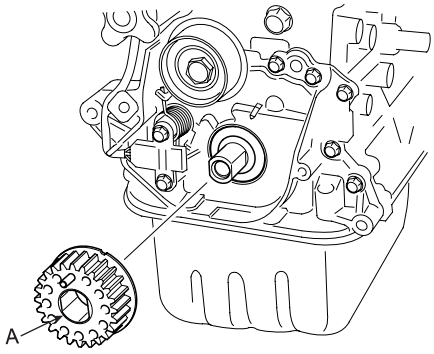


ACHE063A

NOTE

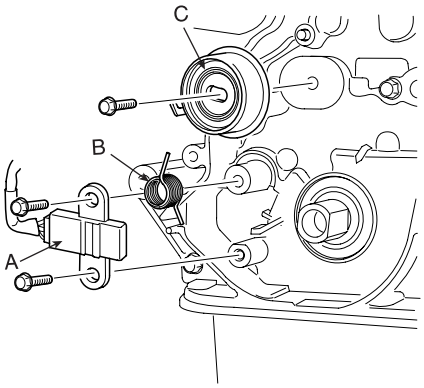
If the timing belt is going reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

19. Remove the crankshaft sprocket (A).



ACHE064A

20. Remove the crankshaft position sensor (A), tensioner spring (B) and tensioner (C).

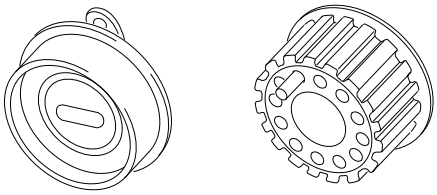


ACHE065A

INSPECTION EFDBD4A4

SPROCKET, TENSIONER

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



ACHE127A

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

TIMING BELT

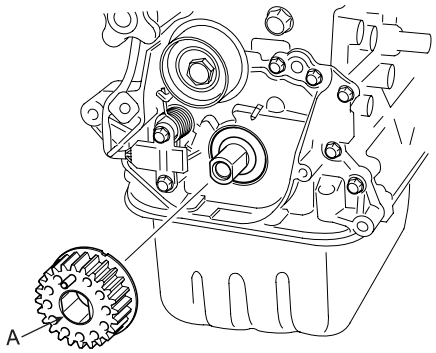
1. Check the belt for oil or dust deposits.
   Replace, if necessary.
   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the carefully. If any damage is found, replace the belt.

NOTE

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.

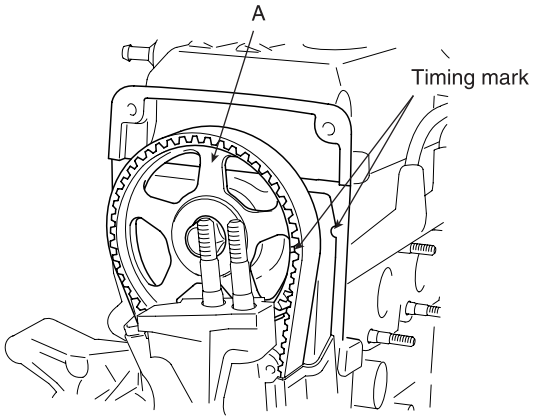
INSTALLATION E5AF7994

1. Install the crankshaft sprocket (A).

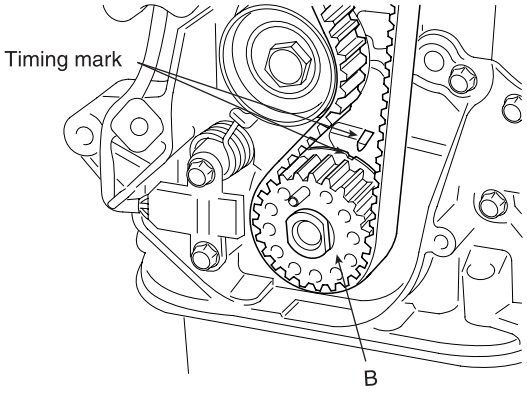


ACHE064A

2. 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.

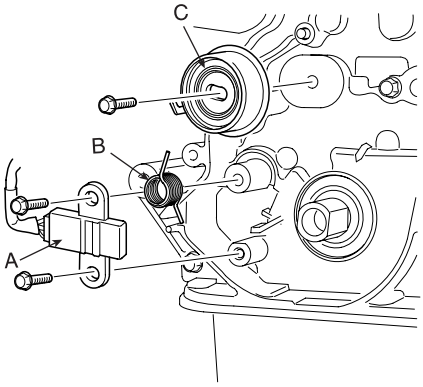


LCHE001A



LCHE003A

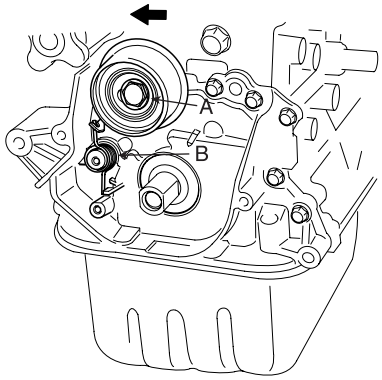
3. Install the crankshaft position sensor (A), tensioner spring (B) and tensioner (C).



ACHE065A

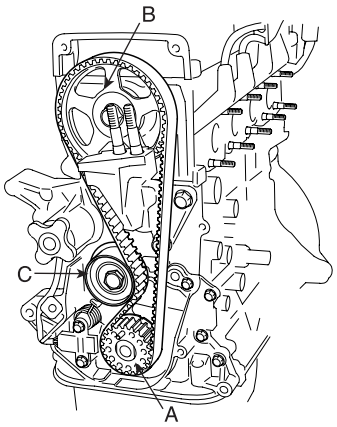
1) Pull the timing belt tensioner (A) in the arrow direcion (to the water pump) until it stops, and then temporarily tighten the tensioner bolt.

2) Hang oneside of the tensioner spring (B) on the tensioner bracket first and using a driver, install otherside to the frontcase.



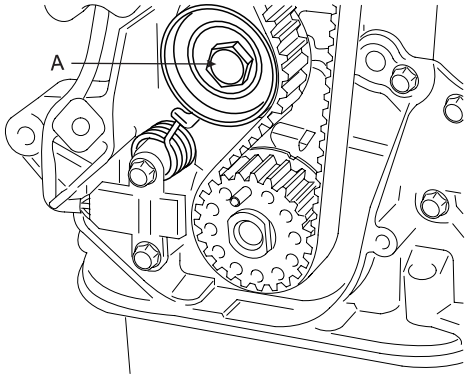
ACHE069A

4. Install the belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt.
Crankshaft sprocket (A) →camshaft sprocket (B) →timing belt tensioner (C).



ACHE070A

5. Apply the spring tension to the timing belt by loosening the tensioner bolt (A).



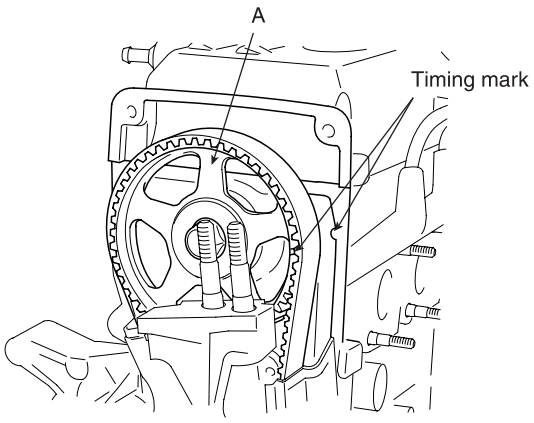
ACHE122A

6. Adjust the timing belt tension.

   1) Rotate crankshaft clock wise (view from the front) through angle equivalent to two teeth (15˚) of camshaft sprocket (A).

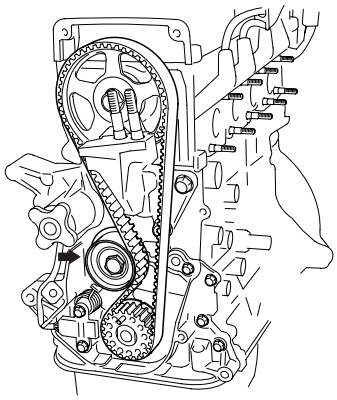
   NOTE

   It is procedure to give uniformly tension in the tension side of timing belt by setting exhaust rocker arm of the No. 2 cylinder on the cam.



LCHE001A

   2) Push the timing belt in the arrow direction and check the installation condition, and then apply spring tension to the timing belt.

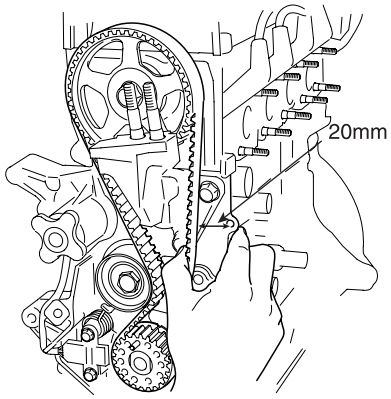


ACHE124A

   3) Tightening the tensioner bolt.

Tightening torque
21.6 ~ 29.4Nm (2.2 ~ 3.0kg-m, 15.9 ~ 21.7lb-ft)

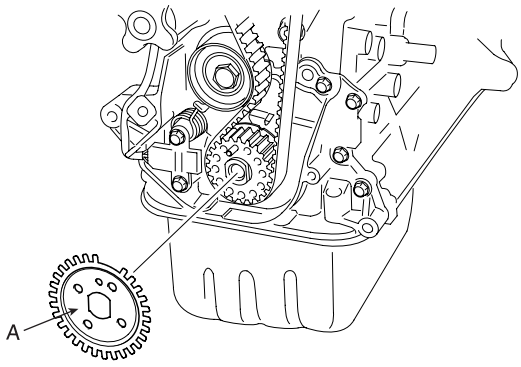
   4) Recheck the belt tension.
   Grasp the timing belt and the cylinder block as shown in the illustration, and then check that the interval between the timing belt and the mounting bolt hole is about 20mm (0.79 in).



ACHE071A

7. Turn the crankshaft two turns in the operating direction (clockwise) and realign the crankshaft sprocket and camshaft sprocket timing marks.

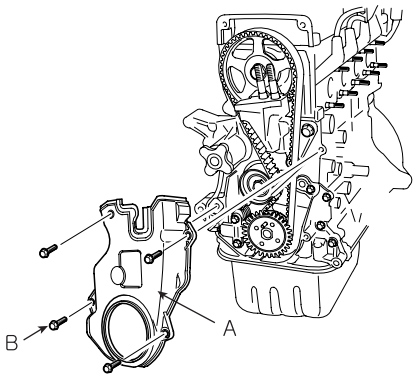
8. Install the crankshaft position sensor target wheel (A).



ACHE061A

9. Install the timing belt lower cover (A) with bolts (B).

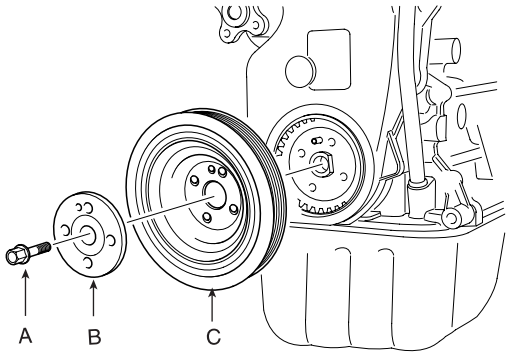
Tightening torque:
9.8 ~ 11.8 Nm (1.0 ~ 1.2kg-m, 7.2 ~ 8.7lb-ft)



ACHE060A

10. Install the crankshaft pulley (C) and washer (B) with bolt (A).

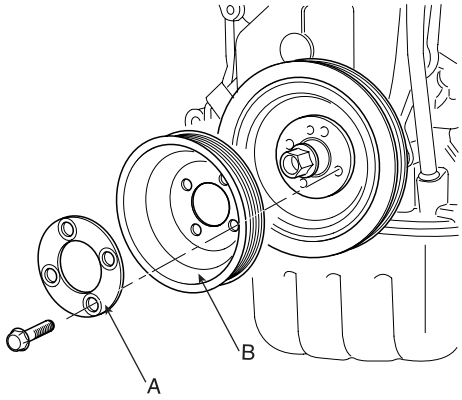
Tightening torque:
122.6 ~ 142.2Nm (12.5 ~ 14.5kg-m, 90.4 ~ 104.9lb -ft)



ACHE059A

11. Install the drive belt pulley (B) and washer (A).

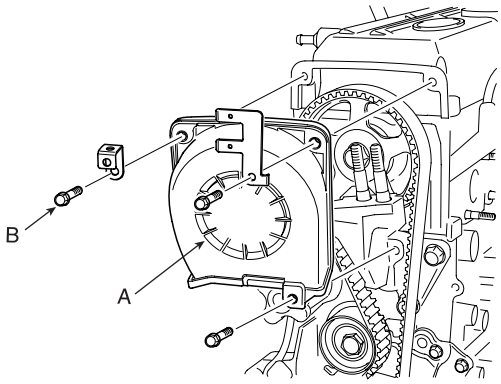
Tightening torque:
9.8 ~ 11.8 Nm (1.0 ~ 1.2kg-m, 7.2 ~ 8.7lb-ft)



ACHE058A

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

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



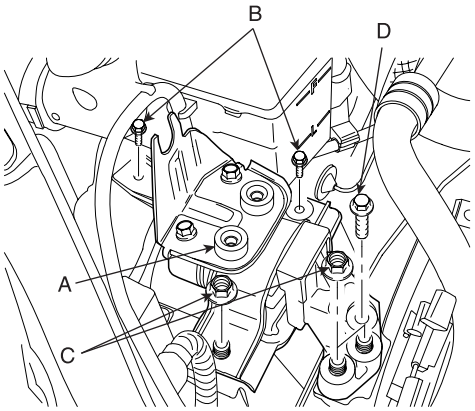
ACHE056A

13. Install the water pump pulley.

14. Install power steering pump drive belt. (See ST group - power steering pump)

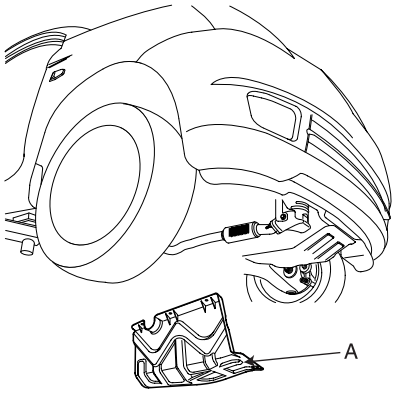
15. Install air conditioner compressor dirve belt. (See HA group - air conditioner compressor)
16. Install alternator dirve belt. (See EE group - alternator)
17. Tighten the water pump pulley bolts.
18. Install the engine mounting bracket.
    1) Install the engine mounting bracket (A) with bolts (B, D) and nut (C).

Tightening torque:
Nut and bolt (B, C, D):
44.1 ~ 58.8Nm (4.5 ~ 6.0kg-m, 32.5 ~ 43.4lb-ft)



ACHE035A

    2) Remove the engine hanger.
19. Install the RH under cover (A).

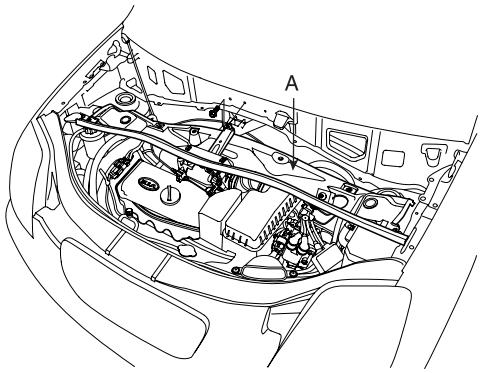


ACHE029A

20. Install the RH front wheel.

Tightening torque:
88.8 ~ 107.9Nm (9.0 ~ 11.0kg-m, 65.1 ~ 79.6lb-ft)

21. Install the cowl panel (A).

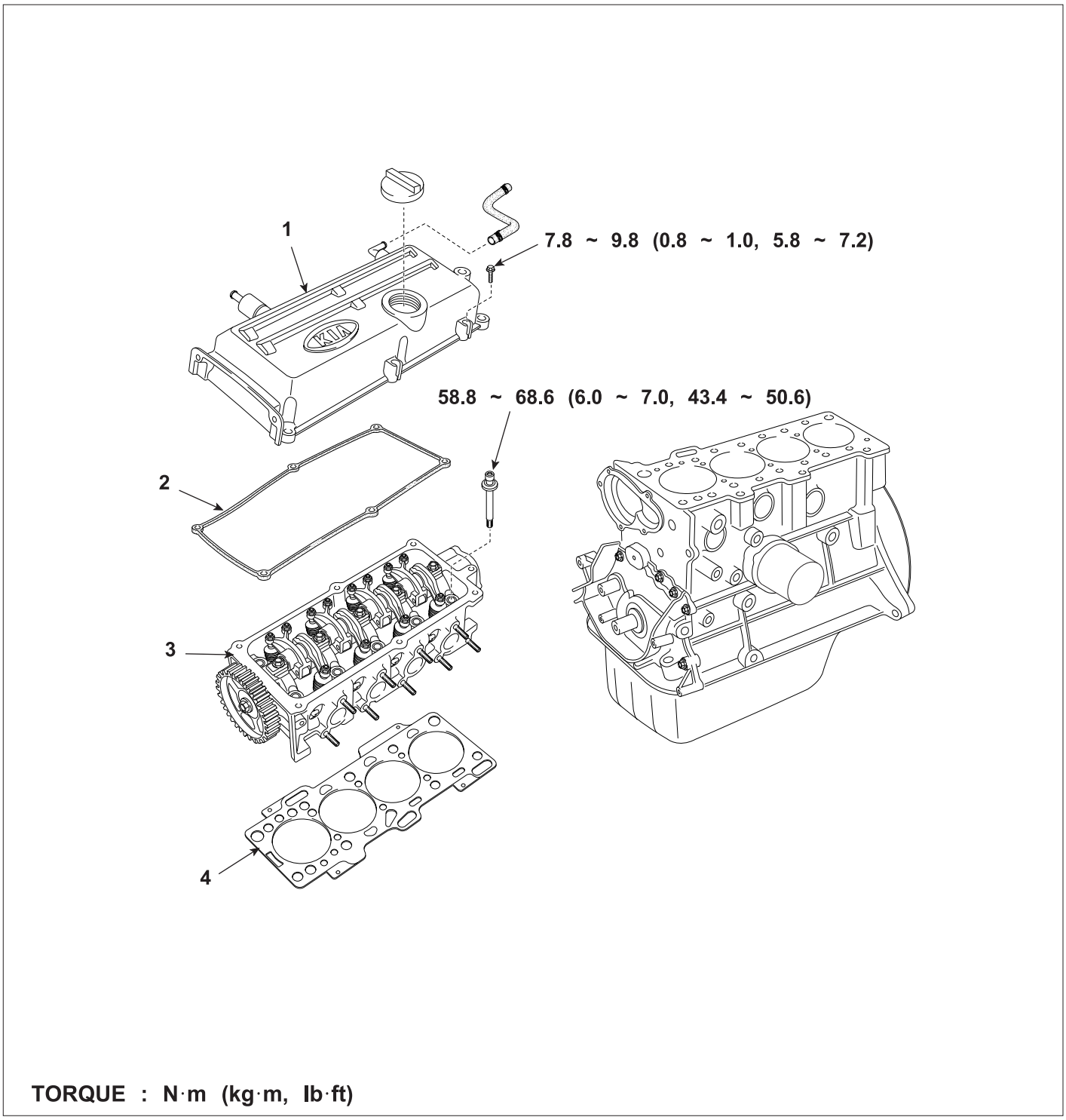


ACHE005A

22. Install the cowl grill and the wiper motor. (See BE group - wiper motor)

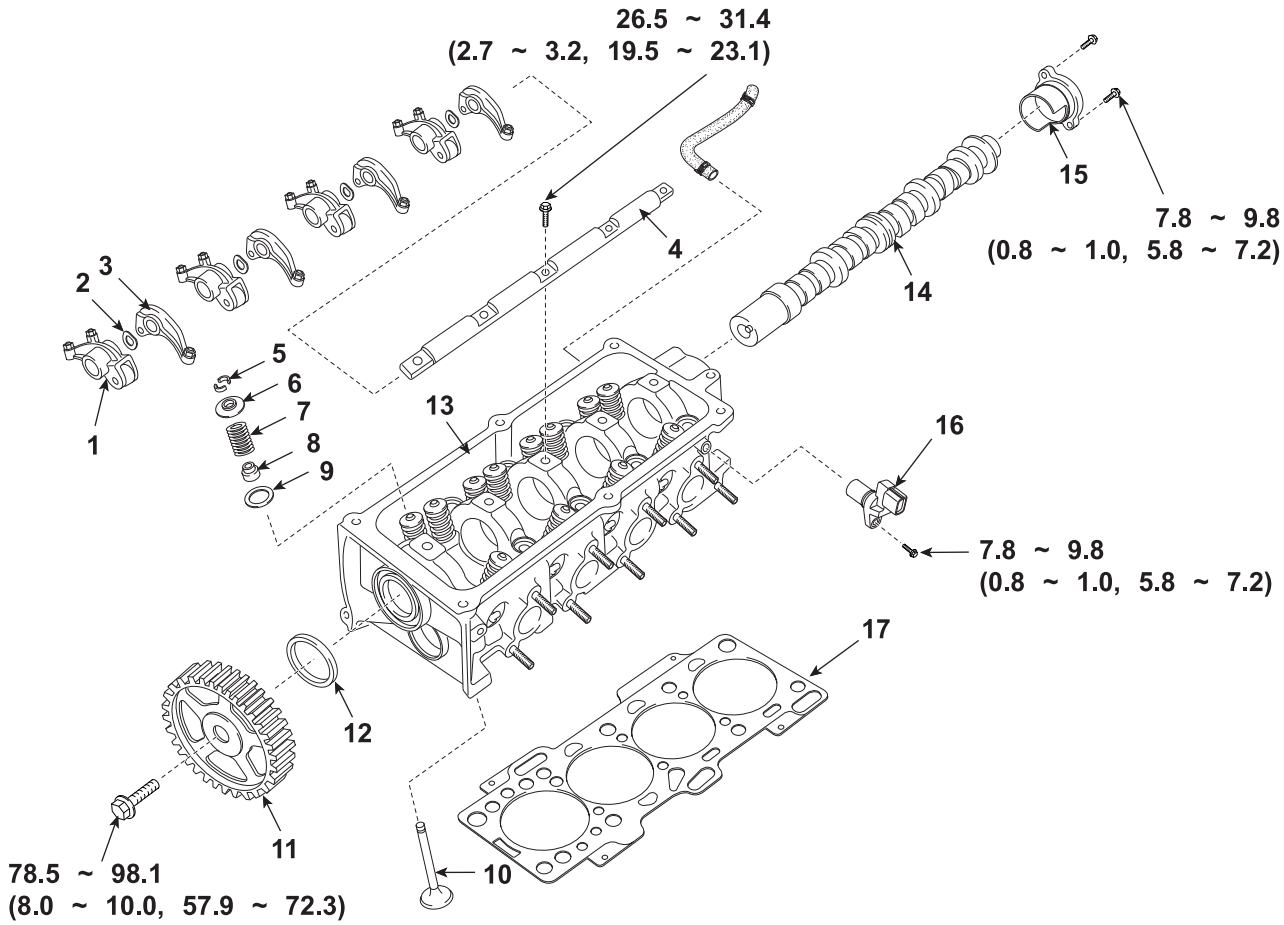
CYLINDER HEAD ASSEMBLY

COMPONENT E8BB6BBE



1. Cylinder head cover
2. Cylinder head cover gasket
3. Cylinder head assembly
4. Cylinder head gasket

LCHE004A



TORQUE : N·m (kg·m, lb·ft)

1. Rocker arm (intake)
2. Wave washer
3. Rocker arm (exhaust)
4. Rocker arm shaft
5. Retainer lock
6. Retainer
7. Valve spring
8. Stem seal
9. Spring seat
10. Valve
11. Camshaft sprocket
12. Camshaft oil seal
13. Cylinder head
14. Camshaft
15. Camshaft thrust cap
16. Camshaft position sensor
17. Cylinder head gasket

LCHE005A

REMOVAL E0E2DD28

Engine removal is not required for this procedure.

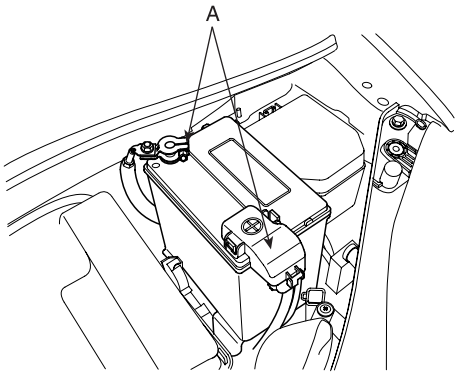
CAUTION

- ***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 handing a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.***
- ***To avoid damage, unplug the wiring connectors carefully while holding the connector portion.***

NOTE

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

1. Disconnect the terminals (A) from battery.

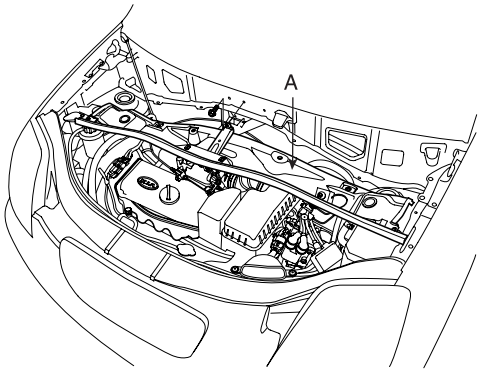


ACHE001A

2. Drain the engine coolant. (Refer to section cooling system - engine coolant refilling and bleeding) Remove the radiator cap to speed draining.

3. Remove the cowl grill and the wiper motor. (See BE group - wiper motor)

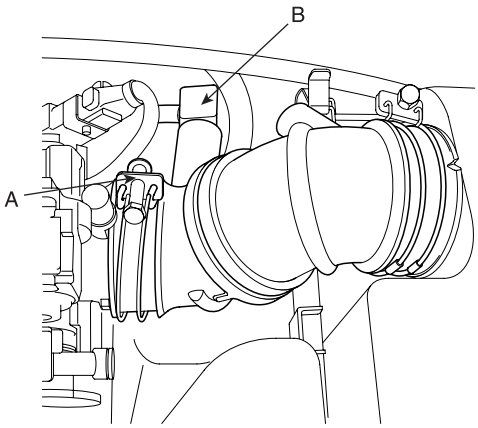
4. Remove the cowl panel (A).



ACHE005A

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

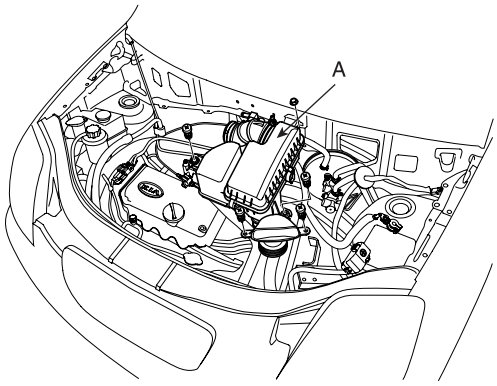
   1) Remove the air hose clamp (A) and the vacuum hose (B).



ACHE006A

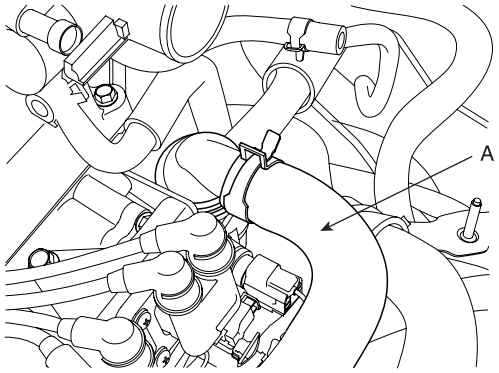
   2) Remove the air cleaner bolts(2ea), nut(1ea) and air duct fasteners(2ea).

   3) Remove the air cleaner assembly (A).

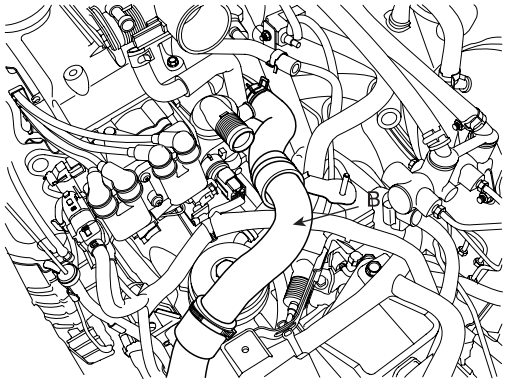


ACHE007A

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

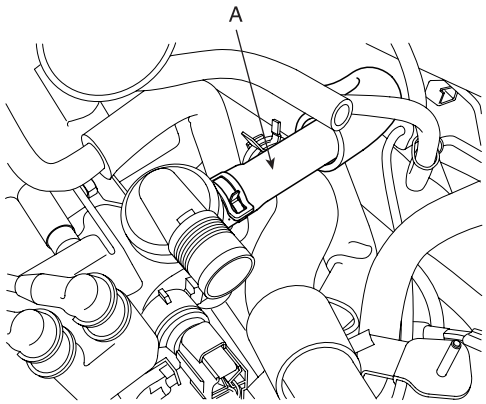


ACHE013A



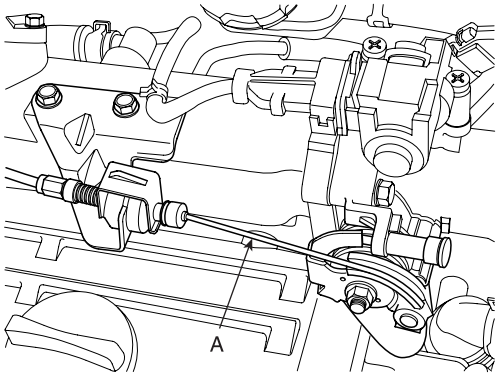
ACHE014A

7. Remove the heater hoses (A).



ACHE015A

8. Remove the accelerator cable (A).



ACHE016A

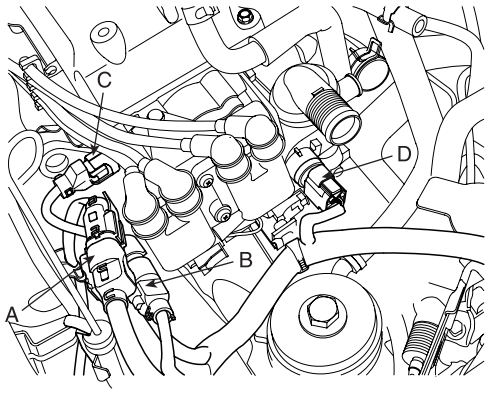
9. Remove the engine wire harness connectors and wire harness clamp from cylinder head and the intake manifold.

   1) Disconnect the rear oxygen sensor connector (A).

   2) Disconnect the ignition coil connector (B).

   3) Disconnect the CMP (Camshaft position sensor) connector (C).

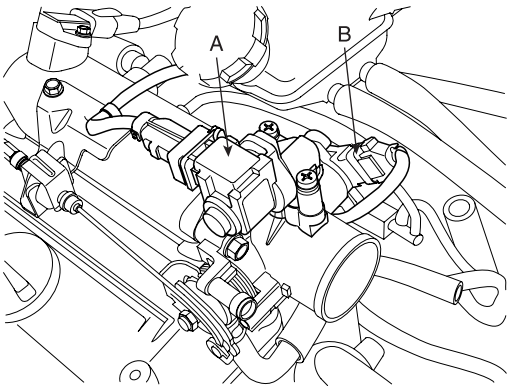
   4) Disconnect the ECT (Engine Coolant Temperature) sensor connector (D).



ACHE017A

   5) Disconnect the ISA (Idle Speed Actuator) connector (A).

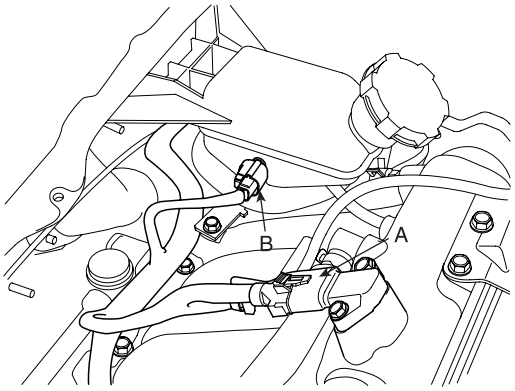
6) Disconnect the TPS (Throttle Position Sensor) connector (B).



ACHE018A

7) Disconnect the MAP (Manifold Absolute Pressure) sensor connector (A).

8) Disconnect the brake oil level switch connector (B).



ACHE019A

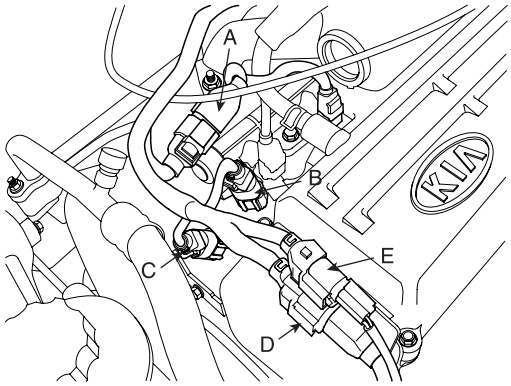
9) Disconnect the injector combination connector (A).

10) Disconnect the CKP (Crankshaft position sensor) connector (B).

11) Disconnect the knock sensor connector (C).

12) Disconnect the front oxygen sensor connector (D).

13) Disconnect the combined power steering pump switch and oil pressure switch connector (E).

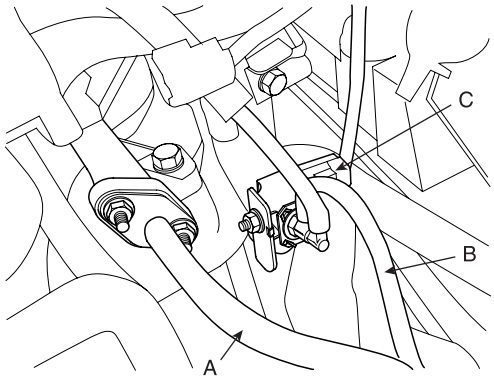


ACHE020A

10. Remove the fuel inlet hose (A) from the delivery pipe.

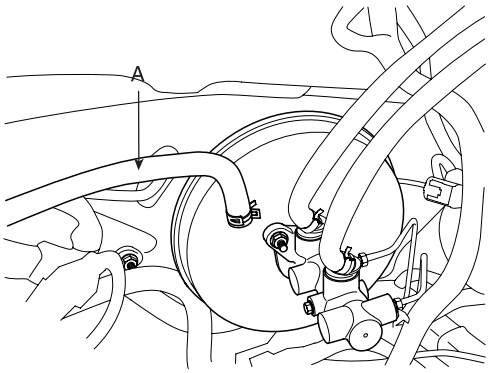
11. Remove the PCSV (Purge Control Solenoid Valve) hose (B).

12. Disconnect the PCSV (Purge Control Solenoid Valve) connector (C).



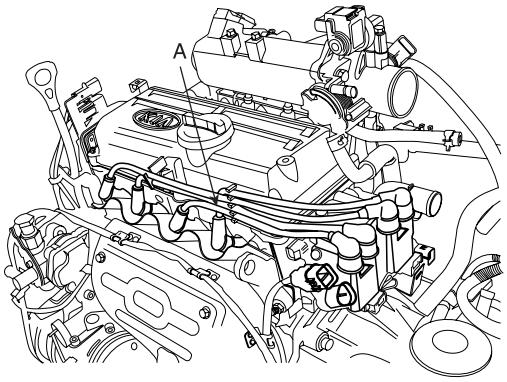
ACHE026A

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



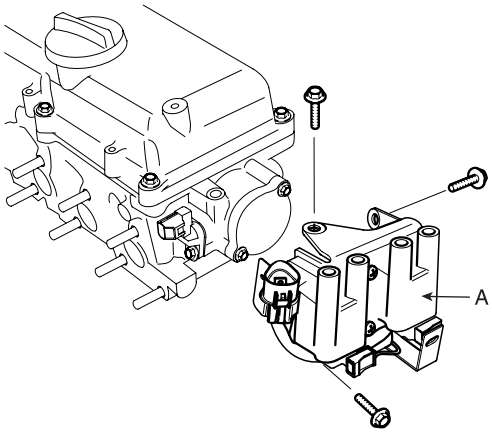
ACHE027A

14. Remove the spark plug cables (A).



ACHE072A

15. Remove the ignition coil assembly (A).



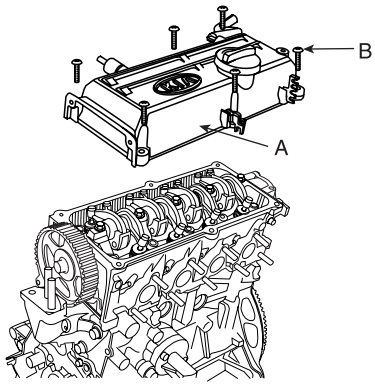
ACHE073A

16. Remove the exhaust manifold. (Refer to section intake and exhaust system - exhaust manifold removal)

17. Remove the intake manifold. (Refer to section intake and exhaust system - intake manifold removal)

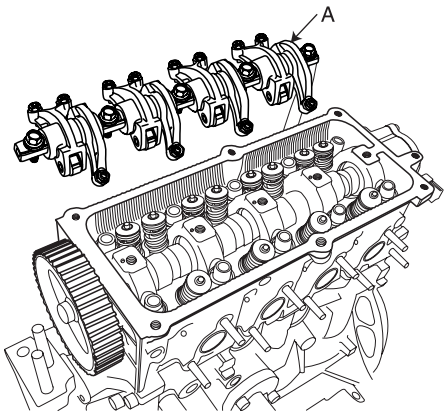
18. Remove the timing belt. (Refer to section timing system - timing belt removal)

19. Remove the bolts (B) and the cylinder head cover (A).



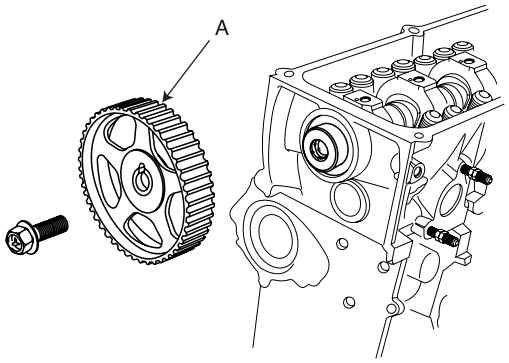
ACHE077A

20. Remove the rocker arm shaft assembly (A).



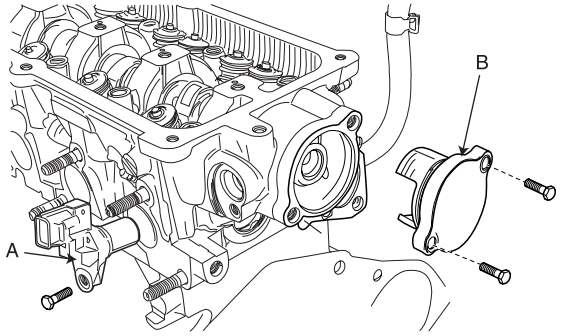
ACHE078A

21. Remove the camshaft sprocket (A).



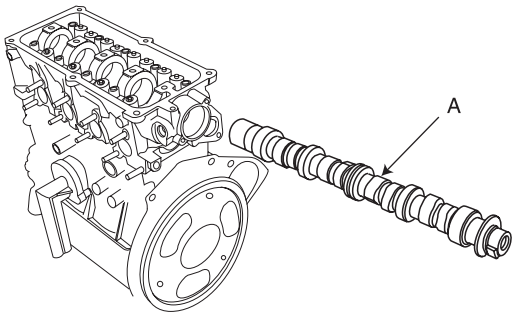
ACHE079A

22. Remove the CMP (Camshaft position sensor)(A) and the thrust cap (B).



ACHE080A

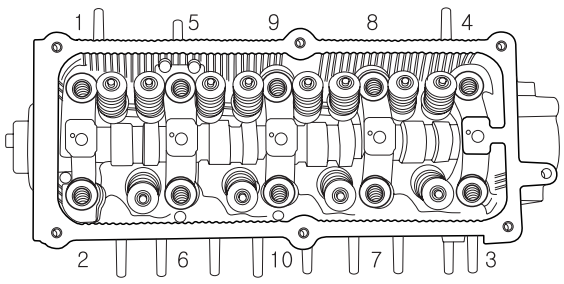
23. Remove the camshaft (A).



ACHE081A

24. Remove the cylinder head bolts, and then remove the cylinder head.

    1) Using hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



ACHE082A

CAUTION

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

2) Lift the cylinder head from the cylinder block, and then place the cylinder head on wooden blocks on a bench.

CAUTION

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

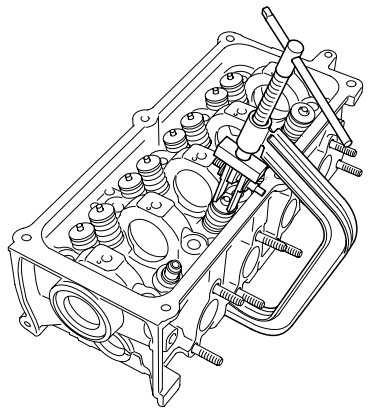
DISSASSEMBLY EA2FCAB7

NOTE

Identify rocker arm, valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the valves.

   1) Using the SST (0K993 120 001, 0K993 120 004), compress the valve spring and remove the retainer lock.



ACHE090A

   2) Remove the spring retainer.

   3) Remove the valve spring.

   4) Remove the valve.

   5) Using needle-nose pliers, remove the oil seal.

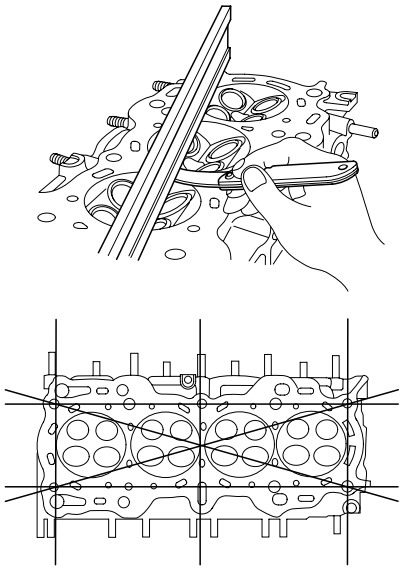
   6) Using a magnetic finger, remove the spring seat.

INSPECTION EA659AED

CYLINDER HEAD

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure flatness in contacting surface of the cylinder block and the manifolds.

Flatness of cylinder head gasket surface Standard: Less than 0.03mm (0.0012in) Limit: 0.10mm (0.0039in) Flatness of manifold mating surface Standard: Less than 0.15mm (0.0059in) Limit: 0.30mm (0.0118in)



ECKD001H

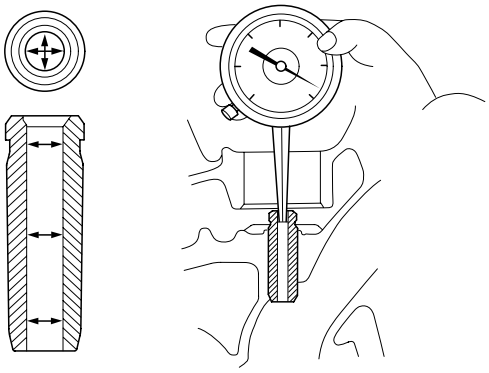
2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

1. Inspect the valve stems and valve guides.

   1) Using the caliper gauge, measure the inner diameter of the valve guide.

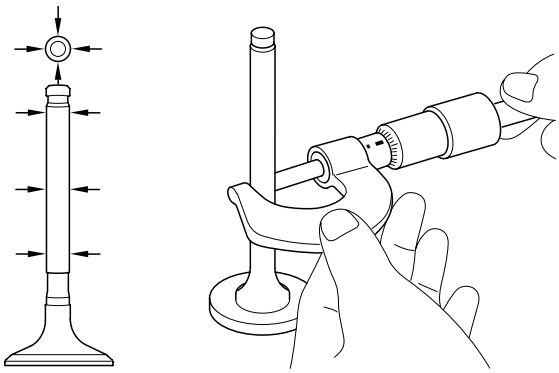
Valve guide inner diameter: 5.500 ~ 5.512mm (0.2165 ~ 0.2170in)



ECKD219A

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

Valve stem outer diameter Intake: 5.465 ~ 5.480mm (0.2152 ~ 0.2157in) Exhaust: 5.430 ~ 5.450mm (0.2138 ~ 0.2146in)



ECKD220A

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

Valve stem- to-guide clearance Standard : Intake: 0.020 ~ 0.047mm (0.0008 ~ 0.0019in) Exhaust: 0.050 ~ 0.082mm (0.0014 ~ 0.0026in)

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

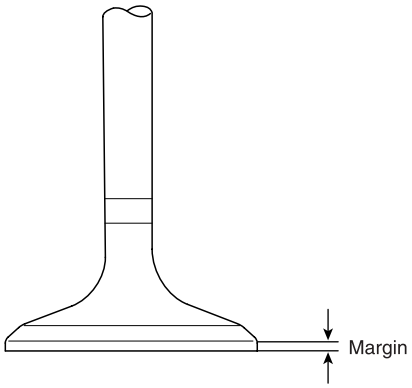
2. Inspect the valves.

   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 then minimum, replace the valve.

Margin Standard Intake: 0.8mm (0.0315in) Exhaust: 1.2mm (0.0472in) Limit Intake: 0.5mm (0.0197in) Exhaust: 0.9mm (0.0354in)



ECKD221A

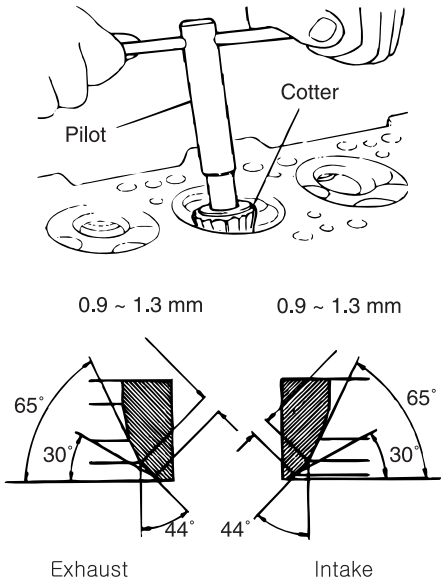
   4) Check the surface of the valve stem tip for wear.
   If the valve stem tip is worn, replace the valve.

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, and 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.



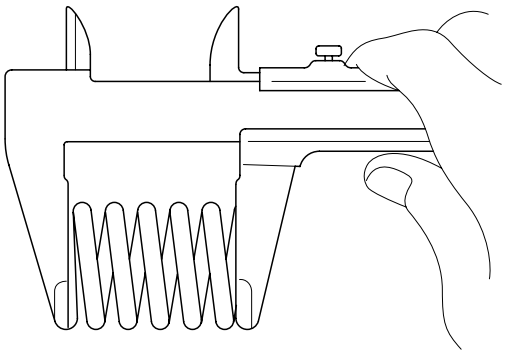
LCHE006A

4. Inspect the valve springs.

   1) Using a steel square, measure the out-of-square of the valve spring.

   2) Using a vernier calipers, measure the free length of the valve spring.

Valve spring
Standard
Free height: 40.50mm (1.5945in)
Load : 15.6±0.9kg/32.0mm (34.4±2.0lb/1.2598in)
33.3±1.8kg/24.5mm (73.4±4.0lb/0.9646in)
Out of square : Less than 1.5 ˚
Limit
Out of square : 3˚



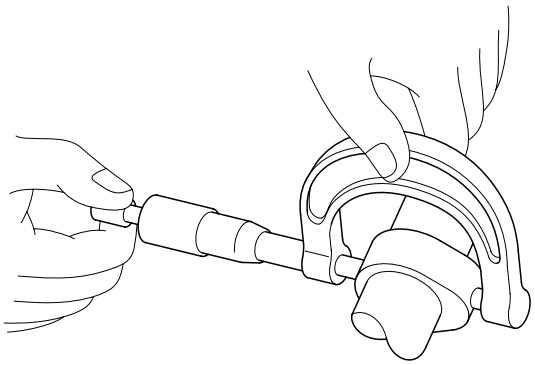
ECKD222A

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: 33.941 ~ 34.141mm (1.3363 ~ 1.3441in)
Exhaust: 34.055 ~ 34.255mm (1.3407 ~ 1.3486in)



ECKD223A

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

2. Inspect the camshaft journal.
   Using a micrometer, measure outer diameter of the camshaft journal.

Camshaft journal outer diameter
Standard: 40.940 ~ 40.955mm (1.6118 ~ 1.6124in)

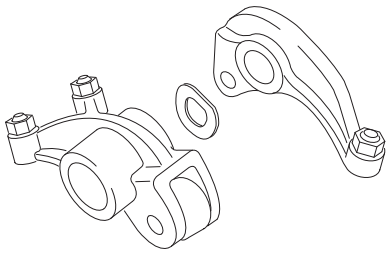
3. Inspect the camshaft end play.
   1) Install the camshaft.
   2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play
Standard: 0.07 ~ 0.19mm (0.0028 ~ 0.0075in)

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

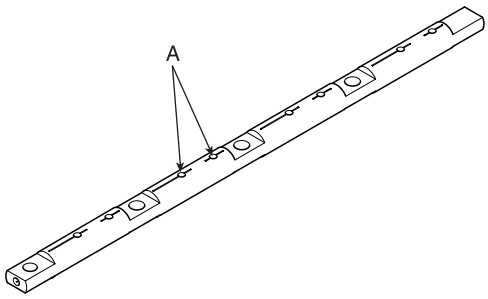
ROCKER ARM AND ROCKER ARM SHAFT

1. Inspect the rocker arm.
   1) Check the rocker arm face.
      Replace it if damaged or pressed.
   2) Check the contacting surface on the cam and valve stem.
      If badly worn or damaged, replace it.



ACHE129A

2. Inspect the rocker arm shaft.
   1) Check the rocker arm shafts for damaged. Replace as necessary.
   2) Check the oil hole (A) whether clogged or not.



ACHE094A

3. Measure the rocker arm-to-rocker arm shaft clearance.

    1) Measure the rocker arm inner diameter.

Rocker arm inner diameter: 17.010 ~ 17.028mm (0.6697 ~ 0.6704in)

    2) Measure the rocker arm shaft outer diameter.

Rocker arm shaft outer diameter: 16.985 ~ 16.998mm (0.6687 ~ 0.6692in)

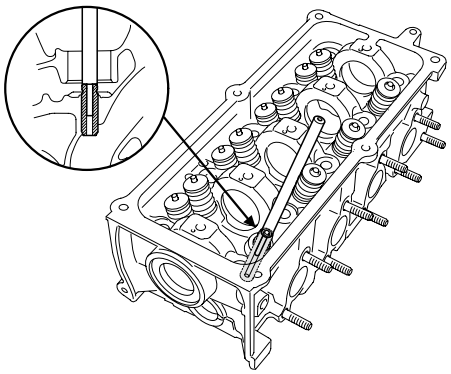
    3) Calculate the difference between the rocker arm inner diameter and the rocker arm shaft outer diameter.

Oil clearance: 0.12 ~ 0.43mm (0.0047 ~ 0.0169in)

REPLACEMENT ED8FE4CD

VALVE GUIDE

1. Using the SST (09222 - 02100), withdraw the old valve guide toward the bottom of cylinder head.



ACHE093A

2. Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.
3. Using SST (09222 - 02100), 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: 46.0mm (1.8110 in) Exhaust: 48.0mm (1.8898 in)

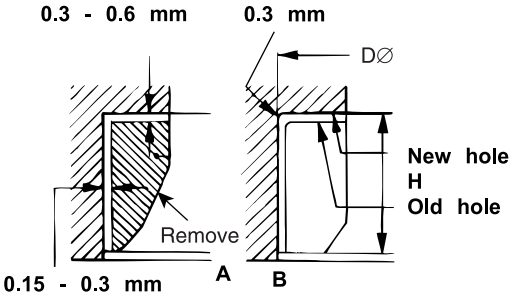
4. After the valve guide is press-fitted, insert a new valve and check for proper stem-to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

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	-	10.000 ~ 10.015 (0.3937 ~ 0.3943)	10.050 ~ 10.060 (0.3957 ~ 0.3961)	Intake: 15.5 ~ 16.1 (0.6102 ~ 0.6339) Exhaust: 14.5 ~ 15.1 (0.5709 ~ 0.5945)
	0.05 (0.002) OS	5	10.050 ~ 10.068 (0.3957 ~ 0.3964)	10.100 ~ 10.110 (0.3976 ~ 0.3980)	
	0.25 (0.010) OS	25	10.250 ~ 10.268 (0.4035 ~ 0.4043)	10.300 ~ 10.310 (0.4055 ~ 0.4059)	
	0.50 (0.020) OS	50	10.500 ~ 10.518 (0.4134 ~ 0.4141)	10.550 ~ 10.560 (0.4154 ~ 0.4157)	

VALVE SEAT RING

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



LCHE007A

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°C(480°F) and press-fit an oversize seat ring for the bore in the cylinder head.
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	-	24.000 ~ 24.021 (0.9449 ~ 0.9457)	24.125 ~ 24.145 (0.9498 ~ 0.9506)	5.900 ~ 6.100 (0.2323 ~ 0.2402)
	0.3 (0.012) OS	30	24.300 ~ 24.321 (0.9567 ~ 0.9575)	24.425 ~ 24.445 (0.9616 ~ 0.9624)	6.200 ~ 6.400 (0.2441 ~ 0.2520)
	0.6 (0.024) OS	60	24.600 ~ 24.621 (0.9685 ~ 0.9693)	24.725 ~ 24.745 (0.9734 ~ 0.9742)	6.500 ~ 6.700 (0.2559 ~ 0.2638)
Exhaust valve seat ring	STD	-	29.000 ~ 29.021 (1.1417 ~ 1.1426)	29.125 ~ 29.145 (1.1467 ~ 1.1474)	5.900 ~ 6.100 (0.2323 ~ 0.2402)
	0.3 (0.012) OS	30	29.300 ~ 29.321 (1.1535 ~ 1.1544)	29.425 ~ 29.445 (1.1585 ~ 1.1592)	6.200 ~ 6.400 (0.2441 ~ 0.2520)
	0.6 (0.024) OS	60	29.600 ~ 29.621 (1.1654 ~ 1.1662)	29.725 ~ 29.745 (1.1703 ~ 1.1711)	6.500 ~ 6.700 (0.2559 ~ 0.2638)

REASSEMBLY E67FADE8

NOTE

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

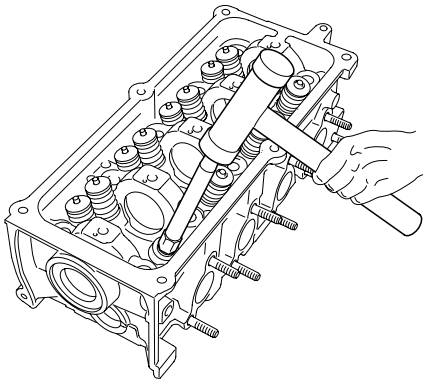
1. Install the valves.

   1) Install the spring seats.

   2) Using the SST (09222 - 02000), push in a new oil seal.

NOTE

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



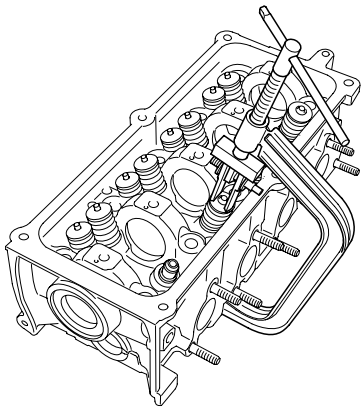
ACHE091A

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

NOTE

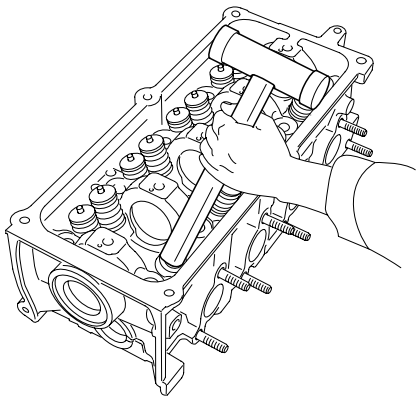
Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

   4) Using SST (0K993 120 001, 0K993 120 004), 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.



ACHE090A

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



ACHE092A

INSTALLATION E1BBEFDB

NOTE

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

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

NOTE

Be careful of the installation direction.

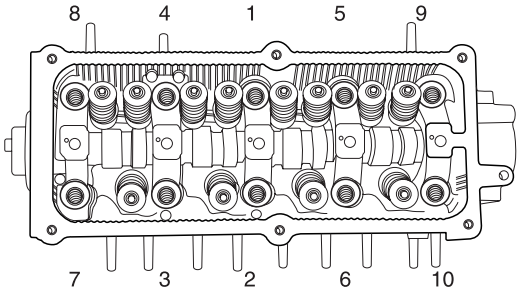
2. Place the cylinder head onto the block carefully in order to prevent damaging the gasket. If the gasket is damaged, fluid leakage could occur.

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.

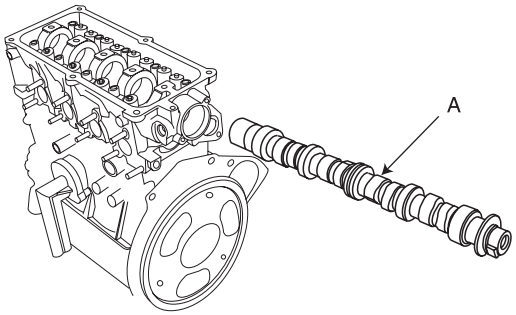
   2) Using hexagon wrench, install and tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

Tightening torque:
55.8 ~ 68.6Nm (6.0 ~ 7.0kg-m, 43.4 ~ 50.6lb-ft)



ACHE130A

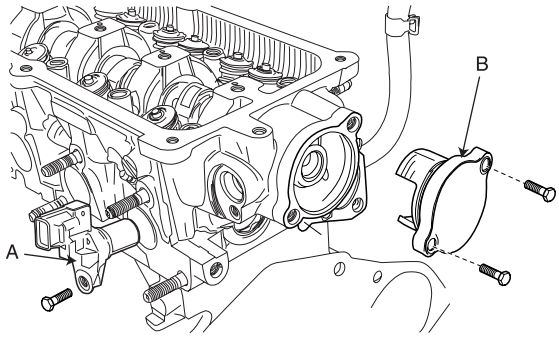
4. Install the camshaft (A).



ACHE081A

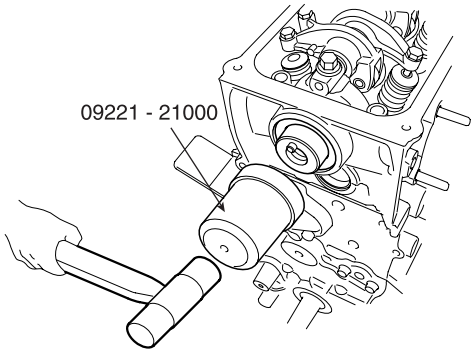
5. Install the thrust cap (B) and CMP (Camshaft position sensor) (A).

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



ACHE080A

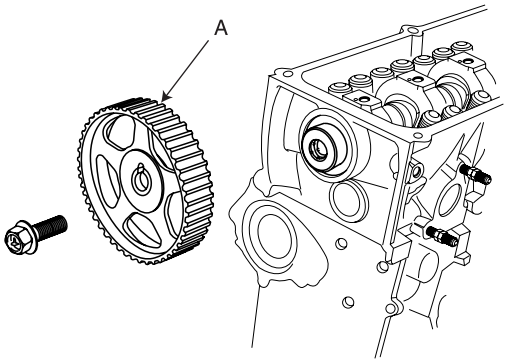
6. Using the SST (09221 - 21000), install the camshaft bearing oil seal.



ACHE095A

7. Install the camshaft sprocket (A).

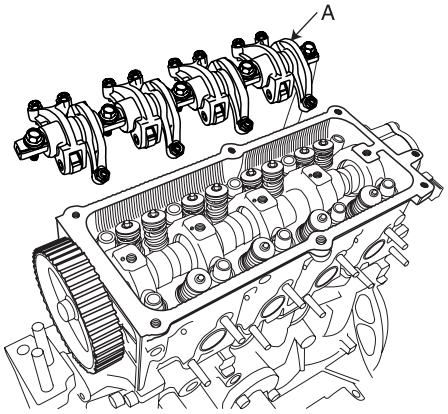
Tightening torque:
78.5 ~ 98.1Nm (8.0 ~ 10.0kg-m, 57.9 ~ 72.3lb-ft)



ACHE079A

8. Install the rocker arm shaft assembly (A).

Tightening torque:
26.5 ~ 31.4Nm (2.7 ~ 3.2kg-m, 19.5 ~ 23.1lb-ft)



ACHE078A

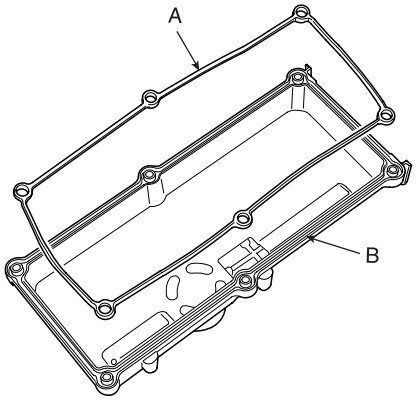
NOTE

- *When installing the rocker arm shaft, set the chamfer side of shaft in front of engine (timing belt side).*
- *At this time, the oil hole of shaft should face downward (cylinder head side).*

9. Inspect and adjust the valve clearance. (Refer to section general - valve clearance inspection and adjustment.)

10. Install the cylinder head cover.

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



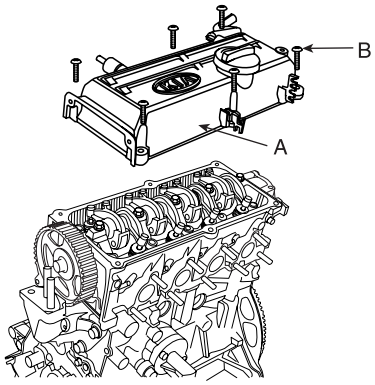
ACHE096A

NOTE

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

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



ACHE077A

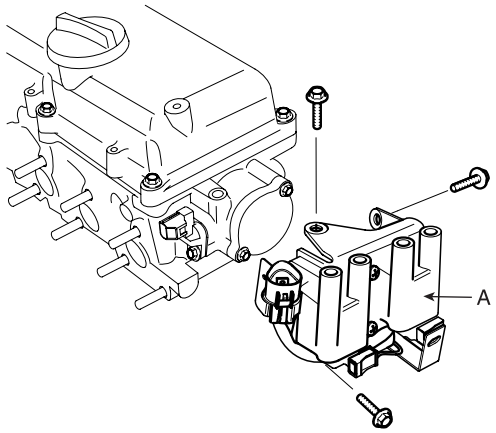
11. Install the timing belt. (Refer to section timing system - timing belt installation)

12. Install the intake manifold. (Refer to section intake and exhaust system - intake manifold removal)

13. Install the exhaust manifold. (Refer to section intake and exhaust system - exhaust manifold removal)

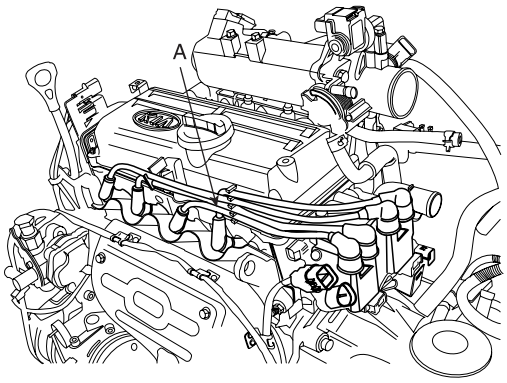
14. Install the ignition coil assembly (A).

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



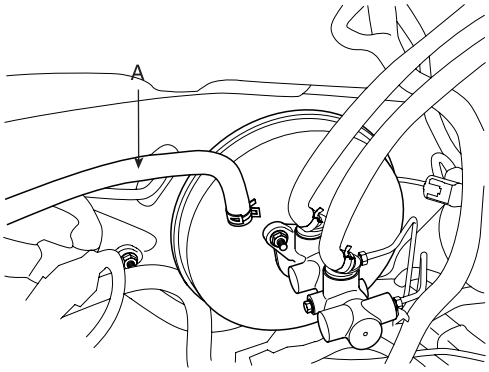
ACHE073A

15. Install the spark plug cables (A).



ACHE072A

16. Install the brake booster hose (A).

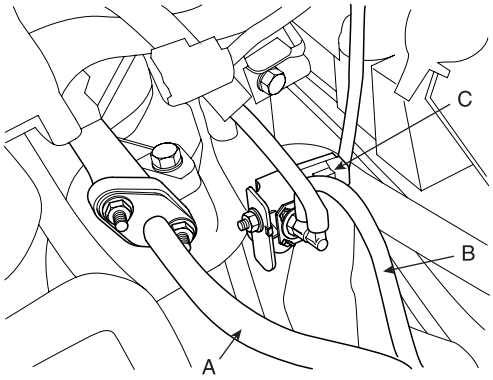


ACHE027A

17. Connect the PCSV (Purge Control Solenoid Valve) connector (C).

18. Connect the PCSV (Purge Control Solenoid Valve) hose (B).

19. Install the inlet fuel hose (A) to delivery pipe.



ACHE026A

20. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.

    1) Connect the combined power steering pump switch and oil pressure switch connector (E).

    2) Connect the front heat oxygen sensor connector (D).

    3) Connect the knock sensor connector (C)

    4) Connect the CKP (Crankshaft position sensor) connector (B).

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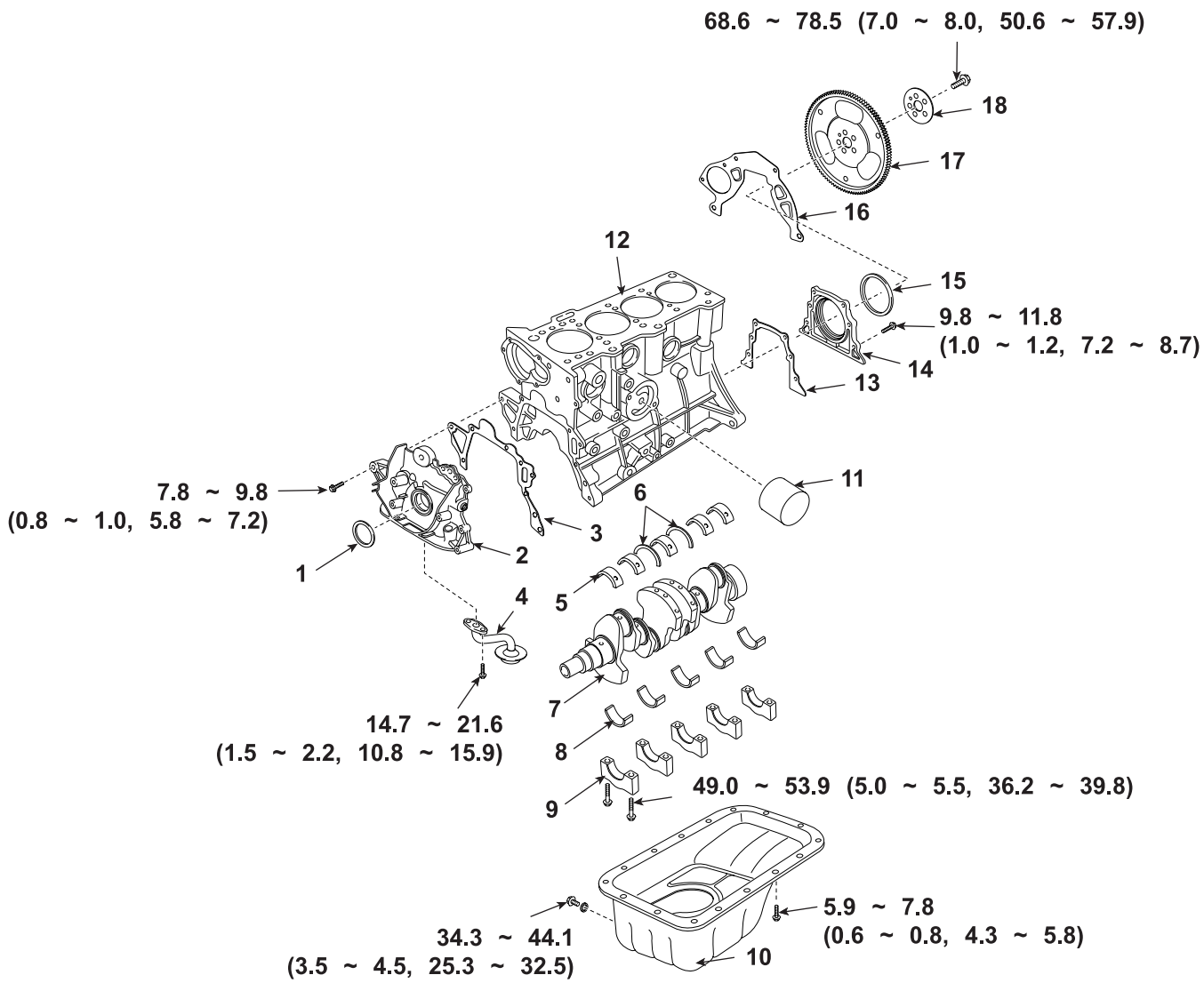
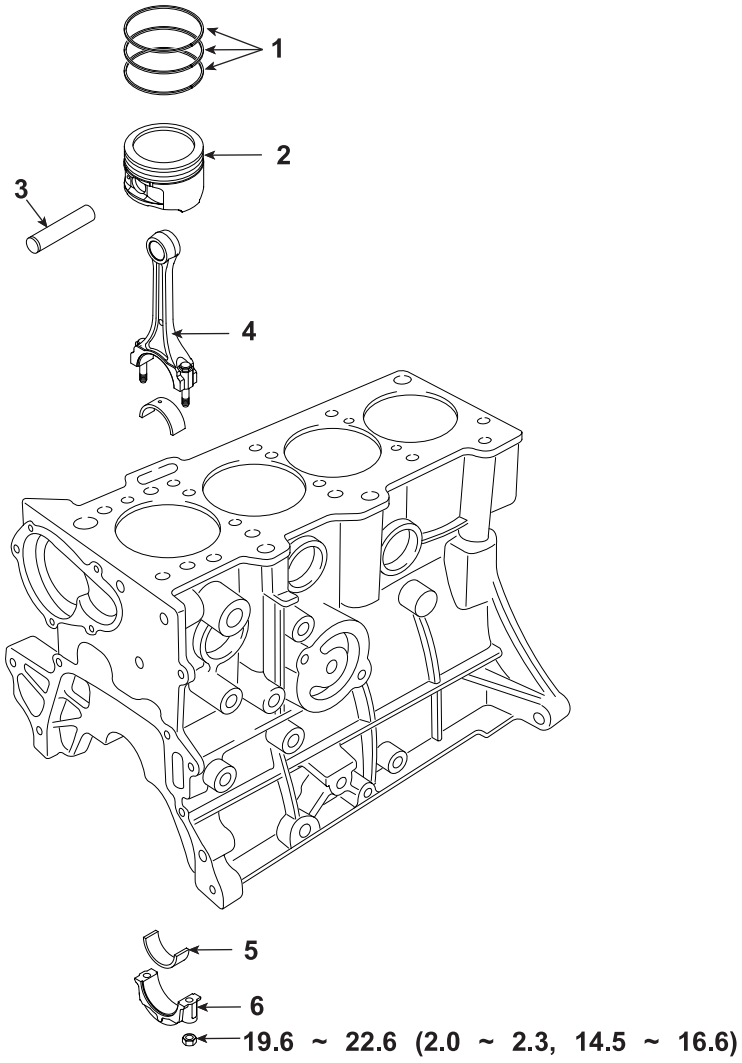
ENGINE BLOCK

COMPONENT EBC09A0D



1. Crankshaft front oil seal
2. Front case
3. Gasket
4. Oil screen
5. Main bearing (Upper)
6. Thrust bearing
7. Crankshaft
8. Main bearing (Lower)
9. Main bearing cap
10. Oil pan
11. Oil filter assembly
12. Cylinder block
13. Gasket
14. Rear oil seal case
15. Rear oil seal
16. Rear plate
17. Drive plate (A/T)
18. Adaptor (A/T)

LCHE008A



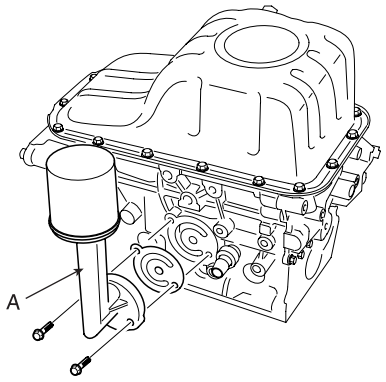
TORQUE : N·m (kg·m, lb·ft)

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

LCHE009A

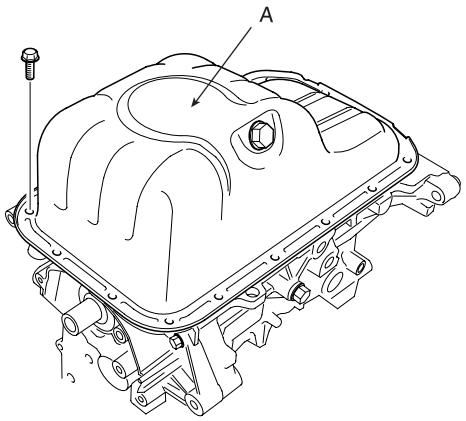
DISASSEMBLY EB29A9C7

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 exhaust manifold. (Refer to section intake and exhaust system - exhaust manifold removal)
5. Remove the intake manifold. (Refer to section intake and exhaust system - intake manifold removal)
6. Remove the timing belt. (Refer to section timing system - timing belt removal)
7. Remove the cylinder head. (Refer to section cylinder head assembly - cylinder head removal)
8. Remove the oil pressure switch (A).
9. Remove the water pump. (Refer to section cooling system - water pump removal)
10. Remove the oil filter assembly (A).



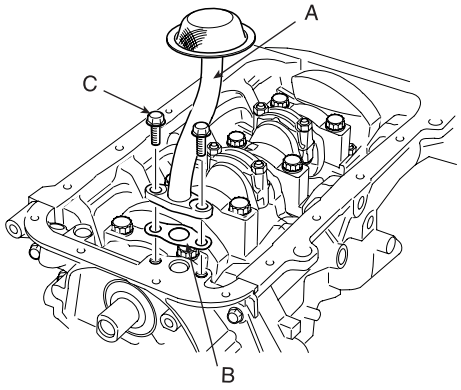
ACHE097A

11. Remove the oil fan (A).



ACHE098A

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



ACHE099A

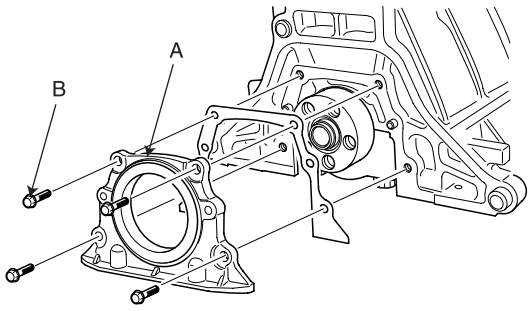
13. Check the connecting rod end play. (Refer to section cylinder block - connecting rod and crankshaft inspection step 1)
14. Remove the connecting rod caps and check oil clearance. (Refer to section cylinder block - connecting rod and crankshaft inspection step 2)
15. Remove the piston and connecting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

NOTE

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

16. Remove the front case. (Refer to section lubrication system - oil pump removal)

17. Remove the rear oil seal case.
Remove the 4 bolts (B) and rear oil seal case (A).



ACHE100A

18. Remove the crankshaft bearing cap and check oil clearance. (Refer to section cylinder block - connecting rod and crankshaft inspection step 4)

19. Check the crankshaft end play. (Refer to section cylinder block - connecting rod and crankshaft inspection step 5)

20. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

NOTE

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

21. 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.

22. 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.

NOTE

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

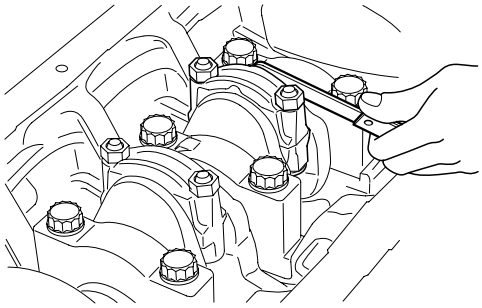
23. Remove the connecting rod from the piston.
Using a press, remove the piston pin from the piston.
[Press-in load: 500 ~ 1100kg (1102 ~ 2425lb)]

INSPECTION EA51F3E5

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 (0.004 ~ 0.010in)
Maximum : 0.4mm (0.016in)



ACHE101A

- 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 crank 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:
19.6 ~ 22.6Nm (2.0 ~ 2.3kg-cm, 14.5 ~ 16.6lb-ft)

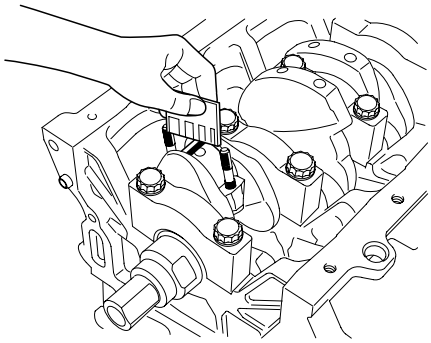
NOTE

Do not turn the crankshaft.

7) Remove the 2 nuts, connecting rod cap and lower bearing.

8) Measure the plastigage at its widest point.

Standard oil clearance
0.012 ~ 0.041mm (0.0005 ~ 0.0016in)



ACHE102A

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 lager or smaller bearing. (Refer to connecting rod bearing selection table)
Recheck the oil clearance.

NOTE

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

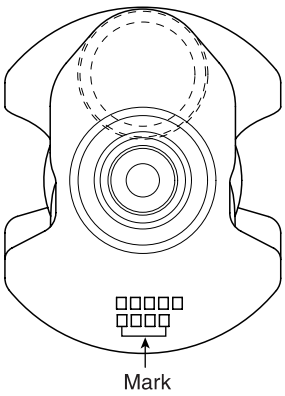
CAUTION

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.

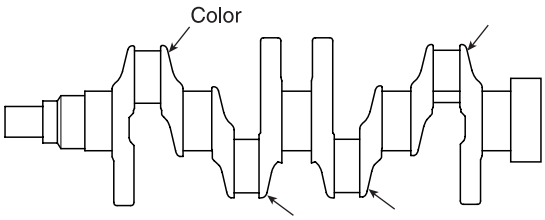
DISCRIMINATION OF CONNECTING ROD

Mark	Connecting rod big-end Inner diameter
NONE	41.000 ~ 41.015mm (1.6142 ~ 1.6148in)

CRANKSHAFT PIN JOURNAL MARK LOCATION



LCHE021A

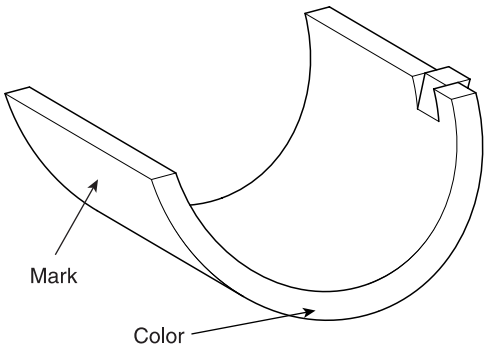


LCHE022A

DISCRIMINATION OF CRANKSHAFT PIN JOURNAL

Mark	Color	Crankshaft pin journal Outer diameter
I	Yellow	37.994 ~ 38.000mm (1.4958 ~ 1.4961in)
II	None	37.986 ~ 37.994mm (1.4955 ~ 1.4958in)
III	White	37.980 ~ 37.986mm (1.4953 ~ 1.4955in)

CONNECTING ROD BEARING MARK LOCATION



LCHE012A

DISCRIMINATION OF CONNECTING ROD BEARING

Mark	Color	Connecting rod bearing thickness
A	Black	1.498 ~ 1.501mm (0.0590 ~ 0.0591in)
B	None	1.494 ~ 1.497mm (0.0588 ~ 0.0589in)
C	Green	1.490 ~ 1.493mm (0.0587 ~ 0.0588in)

11) Select the bearing by using the selection table.

CONNECTING ROD BEARING SELECTION TABLE

Crankshaft pin journal mark	Connecting rod bearing mark	Oil clearance
I(Yellow)	C(Yellow)	0.014 ~ 0.041mm (0.0006 ~ 0.0016in)
II(None)	B(None)	0.012 ~ 0.041mm (0.0005 ~ 0.0016in)
III(White)	A(Blue)	0.012 ~ 0.039mm (0.0005 ~ 0.0015in)

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.

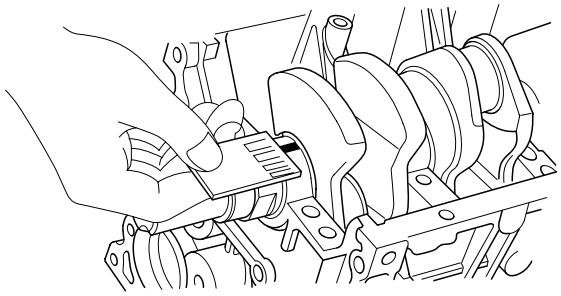
Tightening torque:
49.0 ~ 53.9Nm(5.0 ~ 5.5kg-m, 36.2 ~ 39.8lb-ft)

NOTE

Do not turn the crankshaft.

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

Standard oil clearance:
0.020 ~ 0.038mm (0.0008 ~ 0.0015in)



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 crankshaft main bearing selection table)
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 lager or smaller bearing. (Refer to crankshaft main bearing selection table)
Recheck the oil clearance.

NOTE

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

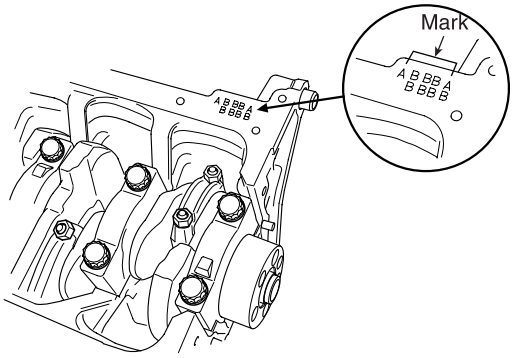
CAUTION

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 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.

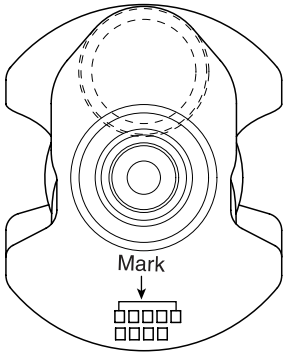


LCHE017A

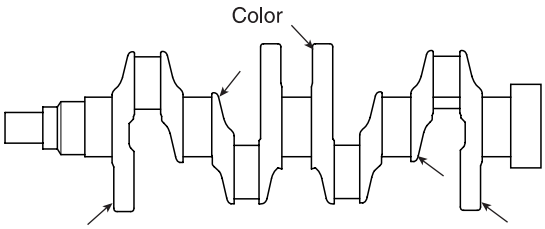
DISCRIMINATION OF CYLINDER BLOCK CRANKSHAFT JOURNAL BORE

Mark	Cylinder block crankshaft journal bore inner diameter
A	46.000 ~ 46.006mm (1.8110 ~ 1.8113in)
B	46.006 ~ 46.012mm (1.8113 ~ 1.8115in)
C	46.012 ~ 46.018mm (1.8115 ~ 1.8117in)

CRANKSHAFT MAIN JOURNAL MARK LOCATION



LCHE013A

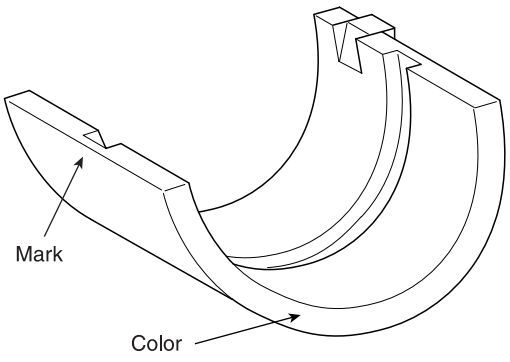


LCHE014A

DISCRIMINATION OF CRANKSHAFT MAIN JOURNAL

Mark	Color	Crankshaft main journal outer diameter
I	YEL-LOW	41.994 ~ 42.000mm (1.6533 ~ 1.6535in)
II	NONE	41.998 ~ 41.994mm (1.6531 ~ 1.6533in)
III	WHITE	41.982 ~ 41.988mm (1.6528 ~ 1.6531in)

CRANKSHAFT MAIN BEARING MARK LOCATION



LCHE015A

DISCRIMINATION OF CRANKSHAFT MAIN BEARING

Mark	Color	Crankshaft main bearing thickness
A	Blue	1.999~ 2.002mm (0.0787 ~ 0.0788in)
B	None	1.996 ~ 1.999mm (0.0786 ~ 0.0787in)
C	Yellow	1.993 ~ 1.996mm (0.0785 ~ 0.0786in)
D	Green	1.990 ~ 1.993mm (0.0783 ~ 0.0785in)
E	Pink	1.987 ~ 1.990mm (0.0782 ~ 0.0783in)

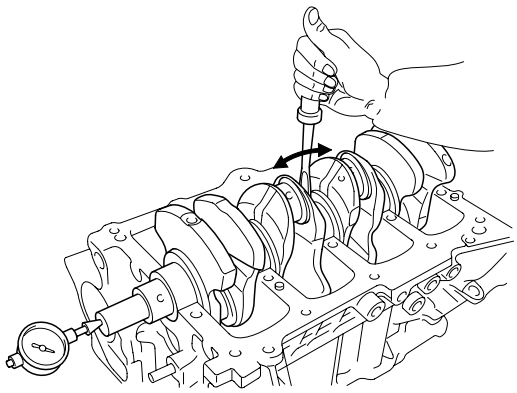
8) Select the bearing by using selection table.

CRANKSHAFT MAIN BEARING SELECTION TABLE

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	I(Yellow)	E (Pink)	D (Green)	C (Yellow)
	II(None)	D (Green)	C (Yellow)	B (None)
	III(White)	C (Yellow)	B (None)	A (Blue)

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

Crankshaft end play:
0.05 ~ 0.25mm (0.0020 ~ 0.0098in)



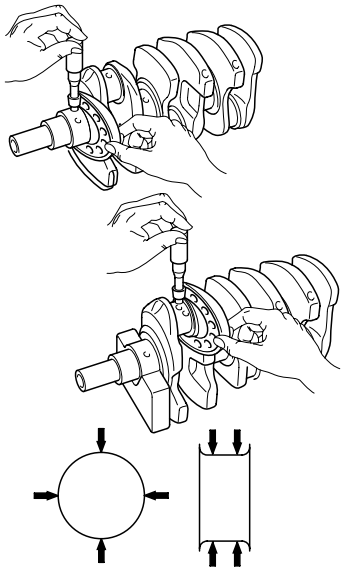
ECKD001B

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

Thrust bearing thickness:
2.470 ~ 2.475mm (0.0972 ~ 0.0974in)

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:
41.982 ~ 42.000mm (1.6528 ~ 1.6535in)
Pin journal diameter:
37.980 ~ 38.000mm (1.4953 ~ 1.4961in)



ECKD001E

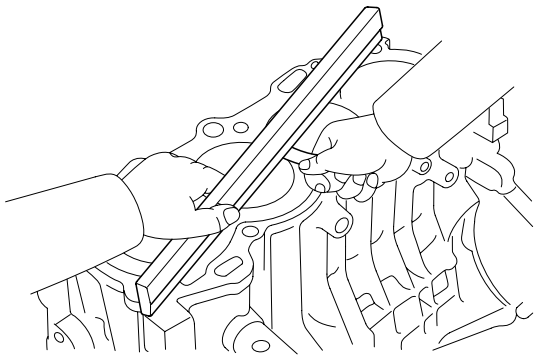
CYLINDER BLOCK

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:
Standard: Less than 0.05mm (0.002in)

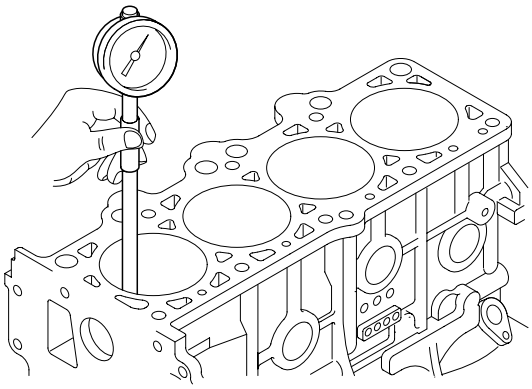


ECKD001L

4. Inspect the cylinder bore.
   Visually check the cylinder for vertical scratchs.
   If deep scratchs are present, replace the cylinder block.

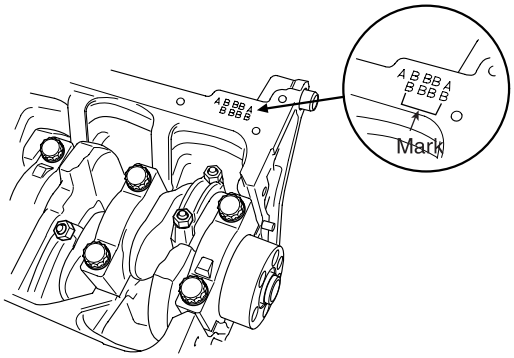
5. Inspect the cylinder bore diameter.
   Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial direction.

Standard diameter:
67.000 ~ 67.030mm (2.6378 ~ 2.6390in)



ECKD318A

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

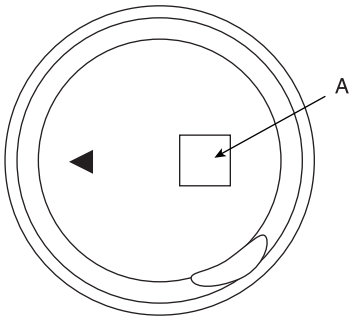


LCHE016A

DISCRIMINATION OF CYLINDER BORE SIZE

Mark	Cylinder bore inner diameter
A	67.00 ~ 67.01mm (2.6378 ~ 2.6457in)
B	67.01 ~ 67.02mm (2.6382 ~ 2.6457in)
C	67.02 ~ 67.03mm (2.6457 ~ 2.6390in)

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



ACHE135A

DISCRIMINATION OF PISTON OUTER DIAMETER

Mark	Piston outer diameter
A	66.97 ~ 66.98mm (2.6366 ~ 2.6370in)
None	66.98 ~ 66.99mm (2.6370 ~ 2.6374in)
C	66.99 ~ 67.00mm (2.6374 ~ 2.6378in)

8. Select the piston related to cylinder bore class.

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

BORING CYLINDER

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

   NOTE

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

2. Measure the outside diameter of the piston to be used.

3. According to the measured O.D (Outer Diameter) calculate the new bore size.

New bore size = piston O.D + 0.02 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 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)

   NOTE

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

PISTON AND PISTON RINGS

1. Clean the piston

   1) Using a gasket scraper, remove the carbon from the piston top.

   2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.

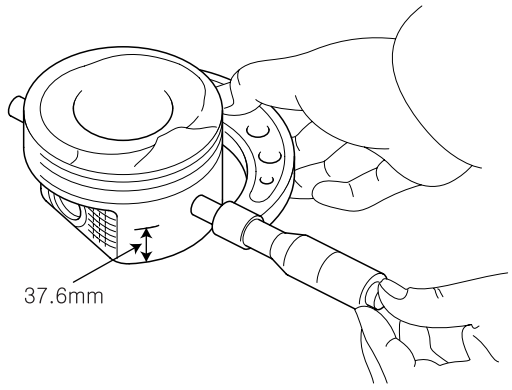
   3) Using solvent and a brush, thoroughly clean the piston.

   NOTE

   Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 37.6mm (1.48in) from top land of the piston.

Standard diameter:
66.97 ~ 67.00mm (2.6366 ~ 2.6378in)



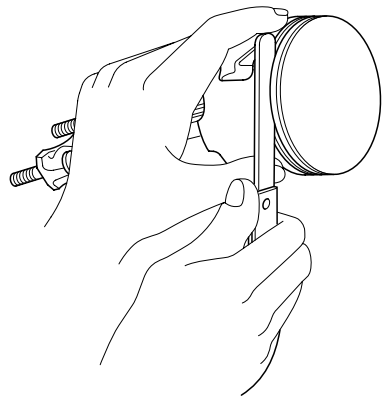
ECKD001D

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 : 0.03 ~ 0.07mm (0.0012 ~ 0.0028in)
No. 2 : 0.02 ~ 0.06mm (0.0008 ~ 0.0024in)
Oil ring : 0.06 ~ 0.15mm (0.0024 ~ 0.0059)

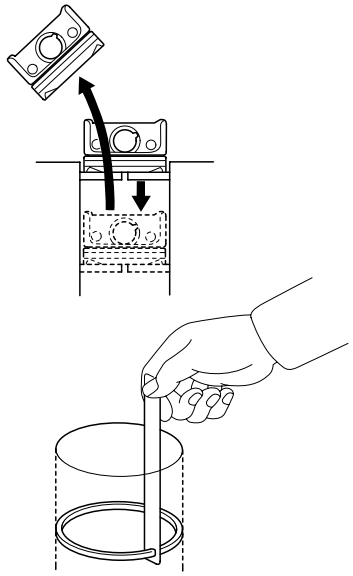


ECKD001G

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 section cylinder block - boring cylinder)

Piston ring end gap
No.1 : 0.15 ~ 0.30mm (0.0059 ~ 0.0118in)
No.2 : 0.30 ~ 0.50mm (0.0118 ~ 0.0197in)
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0276in)

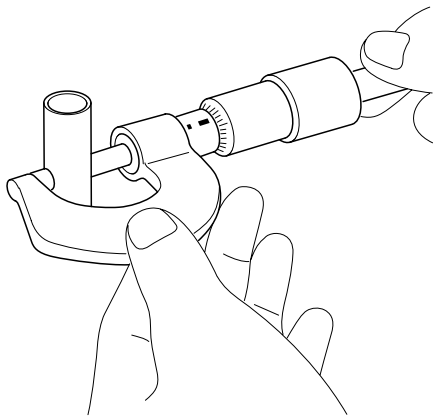


ECKD001K

PISTON PINS

1. Measure the outer diameter of piston pin.

Piston pin diameter:
17.000 ~ 17.003mm (0.6693 ~ 0.6694in)



ECKD001Z

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

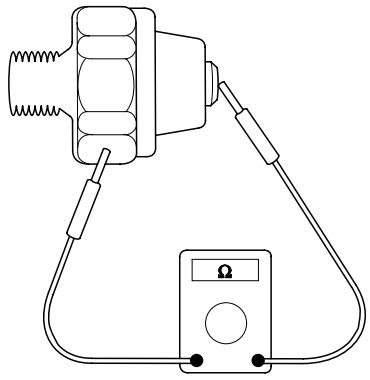
Piston pin-to-piston clearance:
0.008 ~ 0.014mm (0.0003 ~ 0.0006in)

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

Piston pin-to-connecting rod interference:
-0.029 ~ -0.015mm (-0.0011 ~ -0.0006in)

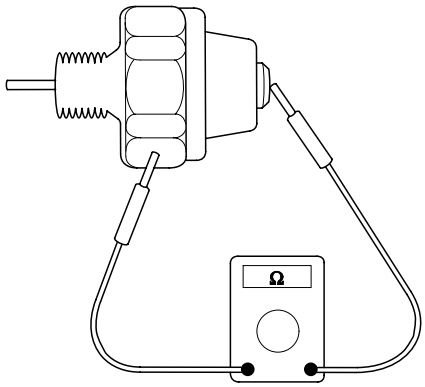
OIL PRESSURE SWITCH

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) pressure 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 EA94E4DE

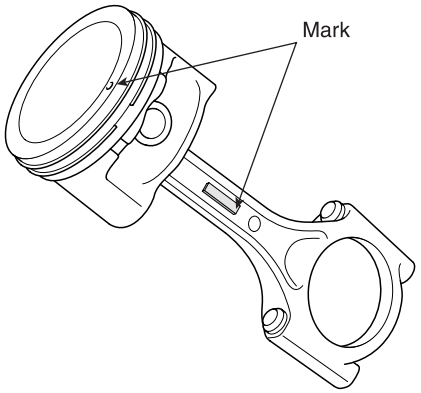
NOTE

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

1. Assemble the piston and connecting rod.

   1) Use a hydraulic press for installation.

   2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



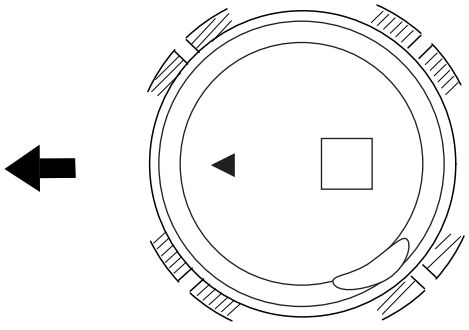
LCHE018A

2. Install the piston rings.

   1) Install the oil ring expender and 2 side rails by hand.

   2) Using a piston ring expender, install the 2 compression rings with the code mark facing upward.

   3) Position the piston rings so that the ring ends are as shown.

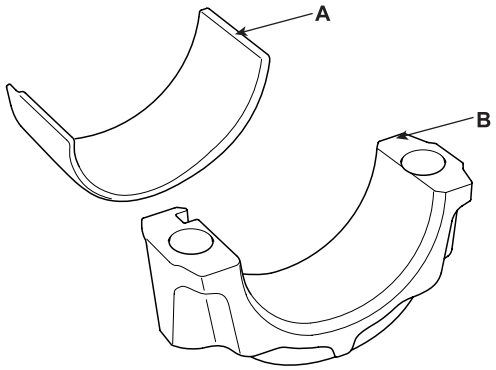


ACHE136A

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).



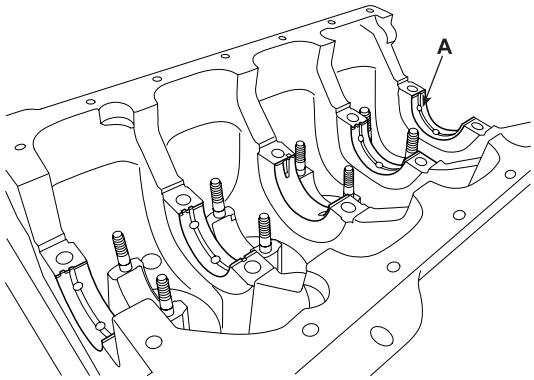
ECKD322A

4. Install the crankshaft main bearings.

   NOTE

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

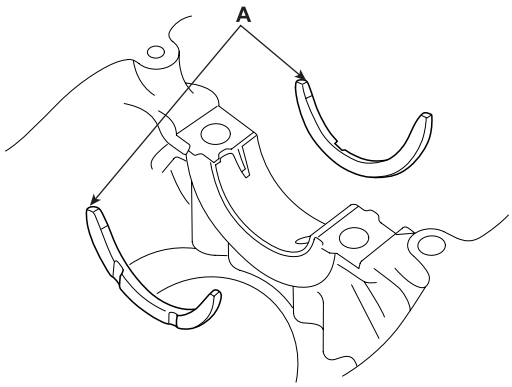
   1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings (A).



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.

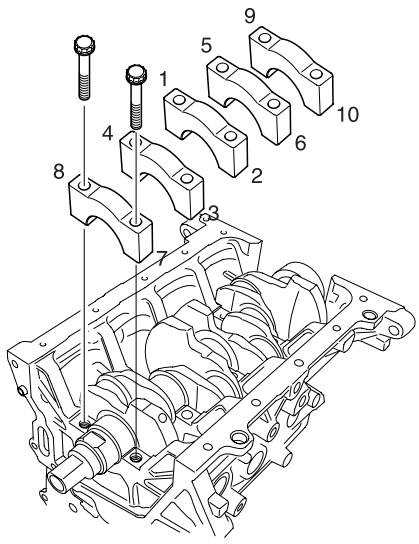
   NOTE

   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, in several passes, in the sequence shown.

Tightening torque:
49.0 ~ 53.9Nm (5.0 ~ 5.5kg-m, 36.2 ~ 39.8lb-ft)



ACHE105A

3) Check that the crankshaft turn smoothly.

9. Check the crankshaft end play. (Refer to section cylinder block - connecting rod and crankshaft inspection step 5)

10. Install the piston and connecting rod assemblies.

NOTE

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

1) 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.

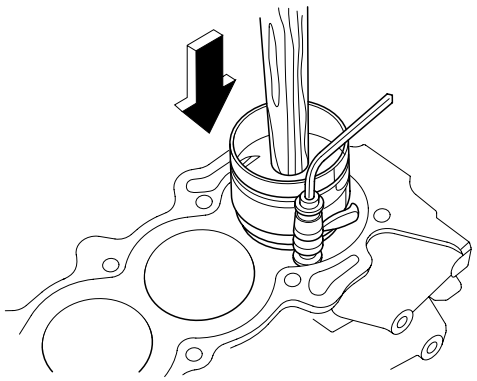
3) Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.

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

Tightening torque:
19.6 ~ 22.6Nm (2.0 ~ 2.3kg-m, 14.5 ~ 16.6lb-ft)

NOTE

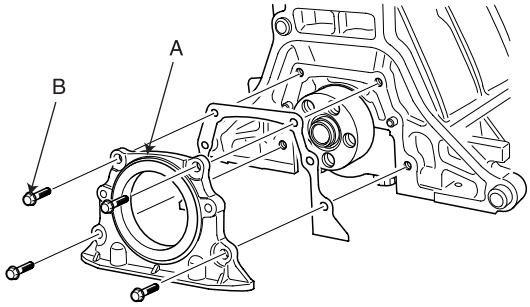
Maintain downward force on the ring compressor to prevent the rings from expending before entering the cylinder bore.



ECKD001F

11. Install a new gasket and rear oil seal case (A) with 4 bolts (B).

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



ACHE100A

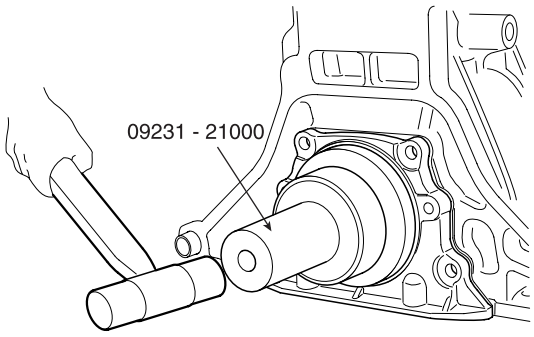
NOTE

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 SST (09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

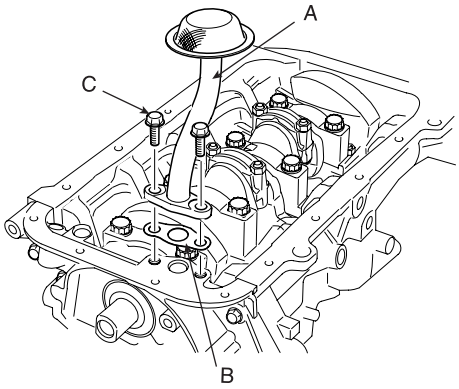


ACHE106A

13. Install the front case. (Refer to section lubrication system - oil pump installation)

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

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



ACHE099A

15. Install the oil pan.

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

    NOTE

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

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

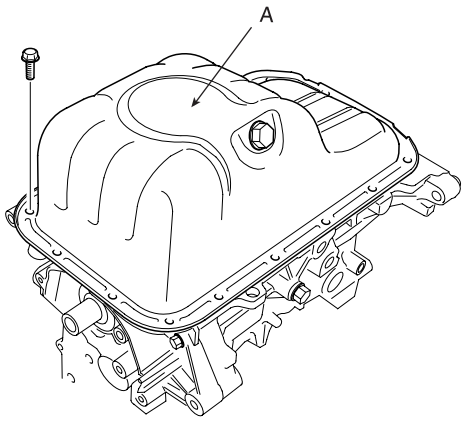
Liquid gasket: MS 721-40A or equivalent

NOTE

- *To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.*
- *Do not install the parts if five minutes of 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.

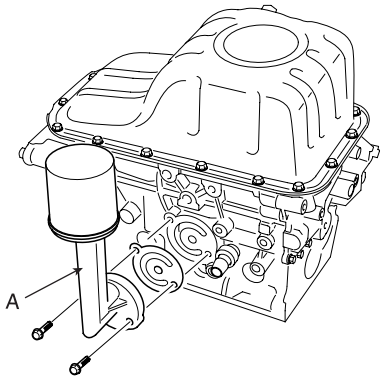
Tightening torque:
5.9 ~ 7.8Nm (0.6 ~ 0.8kg-m, 4.3 ~ 5.8lb-ft)



ACHE098A

16. Install the oil filter assembly (A).

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



ACHE097A

17. Install the water pump. (Refer to section cooling system - water pump installation)

18. 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 .

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

19. Install the cylinder head. (Refer to section cylinder head assembly - cylinder head installation)

20. Install the timing belt. (Refer to section timing system - timing belt installation)

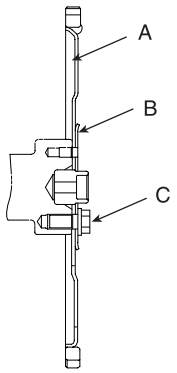
21. Install the intake manifold. (Refer to section intake and exhaust system - intake manifold installation)

22. Install the exhaust manifold. (Refer to section intake and exhaust system - exhaust manifold installation)

23. Remove the engine stand.

24. A/T: install the drive plate (A) and adaptor (B) with bolts (C).

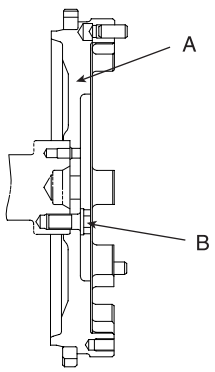
Tightening torque:
68.6 ~ 78.5Nm (7.0 ~ 8.0kg-m, 50.6 ~ 57.9lb-ft)



ACHE107A

25. M/T: install the flywheel (A) with bolts (B).

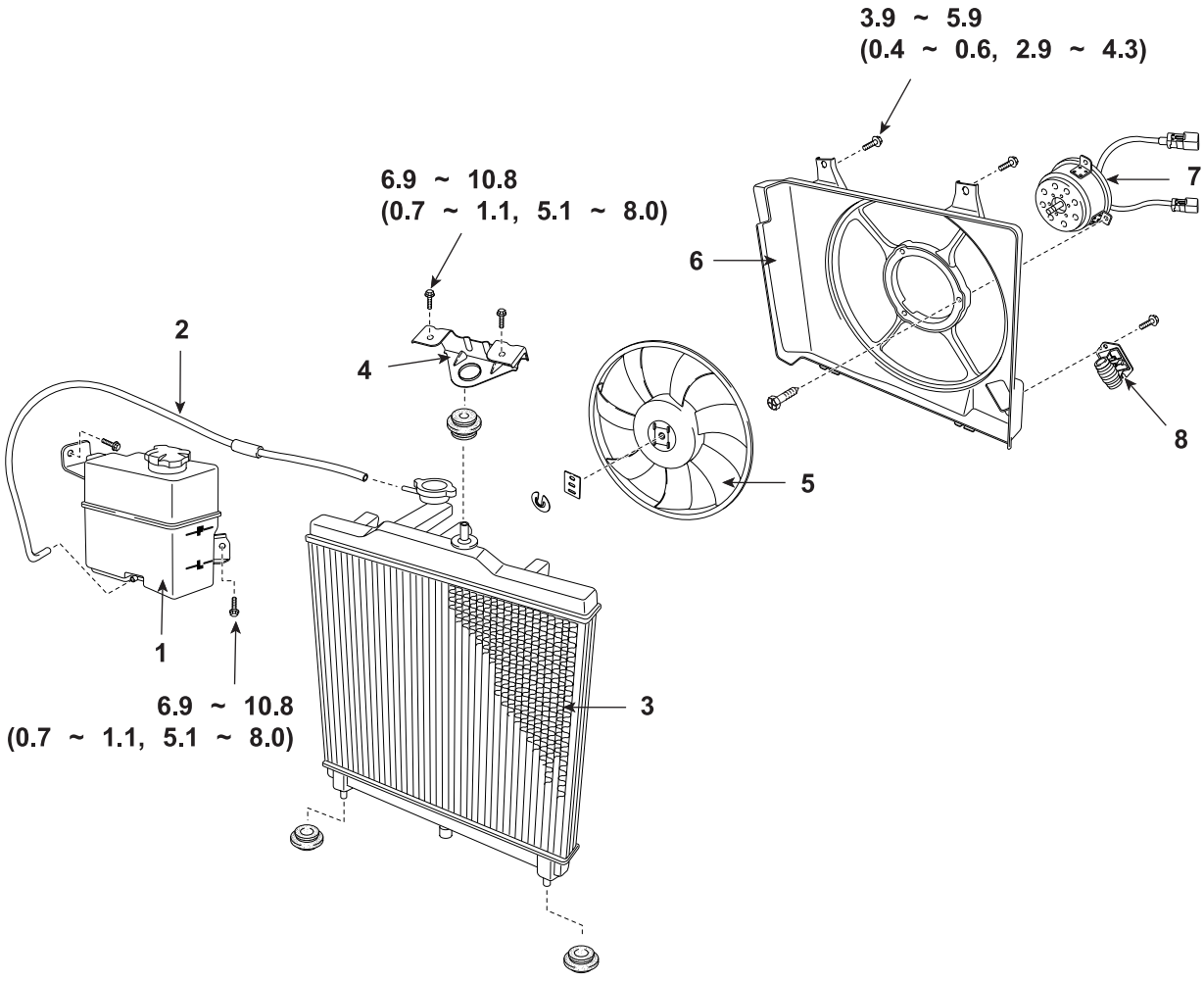
Tightening torque:
68.6 ~ 78.5Nm (7.0 ~ 8.0kg-m, 50.6 ~ 57.9lb-ft)



ACHE108A

COOLING SYSTEM

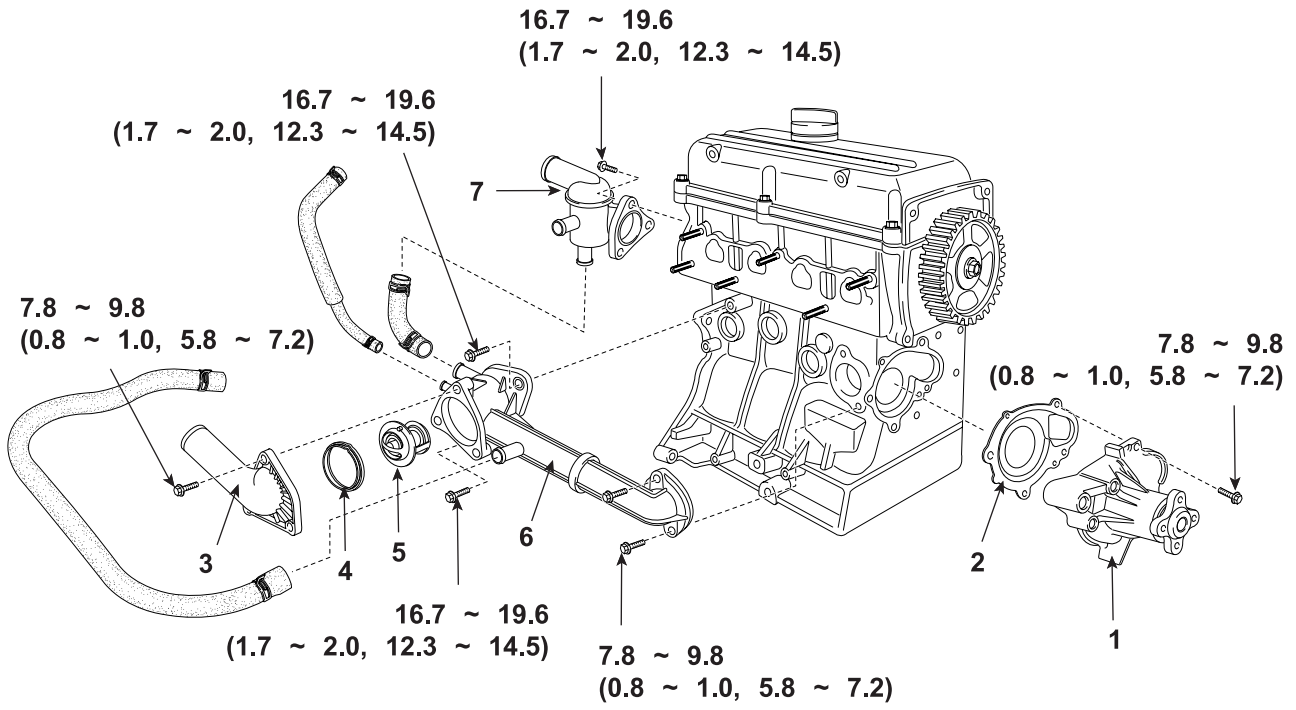
COMPONENT E0DC2C26



TORQUE : N·m (kg·m, lb·ft)

1. Reservior tank
2. Over flow hose
3. Radiator
4. Radiator upper bracket
5. Cooling fan
6. Cooling fan shroud
7. Cooling fan motor
8. Cooling fan resister

LCHE019A



TORQUE : N·m (kg·m, lb·ft)

1. Water pump
2. Water pump gasket
3. Water inlet fitting
4. O-ring
5. Thermostat
6. Water temperature control assembly A
7. Water temperature control assembly B

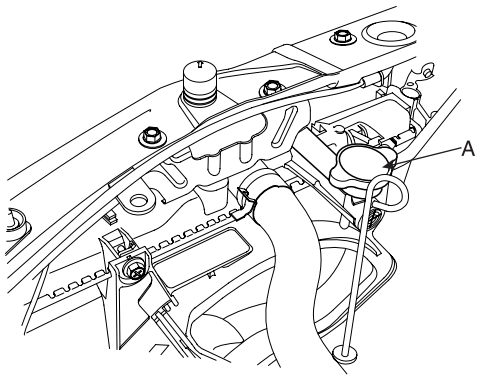
LCHE020A

ENGINE COOLANT REFILLING AND BLEEDING EED979EA

CAUTION

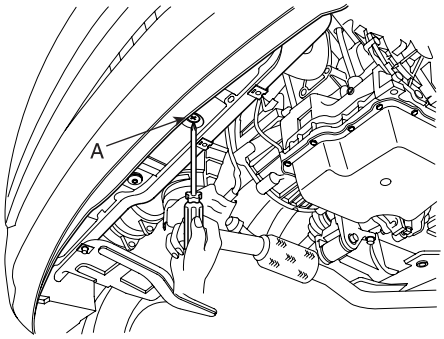
When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts of the paint. If any coolant spills, rinse it off immediately.

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



ACHE137A

3. Loosen the drain plug (A), and drain the coolant.



ACHE003A

4. Tighten the radiator drain plug (A) securely.
5. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the MAX mark with the coolant.
6. Mix the recommended antifreeze with an equal amount of water in a clean container.

NOTE

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

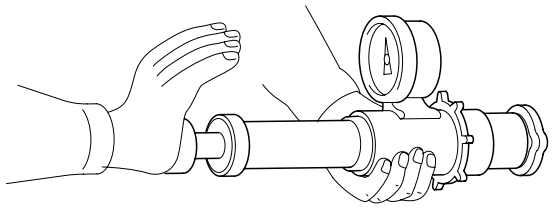
CAUTION

- ***Do not mix different brands of antifreeze/coolants.***
- ***Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.***

7. Pour the coolant into the radiator to the base of the filler neck, and install the radiator cap loosely.
8. Start the engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
9. 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.
10. Put the radiator cap on tightly, then run the engine again and check for leaks.

RADIATOR CAP TESTING

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

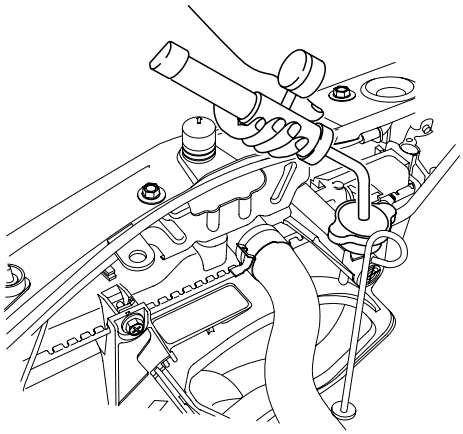


ECKD501X

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

RADIATOR LEAKGE 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).



ACHE138A

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

NOTE

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

REMOVAL EF31CF32

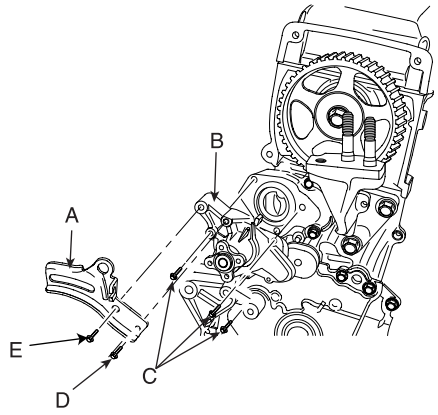
WATER PUMP

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 section timing system - timing belt removal)
4. Remove the alternator (See EE group - alternator)
5. Remove the water pump.
   1) Remove the bolts (D, E), and alternator brace (A).
   2) Remove the bolts (C), and remove the water pump (B) and gasket.



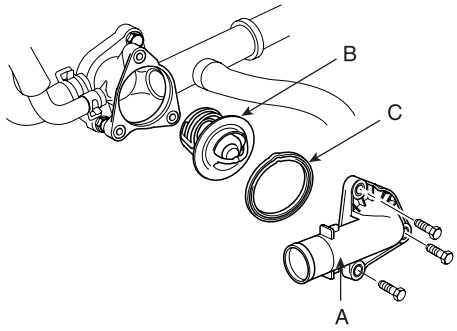
ACHE039A

THRMOSTAT

NOTE

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), O-ring (C) and the thermostat (B).



ACHE075A

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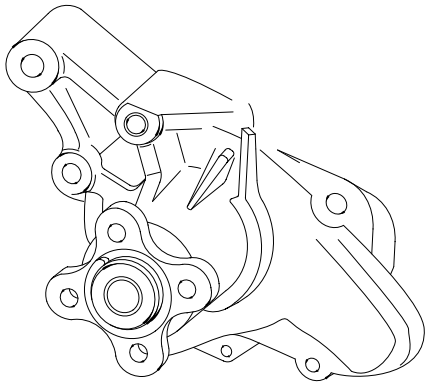
INSPECTION E175B82D

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.



ACHE153A

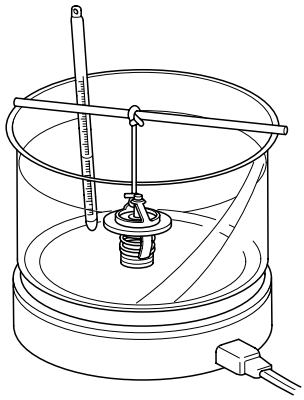
3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly.

NOTE

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°C (179.6±2.7°F) Full opening temperature : 95°C (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°C (203°F)

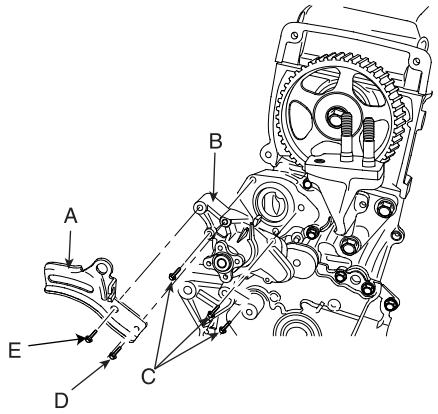
If the valve lift is not as specified, replace the thermostat.

INSTALLATION EB5FE02E

WATER PUMP

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

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



ACHE039A

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

Tightening torque:
Bolt (E): 19.6 ~ 26.5Nm (2.0 ~ 2.7kg-m, 14.5 ~ 19.5lb-ft)
Bolt (D): 9.8 ~ 11.8Nm (1.0 ~ 1.2kg-m, 7.2 ~ 8.7lb-ft)

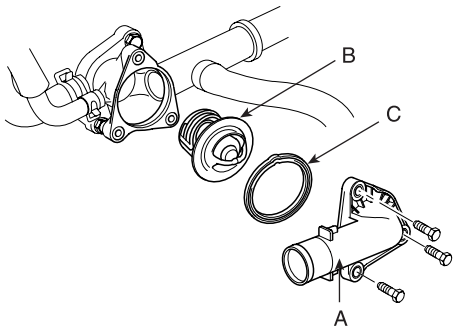
2. Install the alternator. (See EE group - alternator)
3. Install the timing belt. (Refer to section timing system - timing belt installation)
4. Install the water pump pulley.
5. Install the drive belts.
6. Tighten the water pump pulley bolts.

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

7. Fill with engine coolant.
8. Start the engine and check for leaks.
9. Recheck the engine coolant level.

THERMOSTAT

1. Place the thermostat in the thermostat housing.
   1) Install the thermostat (B) with the jiggle valve upward.
   2) Install a new O-ring (C) to the thermostat (B).



ACHE075A

2. Install the water inlet fitting (A).

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

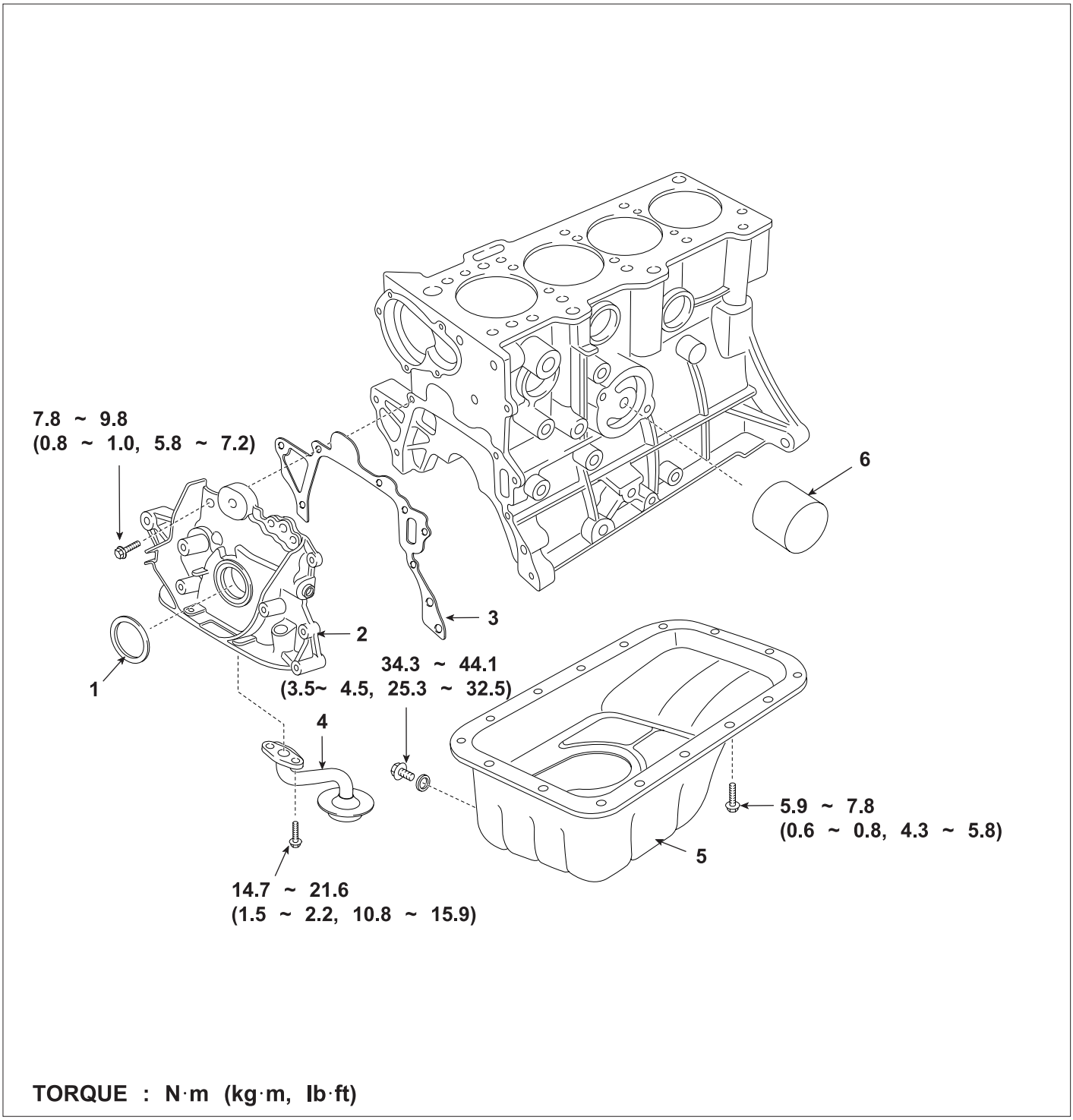
3. Fill with engine coolant.
4. Start the engine and check for leaks.

RADIATOR

1. Install the cooling fan onto radiator.
2. Install the radiator onto the air conditioner condenser. 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 the engine and check for leaks.

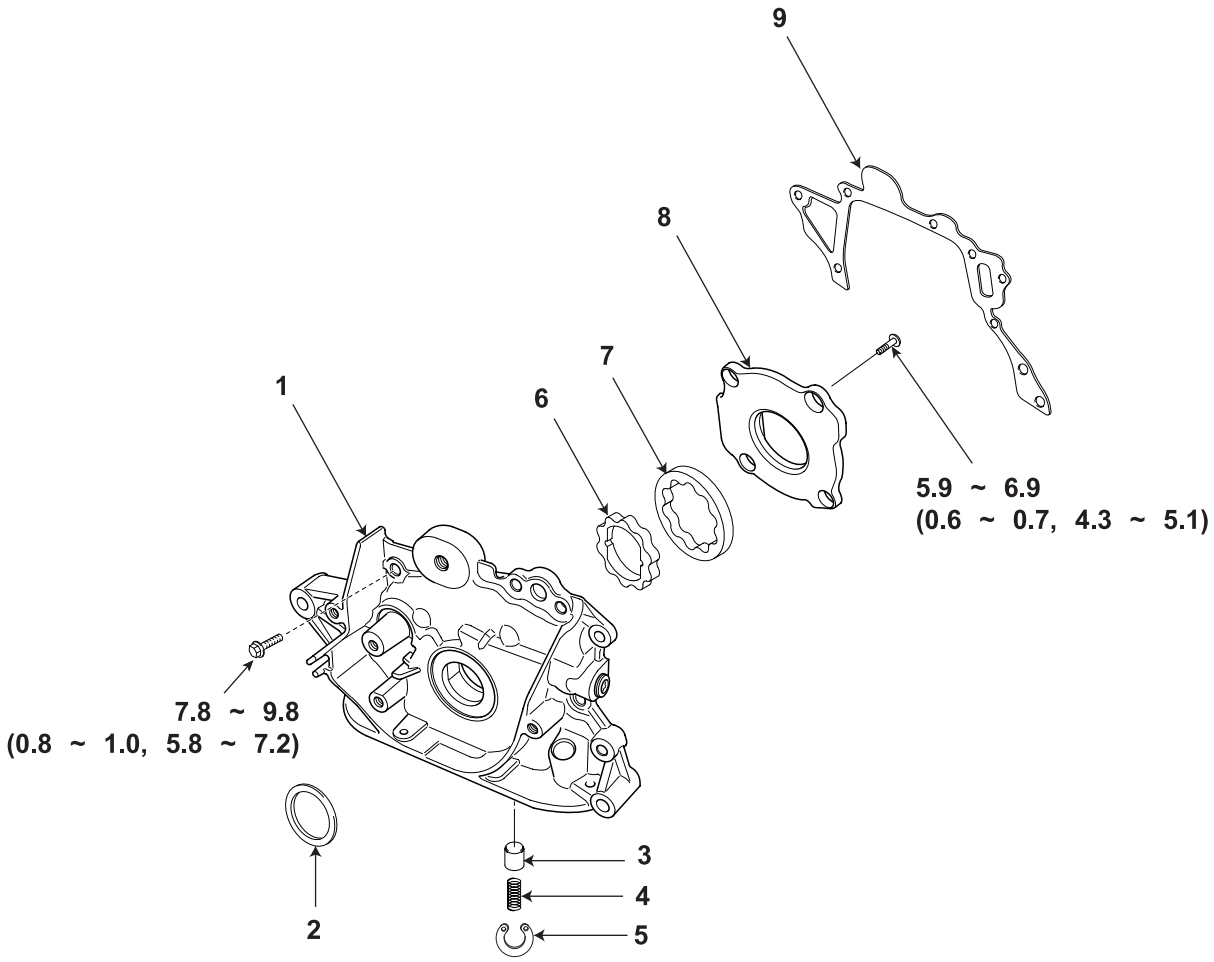
LUBRICATION SYSTEM

COMPONENT E47E14D5



1. Crankshaft front oil seal
2. Front case
3. Gasket
4. Oil screen
5. Oil pan
6. Oil filter assembly

LCHE023A



TORQUE : N·m (kg·m, lb·ft)

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

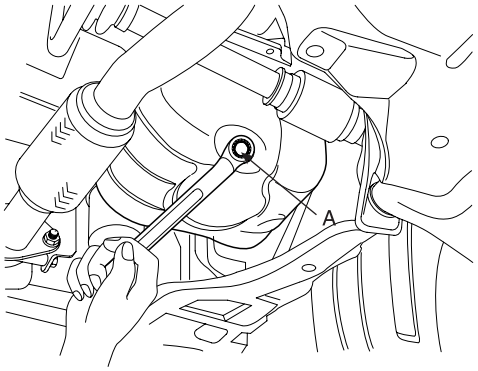
LCHE024A

OIL AND FILTER REPLACEMENT EB75C655

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 waterless 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 (A), and drain the oil into a container.



ACHE004A

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 ~ 49.0Nm (4.0 ~ 5.0kg-m, 28.9 ~ 36.2lb-ft)

   2) Fill with fresh engine oil.

Oil capacity
Total: 3.3 L (3.49 U.S. qt, 2.90 Imp qt)
Oil pan: 3.0 L (3.17 U.S. qt, 2.64 Imp qt)
Oil filter: 0.3 L (0.32 U.S. qt, 0.26 Imp qt)

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

INSPECTION

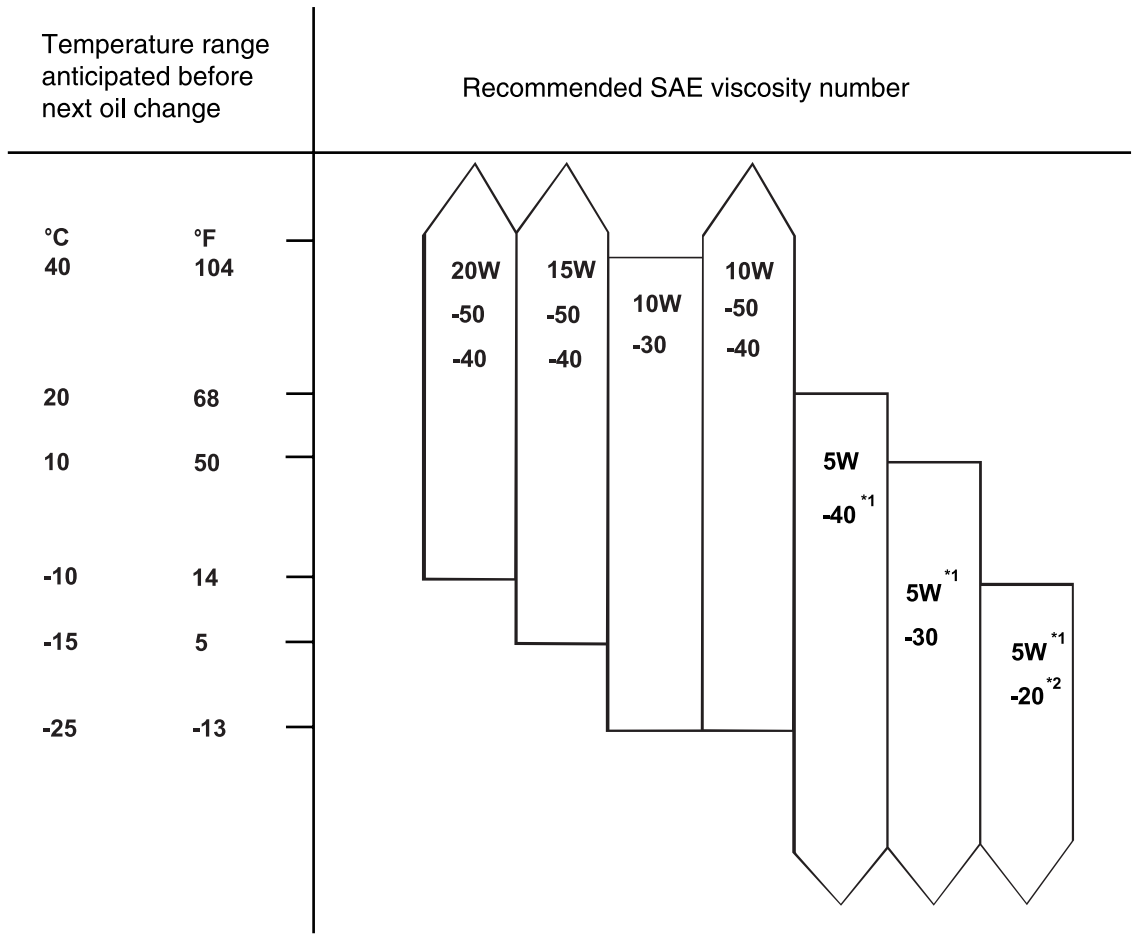
1. Check the engine oil quality.
   Check for oil deterioration, entry of water, discoloring of thinning.
   If the quality is visibly poor, replace the oil.
2. Check the engine oil level.
   After warming up the engine for five minutes, stop the engine and check the oil level. The level should be between 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.

NOTE

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

SELECTION OF ENGINE OIL

Recommended API classification: SG OR ABOVE (For Europe)
SE OR ABOVE (Except Europe)
Recommended SAE viscosity grades:



***1 Restricted by driving condition and environment.**
***2 Not recommended for sustained high speed vehicle operation**

LCGE001A

NOTE

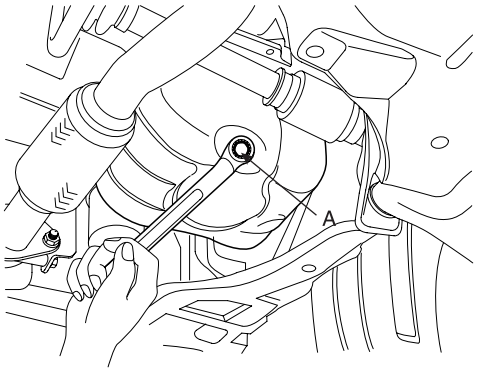
For best performance and maximum protection of all types of operation, select only those lubricants which:

1. *Satisfy the requirement of the API 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 service classification on the container should not be used.*

REMOVAL E20A023A

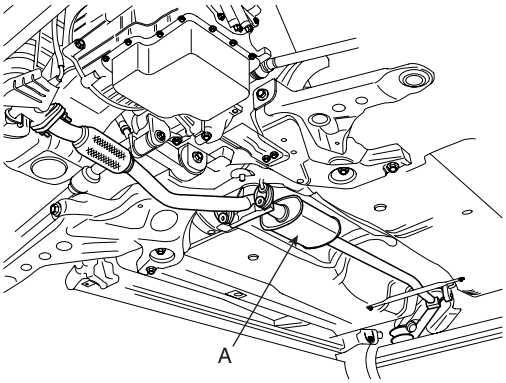
OIL PAN

1. Remove the drain plug (A) and drain engine oil.



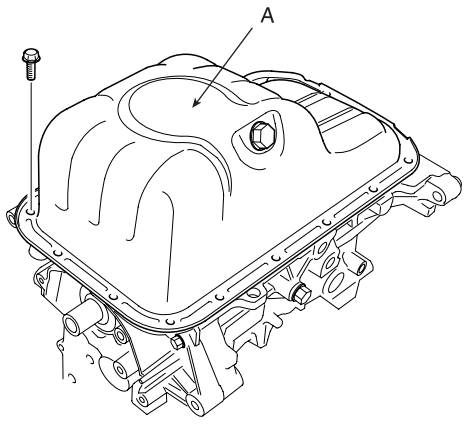
ACHE004A

2. Remove the front muffler (A).



ACHE031A

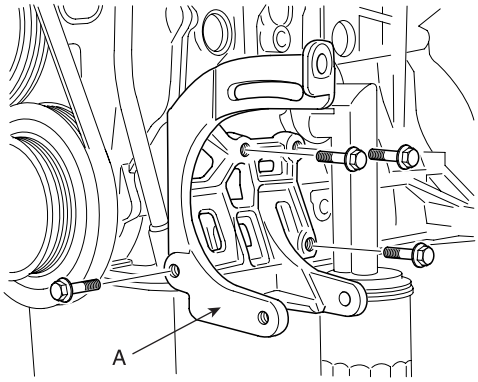
3. Remove the oil pan.



ACHE098A

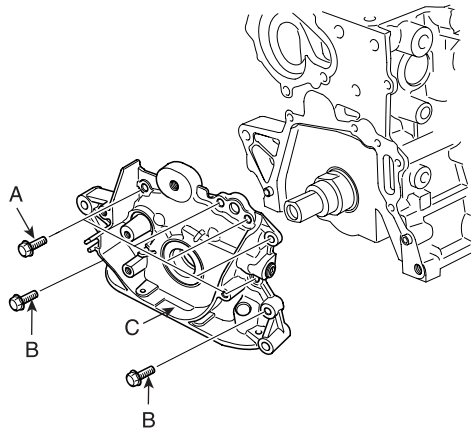
OIL PUMP

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 section timing system - timing belt removal)
5. Remove the timing belt tensioner. (Refer to section timing system - timing belt removal)
6. Remove the oil pan and oil screen.
7. Remove the alternator. (See EE group - alternator)
8. Remove the air conditioner compressor. (See HA group - air conditioner compressor)
9. Remove the air conditioner compressor bracket (A).



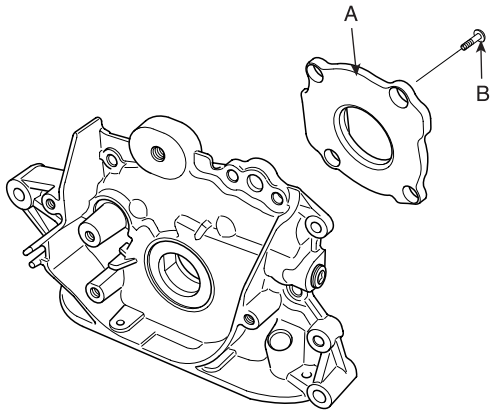
ACHE114A

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



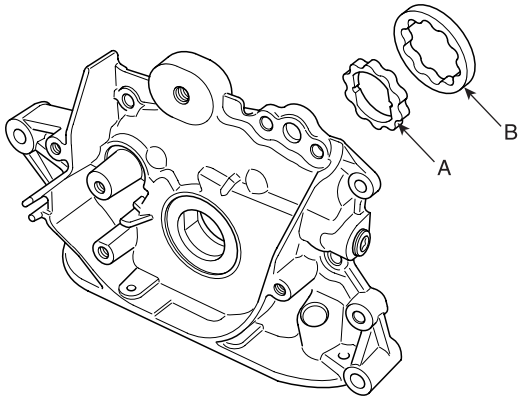
ACHE115A

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



ACHE116A

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

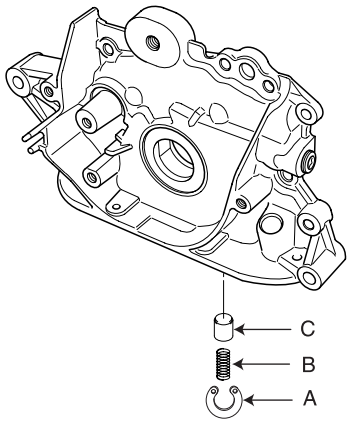


ACHE117A

DISASSEMBLY EFEF13EA

RELIEF PLUNGER

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



ACHE143A

INSPECTION E6240F4B

OIL PUMP

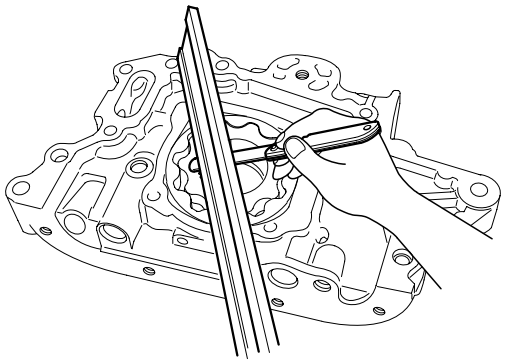
1. Inspect the relief plunger.
   Coat the plunger with engine oil and check that it falls smoothly into the plunger hole by its own weight.
   If it does not, replace the relief plunger. If necessary, replace the front case.

2. Inspect the relief valve spring.
   Inspect for distorted or broken relief valve spring.

Standard value
Free height: 38.6mm (1.5197in)
Load : 3.65±0.4kg/33mm (8.00±0.9 lb /1.2992in)

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	0.040 ~ 0.095mm (0.0016 ~ 0.0037in)
	Inner rotor	0.040 ~ 0.095mm (0.0016 ~ 0.0037in)

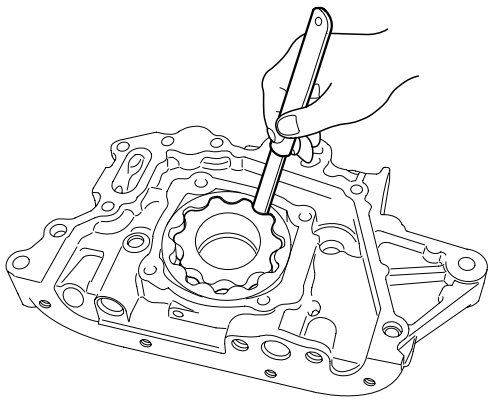


ACHE118A

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
0.06 ~ 0.18mm (0.0024 ~ 0.0071in)

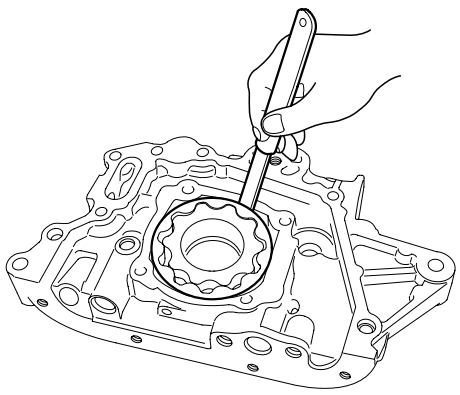


ACHE120A

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
0.100 ~ 0.181mm (0.0039 ~ 0.0071in)



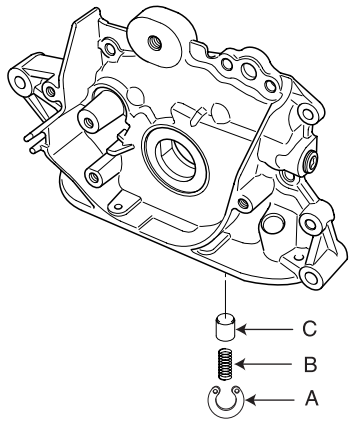
ACHE119A

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

REASSEMBLY EDB019AB

RELIEF PLUNGER

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



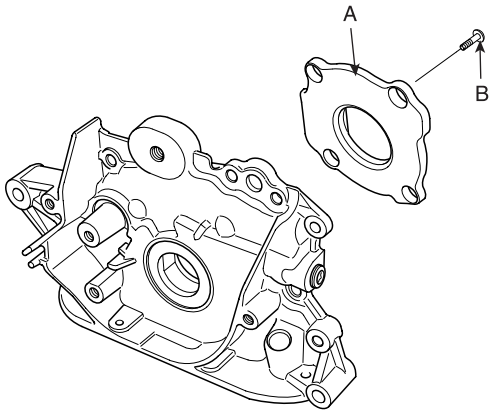
ACHE143A

INSTALLATION EA87AAA0

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 screws (B).

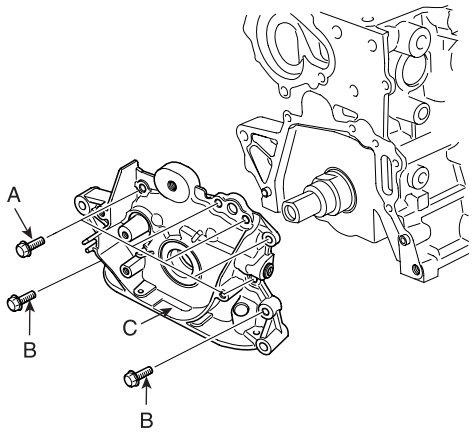
Tightening torque:
5.9 ~ 6.9Nm (0.6 ~ 0.7kg-m, 4.3 ~ 5.1lb-ft)



ACHE116A

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.

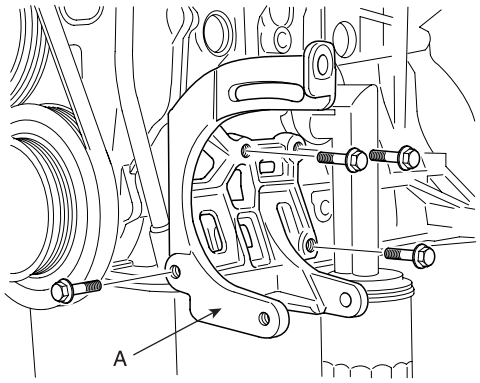
3) When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.



ACHE115A

Bolt length
(A) : 18mm (0.7087in), (B) : 30mm (1.1811in)
Tightening torque:
7.8 ~ 9.8Nm (0.8 ~ 1.0kg-m, 5.8 ~ 7.2lb-ft)

4. Apply a light coat of oil to the front case oil seal lip.
5. Using the SST (09231-22000), install the front case oil seal.
6. Install the air conditioner compressor bracket (A).



ACHE114A

7. Install the air conditioner compressor (See HA group - air conditioner compressor)
8. Install the alternator. (See EE group - alternator)
9. Install the oil screen.

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

10. Install the oil pan.

Tightening torque:
5.9 ~ 7.8Nm (0.6 ~ 0.8kg-m, 4.3 ~ 5.8lb-ft)

NOTE

Clean the oil pan gasket mating surfaces.

11. Install the timing belt tensioner. (Refer to section timing system - timing belt installation)
12. Install the timing belt (Refer to section timing system - timing belt installation)
13. Install the drive belts.
14. 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.

   NOTE

   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.

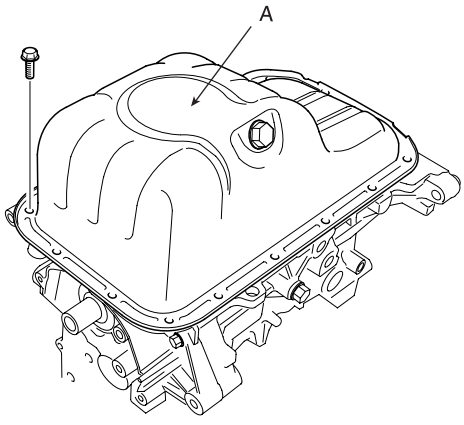
Liquid gasket: MS 721 - 40A or equivalent

   NOTE

   - *To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.*
   - *Do not install the parts if five minutes of 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.*

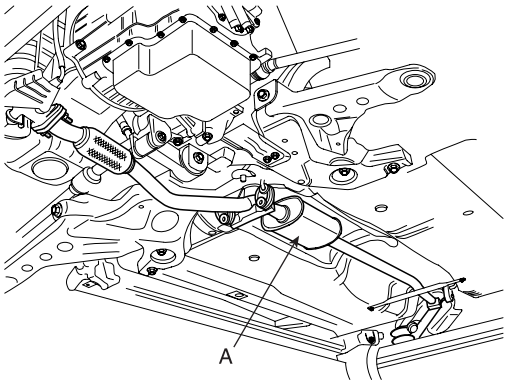
   3) Install the oil pan (A) with the bolts.
   Uniformly tighten the bolts in several passes.

Tightening torque: 5.9 ~ 7.8Nm (0.6 ~ 0.8kg-m, 4.3 ~ 5.8lb-ft)



ACHE098A

2. Install the front muffler (A).



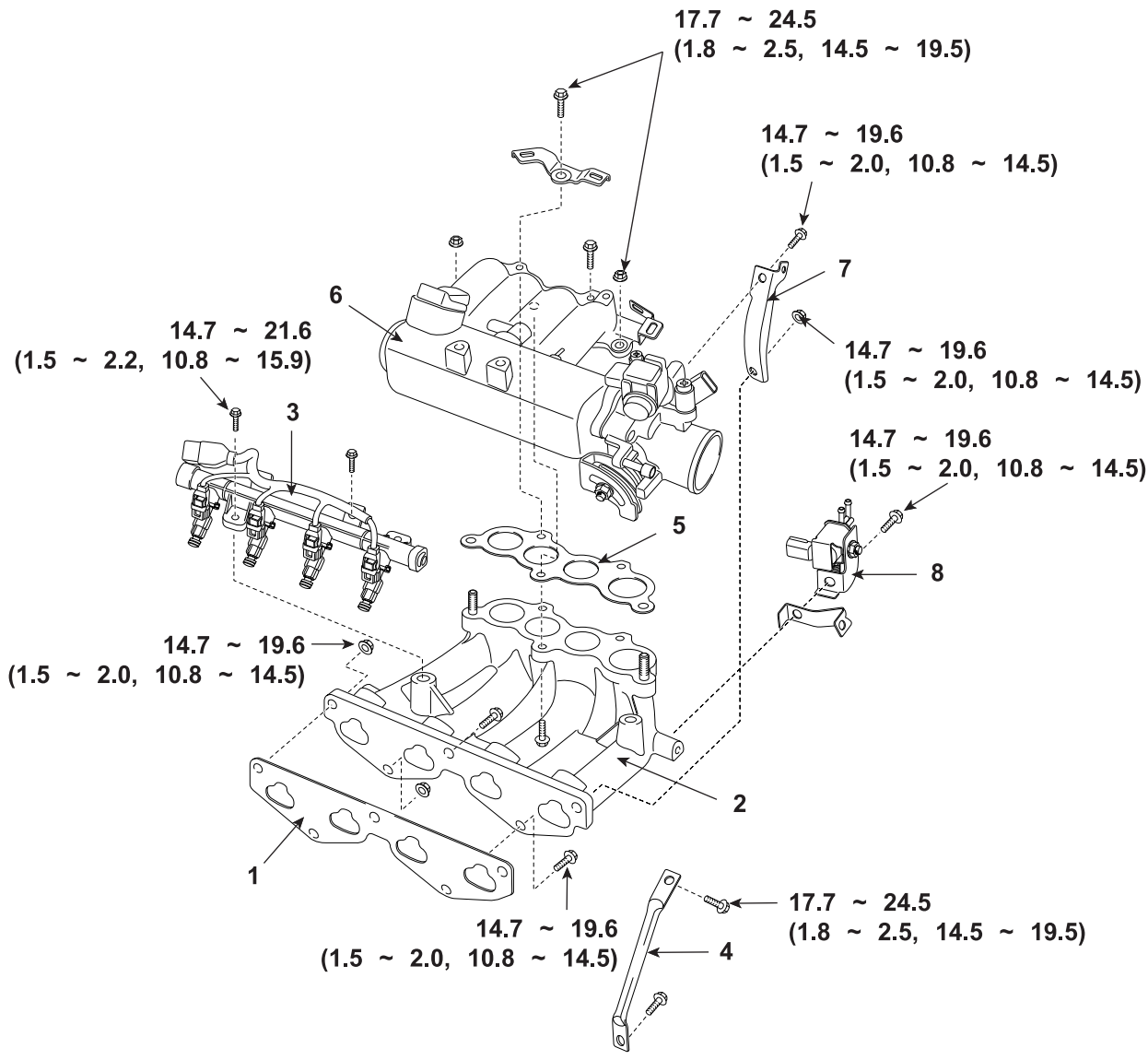
ACHE031A

3. Fill with engine oil.

INTAKE AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENT E06DAA9F



TORQUE : N·m (kg·m, lb·ft)

1. Intake manifold gasket
2. Intake manifold
3. Delivery pipe and injector assembly
4. Intake manifold stay
5. Surge tank gasket
6. Surge tank assembly
7. Surge tank stay
8. PCSV (Purge Control Solenoid Valve)

LCHE025A

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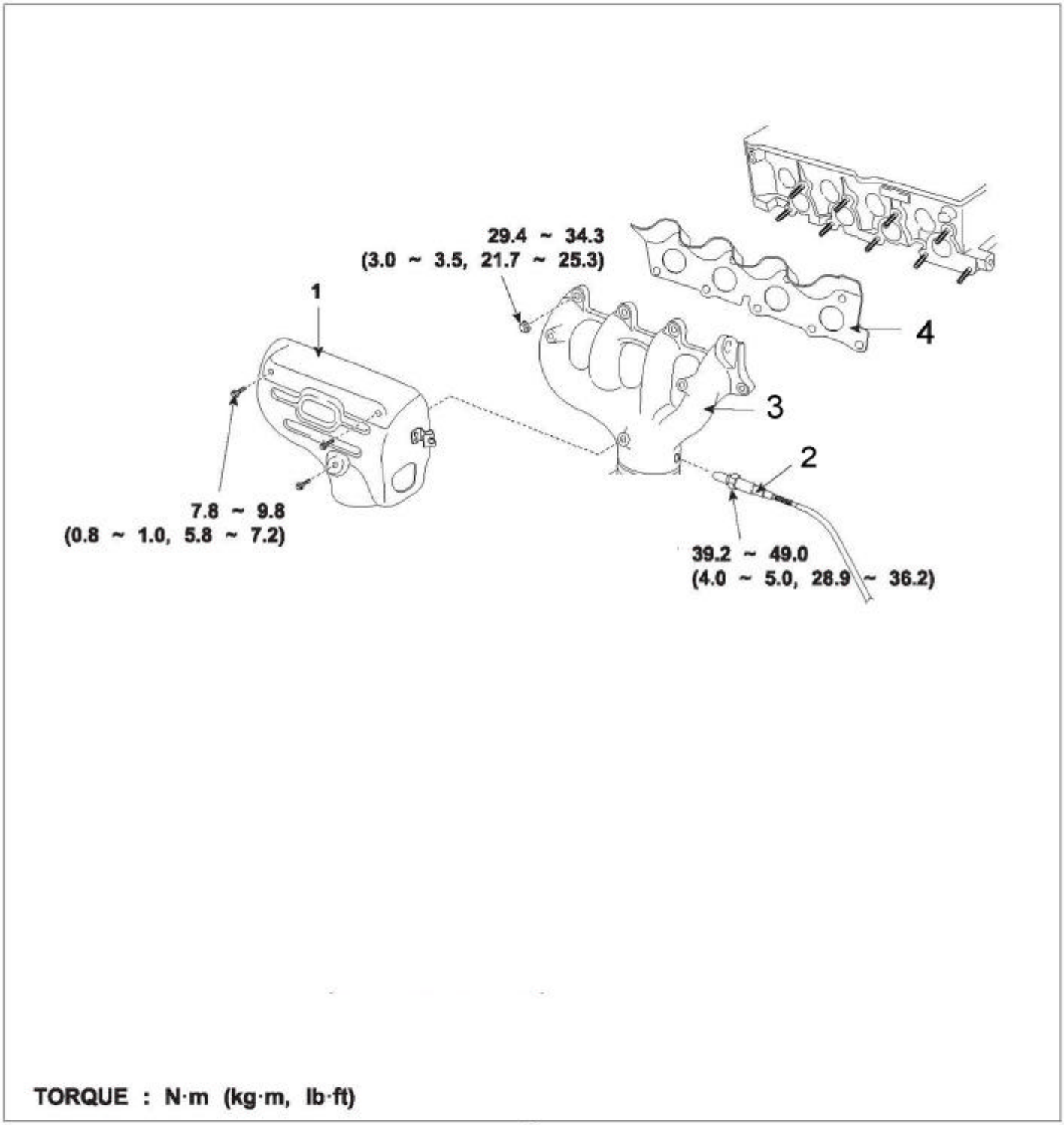
EXHAUST MANIFOLD

COMPONENT EDE51604



1. Exhaust manifold heat protector
2. Oxygen sensor
3. Exhaust manifold and catalytic converter assembly
4. Exhaust manifold gasket