Engine Mechanical System

General Information

Specifications

Description		Specifications	Limit
General			
Туре		In-line, DOHC	
Number of cylinders		4	
Bore		77mm (3.0315in)	
Stroke		85.44mm (3.3638in)	
Total displacement		1,591 cc (97.09 cu.in)	
Compression ratio		10.5 : 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens	ATDC 10°/BTDC 40°	
	Closes	ABDC 63°/ABDC 13°	
Exhaust valve	Opens	BBDC 40°	
	Closes	ATDC 3°	0
Cylinder head			
Flatness of gasket surface		Less than 0.05mm (0.0020in)	
Camshaft	درو سامانه (مست	صرحت دیجیتال خود	
Cam height	Intake	43.85mm (1.726in)	
	Exhaust	42.85mm (1.687in)	
Journal outer diameter	(Intake, Exhaust)	22.964 ~ 22.980mm (0.9041 ~ 0.9047in)	
Camshaft cap oil cleara	nce	0.027 ~ 0.058mm (0.0011 ~ 0.0023in) 0.1mm (0.00	
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)	
Valve			
Valve length	Intake	93.15mm (3.6673in)	
	Exhaust	92.6mm (3.6457in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2152 ~ 0.2157in)	
	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2154in)	
Face angle		45.25° ~ 45.75°	
Thickness of valve he-	Intake	1.1mm (0.0433in)	0.8mm (0.0315in)
ad (margin)	Exhaust	1.26mm (0.0496in)	1.0mm (0.0394in)
Valve stem to valve g-	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
uide clearance	Exhaust	0.030 ~ 0.054mm (0.0012 ~ 0.0021in)	0.15mm (0.0059in)
Valve guide			

General Information

EM-3

Desc	ription	Specifications	Limit
Length	Intake	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
	Exhaust	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
Valve spring			
Free length		44.0mm (1.7323in)	
Out of squareness		Less than 1.5°	
Cylinder block			
Cylinder bore		77.00 ~ 77.03mm (3.0315 ~ 3.0327in)	
Flatness of gasket surfa	ace	Less than 0.05mm (0.0020in) / Less than 0.02mm (0.0008in) 100mm×100mm	
Piston			
Piston outer diameter		76.97 ~ 77.00mm (3.0303 ~ 3.0315in)	
Piston to cylinder cleara	ance	0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	1.26mm (0.0496in)
	No. 2 ring groove	1.22 ~ 1.24mm (0.0480 ~ 0.0488in)	1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	2.05mm (0.0807in)
Piston ring			
Side clearance	No.1 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1 mm (0.0039in)
ولىت محدود)	No.2 ring	0.03 ~ 0.07mm (0.0012 ~ 0.0028in)	0.1 mm (0.0039in)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in)	0.2 mm (0.0079in)
End gap	No. 1 ring	0.14 ~ 0.28mm (0.00 <mark>5</mark> 5 ~ 0.0110in)	0.30mm (0.0 <mark>118in</mark>)
	No. 2 ring	0.30 ~ 0.45mm (0.0118 ~ 0.0177in)	0.50mm (0.0197in)
	Oil ring	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	0.80mm (0.0315in)
Piston pin			
Piston pin outer diamet	er	18.001 ~ 18.006mm (0.7087 ~ 0.7089in)	
Piston pin hole inner dia	ameter	18.016 ~ 18.021mm (0.7093 ~ 0.7095in)	
Piston pin hole clearand	ce	0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small e	nd hole inner diameter	17.974 ~ 17.985mm (0.7076 ~ 0.7081in)	
Piston pin press-in load	1	500~1,500 kg (1,102 ~ 3,306 lb)	
Connecting rod			
Connecting rod big end inner diameter		45.000 ~ 45.018mm (1.7717 ~ 1.7724in)	
Connecting rod bearing oil clearance		0.032 ~ 0.052mm (0.0013 ~ 0.0020in)	0.060mm (0.0024in)
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.35m (0.0138in)
Crankshaft			
Main bearing oil clear- ance	No. 1, 2, 3, 4, 5	0.021 ~ 0.042mm (0.0008 ~ 0.0017in)	0.05mm (0.0020in)
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	0.3mm (0.0118in)

Engine Mechanical System

Description		Specifications	Limit
Engine oil			
Oil quantity	Total	3.7L (3.91US qt, 3.26lmp qt)	When replacing a short engine or a block assembly
, ,	Oil pan	3.0L (3.17US qt, 2.64Imp qt)	
	Drain and refill	3.3L (3.49US qt, 2.90Imp qt)	Including oil filter
	Recommendation (except Middle East)	5W-20/GF4&SM	If not available, refer to the recommended API or ILSAC classifi- cation and SAE visc- osity number.
Oil grade	Classification	API SL, SM or above ILSAC GF3, GF4 or above	Satisfy the requirement of the API or ILS-AC classification.
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"
Oil pressure (at 1000rpm)		100kPa (1.0kg/cm², 14.5psi) or above	Oil temperature in oil pan : $110\pm2^{\circ}\text{C}$ (230 \pm 36°F)
Cooling system			
Cooling method	درو سامانه (مسئ	Forced circulation with cooling fan	
Coolant quantity	, ,,,	$5.5 \sim 5.8 \text{L} (5.81 \sim 6.13 \text{US qt., } 4.84 \sim 5.10 \text{lmp qt.})$	
ودرودر الران	Type	Wax pellet type	
Thermostat	Opening temperature	82 ± 1.5°C (179.6 ± 2.7°F)	
momostat	Pull opening temperat- ure	101°C (214°F)	
Dadistances	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kgf/cm², 13.51 ~ 17.78psi)	
Radiator cap	Vacuum valve opening pressure	MAX. 6.86 kpa(0.07kgf/cm², 1.00 psi)	
Water temperature se	nsor		
Туре		Thermister type	
Desistance	20°C (68°F)	2.45 \pm 0.14 k Ω	
Resistance	80°C (176°F)	0.3222 kΩ	

General Information

EM-5

Tightening Torques

Item	Quantity	N.m	kgf.m	lb-ft
Cylinder block				
Engine support bracket bolts (engine side)	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Ladder frame bolts	13	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Connecting rod cap bolt	8	(17.7~21.6) + (88 ~92°)	(1.8~2.2) + (88~9 2°)	(13.0~15.9) + (88 ~92°)
Crankshaft main bearing cap bolt	10	(17.7~21.6) + (88 ~92°)	(1.8~2.2) + (88~9 2°)	(13.0~15.9) + (88 ~92°)
Flywheel bolts(M/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Drive plate bolts(A/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Timing chain system				
Timing chain and oil pump assembly cover bolt(M6×20)	10	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt(M6×38)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt(M8×22)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Idler pulley assemlby bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39. <mark>8</mark>
Timing chain tensioner arm bolt	1 ,,	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	292	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pully bolt	1	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Timing chain tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ <mark>8.7</mark>
Cylinder head				
Engine cover bolt	4	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Cylinder head cover bolt	16	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolt(M6)	16	11.8 ~ 13.7	1.2 ~ 1.4	8.7 ~ 10.1
Camshaft bearing cap bolt(M8)	4	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Cylinder head bolt	10	(17.7~21.6) + (90 ~95°) + (100~105 °)	(1.8~2.2) + (90~9 5°) + (100~105°)	(13.0~15.9) + (90 ~95°) + (100~105 °)
Cooling system				
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water temperature control assembly mounting bolts	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water inlet fitting nut	2	18.6 ~ 23.5	1.9~ 2.4	13.7 ~ 17.4
Heater pipe mounting bolts/Nuts(M6)	B-1/N-2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting bolt(M8)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4

Engine Mechanical System

Item	Quantity	N.m	kgf.m	lb-ft
Engine coolant temperature sensor(ECTS)	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Oil level gauge assembly mounting bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake and exhaust system				
Intake manifold and cylinder head mounting nut	5	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold and cylinder head mounting nut	9	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Oxygen sensor mounting	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold heat cover	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Head cover protector and cylinder head mounting bolts	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Exhaust manifold and cylinder block, ladder frame mounting bolts	••• تال*خود	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Air cleaner lower cover mounting	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Exhaust manifold and catalytic convertor mounting nut	ه دیچیتا	43.2 ~ 45.1	4.4 ~ 4.6	31.8 ~ 33.3
Center muffler and catalytic convertor mounging nut	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold stay bolts	3	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2

General Information

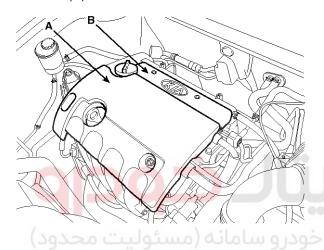
EM-7

Compession Pressure Inspection

MOTICE

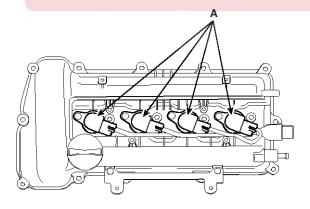
If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

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



STDEM9053D

3. Remove the ignition coil(A).

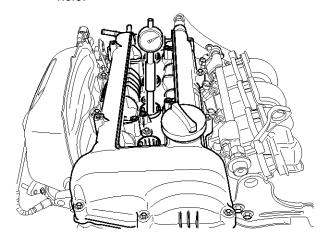


SEDEM7302L

4. Remove the spark plugs.

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

- 5. Check the cylinder compression pressure.
 - 1) Insert a compression gauge into the spark plug hole.



SEDEM8006L

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

MOTICE

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

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

UNOTICE

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

Compression pressure

Standard : 1225.83kPa (12.5kg/cm², 177.79psi)

(200~250 rpm)

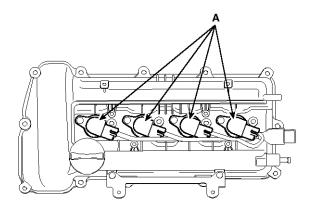
Minimum: 1078.73kPa (11.0kg/cm², 156.46psi)

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

- 5) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
 - 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.

Engine Mechanical System

- 6. Install the spark plugs.
- 7. Install the ignition coil(A).

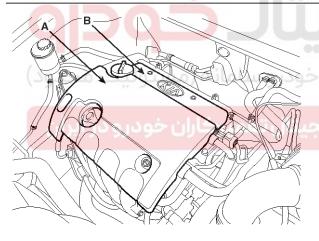


SEDEM7302L

8. Install the engine cover(A) and the engine center cover(B).

Tightening torque:

 $7.8 \sim 11.8 \text{N.m} \ (0.8 \sim 1.2 \text{kgf.m}, \ 5.8 \sim 8.7 \text{lb-ft})$



STDEM9053D

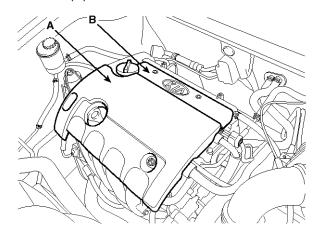
⚠CAUTION Install the cover surely before driving.

Valve Clearance Inspection And Adjustment

MOTICE

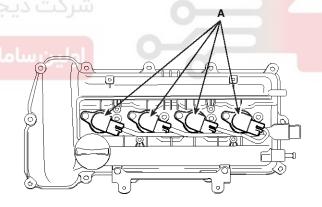
Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

1. Remove the engine cover (A) and the engine center cover (B).



STDEM9053D

- 2. Remove the cylinder head cover.
- 1) Disconnect the ignition coil(A).

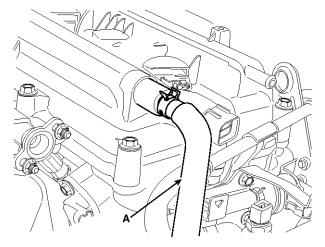


SEDEM7302L

General Information

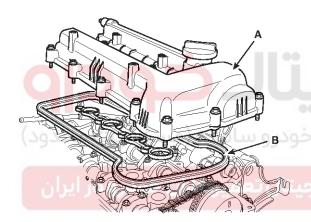
EM-9

2) Disconnect the P.C.V hose(A).



STDEM9022D

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

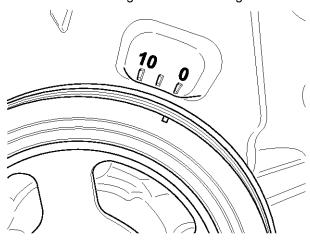


STDEM9041D

ACAUTION

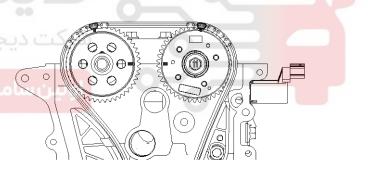
Do not reuse the disassembled gasket (B).

- 3. Set No.1 cylinder to TDC/compression.
 - 1) Turn the crankshaft pulley and align its groove with the timing mark of the timing chain cover.



SHDEM6033E

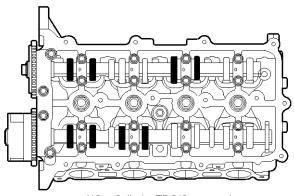
2) Check that the marks of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°).



SFDEM8026L

Engine Mechanical System

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



NO.1 Cylinder TDC/Compression

SLDEM7101L

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

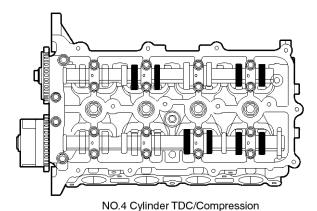
Valve clearance specification (Engine coolant temperature : 20°C [68°F])

Limit

Intake : $0.17 \sim 0.23$ mm ($0.0067 \sim 0.0091$ in.) Exhaust : $0.22 \sim 0.28$ mm ($0.0087 \sim 0.011$ in.)

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

3) Check the intake valves of the 3rd and 4th cylinders and exhaust valves of the 2nd and 4th cylinders for their clearance.



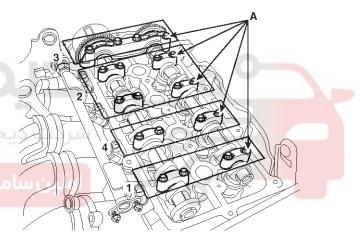
SLDEM7102L

- 5. Adjust the intake and exhaust valve clearance.
 - 1) Set the No.1 cylinder to the TDC/compression position.
 - 2) Put paint marks on the timing chain links (2 places) that meet with the timing marks of the intake, exhaust camshaft sprockets.
 - 3) Remove the exhaust camshaft sprocket bolt.
 - 4) Remove the service hole bolt of the timing chain cover.

CAUTION

The bolt must not be reused once it has been assembled.

- 5) Insert a thin rod in the service hole of the timing chain cover and release the ratchet.
- 6) Remove the exhaust camshaft sprocket.
- 7) Remove the camshaft bearing caps(A) with the order below.



STDEM9030D

- 8) Remove the exhaust camshaft.
- 9) Remove the intake camshaft and CVVT module.

ACAUTION

When disconnecting the timing chain from the camshaft timing sprocket, hold the timing chain.

10) Tie a timing chain with a string.

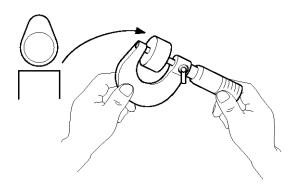
⚠CAUTION

Be careful not to drop anything inside timing chain cover.

General Information

EM-11

11) Measure the thickness of the removed tappet using a micrometer.



EDKE889D

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

Valve clearance (Engine coolant temperature : 20°C)

T : Thickness of removed tappet

A : Measured valve clearance

N: Thickness of new tappet

Intake : N = T + [A - 0.20mm(0.0079in.)]Exhaust : N = T + [A-0.25mm (0.0098in.)]

13) Select a new tappet with a thickness as close as possible to the caculated value.

MOTICE

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

- 14) Place a new tappet on the cylinder head.
- 15) Hold the timing chain, and place the intake camshaft and CVVT module assembly.
- 16) Align the matchmarks on the timing chain and camshaft timing sprocket.
- 17) Install the exhaust camshaft.
- 18) Install the exhaust camshaft sprocket.

Tightening torque:

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

19) Install the camshaft bearing caps with the order below.

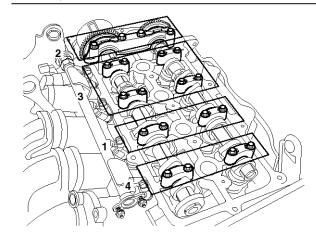
Tightening torque:

M6 bolts : 11.8 \sim 13.7N.m (1.2 \sim 1.4kgf.m, 8.7 \sim

10.1lb-ft)

M8 bolts : 18.6 \sim 22.6N.m (1.9 \sim 2.3kgf.m, 13.7 \sim

16.6lb-ft)



STDEM9023D

20) Install the service hole bolt.

Tightening torque:

 $11.8 \sim 14.7 \text{N.m} (1.2 \sim 1.5 \text{kgf.m}, 8.7 \sim 10.8 \text{lb-ft})$

- 21) Turn the crankshaft two turns in the operating direction(clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.
- 22) Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)

[Specification]

Intake : $0.17 \sim 0.23$ mm ($0.0067 \sim 0.0091$ in.) Exhaust : $0.22 \sim 0.28$ mm ($0.0087 \sim 0.0110$ in.)

Engine Mechanical System

Troubleshooting

Symptom	Suspect area	Remedy
Engine misfire with ab-	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
normal internal lower engine noises.	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression . Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.		Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and MLA.
Engine misfire with coolant consumption.	 Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. Coolant consumption may or may not cause the engine to overheat. 	 Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, valve guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	Inspection the cylinder for a loss of compression. Repair or replace as required.
Engine noise on start- up, but only lasting a	Incorrect oil viscosity.	Drain the oil. Install the correct viscosity oil.
few seconds.	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise,	Low oil pressure.	Repair or replace as required.
regardless of engine speed.	Broken valve spring.	Replace the valve spring.
ороса.	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	Inspect the camshaft lobes. Replace the camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.)	Inspect the valves and valve guides, then repair as required.

General Information

EM-13

Symptom	Suspect area	Remedy
regardless of engine	Low oil pressure.	Repair or replace damaged components as required.
speed.	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.
ولیت محدود)	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 lo-	Low oil pressure.	Repair or replace as required.
ad.	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. The connecting rod bearings. The connecting rods. The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. The crankshaft bearings. The crankshaft journals. The cylinder block crankshaft bearing bore.

Engine Mechanical System

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 chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.	
	Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/ or foreign materials. Repair or replace as required.	
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.	
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.	
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.	



اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

General Information

EM-15

Special Service Tools

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09455-21200)		Installation of the front oil seal
	EDKA010A	
Valve stem oil seal installer (09222-2B100)		Installation of the valve stem oil seal
	SHDEM6151D	
Valve spring compressor and holder A: (09222-3K000) B: (09222-3K100)	A	Removal and installation of the intake or exhaust valve
ن خودرودر ایران	ECRF003A	
Crankshaft rear oil seal inst- aller A: (09231-H1100) B: (09231-2B200)	SAMEM9001N	Installation of the crankshaft rear oil seal
Ring gear stoppper (09231-2B100)		Installation of crankshaft pulley bolt
	SHDEM6201D	

Engine Mechanical System

Tool (Number and name)	Illustration	Use
Engine coolant temperature sensor socket wrench (09221-25100)		Removal and installation of engine coolant sensor
	EDKD101B	
Oil pan remover (09215-3C000)		Removal of oil pan
	ACJF125A	
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method
	LCAC030A	

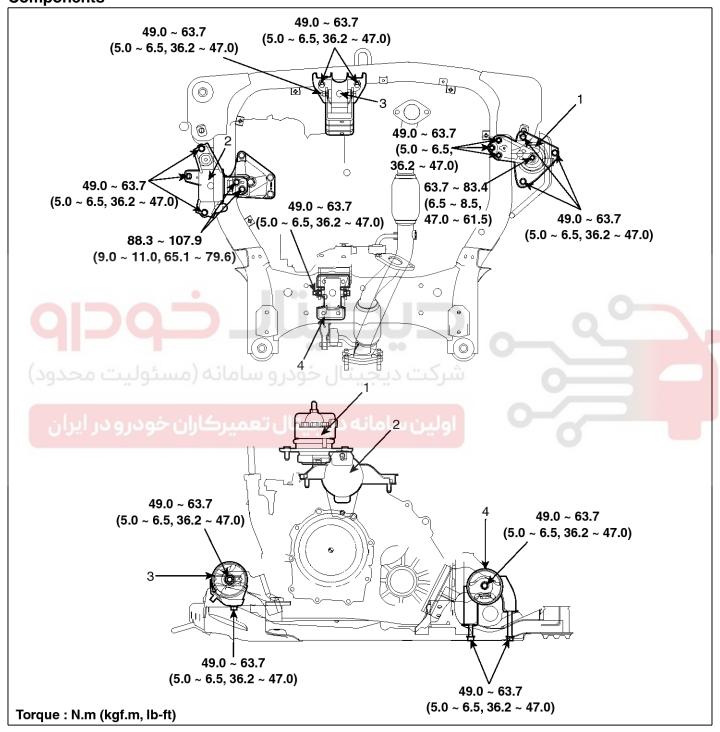
Engine And Transaxle Assembly

EM-17

Engine And Transaxle Assembly

Engine Mounting

Components



STDEM9011L

- 1. Engine mounting bracket
- 2. Transaxle mounting bracket

- 3. Front roll stopper
- 4. Rear roll stopper

Engine Mechanical System

Engine And Transaxle Assembly

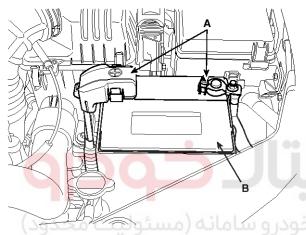
Removal

ACAUTION

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

MOTICE

- Mark all wiring and hoses to avoid misconnection.
- 1. Disconnect the terminals (A) from battery and remove the battery (B).

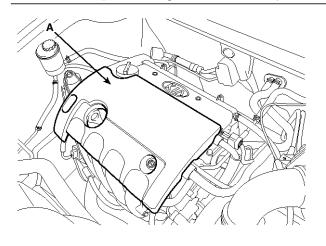


SHDEM6001D

2. Remove the engine cover(A).

Tightening torque:

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

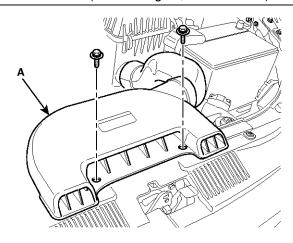


STDEM9043D

3. Remove the air duct(A).

Tightening torque:

 $7.8 \sim 10.8 \text{N.m} \ (0.8 \sim 1.1 \text{kgf.m}, \ 5.8 \sim 8.0 \text{lb-ft})$

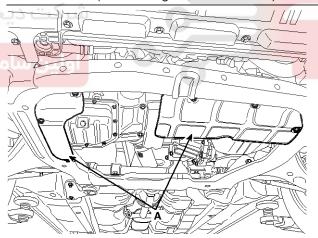


SFDM38001L

- 4. Remove the radiator cap to speed draining.
- 5. Remove the under cover(A).

Tightening torque:

 $8.8 \sim 10.8 \text{N.m} \ (0.9 \sim 1.1 \text{kgf.m}, 6.5 \sim 8.0 \text{lb-ft})$



SHDEM6003D

6. Loosen the radiator drain plug and drain the engine coolant.

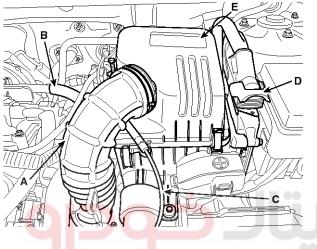
Engine And Transaxle Assembly

EM-19

- 7. Remove the air cleaner assembly.
 - 1) Disconnect the air cleaner hose(A) and the breather hose(B).
 - Disconnect the accelerator cable(C) from the air cleaner.
 - 3) Disconnect the PCM connectors(D).
 - 4) Remove the air cleaner assembly(E).

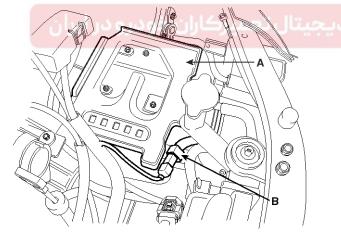
Tightening torque:

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



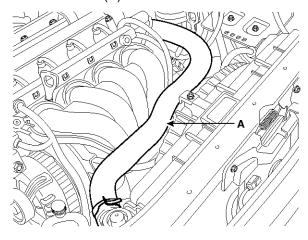
SHDEM6004D

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

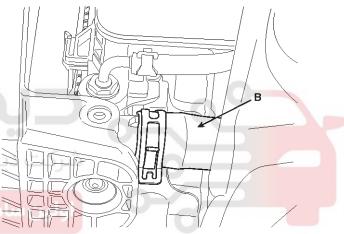


SEDEM7002L

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



SEDEM7003L

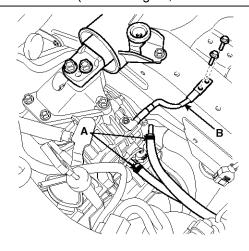


SHDEM6008D

10. Remove the ATF oil cooler hoses(A) and the transaxle ground line(B).

Tightening torque:

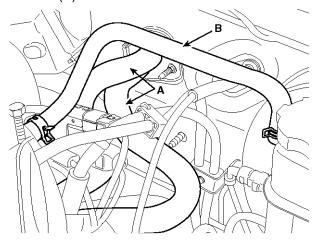
 $9.8 \sim 11.8$ N.m ($1.0 \sim 1.2$ kgf.m, $7.2 \sim 8.7$ lb-ft)



SFDEM8025L

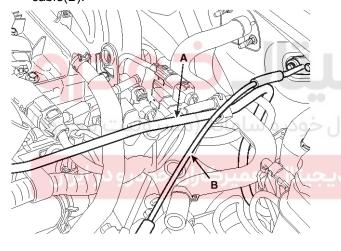
Engine Mechanical System

11.Remove the heater hoses(A) and brake booster hose(B).



SHDEM6012D

12. Remove the fuel hose(A) and the accelerator cable(B).

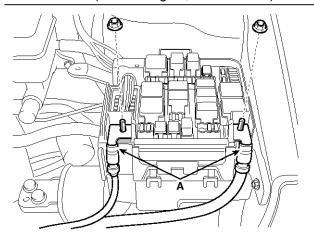


SHDEM6013D

- 13. Remove the fuse box cover.
- 14. Disconnect the terminals(A) from the fuse box.

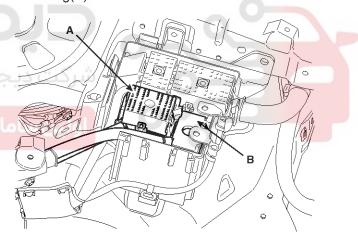
Tightening torque:

 $9.8 \sim 11.8 \text{N.m} \ (1.0 \sim 1.2 \text{kgf.m}, 7.2 \sim 8.7 \text{lb-ft})$



STDEM9003D

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



SHDEM6066D

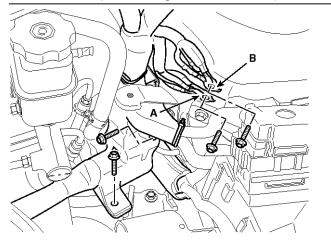
Engine And Transaxle Assembly

EM-21

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

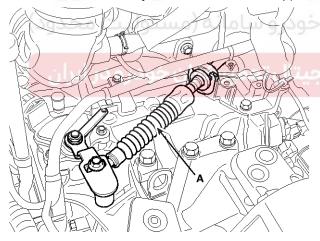
Tightening torque:

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



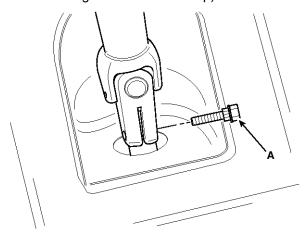
SFDEM8008L

- 17.Recover refrigerant and remove the high & low pressure pipe. (Refer to Air conditioner compressor in HA Group).
- 18. Disconnect the transaxle control cable(A). (Refer to Transaxle control system in MT or AT Group).



SHDEM6039D

19. Remove the steering column mounting bolt(A), (Refer to Steering column in ST Group).

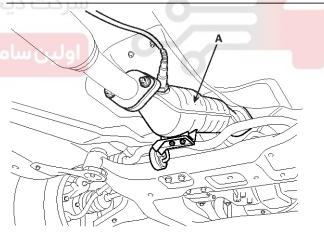


SFDM38014L

- 20. Remove the front wheels and tires.
- 21. Disconnect the stabilizer bar link and remove the mounting bolts from the lower arm and the front axles.
- 22. Remove the catalytic convertor (A).

Tightening torque:

Bolt: 43.2 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~ 33.3lb-ft) Nut: 39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



STDEM9051D

Engine Mechanical System

- 23. Support the engine and transaxle assembly with a jack.
- 24. Remove the engine mounting support bracket(A) and the ground line(B).

Tightening torque:

Bolt(C):

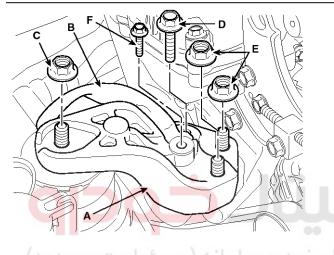
 $63.7 \sim 83.4$ N.m ($6.5 \sim 8.5$ kgf.m, $47.0 \sim 61.5$ lb-ft)

Bolt(D), Nut(E):

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

Bolt(F):

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

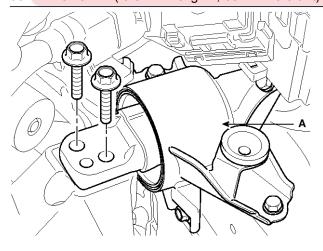


(SHDEM6164D

25. Remove the transaxle mounting bracket(A).

Tightening torque:

88.2 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.5lb-ft)

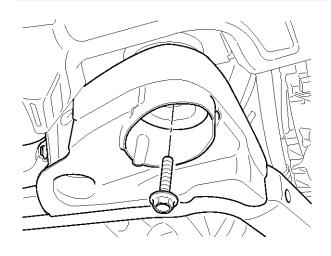


SHDEM6016D

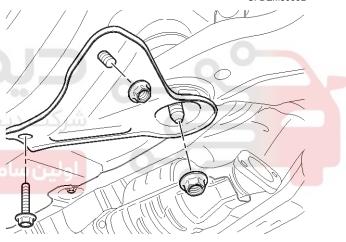
26. Remove the sub frame bolts and nuts.

Tightening torque:

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



SFDEM8009L



SHDEM6019D

Engine And Transaxle Assembly

EM-23

Installation

Installation is in the reverse order of removal.

Perform the following:

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

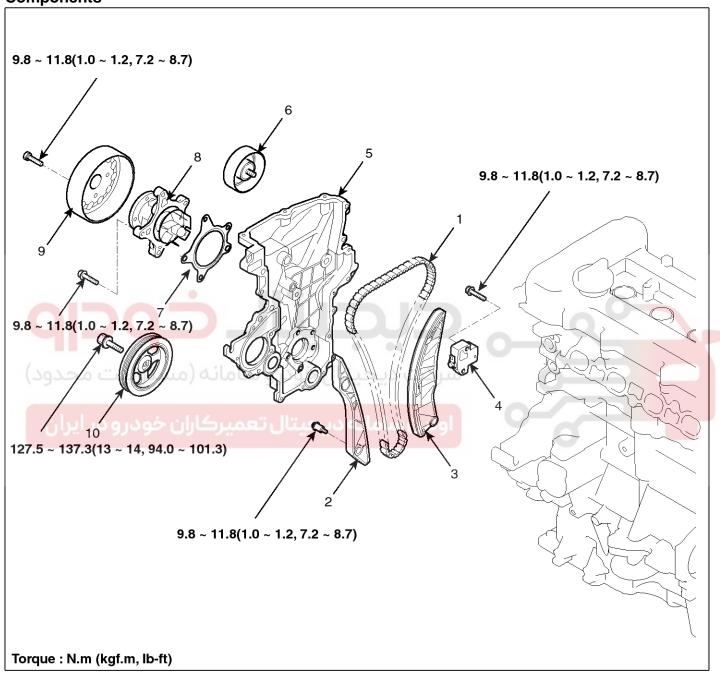


Engine Mechanical System

Timing System

Timing Chain

Components



STDEM9012L

- 1. Timing chain
- 2. Timing chain guide
- 3. Timing chain arm
- 4. Timing chain auto tensionr
- 5. Timing chain cover
- 6. Drive belt idler
- 7. Water pump gasket
- 8. Water pump
- 9. Water pump pulley
- 10. Crank shaft pulley

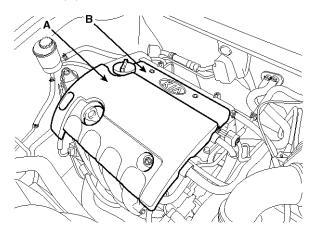
Timing System

EM-25

Removal

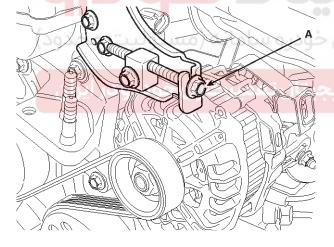
Engine removal is not required for this procedure.

1. Remove the engine cover(A) and the engine center cover(B).



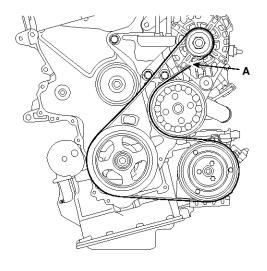
STDEM9053D

- 2. Loosen the water pump pulley bolt and the drive idler mounting bolt.
- 3. Loosen the alternator tension adjusting bolt(A) to loosen tension.



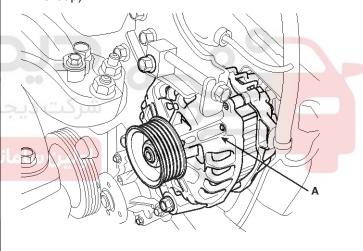
SHDEM6021D

4. Remove the alternator drive belt(A).



STDEM9024D

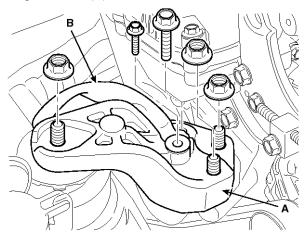
5. Remove the alternator(A). (Refer to Alternator in EE Group).



SHDEM6069D

Engine Mechanical System

- 6. Remove the RH front wheel.
- 7. Remove the engine mounting bracket(A) and the ground line(B).

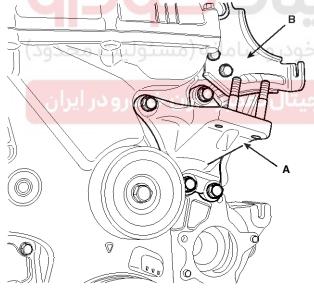


SHDEM6015D

MOTICE

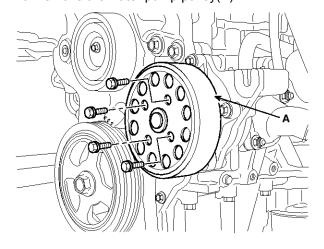
Support the engine with a jack not to be tilted.

- 8. Remove the alternator bracket(B).
- 9. Remove the engine support bracket(A).



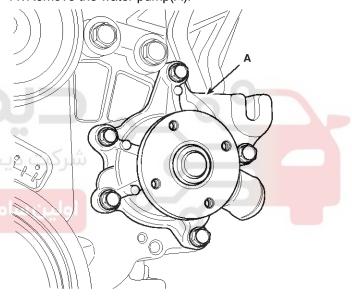
SHDEM6040L

10. Remove the water pump pulley(A).



SHDEM6024D

11. Remove the water pump(A).

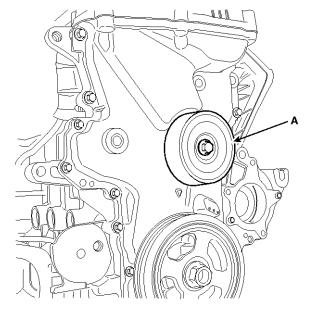


SHDEM6025D

Timing System

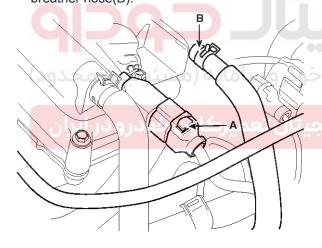
EM-27

12. Remove the drive belt idler(A).



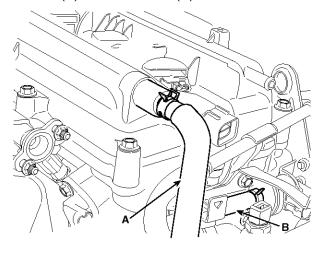
STDEM9025D

13. Disconnect the ignition coil connector(A) and the breather hose(B).



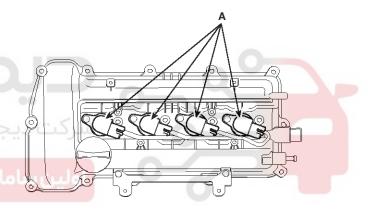
SEDEM7304L

14. Disconnect the positive crankcase ventilation(PCV) hose(A) and PCSV hose(B).



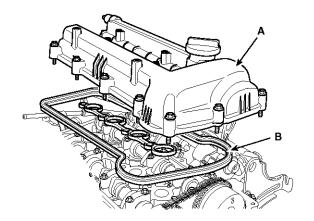
STDEM9026D

15. Remove the ignition coils(A).



SEDEM7302L

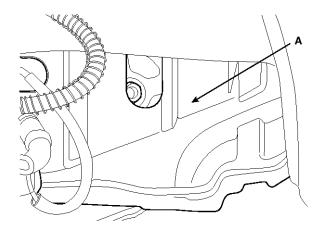
16. Remove the cylinder head cover(A) with its gasket(B).



STDEM9041D

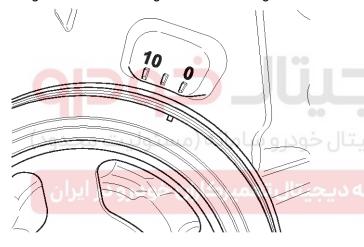
Engine Mechanical System

17. Remove side cover (A).



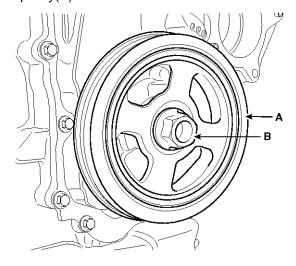
SHDEM6071D

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



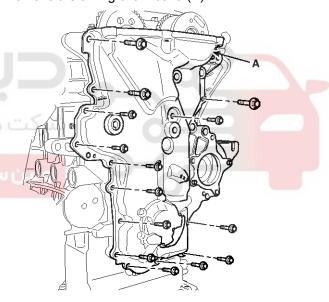
SHDEM6033D

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



SHDEM6028D

20. Remove the timing chain cover(A).



STDEM9027D

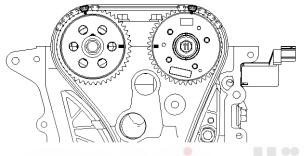
Timing System

EM-29

- 21. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.
 - 1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

ACAUTION

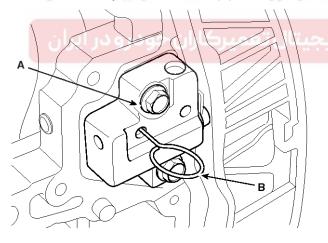
Put paint marks on the timing chain links(3 places) that meet with the timing marks of the camshaft sprockets(In, Ex : 2) and the crankshaft sprocket.



يتالـ خودرو

SFDEM8026L

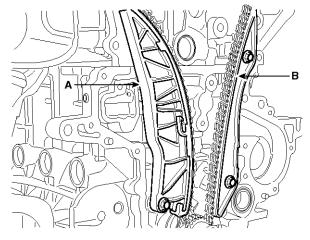
22. Remove the hydraulic tensioner(A).



SHDEM6072D

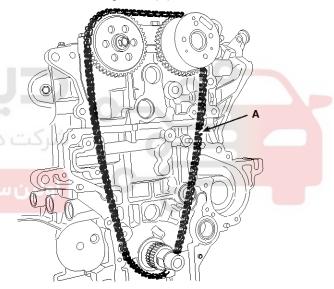
ACAUTION

Before removing the tensioner, fix the piston of the tensioner with a pin (B) through the hole at TDC. 23. Remove the timing chain tensioner arm(A) and guide(B).



SHDEM6037D

24. Remove the timing chain(A).



STDEM9028D

Engine Mechanical System

Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm

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

Belt, Idler, Pulley

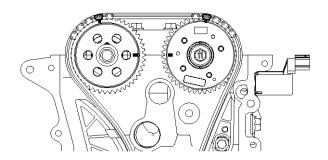
- 1. Check the idler for excessive oil leakage, abnormal rotation or vibration. Replace if necssery.
- 2. Check belt for maintenance and abnormal wear of V-ribbed part. Replace if necssery.
- 3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necssery.

MOTICE

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

Installation

 Align the timing marks of the camshaft sprocket with the upper sureface of the cylinder head to make No.1 cylinder be positioned at TDC.

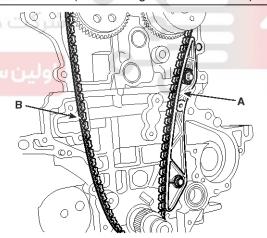


SFDEM8026L

- 1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.
- 2) Install the timing chain guide(A).

Tightening torque:

 $9.8 \sim 11.8 \text{N.m} (1.0 \sim 1.2 \text{kgf.m}, 7.2 \sim 8.7 \text{lb-ft})$



SHDEM6076D

 When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.

Order : Crankshaft sprocket \rightarrow Timing chain guide \rightarrow Intake camshaft sprocket \rightarrow Exhaust camshaft sprocket.

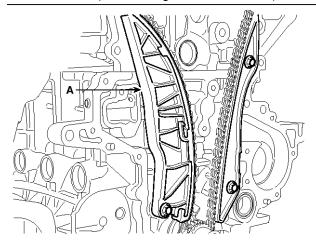
Timing System

EM-31

2. Install the chain tensioner arm(A).

Tightening torque:

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

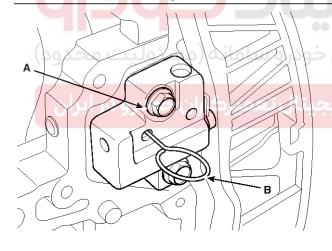


STDEM9035D

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

Tightening torque:

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



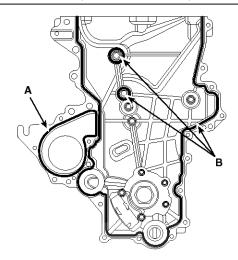
SHDEM6072D

MOTICE

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

- 4. Install the timing chain cover(A).
 - 1) Before installing, remove the hardened sealant from the cylinder block and ladder frame surface.
 - 2) Apply the liquid gasket(1217H) on the surface between the cylinder head and the cylinder block.

Width: $3 \sim 5 \text{mm}(0.1181 \sim 0.1969 \text{in.})$



STDEM9044D

3) Apply the liquid gasket, THREE BOND 1282B on the water pump contact parts of the timing chain cover and THREE BOND 1217H on the rest parts. Reassemble the cover(A) within 5 minutes.

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

ACAUTION

Remove oil or dust on the surface surely.

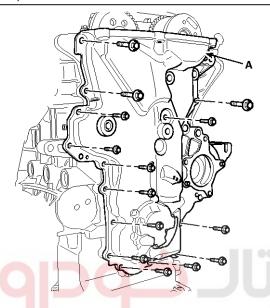
Engine Mechanical System

4) Align the dowel pin of the cylinder block and the holes of the oil pump.

Tightening torque:

12mm bolts - 18.6 \sim 23.5N.m (1.9 \sim 2.4kgf.m, 13.7 \sim 17.4lb-ft)

10mm bolts - 9.8 \sim 11.8Nm (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft)

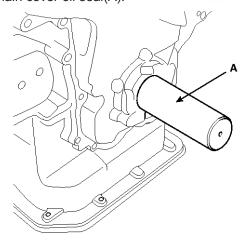


STDEM9027D

تال خودر و سامانه (مسئولـ CAUTION)

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

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

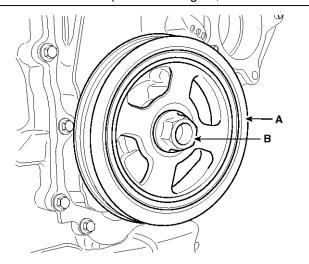


SHDEM6073D

6. Install the crankshaft pulley(A).

Tightening torque:

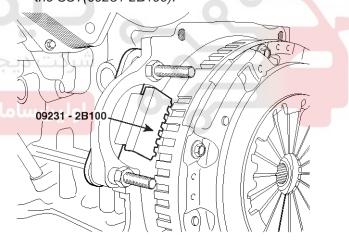
127.5 ~ 137.3N.m (13.0 ~ 14.0kgf.m, 94.0 ~ 101.3lb-ft)



SHDEM6028D

MOTICE

When installing the pulley, remove the starter and fix the SST(09231-2B100).



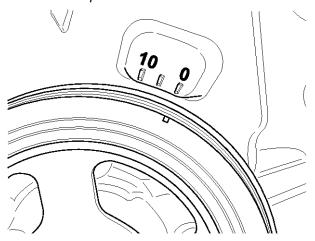
SHDEM6182D

Timing System

EM-33

MOTICE

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



SHDEM6033D

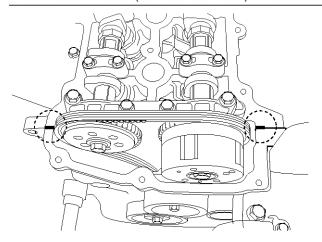
7. Install side cover.

Tightening torque:

 $8.8 \sim 10.8 \text{N.m} \ (0.9 \sim 1.1 \text{kgf.m}, \ 6.5 \sim 8.0 \text{lb-ft})$

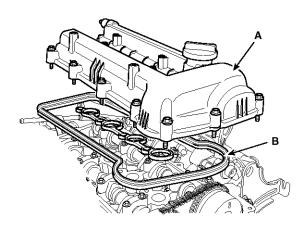
- 8. Install the front right wheel and tire.
- Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
- 10. After applying the liquid gasket, THREE BOND 1217H on the cylinder head cover, reassemble the cover within five minutes.

Width: $2.0 \sim 2.5 \text{mm} (0.0787 \sim 0.0984 \text{in.})$



STDEM9029D

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



STDEM9041D

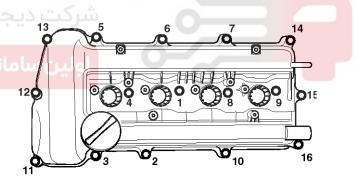
⚠CAUTION

Do not reuse the disassembled gasket.

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

Tightening torque:

1st step - $3.9 \sim 5.9$ N.m (0.4 ~ 0.6 kgf.m, $2.9 \sim 4.3$ lb-ft) 2nd step - $7.8 \sim 9.8$ N.m (0.8 ~ 1.0 kgf.m, $5.8 \sim 7.2$ lb-ft)



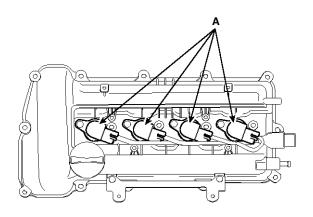
SHDEM6078D

Engine Mechanical System

13. Install the ignition coils(A).

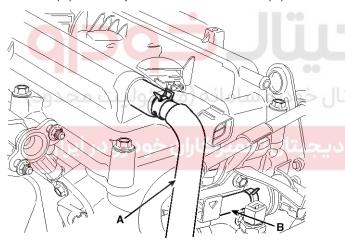
Tightening torque:

 $9.8 \sim 11.8 \text{N.m} \; (1.0 \sim 1.2 \text{kgf.m}, \, 7.2 \sim 8.7 \text{lb-ft})$



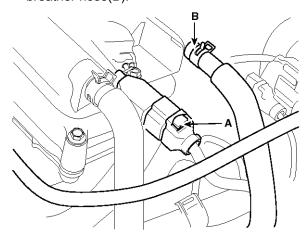
SEDEM7302L

14.Install the positive crankcase ventilation(PCV) hose(A) and the positive and PCSV hose(B).



STDEM9026D

15. Connect the ignition coil connector(A) and the breather hose(B).

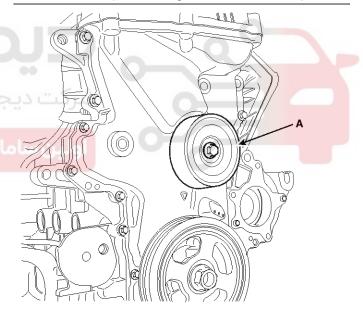


SEDEM7304L

16. Install the drive belt idler(A).

Tightening torque:

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



STDEM9025D

Timing System

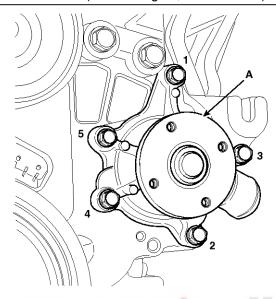
EM-35

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

Tighten bolts with the order below.

Tightening torque:

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

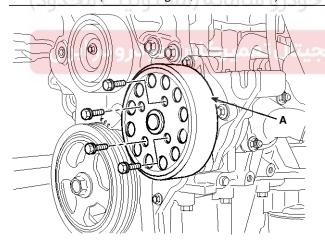


STDEM9040D

18. Install the water pump pulley(A).

Tightening torque:

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



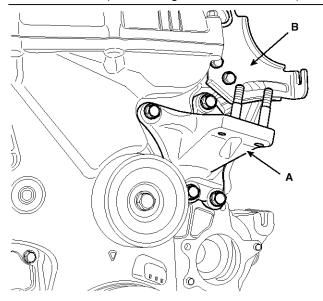
SHDEM6024D

⚠CAUTIONTighten the bolts diagonally.

19. Install the engine support bracket(A).

Tightening torque:

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



SHDEM6040L

20. Install the alternator bracket(B).

Tightening torque:

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

21. Supporting the engine with a jack, install the engine mounting bracket(A) and the ground line(B).

Tightening torque:

Bolt(C):

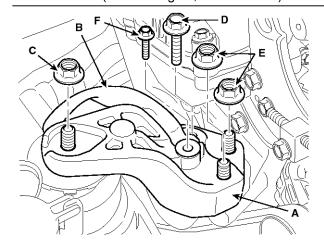
 $63.7 \sim 83.4$ N.m (6.5 \sim 8.5kgf.m, 47.0 \sim 61.5lb-ft)

Bolt, Nuts(D, E):

 $49.0 \sim 58.8$ N.m ($5.0 \sim 6.0$ kgf.m, $36.2 \sim 43.4$ lb-ft)

Bolt(F):

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



SHDEM6179D

Engine Mechanical System

22. Install the alternator(A).

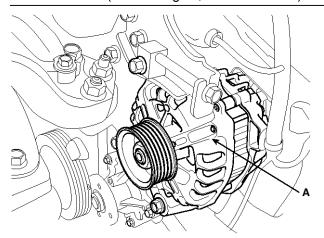
Tightening torque:

12mm bolt:

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

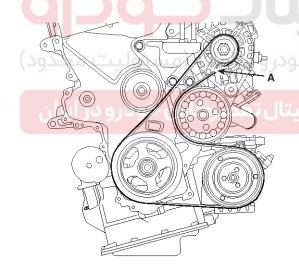
14mm bolt:

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



SHDEM6069D

23. Install the drive belt(A).

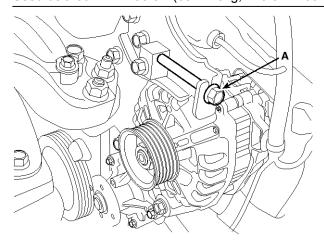


STDEM9024D

24. Adjust tension by tightening the alternator tension adjust bolt(A). (Refer to Charging system in EE Group).

Tension

New belt: 882.6 \sim 980.7N (90 \sim 100kg, 198.4 \sim 220.5lb) Used belt: 637.4 \sim 735.5N (65 \sim 75kg, 143.3 \sim 165.3lb)



STDEM9045D

25. Tighten the alternator fixing bolts.

Tightening torque:

Bolt (12mm):

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

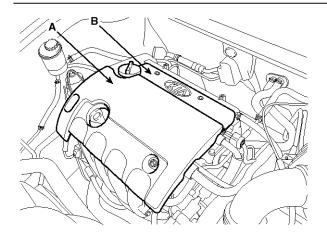
Bolt (14mm):

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

26. Install the engine center cover(B) and the engine cover(A).

Tightening torque:

 $7.8 \sim 11.8 \text{N.m} \ (0.8 \sim 1.2 \text{kgf.m}, 5.8 \sim 8.7 \text{lb-ft})$



STDEM9053D

ACAUTION

Install the cover surely before driving.

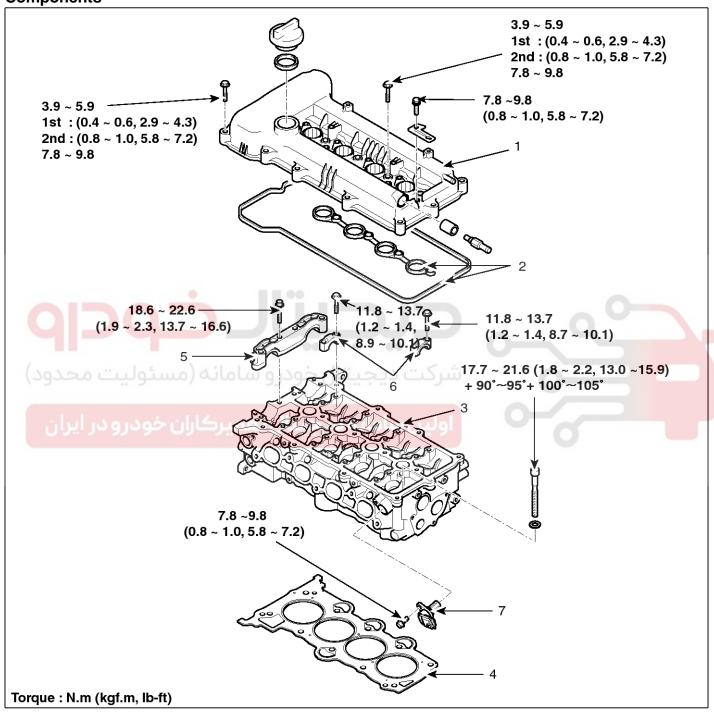
Cylinder Head Assembly

EM-37

Cylinder Head Assembly

Cylinder Head

Components

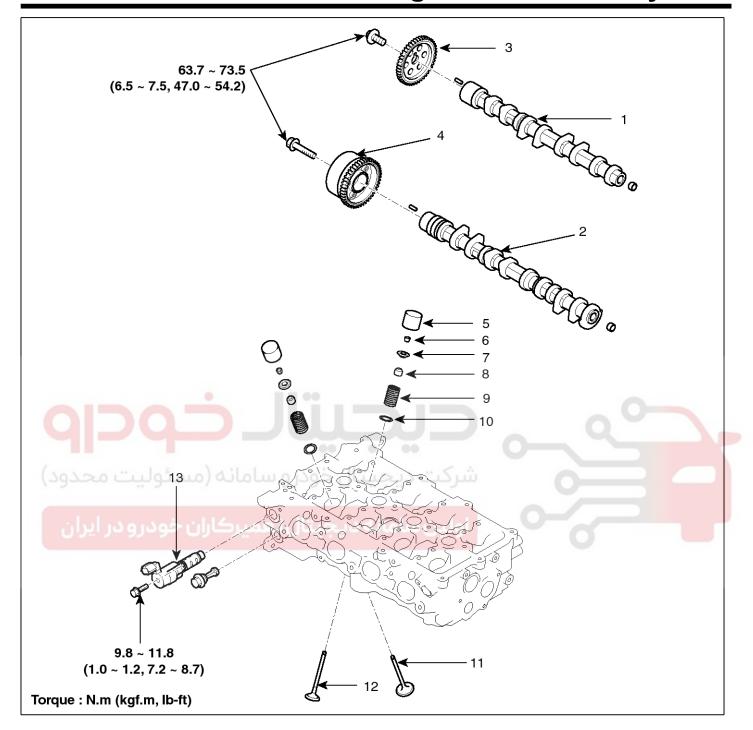


STDEM9013L

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

- 5. Camshaft front bearing cap
- 6. Camshaft bearing cap
- 7. Camshaft position sensor

Engine Mechanical System



STDEM9014L

- 1. Exhaust camshaft
- 2. Intake camshaft
- 3. Exhaust camshaft sproket
- 4. CVVT assembly
- 5. Mechanical Lash Adjuster(MLA)
- 6. Retainer lock
- 7. Retainer
- 8. Valve stem seal
- 9. Valve spring
- 10. Valve spring seat

- 11. Intake valve
- 12. Exhaust valve
- 13. Oil Control Valve(OCV)

EM-39

Removal

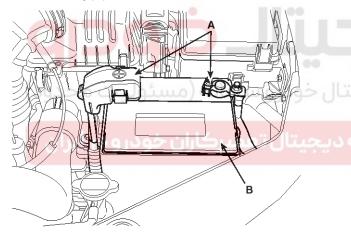
Engine removal is not required for this procedure.

CAUTION

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

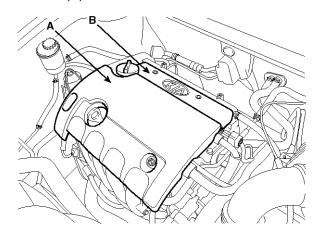
MNOTICE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.
- 1. Disconnect the terminals(A) from battery and remove the battery(B).



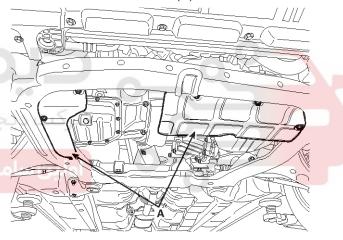
SHDEM6001D

Remove the engine cover(A) and engine center cover(B).



STDEM9053D

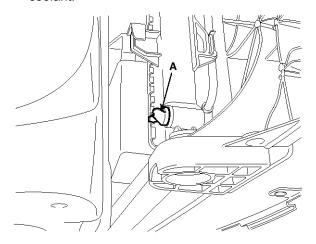
- 3. Remove the radiator cap to speed draining.
- 4. Remove the under cover(A).



SHDEM6003D

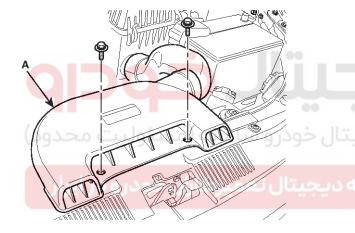
Engine Mechanical System

5. Loosen the radiator drain plug(A) and drain engine coolant.



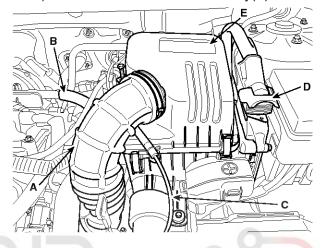
SEDM17003L

6. Remove the air duct(A).



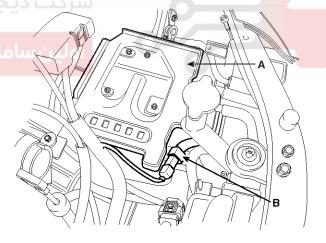
SFDM38001L

- 7. Remove the intake air hose(A) and air cleaner assembly.
 - 1) Disconnect the breather hose(B) from intake air hose(A).
 - 2) Disconnect the intake air hose(A) and accelerator cable(C).
 - 3) Disconnect the PCM connector(D).
 - 4) Remove the air cleaner assembly(E).



SHDEM6004D

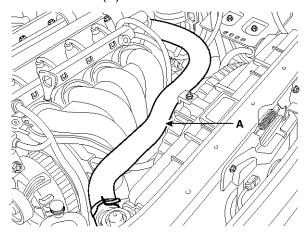
8. Remove the battery tray(A) and disconnect the front connector(B).



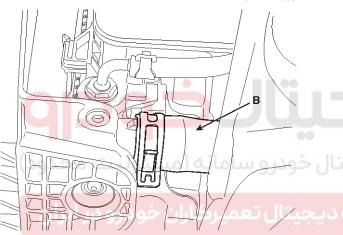
SEDEM7002L

EM-41

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



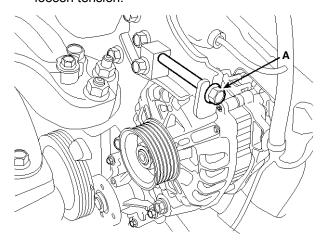
SEDEM7003L



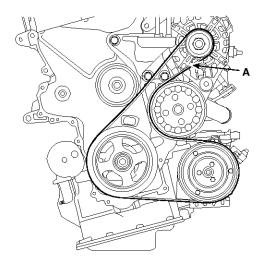
SHDEM6008D

STDEM9045D

- 10.Loosen the water pump mounting bolt and the drive idler mounting bolt.
- 11.Loosen the alternator tension adjusting bolt(A) to loosen tension.

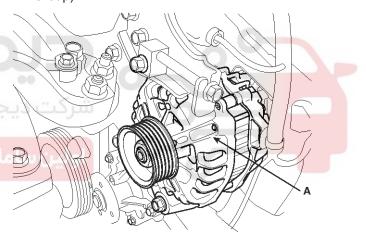


12. Remove the alternator drive belt(A).



STDEM9024D

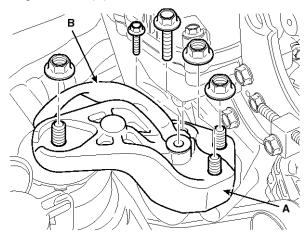
13. Remove the alternator(A). (Refer to Alternator in EE Group).



SHDEM6069D

Engine Mechanical System

- 14. Remove the RH front wheel.
- 15. Remove the engine mounting bracket(A) and the ground line(B).



SHDEM6015D

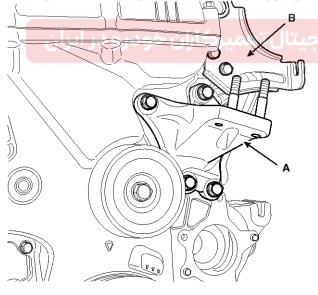
MOTICE

Support the engine with a jack not to be tilted.

ACAUTION

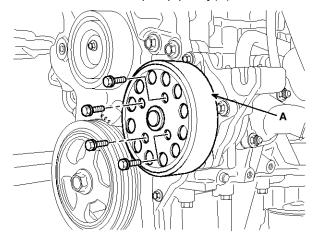
Do not support the engine - transaxle - subframe assembly with the hangers.

- 16. Remove the alternator bracket(B).
- 17. Remove the engine support bracket(A).



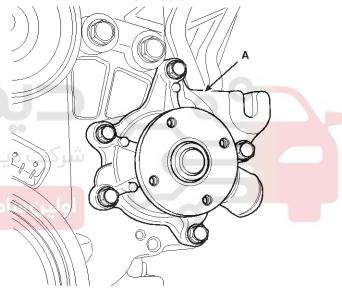
SHDEM6040L

18. Remove the water pump pulley(A).



SHDEM6024D

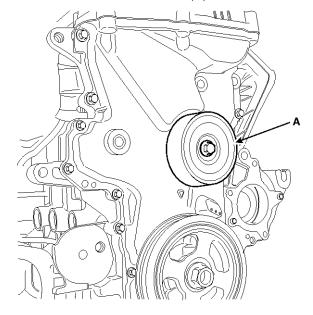
19. Remove the water pump(A).



SHDEM6025D

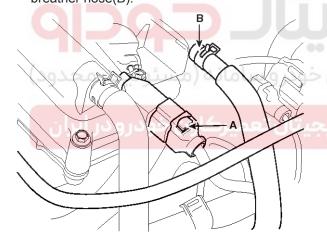
EM-43

20. Remove the drive belt idler(A).



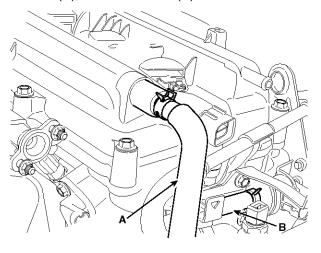
STDEM9025D

21. Disconnect the ignition coil connector(A) and the breather hose(B).



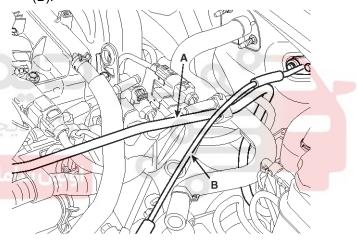
SEDEM7304L

22. Disconnect the positive crankcase ventilation(PCV) hose(A), and PCSV hose(B).



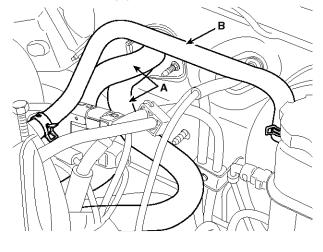
STDEM9026D

23. Remove the fuel hose (A) and the accelerator cable (B).



SHDEM6013D

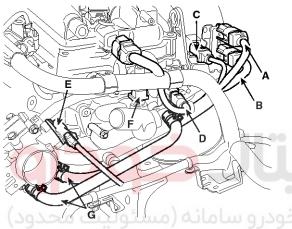
24. Disconnect the heater hose (A) and the brake booster hose (B).



SHDEM6012D

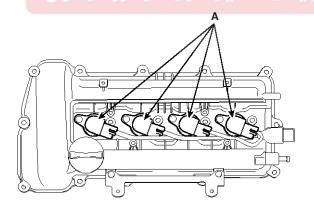
Engine Mechanical System

- 25. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
 - 1) Disconnect the front(A) and the rear(B) oxygen sensor connector.
 - Disconnect the ignition coil condenser connector(C) and the purge control solenoid valve(PCSV) connector(D).
 - 3) Disconnect the throttle position sensor(TPS) connector(E).
 - Disconnect the engine coolant temperature sensor(ECTS) connector(F) and the water hose(G).



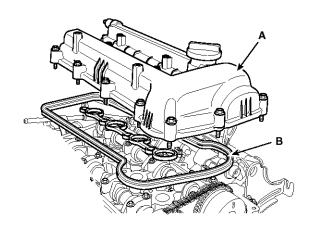
SFDEM8012L

26. Remove the ignition coil(A).



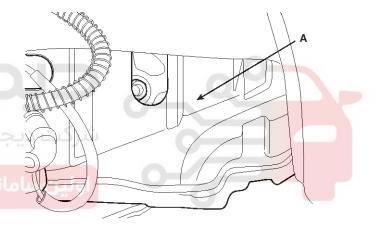
SEDEM7302L

27.Remove the cylinder head cover(A) with its gasket(B).



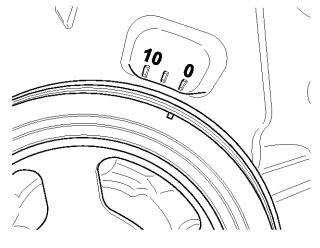
STDEM9041D

28. Remove side cover (A).



SHDEM6071D

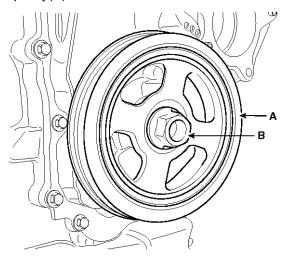
29. Turn the crankshaft pulley clockwise, and align its groove with the timing mark of the timing chain cover.



SHDEM6033D

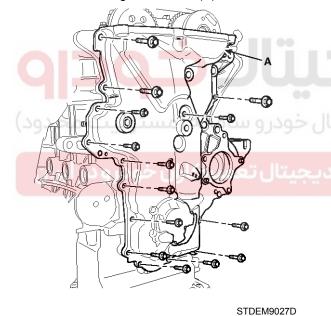
EM-45

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



SHDEM6028D

31. Remove the timing chain cover(A).

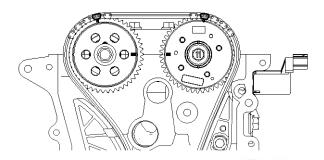


32. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.

1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.

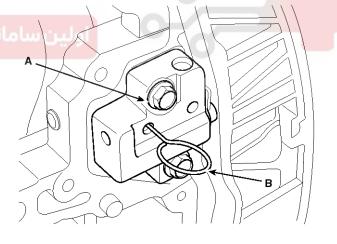
⚠CAUTION

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



SFDEM8026L

33. Remove the hydraulic tensioner(A).



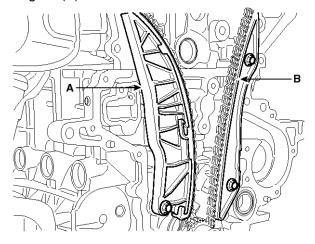
SHDEM6072D

CAUTION

Before removing the tensioner, fix the piston of the tensioner with a pin(B) through the hole at TDC.

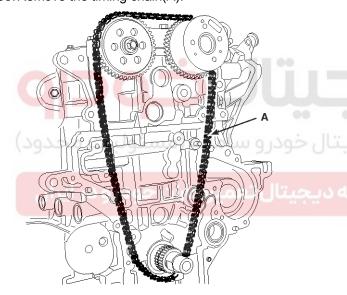
Engine Mechanical System

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



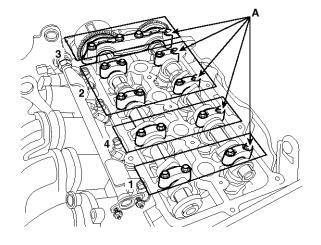
SHDEM6037D

35. Remove the timing chain(A).



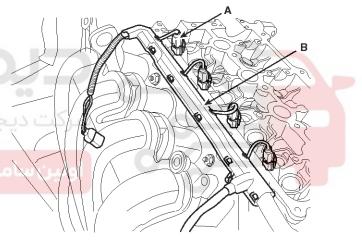
STDEM9028D

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



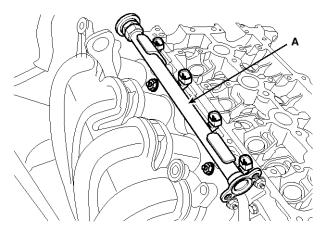
STDEM9030D

37. Remove the injector connectors(A) and the harness bracket(B).



SHDEM6170D

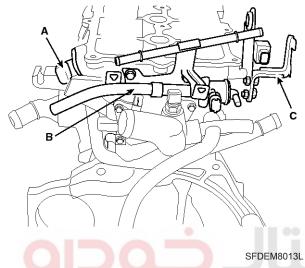
38. Remove the delivery pipe(A).



SHDEM6080D

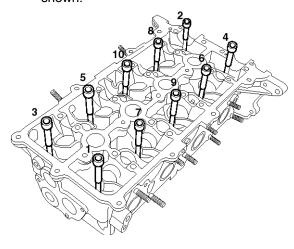
EM-47

- 39. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
- 40. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
- 41. Disconnect the camshaft position sensor(CMP) connector(A) and remove the purge control solenoid valve(PCSV) bracket(B) and the module hanger bracket(C).



42. Remove the water temperature control assembly and the oil control valve(OCV).

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



SHDEM6086D

ACAUTION

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

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

ACAUTION

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

Engine Mechanical System

Disassembly

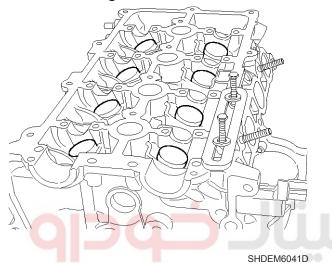
MOTICE

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

1. Remove the MLAs(A).

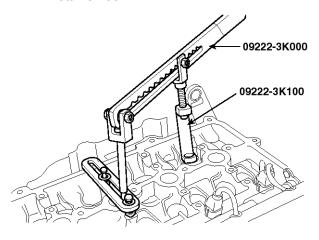
ACAUTION

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



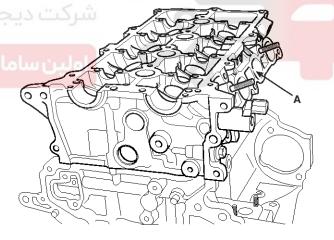
2. Remove the valves.

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



STDEM9031D

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



SHDEM6088D

ACAUTION

Do not reuse the valve stem seals.

EM-49

Inspection

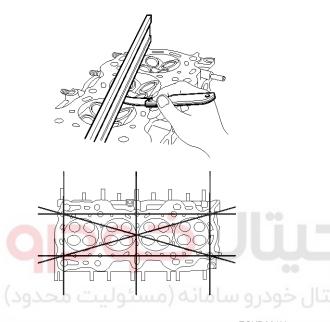
Cylinder Head

1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard: Less than 0.05mm (0.0020in)



ECKD001H

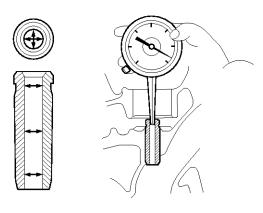
Inspect for cracks.
 Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

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

Valve guide inner diameter:

5.500 ~ 5.512mm (0.2165 ~ 0.2170in)

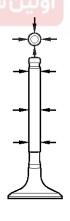


ECKD219A

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

Valve stem outer diameter

Intake : $5.465 \sim 5.480$ mm ($0.2152 \sim 0.215$ 7in) Exhaust : $5.458 \sim 5.470$ mm ($0.2149 \sim 0.21$ 54in)





ECKD220A

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

Valve stem- to-guide clearance

Intake : $0.020 \sim 0.047$ mm ($0.0008 \sim 0.0019$ in) Exhaust : $0.030 \sim 0.054$ mm ($0.0012 \sim 0.0021$ in)

If the clearance is greater than specification,

Engine Mechanical System

replace the valve or the cylinder head.





EM-51

- 2. Inspect the valves.
 - 1) Check the valve is ground to the correct valve face angle.
 - Check that the surface of valve for wear.If the valve face is worn, replace the valve.
 - Check the valve head margin thickness.
 If the margin thickness is less than minimum, replace the valve.

Margin Standard

Intake : 1.1mm (0.0433in) Exhaust : 1.26mm (0.0496in)



ECKD221A

4) Check the length of valve.

Valve length

Standard

Intake: 93.15mm (3.6673 in) Exhaust: 92.60mm (3.6457 in)

- 5) Check the surface of valve stem tip for wear. If the valve stem tip is worn, replace the valve.
- 3. Inspect the valve seats.
 - Check the valve seat for evidence of overheating and improper contact with the valve face. If the valve seat is worn, replace the cylinder head.
 - Check the valve guide for wear. If the valve guide is worn, replace the cylinder head.

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

Valve spring Standard

Free height: 44mm (1.7323in) Out of square: Less than 1.5°



Engine Mechanical System

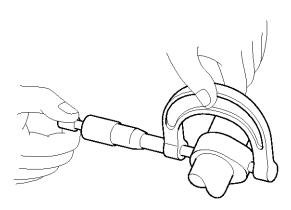
Camshaft

1. Inspect the cam height.

Using a micrometer, measure the cam height.

Cam height

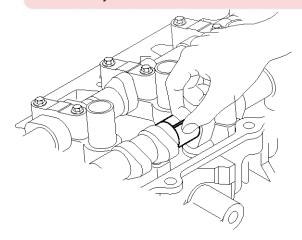
Intake: 43.85mm (1.7264in) Exhaust: 42.85mm (1.6870in)



ECKD223A

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

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



SHDEM6043L

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

Tightening torque:

M6 bolts:

 $11.8 \sim 13.7 \text{Nm} (1.2 \sim 1.4 \text{kgf.m}, 8.7 \sim 10.1 \text{lb-ft})$

M8 bolts:

 $18.6 \sim 22.6 \text{Nm} (1.9 \sim 2.3 \text{ kgf.m}, 13.7 \sim 16.6 \text{lb-ft})$

⚠CAUTION

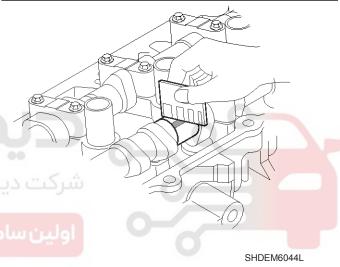
Do not turn the camshaft.

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

Bearing oil clearance

Standard : $0.027 \sim 0.058$ mm ($0.0011 \sim 0.0023$ in)

Limit: 0.1mm (0.0039in)



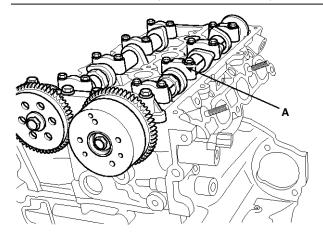
If the oil clearance is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

EM-53

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

Camshaft end play

Standard : $0.1 \sim 0.2$ mm ($0.0039 \sim 0.0079$ in)



SHDFM6089D

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

3) Remove the camshafts.



Continuous Variable Valve Timing(CVVT) Assembly

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

MOTICE

- Wrap around it with a shop rag and the likes, because the oil splashes.
- After releasing the pin, you can turn the CVVT assembly for advance by hand.
- If there may be much air leakage, the pin can not be released.
- 5) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
 - Depending on the air pressure, the CVVT assembly will turn to the advance side.
 - Also, under the condition that the pressure
 can be hardly applied because of the air
 leakage from the port, there may be the case
 that the lock pin could be hardly released.
- 6) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 25°

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

Engine Mechanical System

Reassembly

MNOTICE

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- · Replace oil seals with new ones.
- 1. Install the valves.
 - 1) Install the spring seats.
 - 2) Using the SST (09222 29000), push in a new oil seal.

MOTICE

Do not reuse old valve stem oil seals.

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

ACAUTION

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

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

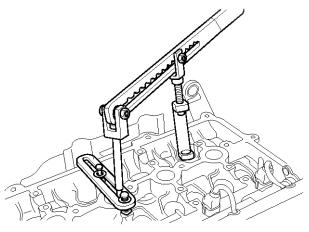
MOTICE

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

 Using the SST(09222 - 3K000, 09222 - 3K100), compress the spring and install the retainer locks.

After installing the valves ensure that the retainer

After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

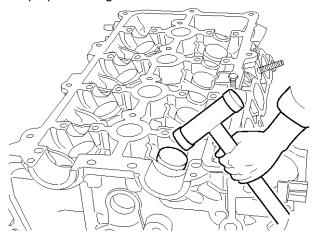


STDEM9032D

ACAUTION

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

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



SHDEM6172D

Install the MLA(Mechanical lash adjuster)s.
 Check that the MLA rotates smoothly by hand.

MOTICE

All the MLAs should be installed in its original position.

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EM-55

Installation

MNOTICE

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- Always use a new cylinder head bolt.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC.
- 1. Install the cylinder head assembly.
 - 1) Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
 - Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.



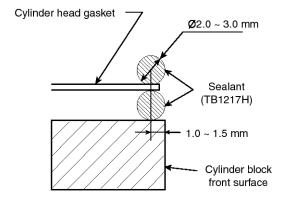
SHDEM6091D

MNOTICE

Refer to the illustration for applying sealant.

Width: $2.0 \sim 3.0$ mm $(0.0787 \sim 0.1181$ in.) **Position:** $1.0 \sim 1.5$ mm $(0.0394 \sim 0.0591$ in.)

Specification: Three bond 1217H

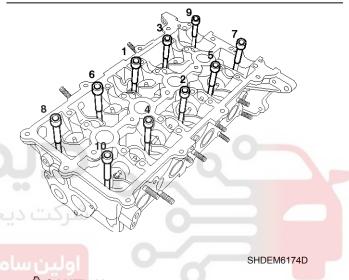


SHDEM6017L

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

Tightening torque:

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 90~95° + 100~105°



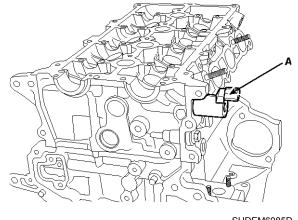
ACAUTION

Always use new cylinder head bolts.

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

Tightening torque:

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



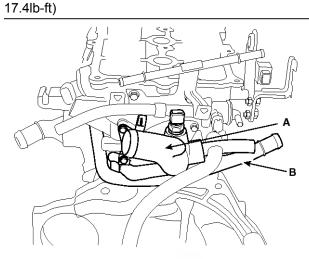
SHDEM6085D

Engine Mechanical System

5. Tighten the mounting bolts for the water temperature control assembly(A) after installing the heater pipe(B).

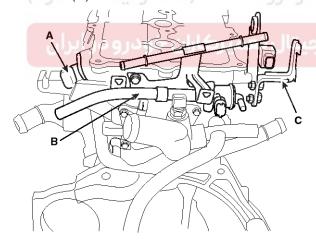
Tightening torque:

M6 bolts : $9.8 \sim 11.8$ N.m ($1.0 \sim 1.2$ kgf.m, $7.2 \sim 8.7$ lb-ft) M8 bolts : $18.6 \sim 23.5$ N.m ($1.9 \sim 2.4$ kgf.m, $13.7 \sim 11.5$ ft)



SFDEM8014L

 Connect the camshaft position sensor(CMP) connector(A) and install the purge control solenoid valve(PCSV) bracket(B) and the module hanger bracket(C).



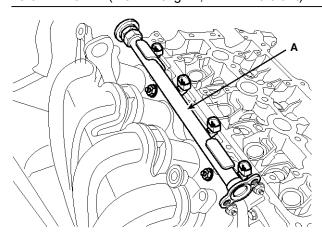
SFDEM8013L

- 7. Install the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
- 8. Install the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)

9. Install the delivery pipe assembly(A).

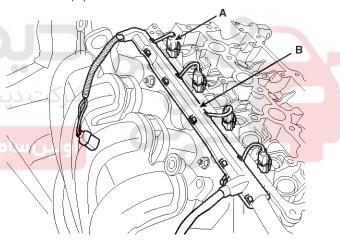
Tightening torque:

 $19.6 \sim 24.5$ N.m ($2.0 \sim 2.5$ kgf.m, $14.4 \sim 18.0$ lb-ft)



SHDEM6080D

10.Install the injector connector(A) and harness bracket(B).



SHDEM6170D

- 11. Install the camshafts.
 - 1) Before installing, apply engine oil on journals.

⚠CAUTION

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

2) After installing, check the valve clearance.

EM-57

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

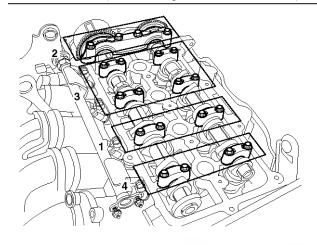
Tightening torque:

M6 bolts:

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

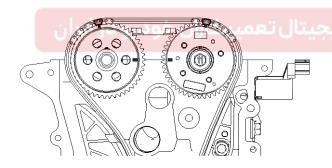
M8 bolts:

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



STDEM9023D

13. Align the timing marks of the camshaft sprocket with the upper surface of the cylinder head to make No.1 cylinder be positioned at TDC.



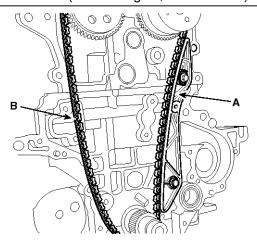
SFDEM8026L

- 1) Check the dowel pin of the crankshaft for facing upside of the engine at this monent.
- 2) Install the timing chain guide(A).

14. After installation of the chain guide(A), reassemble the timing chain(B).

Tightening torque:

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



SHDEM6076E

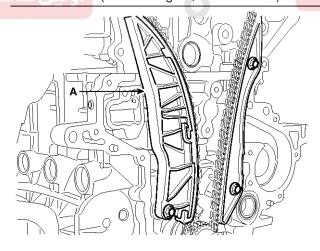
1) When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.

Order : Crankshaft sprocket → Timing chain guide → Intake camshaft sprocket → Exhaust camshaft sprocket.

15. Install the chain tensioner arm(A).

Tightening torque:

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



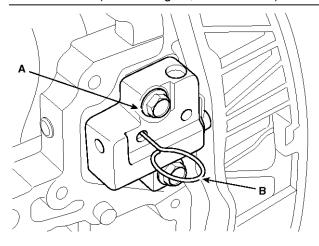
STDEM9035D

Engine Mechanical System

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

Tightening torque:

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



SHDEM6072D

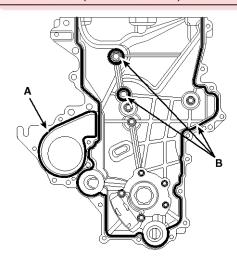
MOTICE

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

17. Install the timing chain cover.

- 1) Before installing, remove the hardened sealant from the cylinder block and ladder frame surface.
- 2) Apply the liquid gasket(1217H) on the surface between the cylinder head and the cylinder block.

Width: $3 \sim 5 \text{mm} (0.118 \sim 0.197 \text{in.})$



STDEM9044D

3) Apply the liquid gasket, THREE BOND 1282B (A) on the water pump contact parts of the timing chain cover and THREE BOND 1217H (B) on the rest parts. Reassemble the cover within 5 minutes.

Width: $3.5 \sim 4.5 \text{ mm} (0.1378 \sim 0.1772 \text{ in.})$

ACAUTION

Remove oil or dust on the surface surely.

4) Align the dowel pin of the cylinder block and the holes of the oil pump.

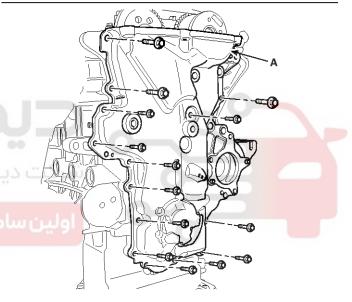
Tightening torque:

12mm bolts:

 $18.6 \sim 23.5 \text{N.m} (1.9 \sim 2.4 \text{kgf.m}, 13.7 \sim 17.4 \text{lb-ft})$

10mm bolts:

 $9.8 \sim 11.8 \text{N.m} \ (1.0 \sim 1.2 \text{kgf.m}, \ 7.2 \sim 8.7 \text{lb-ft})$



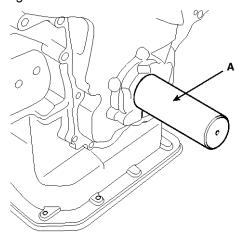
STDEM9027D

ACAUTION

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

EM-59

18. Using the SST(09455-21200) (A), reassemble the timing chain oil seal.

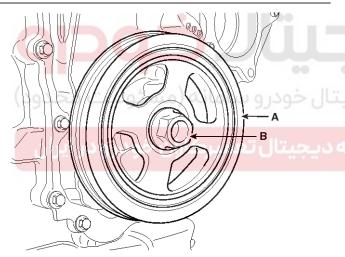


SHDEM6073D

19. Install the crankshaft pulley(A).

Tightening torque:

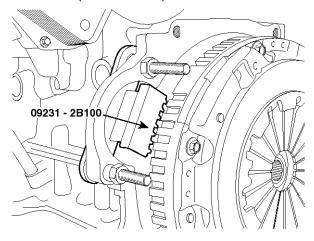
127.5 ~ 137.3N.m (13.0 ~ 14.0kgf.m, 94.0 ~ 101.3lb-ft)



SHDEM6028D

MOTICE

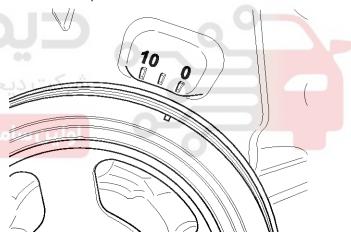
When installing the pulley, remove the starter and fix the SST(09231-2B100).



SHDEM6182D

MOTICE

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



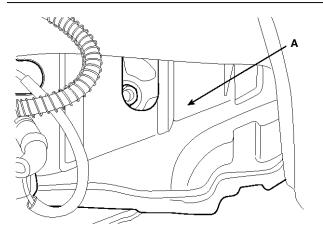
SHDEM6033D

Engine Mechanical System

20. Install side cover(A).

Tightening torque:

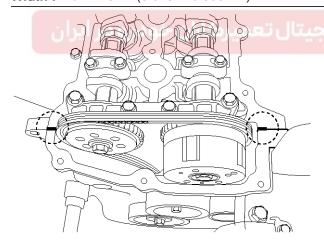
 $8.8 \sim 10.8 \text{N.m} \; (0.9 \sim 1.1 \text{kgf.m}, \, 6.5 \sim 8.0 \text{lb-ft})$



SHDEM6071D

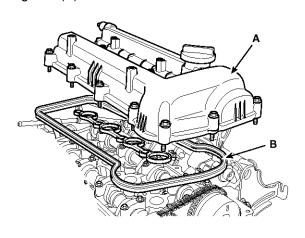
- 21. Install front right wheel and tire.
- 22. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
- 23. After applying the liquid gasket, THREE BOND 1217H on the cylinder head cover, reassemble the cover within five minutes.

Width: $2.0 \sim 2.5 \text{mm} (0.0787 \sim 0.0984 \text{in.})$



STDEM9029D

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



STDFM9041D

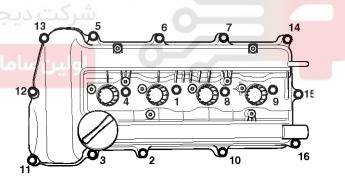
ACAUTION

Do not reuse the disassembled gasket.

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

Tightening torque:

1st step - $3.9 \sim 5.9$ N.m (0.4 ~ 0.6 kgf.m, $2.9 \sim 4.3$ lb-ft) 2nd step - $7.8 \sim 9.8$ N.m (0.8 ~ 1.0 kgf.m, $5.8 \sim 7.2$ lb-ft)



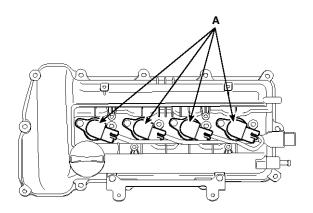
SHDEM6078D

EM-61

26. Install the ignition coils(A).

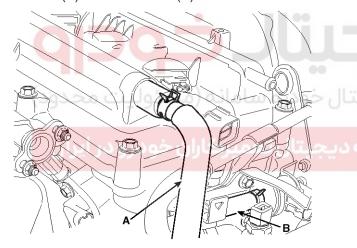
Tightening torque:

 $9.8 \sim 11.8 \text{N.m} \; (1.0 \sim 1.2 \text{kgf.m}, \, 7.2 \sim 8.7 \text{lb-ft})$



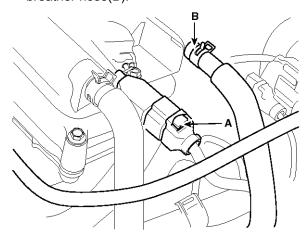
SEDEM7302L

27.Install the positive crankcase ventilation(PCV) hose(A) and PCSV hose(B).



SEDEM7305L

28. Connect the ignition coil connector(A) and the breather hose(B).

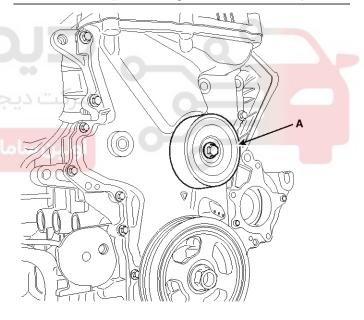


SEDEM7304L

29. Install the drive belt idler(A).

Tightening torque:

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



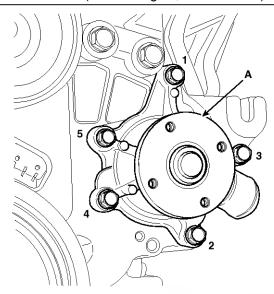
STDEM9025D

Engine Mechanical System

30. Install the water pump(A) with a gasket. Tighten bolts with the order below.

Tightening torque:

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

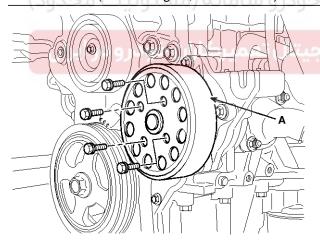


STDEM9040D

31. Install the water pump pulley(A).

Tightening torque:

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



SHDEM6024D

ACAUTION

Tighten the bolts diagonally.

32. Install the engine support bracket(A).

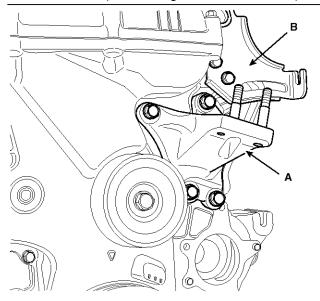
Tightening torque:

 $29.4 \sim 41.2 \text{N.m} (3.0 \sim 4.2 \text{kgf.m}, 21.7 \sim 30.4 \text{lb-ft})$

33. Install the alternator bracket(B).

Tightening torque:

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



SHDEM6040

34. Supporting the engine with a jack, install the engine mounting bracket(A) and the ground line(B).

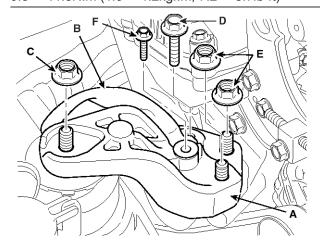
Tightening torque:

Bolt(C):

 $63.7 \sim 83.4$ N.m ($6.5 \sim 8.5$ kgf.m, $47.0 \sim 61.5$ lb-ft) Bolt, Nuts(D, E) :

49.0 ~ 58.8N.m (5.0 ~ 6.0kgf.m, 36.2 ~ 43.4lb-ft)
Bolt(F):

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



SHDEM6179D

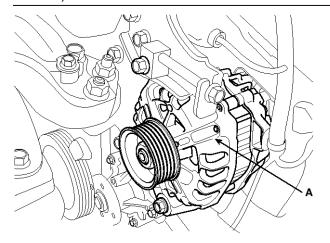
EM-63

35. Install the alternator(A).

Tightening torque:

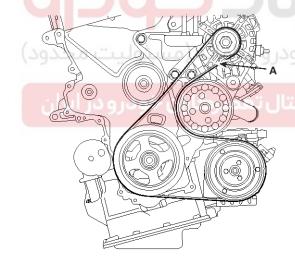
12mm bolt - 19.6 \sim 26.5N.m (2.0 \sim 2.7kgf.m, 14.5 \sim 19.5lb-ft)

14mm bolt - 29.4 \sim 41.2N.m (3.0 \sim 4.2kgf.m, 21.7 \sim 30.4lb-ft)



SHDEM6069D

36. Install the drive belt(A).

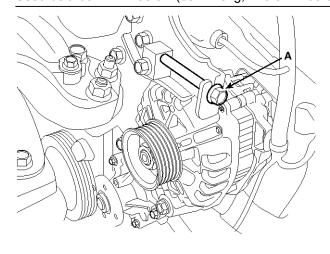


STDEM9024D

37. Adjust tension by tightening the alternator tension adjust bolt(A). (Refer to Charging system in EE Group).

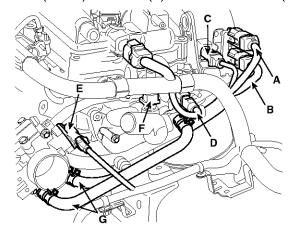
Tension

New belt: 882.6 \sim 980.7N (90 \sim 100kg, 198.4 \sim 220.5lb) Used belt: 637.4 \sim 735.5N (65 \sim 75kg, 143.3 \sim 165.3lb)



STDEM9045D

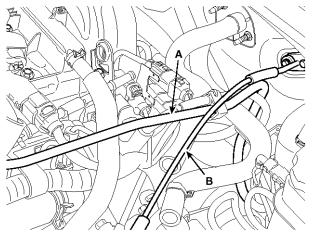
- 38. Connect the connectors on the cylinder head and install the clamps.
- Connect the front(A) and the rear(B) oxygen sensor connector.
 - Connect the ignition coil condenser connector(C) and the purge control solenoid valve(PCSV) conector(D).
 - 3) Connect the throttle position sense (TPS) connector(E).
 - 4) Connect the engine coolant temperature sensor (ECTS) connector(F) and the water hose(G).



SFDEM8012L

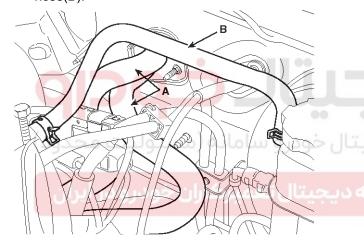
Engine Mechanical System

39.Install the fuel hose(A) and the accelerator cable(B).



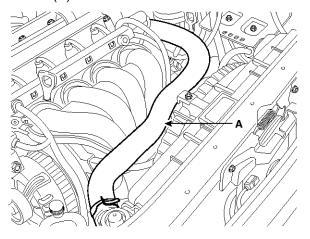
SHDEM6013D

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

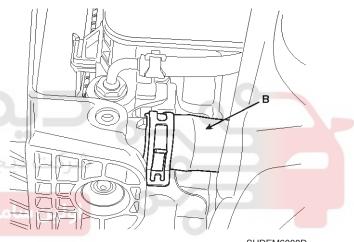


SHDEM6012D

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



SEDEM7003L

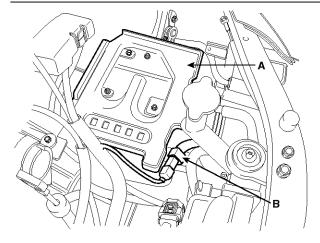


SHDEM6008D

42.Install the battery tray(A) and connect front connector(B).

Tightening torque:

 $8.8 \sim 10.8 \text{N.m} \; (0.9 \sim 1.1 \text{kgf.m}, \, 6.5 \sim 8.0 \text{lb-ft})$



SEDEM7002L

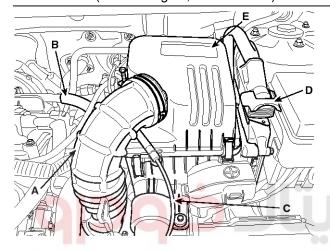
EM-65

43. Install the air cleaner assembly.

- 1) Connect the bleeder hose (B) to the air cleaner hose (A).
- 2) Install the accelerator cable(A) to the air cleaner assembly.
- 3) Connect the power control module (PCM) connectors(D).
- 4) Install the air cleaner assembly (E)

Tightening torque:

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

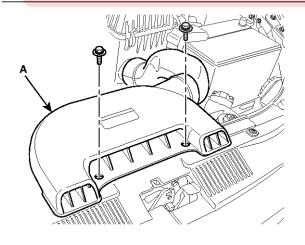


SHDEM6004I

44. Install the air duct(A).

Tightening torque:

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

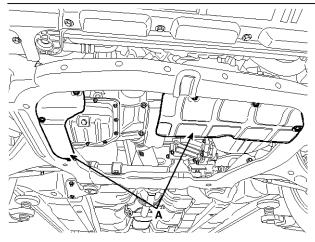


SFDM38001L

45. Install the under cover(A).

Tightening torque:

 $8.8 \sim 10.8$ N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 8.0 lb-ft)

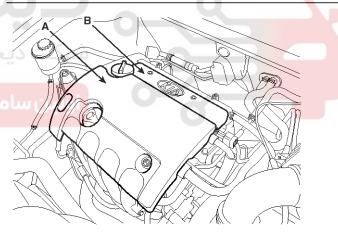


SHDEM6003D

46.Install the engine center cover(B) and the engine cover(A).

Tightening torque:

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



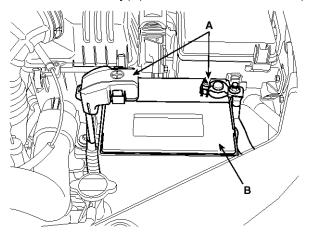
STDEM9053D

ACAUTION

Install the cover surely before driving.

Engine Mechanical System

47. Install the battery(B) and connect the terminals(A).



SHDEM6001D

- 48. Refill engine coolant and engine oil.
- 49. Start engine and check for leakage.
- 50. Recheck the level of engine oil and coolant.





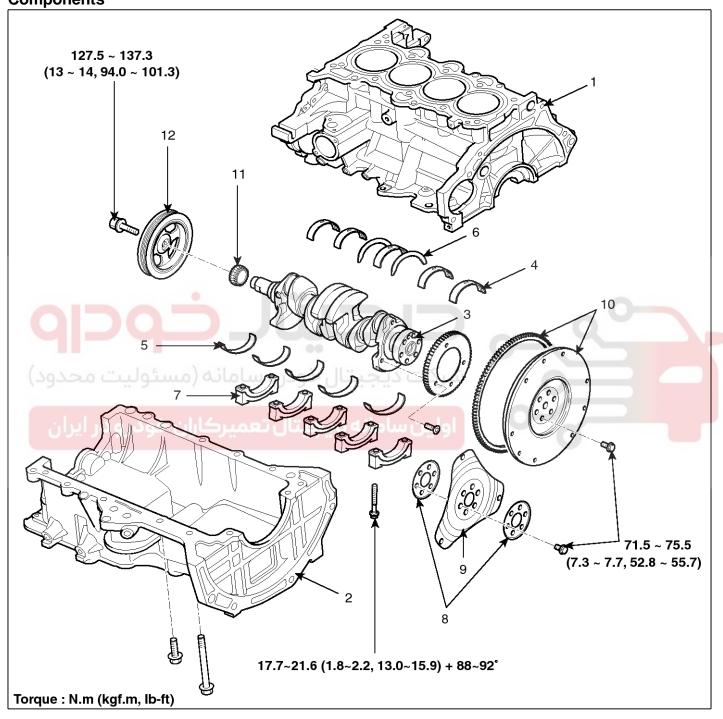
Cylinder Block

EM-67

Cylinder Block

Cylinder Block

Components

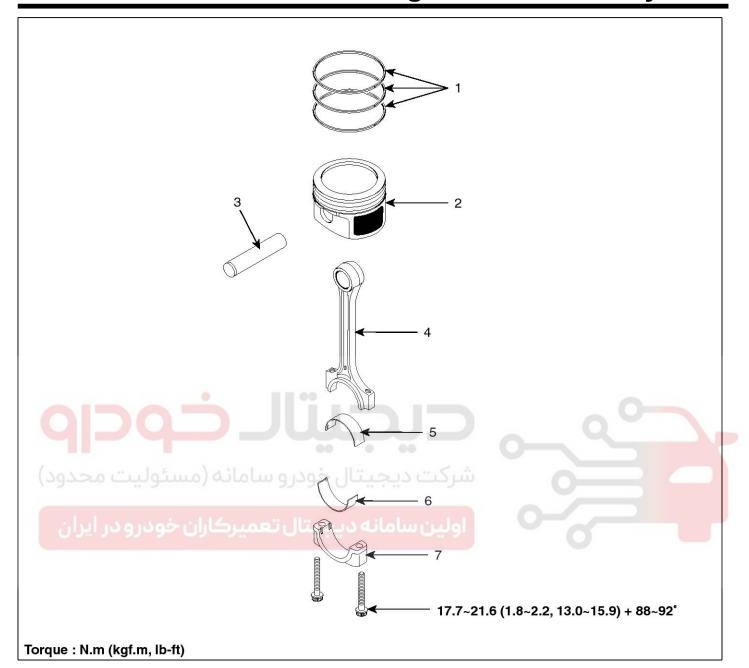


STDEM9015L

- 1. Cylinder block
- 2. Ladder freme
- 3. Crankshaft
- 4. Crankshaft upper bearing
- 5. Crankshaft lower bearing
- 6. Thrust bearing
- 7. Main bearing cap
- 8. Adapter plate

- 9. Drive plate
- 10. Fly wheel & ring gear
- 11. Crankshaft sproket
- 12. Crankshaft pulley

Engine Mechanical System



STDEM9016L

- 1. Piston ring
- 2. Piston
- 3. Piston pin
- 4. Connecting rod

- 5. Connecting rod upper bearing
- 6. Connecting rod lower bearing
- 7. Connecting rod bearing cap

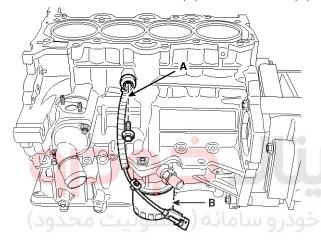
Cylinder Block

EM-69

Disassembly

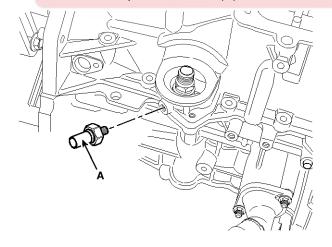
Engine removal is required for this procedure. (Refer to Engine and transaxle assembly removal in this group)

- 1. M/T : Remove the fly wheel.
- 2. A/T: Remove the drive plate.
- 3. Install the engine to engine stand for disassembly.
- 4. Remove the timing chain. (Refer to Timing chain in this group)
- 5. Remove the cylinder head. (Refer to Cylinder head in this group)
- 6. Remove the oil level gauge tube.
- 7. Remove the knock sensor(A) and the oil filter(B).



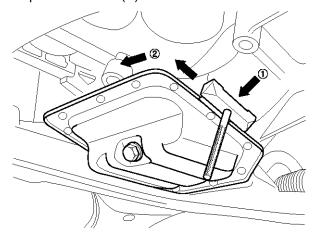
SHDEM6045D

8. Remove the oil pressure switch(A).



SHDEM6048D

9. Using the SST (09215-3C000), remove the oil pressure switch(A).

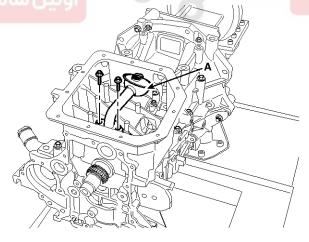


SFDEM8016L

ACAUTION

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

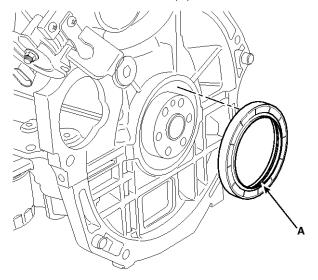
10. Remove the oil screen(A).



SHDEM6047D

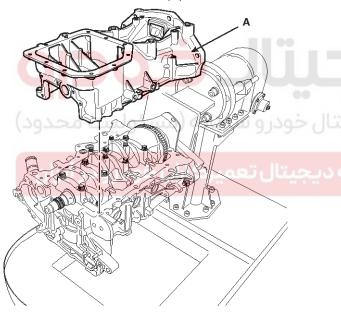
Engine Mechanical System

11. Remove the rear oil seal(A).



SHDEM6050D

12. Remove the ladder frame(A).



SHDEM6049D

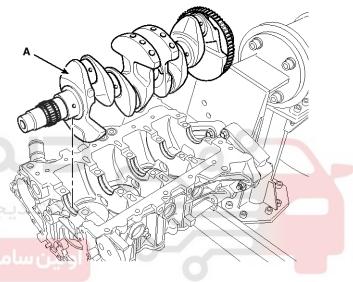
- 13. Check the connecting rod end play.
- 14. Remove the connecting rod caps and check oil clearance.
- 15. Remove the piston and connecting rod assemblies.
 - 1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
 - Push the piston, connecting rod assembly and upper bearing through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

MOTICE

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- 16. Remove the crankshaft bearing cap and check oil clearance.
- 17. Check the crankshaft end play.
- 18.Lift the crankshaft(A) out of the engine, being careful not to damage journals.

MOTICE

Arrange the main bearings and thrust bearings in the correct order



SHDEM6051D

19. 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.

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

MNOTICE

Arrange the piston rings in the correct order only.

21. Remove the connecting rod from the piston.

Using a press, remove the piston pin from piston.

(Press-in load : $500 \sim 1,500 \text{kg} (1,102 \sim 3,306 \text{lb})$)

Cylinder Block

EM-71

Inspection

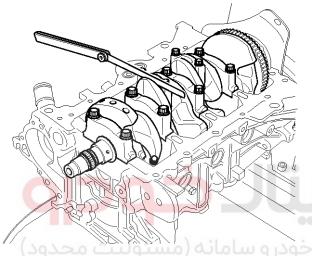
Connecting Rod And Crankshaft

 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 \sim 0.25mm (0.0039 \sim 0.0098in)

Maximum: 0.35mm (0.0138in)



SHDEM6052D

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

Tightening torque:

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

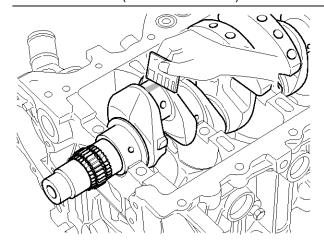
MOTICE

Do not turn the crankshaft.

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

Standard oil clearance

 $0.032 \sim 0.052$ mm (0.0013 ~ 0.0020 in)



SHDEM6053D

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

Recheck the oil clearance.

⚠CAUTION

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

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

MOTICE

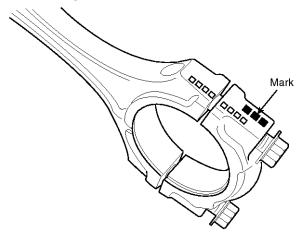
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and restart over.

⚠CAUTION

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

Engine Mechanical System

Connecting rod mark location

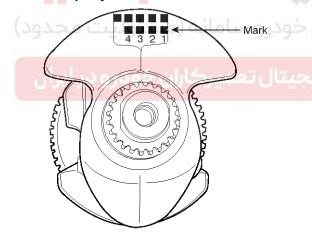


SFDEM8028L

Discrimination of connecting rod

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

Crankshaft pin journal mark location

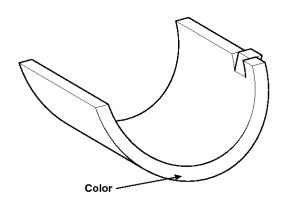


STDEM9037L

Discrimination of crankshaft pin journal

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

Connecting rod bearing color location



SHDEM6026L

Discrimination of connecting rod bearing

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

11) Select the bearing by using selection table.

Connecting rod bearing selection table

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

Cylinder Block

EM-73

- 3. Check the connecting rods.
 - When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
 - Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
 - 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

MOTICE

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

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

Tightening torque:

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

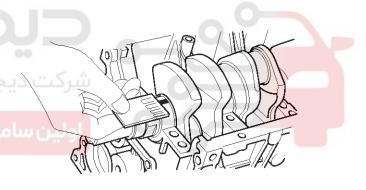
MOTICE

Do not turn the crankshaft.

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

Standard oil clearance:

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



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 in this Group).

Recheck the oil clearance.

⚠CAUTION

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

Engine Mechanical System

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

Recheck the oil clearance.

MNOTICE

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

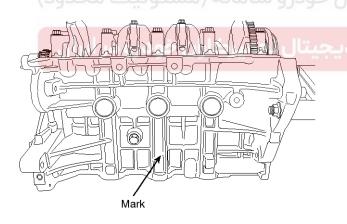
ACAUTION

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

Cylinder block crankshaft journal bore mark location

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

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

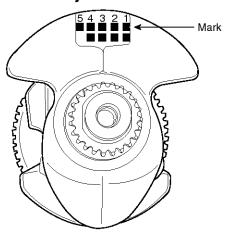


SHDEM6020L

Discrimination of cylinder block crankshaft journal bore

Mark	Cylinder block crankshaft journal bore i nner diameter				
Α	52.000 ~ 52.006mm (2.0472 ~ 2.0475in)				
В	52.006 ~ 52.012mm (2.0475 ~ 2.0477in)				
С	52.012 ~ 52.018mm (2.0477 ~ 2.0479in)				

Crankshaft main journal mark location



STDEM9038L

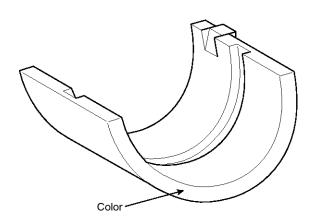
Discrimination of crankshaft main journal

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

Cylinder Block

EM-75

Crankshaft main bearing color location



SHDEM6027L

Discrimination of crankshaft main bearing

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

8) Select the bearing by using selection table.

Crankshaft main bearing selection table

		Cylinder block crankshaft jou- rnal bore mark				
		А	В	С		
	1	E (Red)	D (Green)	C (None)		
Crank shaft main journ- al mark	2	D (Green)	C (None)	B (Black)		
ai mark	3	C (None)	B (Black)	A (Blue)		

5. Check the crankshaft end play.

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

End play

Standard: $0.05 \sim 0.25 \text{mm} (0.0020 \sim 0.0098 \text{in})$

Limit: 0.30mm (0.0118in)

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

Engine Mechanical System

Cylinder Block

- Remove the gasket material.
 Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- Clean the cylinder block
 Using a soft brush and solvent, thoroughly clean the cylinder block.
- Inspect the top surface of cylinder block for flatness.
 Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface Standard :

Less than 0.05mm (0.0020in)

Less than 0.02mm (0.0008in) - 100mm \times 100mm



SHDEM6042D

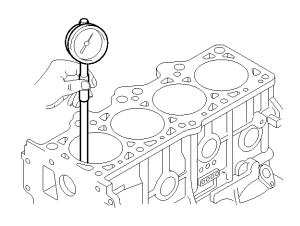
Inspect the cylinder bore.
 Visually check the cylinder for vertical scratchs.
 If deep scratchs are present, replace the cylinder block.

5. Inspect the cylinder bore diameter.

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

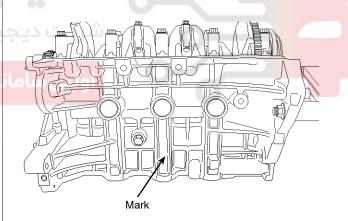
Standard diameter:

 $77.00 \sim 77.03$ mm (3.0315 ~ 3.0327 in)



ECKD318A

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



SHDEM6022L

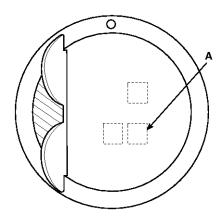
Discrimination of cylinder bore size

Mark	Cylinder bore inner diameter
А	77.00 ~ 77.01mm (3.0315 ~ 3.0319in)
В	77.01 ~ 77.02mm (3.0319 ~ 3.0323in)
С	77.02 ~ 77.03mm (3.0323 ~ 3.0327in)

Cylinder Block

EM-77

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



SHDEM9103D

Discrimination of piston outer diameter

Mark	Piston outer diameter					
А	76.97 ~ 76.98mm (3.0303 ~ 3.0307in)					
В	76.98 ~ 76.99mm (3.0307 ~ 3.0311in)					
С	76.99 ~ 77.00mm (3.0311 ~ 3.0315in)					

8. Select the piston related to cylinder bore class.

Piston -to-cylinder clearance :

 $0.02 \sim 0.04$ mm ($0.0008 \sim 0.0016$ in)

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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.

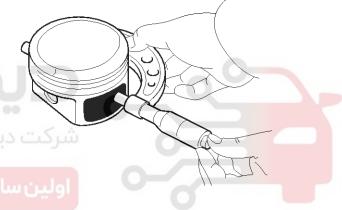
MOTICE

Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 33.9mm(1.5697in) from top land of the piston.

Standard diameter:

76.97 ~ 77.00mm (3.0303 ~ 3.0315in)



SHDEM6028L

Engine Mechanical System

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

Piston-to-cylinder clearance:

 $0.02 \sim 0.04$ mm ($0.0008 \sim 0.0016$ in)

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

Oil ring : $0.06 \sim 0.15$ mm ($0.0024 \sim 0.0059$ in)

No.1 ring: 0.1mm (0.0039in) No.2 ring: 0.1mm (0.0039in) Oil ring: 0.2mm (0.0079in)

No.1 ring : $0.03 \sim 0.07$ mm ($0.0012 \sim 0.0028$ in) No.2 ring : $0.03 \sim 0.07$ mm ($0.0012 \sim 0.0028$ in)



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

5. Inspect the piston ring end gap.

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

Piston ring end gap

Standard

No.1 ring: $0.14 \sim 0.28$ mm $(0.0079 \sim 0.0138$ in) No.2 ring : $0.30 \sim 0.45$ mm ($0.0118 \sim 0.0177$ in) Oil ring : $0.20 \sim 0.70$ mm $(0.0079 \sim 0.0276$ in)

Limit

No.1 ring: 0.3mm(0.0118in) No.2 ring: 0.5mm(0.0197in) Oil ring: 0.8mm(0.0315in)



ACJF112A

Cylinder Block

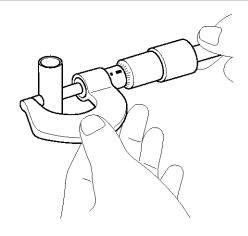
EM-79

Piston Pins

1. Measure the outer diameter of piston pin

Piston pin diameter :

18.001 ~ 18.006mm (0.7087 ~ 0.7089in)



ECKD001Z

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

Piston pin-to-piston clearance :

 $0.010 \sim 0.020$ mm $(0.0004 \sim 0.0008$ in)

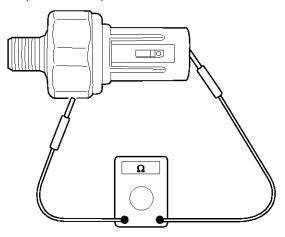
 Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

Piston pin-to-connecting rod interference:

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

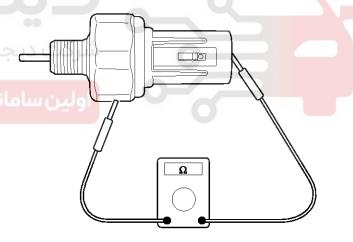
Oil Pressure Switch

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



SHDEM6059D

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.



SHDEM6157

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

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

Engine Mechanical System

Reassembly

MNOTICE

- 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
 - The piston front mark and the connecting rod front mark must face the timing chain side of the engine.



SHDEM6009L

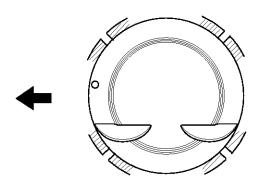
Install the piston rings.

MOTICE

The engine's piston ring sets are classified according to the displacement (1.4L, 1.6L), fuel type (Leaded, Unleaded) and application of the ISG(Idle Stop & Go) function.

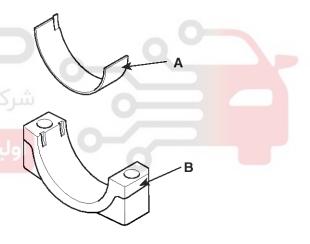
Identify the engine type before selecting the piston ring set.

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



SEDEM7404L

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



SHDEM6031L

Cylinder Block

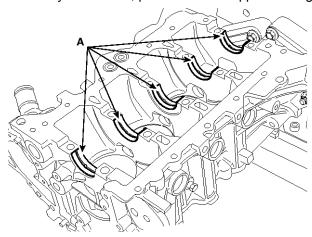
EM-81

4. Install the crankshaft main bearings.

MOTICE

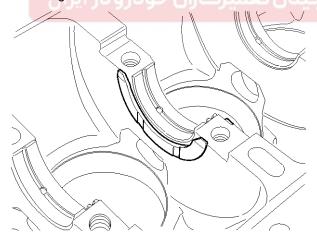
Upper bearings have an oil groove of oil holes; Lower bearings do not.

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



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

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



SHDEM6061D

- 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.

MOTICE

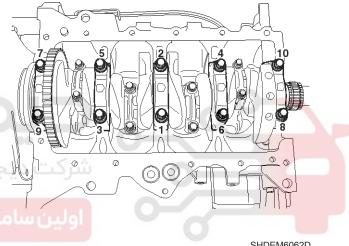
The main bearing cap bolts are tightened in 2 progressive steps.

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:

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



SHDEM6062D

Do not reuse the main bearing cap bolts.

3) Check that the crankshaft turns smoothly.

Engine Mechanical System

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

MOTICE

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

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

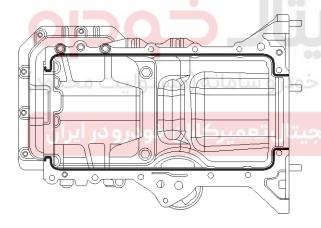
Tightening torque:

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

ACAUTION

Do not reuse the connecting rod cap bolts.

11. Apply the sealant on the ladder frame.



SLDEM7203D

MNOTICE

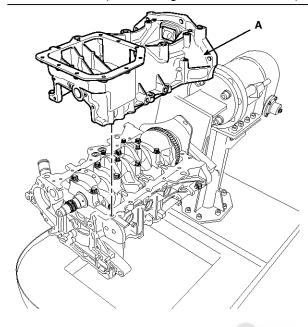
 Apply the sealant, THREE-BOND 1217H on the ladder frame rail portion and install it with in five minutes.

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

 Apply sealant along the inner line of the bolt holes. 12. Install the ladder frame(A).

Tightening torque:

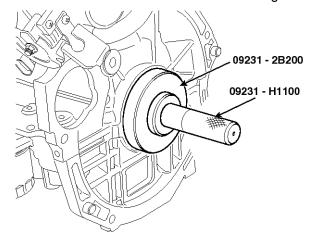
 $18.6 \sim 24.2$ N.m ($1.9 \sim 2.4$ kgf.m, $13.7 \sim 17.4$ lb-ft)



SHDEM6049D

CAUTION

- Apply the sealant, THREE-BOND 1217H on the ladder frame rail portion and install it with in five minutes.
- Apply sealant along the inner line of the bolt holes.
- 13. Install the rear oil seal.
 - 1) Apply engine oil to a new oil seal lip.
 - 2) Using the SST(09231-H1100, 09231-2B200) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



STDEM9036N

Cylinder Block

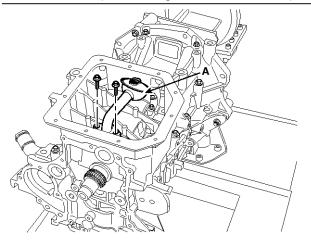
EM-83

14. Install the oil screen.

Install a new gasket and oil screen with 2 bolts.

Tightening torque:

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



SHDEM6047D

15. Install the oil pan.

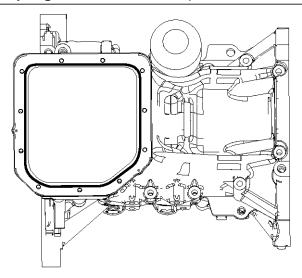
1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

MOTICE

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

 Apply liquid gasket with the width of Ø3mm, starting 1mm-away position from the inner rounding of the oil pan rail.

Liquid gasket: TB 1217H or equivalent



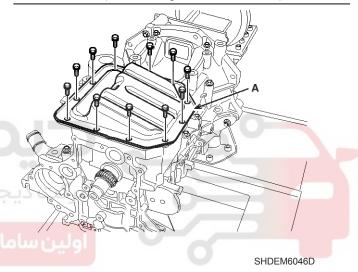
SHDEM6033L

MOTICE

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

Tightening torque:

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

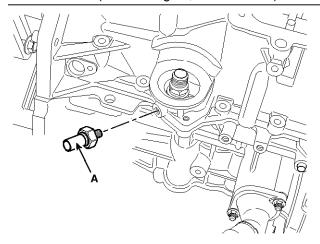


Engine Mechanical System

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

Tightening torque:

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

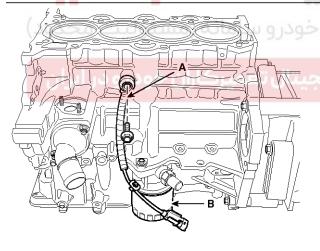


SHDEM6048D

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

Tightening torque:

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



SHDEM6045D

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

Tightening torque:

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

- 19.Install the cylinder head. (Refer to Cylinder head in this group)
- 20. Install the timing chain. (Refer to Timing chain in this group)
- 21. Remove the engine stand.
- 22. A/T :install the drive plate.

Tightening torque:

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

23. M/T :install the fly wheel.

Tightening torque:

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

24. Install the engine. (Refer to Engine and transaxle assembly in this group)

EM-85

Cooling System

Coolant

Engine Coolant Refilling And Bleeding

WARNING

Never remove the radiator cap when the engine is hot.

Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

ACAUTION

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. Remove the radiator cap.
- 2. Loosen the drain plug, and drain coolant.
- 3. Tighten the radiator drain plug securely.
- Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the "F" mark with coolant mixture.(coolant 5: water 5)
- Fill coolant mixture into the radiator to the base of filler neck. Gently squeeze the upper/lower hoses of radiator so as to bleed air easily.

MOTICE

- Mix the recommended antifreeze with an equal amount of water in a clean container.
- · 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 concentration 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.

- Start engine and allow coolant mixture to circulate.
 When the cooling fan operates and coolant circulates, refill coolant through the radiator filler
- 7. Repeat 6 until the cooling fan 3~5 times and bleed air sufficiently out of the cooling system.
- 8. Install the radiator cap and fill the reservoir tank to the "F" line with coolant.
- 9. Run the vehicle under idle until the cooling fan operates $2\sim3$ times.
- 10. Stop the engine and allow coolant to cool.
- 11. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

MOTICE

neck.

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

Coolant capacity:

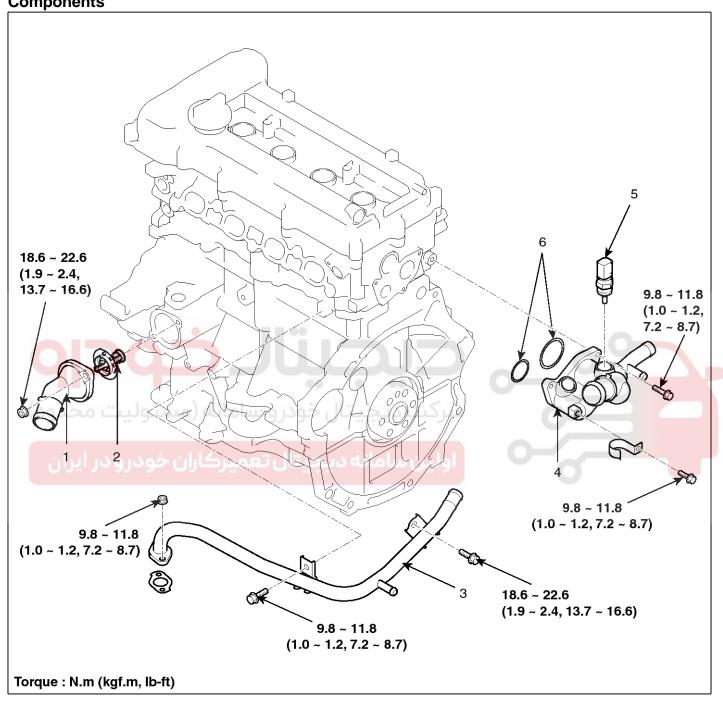
 $5.5 \sim 5.8$ liters($5.81 \sim 6.13$ US qt, $4.84 \sim 5.10$ Imp qt)

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Engine Mechanical System

Thermostat

Components



STDEM9017L

- 1. Water inlet fitting
- 2. Thermostat
- 3. Heater pipe

- 4. Water temp control assembly
- 5. Water temperature sensor
- 6. Gasket

EM-87

Removal

MOTICE

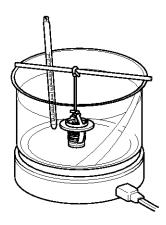
Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

- 1. Drain engine coolant so that its level would be under the thermostat height.
- 2. Remove the radiator lower hose.
- 3. Remove the water inlet fitting(A) and thermostat(B).



Inspection

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



ECKD503B

2. Check the valve opening temperature.

Valve opening temperature : 88°C (190.4°F) Full opening temperature : 101°C (213.8°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.

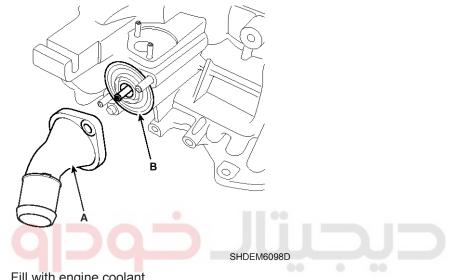
Engine Mechanical System

Installation

- 1. Place the thermostat in the block.
 - 1) Install the thermostat(B) with the jiggle valve
 - 2) Install a new gasket to the thermostat(B).
- 2. Install the water inlet fitting(A).

Tightening torque:

 $18.6 \sim 23.5 \text{N.m} (1.9 \sim 2.4 \text{kgf.m}, 13.7 \sim 17.4 \text{lb-ft})$



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





EM-89

Troubleshooting

Symptoms		Possible Causes		Remedy			
Coolant leakage	•	From the therm- ostat gasket	Check the mounting bolts	•	Check the torque of the mounting bolts	•	Retighten the bolts and check leakage again.
			Check the gasket for damage	•	Check gasket or seal for damage	•	Replace gaskets and reuse the thermostat.
Cooled excessively		Low heater performance (cool air blowed-out) Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	•	Insufficient coolant or leakage.	•	After refilling coolant, recheck.
			GDS check & Starting engine	• * ys	Check DTCs Check connection of the fan clutch or the fan motor. If the fan clutch is alwaconnected, there will be noise at idle.	•	Check the engine coolant sensor, wiring and connectors. Replace the componants
٩D			Remove the thermostat and inspect		Check if there are dusts or chips in the thermostat valve. Check adherence of the thermostat.		Clean the thermostat valve and reuse the thermostat. Replace the thermostat, if it doesn't work properly
Heated excessively	ي رو	Engine overheated Thermogauge indicates 'HI'	Visually check after removing the radiator cap.		Insufficient coolant or leakage. ** Be careful when removing a radiator cap of the overheated vehicle. Check air in cooling system.		After refilling coolant, recheck. Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
			GDS check & Starting engine		Check DTCs Check the fan motor performance as temperature varies. Check if the fan clutch slips. Check the water pump adherence or impeller damaged.	•	Check the engine coolant sensor, wiring and connectors. Check the fan motor, the relay and the connector. Replace the fan clutch, if it doesn't work properly. Replace the water pump, if it doesn't work properly.
			Immerse the thermostat in boiling water and inspection.	* op	After removing the thermostat, check it works properly. Check the thermostatens at the valve opening perature.	•	Replace the thermostat, if it doesn't work properly .

Engine Mechanical System

Water pump

Removal

Water Pump

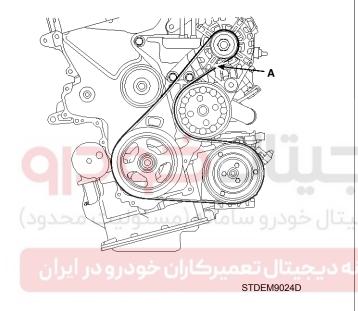
1. Drain engine coolant.

WARNING

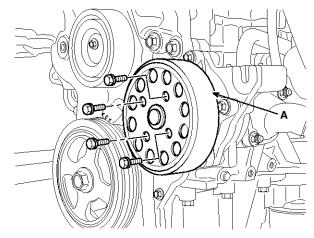
System is under high pressure when the engine is hot

To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Remove the drive belt(A).

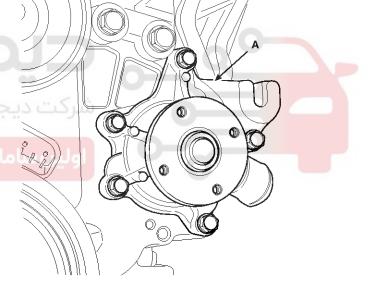


3. Remove the water pump pulley(A).



SHDEM6024D

4. Remove the water pump(A).

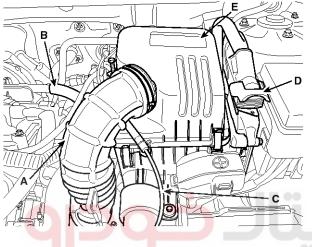


SHDEM6025D

EM-91

Water Temperature Control Assembly

- 1. Drain engine coolant.
- 2. Remove the air cleaner assembly.
 - Disconnect the air cleaner hose(A) and breather hose(B).
 - 2) Remove the accelerator cable(C).
 - 3) Disconnect the powertrain control module(PCM) connector(D).
 - 4) Remove the air cleanerassemlby(E).

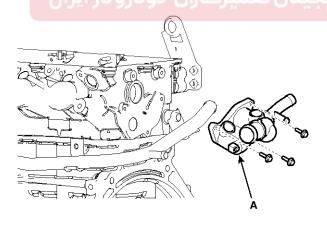


SHDEM6004D

3. Remove the water temperature control assemby(A).

Tightening torque:

 $9.8 \sim 11.7$ N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



SFDEM8021L

4. To install, reverse the removal orders.

ACAUTION

Clean the surface of the water temperature control assembly before installing.

Inspection

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

WNOTICE

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

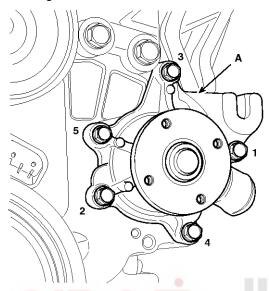


Engine Mechanical System

Installation

- 1. Install the water pump.
 - 1) Install the water pump(A) and a new gasket with the bolts.

Tighten the bolts with the order blow.

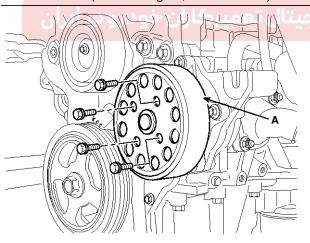


SEDEM7408L

 Install the water pump pulley(A) with the four bolts.

Tightening torque:

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



SHDEM6024D

⚠CAUTION
Tighten the bolts diagonally.

- 2. Install the drive belts.
- 3. Fill with engine coolant.
- 4. Start engine and check for leaks.
- 5. Recheck engine coolant level.



EM-93

Troubleshooting Water Pump

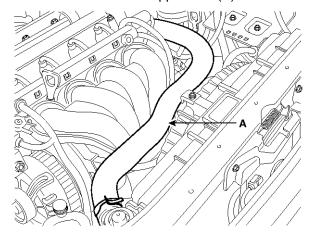
Symptoms		Possil	Remedy	
Coolant leaka- ge	 From the bleed hole of the water pump 	Visually check	Check leaks after about ten-minute wa-	If coolant still leaks, replac- e a water pump.
			rming up.	If leakage stops, reuse the water pump (Do not repla- ce the pump with a new one).
	From gaskets or bolts		Check the tightening of the water pump mounting bolts.	Retighten the mounting bo- lts.
			Check damage of gaskets or inflow of dust.	Replace the gasket and clean dust off.
	From outer surface of water pump		Check the material or any cracks of the water pump.	1
Noise	 From bearings From mechanical seals Inspection with a ste-thoscope gine, check noise with a stethoscope. 			
محدود)	Impeller interferen- ce	• •• جيتال خودرو س	•• ۵– شرکت دب	If there is any noise from the water pump, remove the drive belt and recheck.
در ایران	میرکاران خودرو د	Inspection after rem- oving a drive belt	After removing a water pump and a drive belt, check noise ag-	water pump. Check other
			ain.	If there is no noise, replac- e the water pump with a new one.
		Inspection after rem- oving a water pump	After removing a water pump and a drive belt, check noise again.	between them, replace the
Overheating	Damaged impellerLoosened impeller	Loosened impeller	Corrosion of the imp- eller wing	Check engine coolant. Poor coolant quality / Maintenance check
			Impeller seperation from the shaft	Replace the water pump.

Engine Mechanical System

Radiator

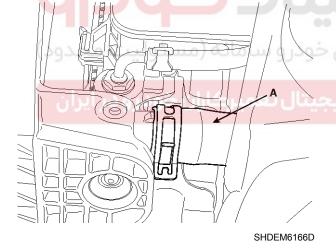
Removal

- Drain the engine coolant.
 Remove the radiator cap to speed draining.
- 2. Remove the radiator upper hose(A).

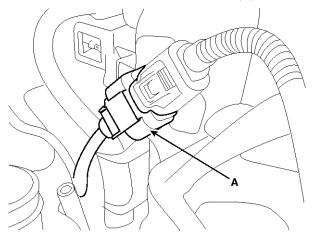


SEDEM7003L

3. Remove the radiator lower hose(A).

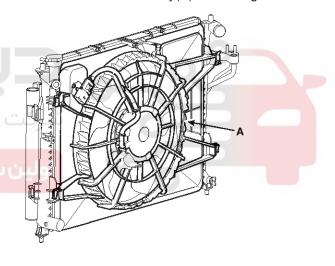


4. Disconnect the fan motor connector(A).



SHDEM6099F

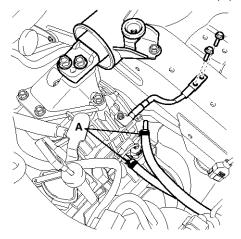
5. Remove the blower assembly(A) for cooling module.



SEDM17400L

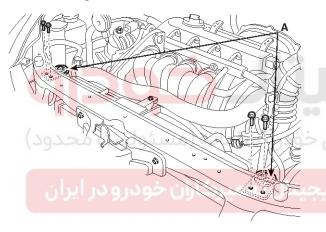
EM-95

6. Disconnect the ATF oil cooler hoses(A).



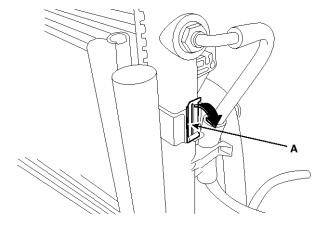
SFDEM8018L

7. Remove the radiator upper bracket(A), then pull up the cooling module.



SFDEM8019L

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

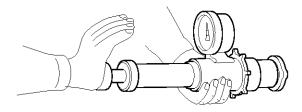


SHDEM6103D

Inspection

Radiator Cap Testing

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



ECKD501X

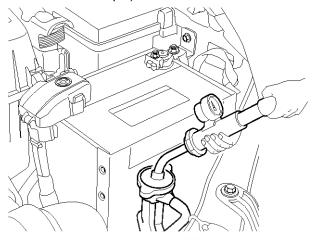
- 2. Apply a pressure of 93.16 \sim 122.58kpa (0.95 \sim 1.25kg/cm², 13.51 \sim 17.78psi).
- 3. Check for a drop in pressure.
- 4. If the pressure drops, replace the cap.



Engine Mechanical System

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 \sim 122.58kpa (0.95 \sim 1.25kg/cm², 13.51 \sim 17.78psi).



SHDM16323L

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

MOTICE

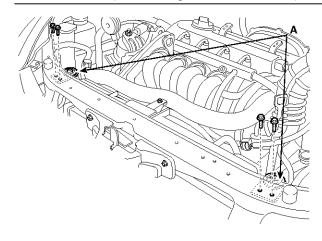
Check for engine oil in the coolant and/or coolant in the engine oil.

Installation

- 1. Install the radiator.
- 2. Install the radiator upper bracket(A).

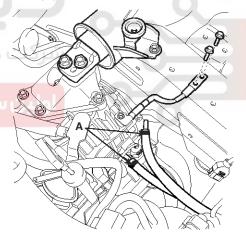
Tightening torque:

 $11.7 \sim 14.7$ N.m (1.2 ~ 1.5 kgf.m, 8.7 ~ 10.8 lb-ft)



SFDEM8019L

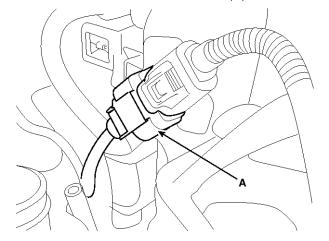
3. Install the ATF(Automatic Transaxle Fluid) oil cooler hoses(A).



SFDEM8018L

EM-97

4. Connect the fan motor connector(A).

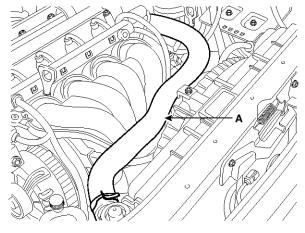


SHDEM6099D

SHDEM6166D

5. Install the radiator lower hose(A).





SEDEM7003L

- 7. Fill with engine coolant.
- 8. Start engine and check for leaks.



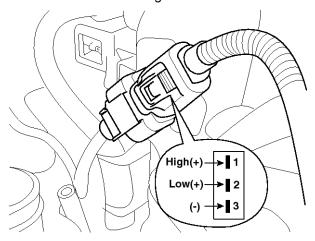


Engine Mechanical System

Cooling Fan Motor Assembly

Inspection

1. Disconnect the cooling fan motor connector.



SEDEM7407L

2. Check that the radiator fan rotates when battery voltage is applied between the terminals.

Cooling fan i- nspection		Cooling	Action		
		1	2	3	••
(agas	24 (ئوويا.	mo) a	اسامان	High spee-
Battery	-			0	d
Battery	در اا	غودرو	0	تعمير	Low speed
Dattery	-			0	Low speed



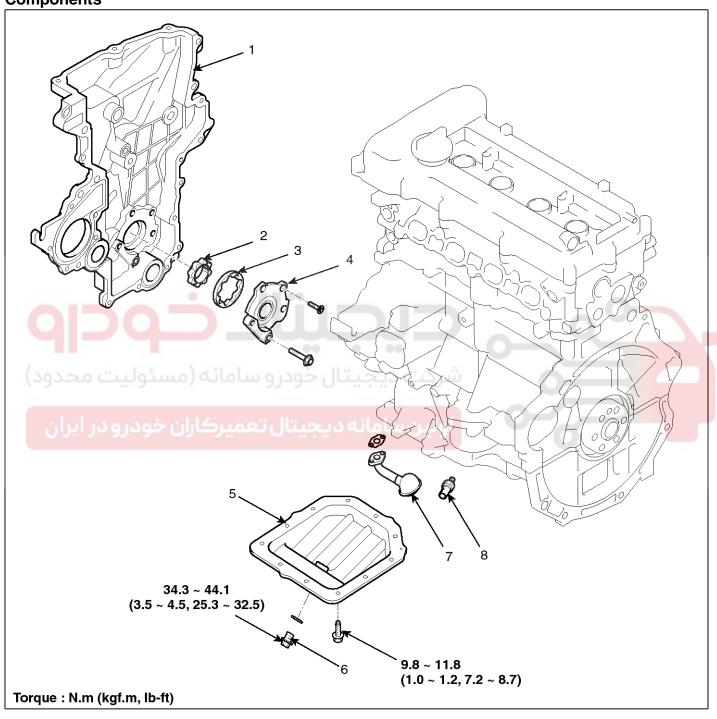
Lubrication System

EM-99

Lubrication System

Oil Pump

Components



STDEM9018L

- 1. Timing chain cover
- 2. Inner roter
- 3. Outer roter
- 4. Pump cover

- 5. Oil pan
- 6. Oil drain plug
- 7. Oil screen
- 8. Oil pressure gauge

Engine Mechanical System

Engine Oil

Oil And Filter Replacement

ACAUTION

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

ديجيتال تعميركاران خودرو در ايران

- 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 with the torque below.

Tightening torque:

11.8 \sim 15.7N.m (1.2 \sim 1.6kgf.m, 8.7 \sim 11.6lb-ft)

- 3. Refill with engine oil.
 - Clean and install the oil drain plug with a new gasket.

Tightening torque:

 $34.3 \sim 44.1$ N.m (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.5 lb-ft)

2) Fill with fresh engine oil.

Capacity

Total: 3.7L (3.91US qt, 3.26lmp qt)

Oil pan: 3.0L (3.17US qt, 2.64lmp qt)

Drain and refill including oil filter: 3.3L (3.49US qt, 2.90Imp qt)

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

Inspection

Engine Oil

1. Check the engine oil quality.

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

If the quality is visibly poor, replace the oil.

2. Check the engine oil level.

After warning up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks in the dipstick.

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

MOTICE

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

Lubrication System

EM-101

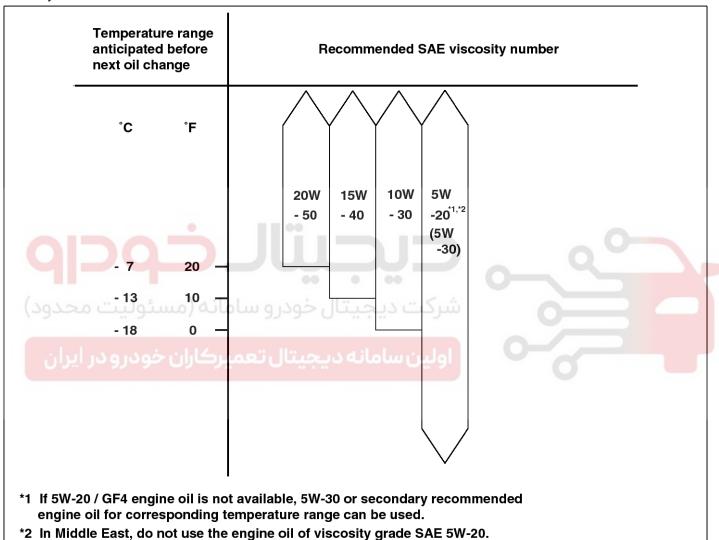
Selection Of Engine Oil

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

classification and SAE viscosity number.)
API classification : SL, SM or above
ILSAC classification : GF3. GF4 or above

SAE viscosity grade: Refer to the recommended SAE

viscosity number.



SAMM29103L

MOTICE

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

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

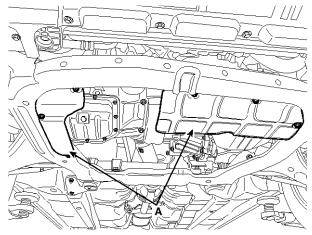
the container should not be used.

Engine Mechanical System

Oil Pan

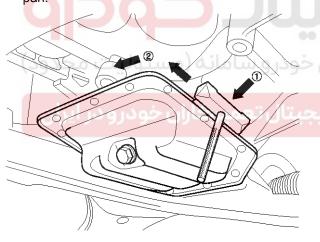
Removal

1. Remove the under cover(A).



SHDEM6003D

- 2. Drain engine oil.
- 3. Using the SST(09215-3C000) and remove the oil pan.



SFDEM8016L

ACAUTION

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

Installation

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

MOTICE

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: TB 1217H or equivalent

MOTICE

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

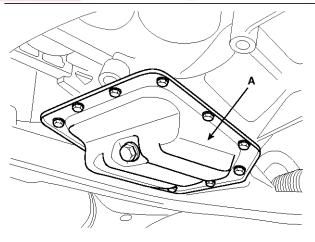
Instead, reapply liquid gasket after removing the residue.

- After assembly, wait at least 30 minutes before filling the engine with oil.
- 3) Install the oil pan(A) with the bolts.

Uniformly tighten the bolts in several passes.

Tightening torque:

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



SHDEM6178D

2. Refill engine oil.

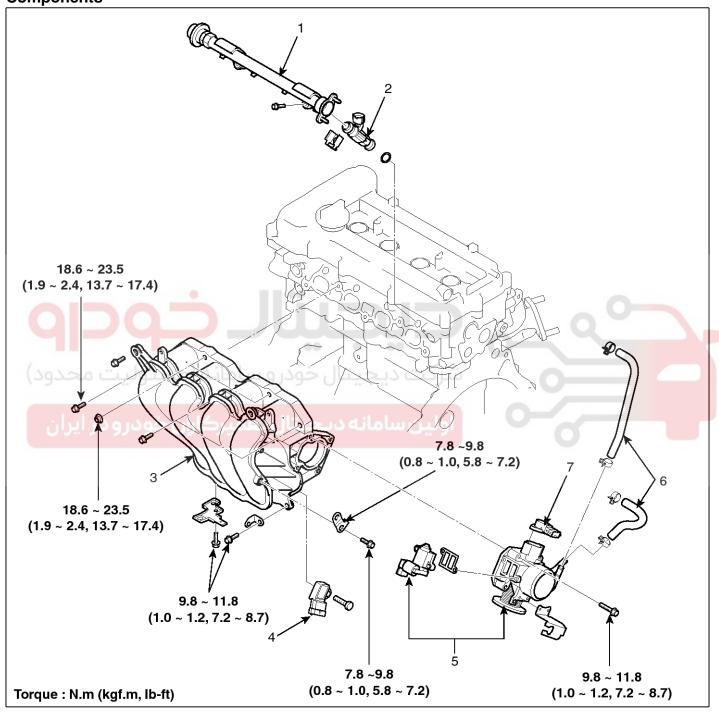
Intake And Exhaust System

EM-103

Intake And Exhaust System

Intake Manifold

Components



STDEM9019L

- 1. Delivery pipe
- 2. Injector
- 3. Intake manifold
- 4. MAP semsor

- 5. Throttle body
- 6. Water hose
- 7. Throttle position sensor(TPS)

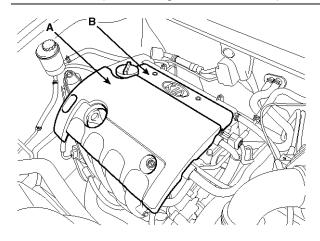
Engine Mechanical System

Removal

1. Remove the engine cover(A) and the engine center cover(B).

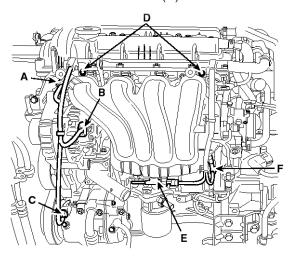
Tightening torque:

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



STDEM9053D

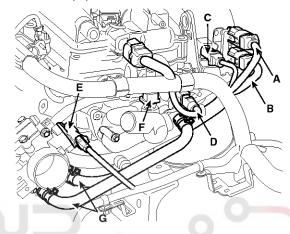
- Disconnect the harness connectors over the cylinder head.
 - 1) Disconnect the oil control valve(OCV) connector(A) and alternator connector(B).
 - 2) Disconnect the air conditioning compressor connector(C).
 - 3) Remove the ignition coil harness mounting bolts(D).
 - Disconnect the MAP sensor connector(F) and the knock sensor bracket(E).



SHDFM6065D

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

- 1) Disconnect the front(A) and the rear(B) oxygen sensor connector.
- Disconnect the ignition coil condenser connector(C) and the purge control solenoid valve(PCSV) connector(D).
- 3) Disconnect the throttle position sensor(TPS) connector(E).
- Disconnect the engine coolant temperature sensor(ECTS) connector(F) and the water hose(G).



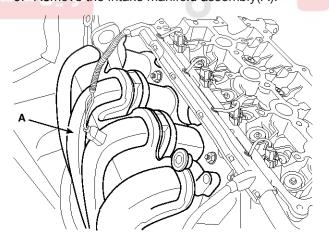
SFDEM8012L

4. Remove the oil level gauge assembly.

Tightening torque:

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

5. Remove the intake manifold assembly(A).



SHDEM6079D

Tightening torque:

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

6. To install, reverse the removal order.

ACAUTION

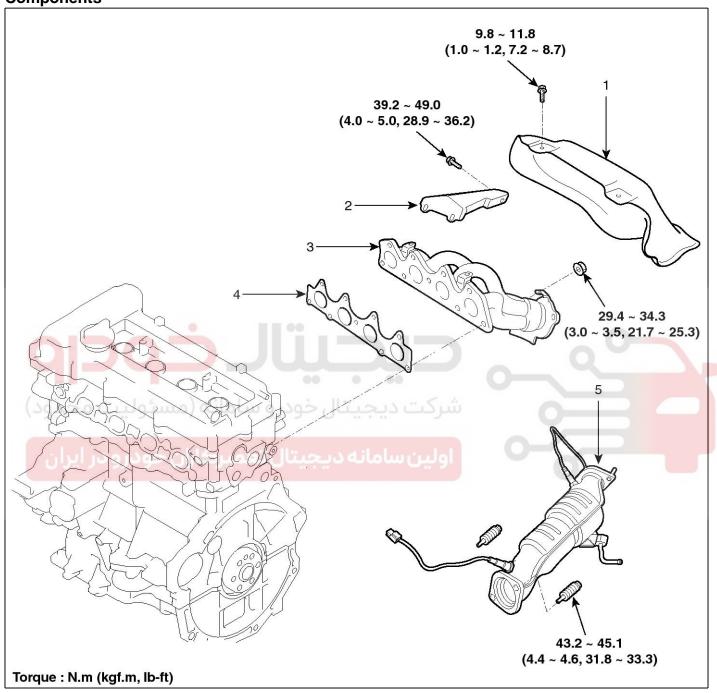
Install the engine cover surely before driving.

Intake And Exhaust System

EM-105

Exhaust Manifold

Components



STDEM9020L

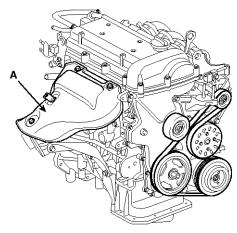
- 1. Heat protector
- 2. Exhaust manifold assembly stay
- 3. Exhaust manifold assembly

- 4. Gasket
- 5. Catalytic convertor

Engine Mechanical System

Removal

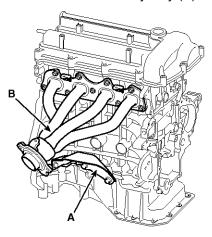
1. Remove the heat protector(A) after disconnecting oxygen sensor connector.



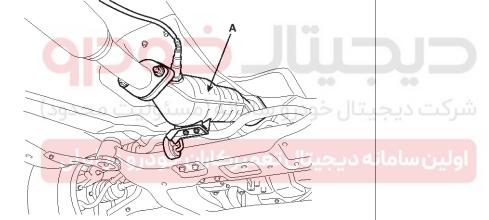
STDEM9052D

2. Remove the catalytic convertor (A).

3. Remove the exhaust manifold assembly (A) and the exhaust manifold assembly stay (B).



STDEM9054D



STDEM9051D

Intake And Exhaust System

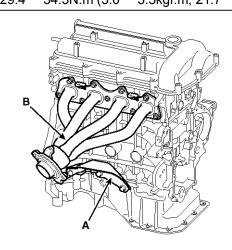
EM-107

Installation

1. Install the exhaust manifold assembly stay (A) and the exhaust manifold assembly (B).

Tightening torque:

A: $39.2 \sim 49.0$ N.m ($4.0 \sim 5.0$ kgf.m, $28.9 \sim 36.2$ lb-ft) B: $29.4 \sim 34.3$ N.m ($3.0 \sim 3.5$ kgf.m, $21.7 \sim 25.3$ lb-ft)

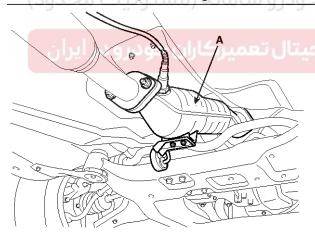


STDEM9054D

2. Install the catalytic convertor (A).

Tightening torque:

Bolt: 43.2 ~ 45.1N.m (4.4 ~ 4.6kgf.m, 31.8 ~ 33.3lb-ft) Nut: 39.2 ~ 58.8N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 43.4lb-ft)

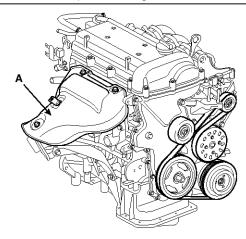


STDEM9051D

3. Install the heat protector (A) and connect the oxygen sensor connector.

Tightening torque:

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



STDEM9052D

