Engine Mechanical System

General Information

Specifications

Description			Specifications	Limit
General				
Туре			V-type, DOHC	
Number of cylinde	ers		6	
Bore			92mm(3.6220in.)	
Stroke			87.0mm(3.4252in.)	
Total displaceme	nt		3,470cc(211.75cu.in.)	
Compression ration	0		10.6	
Firing order			1-2-3-4-5-6	
Valve timing				
Intoles	Opens(ATDC)		10°	
Intake	Closes(ABDC)		74°	
Exhaust	Opens(BBDC)		52°	0
Exhaust	Closes(ATDC)		0°	
Cylinder head				
Flatness of gasket surface		درو سا	Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.) / 150x150]	
Flatness of man-	ال تعميركاران Intake		Less than 0.1mm(0.0039in.) [Less than 0.03mm(0.001in.) / 110x110]	
ifold mounting Exhaust			Less than 0.1mm(0.0039in.) [Less than 0.03mm(0.001in.) / 110x110]	
Camshaft				
	LH Camshaft	Intake	47.2mm (1.8582in.)	
Com boight		Exhaust	45.8mm (1.8031in.)	
Cam height	RH	Intake	47.2mm (1.8582in.)	
	Camshaft	Exhaust	45.8mm (1.8031in.)	
Journal outer di-	Intake		No.1: 27.964 ~ 27.978mm (1.1009 ~ 1.1015in.) No.2,3,4: 23.954 ~ 23.970mm(0.9430 ~ 0.9437in.)	
ameter	LH, RHcamshaft -	Exhaust	No.1: 27.964 ~ 27.978mm(1.1009 ~ 1.1015in.) No.2,3,4: 23.954 ~ 23.970mm(0.9430 ~ 0.9437in.)	
Bearing oil clea-		Intake	No.1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in.) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
rance	LH, RHcamshaft	Exhaust	No.1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in.) No.2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
End play		•	0.02 ~ 0.18mm (0.0008 ~ 0.0071in.)	
Valve				

EM-3

[Description	Specifications	Limit	
) /alva lanath	Intake	105.27mm(4.1445in.)		
Valve length Exhaust		105.50mm (4.1535in.)		
Stem outer dia-	Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)		
meter	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)		
Face angle		45.25° ~ 45.75°		
Thickness of val-	Intake	1.56 \sim 1.86mm (0.06142 \sim 0.07323in.)		
vehead(margin)	Exhaust	1.73 \sim 2.03mm (0.06811 \sim 0.07992in.)		
Valve stem to	Intake	$0.020 \sim 0.047$ mm ($0.00078 \sim 0.00185$ in.)	0.07mm (0.00275in.)	
valve guide cle- arance	Exhaust	$0.030 \sim 0.054$ mm ($0.00118 \sim 0.00212$ in.)	0.09mm (0.00354in.)	
Valve guide				
laner diameter	Intake	5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)		
Inner diameter	Exhaust	5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)		
l a sa antila	Intake	41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)		
Length	Exhaust	41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)	0	
Valve seat				
Width of seat co-	Intake	1.15 ~ 1.45mm(0.05118 ~ 0.05709in.)		
ntact	Exhaust	1.35 ~ 1.65mm(0.05315 ~ 0.06496in.)		
Soot angle	Intake	44.75° ~ 45.20°		
Seat angle	Exhaust	44.75° ~ 45.20°		
Valve spring				
Free length		45.5mm (1.7913in.)		
Load		19.3±0.8kg/34.0mm (42.7±1.8 lb/1.3386in.)		
Load		42.3±1.3kg/23.8mm (93.3±2.9 lb/0.9370in.)		
Out of squarenes	s	Less than 1.5°		
MLA				
MLA outer diam-	Intake	34.964 ~ 34.980mm (1.3765 ~ 1.3772in.)		
eter	Exhaust	$34.964 \sim 34.980$ mm (1.3765 \sim 1.3772in.)		
Cylinder head	Intake	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)		
tappet bore inn- er diameter	Exhaust	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)		
MLA to tappet bore clearance	Intake	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)	
	Exhaust	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)	
Valve clearance (At 20°C [68°F])				
Intake		0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	$0.10 \sim 0.30$ mm $(0.0039 \sim 0.0118$ in.)	

Engine Mechanical System

	Description	Specifications	Limit
Exhaust		0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder block			
Cylinder bore		92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)	
Flatness of gaske	et surface	Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.) / 150x150]	
Piston			
Piston outer diam	neter	91.96 ~ 91.99mm(3.6204 ~ 3.6216in.)	
Piston to cylinder	clearance	0.03 ~ 0.05mm(0.0012 ~ 0.0020in.)	
	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in.)	
Ring groove wid- th	No. 2 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in.)	
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in.)	
Piston ring			
	No. 1 ring	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)
Side clearance	No. 2 ring	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)
9	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)	0.2mm (0.008in.)
,	No. 1 ring	0.17 ~ 0.32mm (0.0067 ~ 0.0126in.)	0.6mm (0.0236in.)
End gap	No. 2 ring	0.37 ~ 0.52mm (0.0145 ~ 0.0204in.)	0.7mm (0.027 <mark>5in</mark> .)
	Oil ring	0.20 ~ 0.50mm (0.0078 ~ 0.0196in.)	0.8 <mark>mm (0.0315in</mark> .)
Piston pin	نال تعمیرکاران خود	اولین سامانه دیجیت	
Piston pin outer o	liameter	21.097 ~ 22.000mm (0.8305 ~ 0.8661in.)	
Piston pin hole in	ner diameter	22.004 ~ 22.010mm (0.8662 ~ 0.8665in.)	
Piston pin hole cl	earance	0.004 ~ 0.013mm (0.00015 ~ 0.00051in.)	
Connecting rod s	mall end inner diameter	22.005 ~ 22.016mm (0.8663 ~ 0.8667in.)	
Connecting rod s	mall end hole clearance	0.005 ~ 0.019mm (0.00019 ~ 0.00074in.)	
Connecting rod			
Connecting rod b	ig end inner diameter	58.000 ~ 58.018mm(2.2834 ~2.2842in.)	
Connecting rod b	earing oil clearance	$0.038 \sim 0.056$ mm ($0.0014 \sim 0.0022$ in.)	
Side clearance		$0.1 \sim 0.25$ mm ($0.0039 \sim 0.0098$ in.)	
Crankshaft			
Main journal outer diameter		68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)	
Pin journal outer	diameter	54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)	
Main bearing oil of	clearance	0.022 ~ 0.040mm (0.0008 ~ 0.0016in.)	
End play		0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)	
Oil pump			

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Description		Specifications	Limit
Regulating pressure		400 ~ 450kPa	
		$(4.08 \sim 4.59 \text{kgf/cm}^2, 58.01 \sim 65.27 \text{psi})$	
Engine oil			1
	Total	6.0 L (6.34 US qt, 5.28 lmp.qt)	
Oil quantity	Oil pan	5.5 L (5.81 US qt, 4.84 lmp.qt)	
	Drain and refill	5.2 L (5.49 US qt, 4.58 Imp.qt)	Including oil filter
	Recommendation	5W-20 / GF4&SM	If not available, refer to the recommended API or ILSAC classif- ication and SAE vis- cosity 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)		130kPa(1.32kgf/cm², 18.77psi) [at 1000rpm,110°C(230°F)]	Oil temperature (oil pan): 110±2°C (230 ±35.6°F)
Cooling syster	درو سامانه (مسئول ۳	شرکت دیجیتال خو	
Cooling method	. , ,	Forced circulation with water pump	
Coolant quantity	ال رتعمب کاران خودر۷	8.6 L (9.1 us.qts, 7.6 lmp.qts)	
	Туре	Wax pellet type	
Thermodist	Opening temperature	82±2°C (179.6±3.6°F)	
Thermostat	Fully opened temperature	95°C (203°F)	
	Full lift	10mm (0.3937in.) MIN	
Dedictor	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm², 13.51 ~ 17.78psi)	
Radiator cap	Vacuum valve opening pressure	0 ~ 6.86 kpa (0 ~ 0.07kg/cm², 0 ~ 0.99psi)	
Water tempera	ture sensor		
Туре		Thermister type	
	20°C (68°F)	2.31 ~ 2.59KΩ	
Resistance	80°C(176°F)	0.3222 ΚΩ	
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Engine Mechanical System

Tightening Torques

Item	Quantity	Nm	kgf.m	lb-ft
Crankshaft pulley bolt	1	284.4 ~ 304.0	29.0 ~ 31.0	209.8 ~ 224.2
Timing chain cover bolt B	17	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Timing chain cover bolt C	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt D	2	58.8 ~ 68.6	6.0 ~ 7.0	43.4 ~ 50.6
Timing chain cover bolt F	2	24.5 ~ 26.5	2.5 ~ 2.7	18.1 ~ 19.5
Timing chain cover bolt G	4	21.6 ~ 23.5	2.2 ~ 2.4	15.9 ~ 17.4
Timing chain cover bolt H	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt I	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt J	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt K	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt L	1	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
Timing chain auto tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain auto tensioner nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain auto tensioner arm bolt	2	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Timing chain guide bolt	4	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Oil pump chain cover bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain tensioner bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain sprocket bolt	1	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Lower oil pan bolt	13	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Drive belt auto tensioner bolt(M12)	1	81.4 ~ 85.3	8.3 ~ 8.7	60.0 ~ 62.9
Drive belt auto tensioner bolt(M8)	1	17.7 ~ 21.6	1.8 ~ 2.2	13.0 ~ 15.9
Drive belt idler bolt	1	53.9 ~ 57.9	5.5 ~ 5.9	39.8 ~ 42.7
OCV(oil control valve) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head bolt	16	(37.3~41.2) + (118 ~122°) + (88~92°)	(3.8~4.2) + (118~ 122°) + (88~92°)	(27.5~30.4) + (118 ~122°) + (88~92°)
Cylinder head bolt	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
CVVT bolt	4	64.7 ~ 76.5	6.6 ~ 7.8	47.7 ~ 56.4
Camshaft bearing cap bolt	32	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head cover bolt	38	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Connecting rod bolt	12	(17.7~21.6) + (88 ~92°)	(1.8~2.2) + (88~9 2°)	(13.0~15.9) + (88 ~92°)
Main bearing cap inner bolt(M11)	8	49.0 + 90°	5.0 + 90°	36.2 + 90°
Main bearing cap outer bolt(M8)	8	19.6 + 120°	2.0 + 120°	14.5 + 120°
Main bearing cap side bolt(M8)	8	29.4 ~ 31.4	3.0 ~ 3.2	21.7 ~ 23.1

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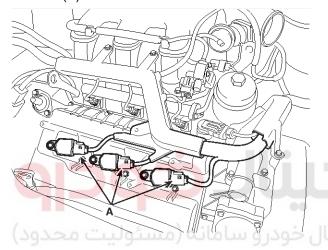
Item	Quantity	Nm	kgf.m	lb-ft
Oil drain cover bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil jet bolt	3	27.5 ~ 31.3	2.8 ~ 3.2	20.2 ~ 23.1
Rear oil seal case bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Baffle plate bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Upper oil pan bolt	16	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Knock sensor bolt	2	15.7 ~ 23.5	1.6 ~ 2.4	11.6 ~ 17.4
Drive plate bolt	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap		35.0	3.57	25.8
Oil drain bolt	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil pump bolt	3	20.6 ~ 22.6	2.1 ~ 2.3	15.2 ~ 16.6
Oil filter body bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil cover bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt(Timing chain cover bolt L)	1	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
Water pump bolt(Timing chain cover bolt K)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt(Timing chain cover bolt G)	4	21.6 ~ 23.5	2.2 ~ 2.4	15.9 ~ 17.4
Water pump pulley bolt	00 4 0	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water temp. control nut	صت4 رخ	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water temp. control bolt	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water inlet pipe bolt	انه 3 ـــ	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Intake manifold bolt	6	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Intake manifold nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank bolt (M6 × 36)	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank bolt (M6 × 128)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank stay bolt (M10 × 20)	2	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Exhaust manifold nut	16	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.6
Exhaust manifold stay bolt	4	24.5 ~ 35.3	2.5 ~ 3.6	18.1 ~ 26.0
Heat protector bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Front muffler nut	4	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Center muffler nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Main muffler nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Air cleaner assembly bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Intake air hose clamp bolt	1	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6

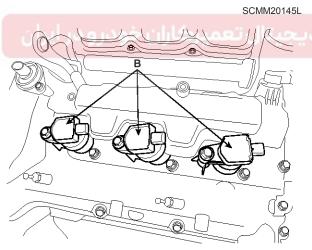
Compression Pressure Inspection

MOTICE

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

- 1. Warm up engine until the normal operating temperature(80~95°C(176-203°F)).
- 2. Remove the surge tank. (Refer to Intake and exhaust system in this group)
- 3. Remove the ignition coil connectors (A) and ignition coils (B).





SBHEM8150D

Engine Mechanical System

4. Remove the spark plugs.

Using a 16mm plug wrench, remove the 6 spark plugs.

- 5. Check cylinder compression pressure.
 - 1) Insert a compression gauge into the spark plug hole.
 - 2) Fully open the throttle.
 - 3) Crank the engine over 7 times to measure compression pressure.

MNOTICE

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

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

MOTICE

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

Compression pressure:

1,029kPa (10.5kgf/cm², 149psi) (250~400 rpm)

Minimum pressure:

882kPa (9.0kgf/cm², 128psi)

Difference between each cylinder:

98kPa (1.0kg/cm², 14psi) or less

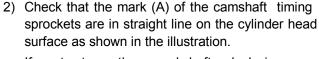
- 5) If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
 - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
 - b. If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
- 6. Reinstall the spark plugs.
- 7. Install the ignition coils and ignition connectors.
- 8. Install the surge tank. (Refer to Intake and exhaust system in this group)

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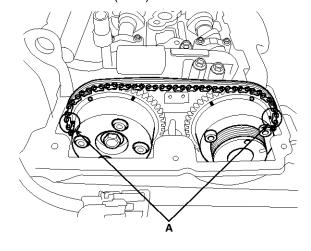
Valve Clearance Inspection And Adjustment **₩NOTICE**

Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C(68°F)) and cylinder head is installed on the cylinder block.

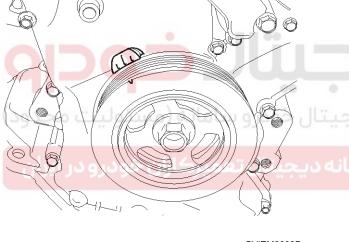
- 1. Remove the engine cover.
- 2. Remove the engine side cover.
- 3. Remove air cleaner assembly.
- 4. Remove the surge tank. (Refer to Intake and exhaust system in this group)
- 5. Remove the cylinder head cover. (Refer to Timing system in this group)
- 6. Set No.1 cylinder to TDC/compression.
 - Turn the crankshaft pulley clockwise and align its groove with the timing mark "T" of the lower timing chain cover.



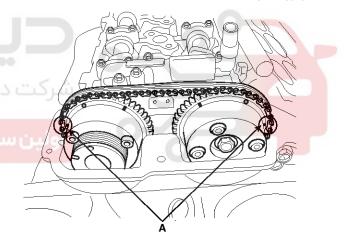
If not, turn the crankshaft clockwise one revolution (360°).



SVIEM9010D



SVIEM9009D



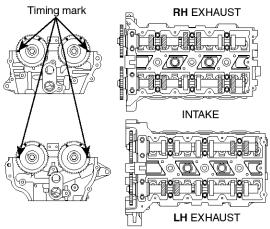
SVIEM9011D

MNOTICE

Do not rotate engine counterclockwise.

Engine Mechanical System

- 7. Inspect the valve clearance.
 - 1) With No.1 cylinder at TDC inspect clearances only on the valves shown in diagram below.



EDRF021A

Measurement method.

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

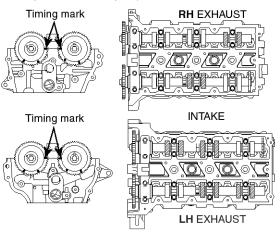
Valve clearance Specification

Engine coolant temperature : 20°C [68°F]

Limit

Intake : $0.10 \sim 0.30$ mm ($0.0039 \sim 0.0118$ in.) Exhaust : $0.20 \sim 0.40$ mm ($0.0078 \sim 0.0157$ in.)

- 2) Turn the crankshaft pulley clockwise one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.
- 3) With No.4 cylinder at TDC inspect clearances only the valves shown in diagram below. (Refer to procedure step 1.)

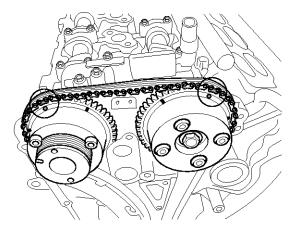


EDRF022A

- 8. Adjust the intake and exhaust valve clearance.
 - 1) Set the No.1 cylinder to the TDC/compression.
 - 2) Remove the timing chain.

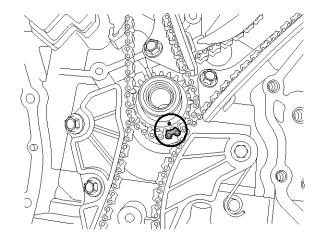
WNOTICE

Before removing the timing chain, mark the RH/LH timing chain with an identification based on the location of the sprocket because the identification mark on the chain for TDC (Top Dead Center) can be erased.



SVIEM9012D

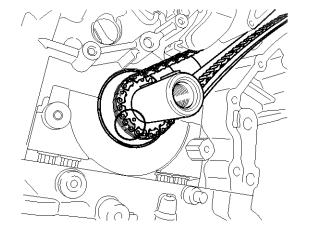
EM-11



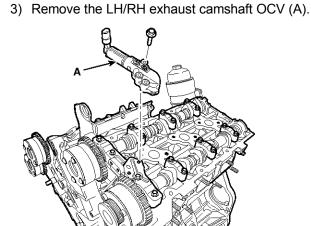
KDRF129A



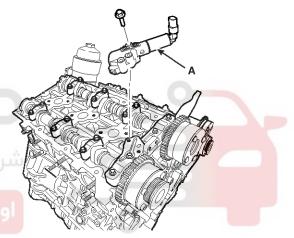
SVIEM9013D



SBHEM8074D



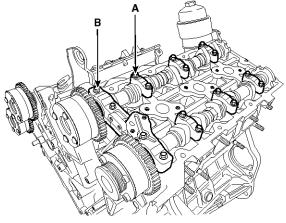
SCMM20025L



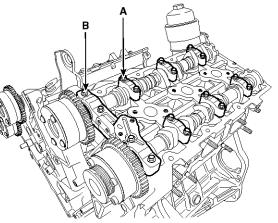
SCMM20026L

Engine Mechanical System

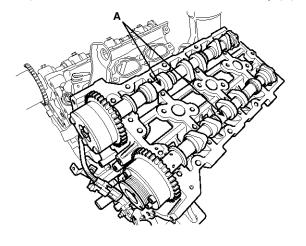
4) Remove the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).



SCMM20035L



5) Remove the LH/RH camshaft assembly (A).



SBHEM8072D

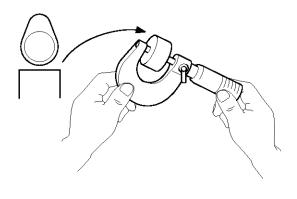


SCMM20036L

SBHEM8073D

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- 6) Remove the tappets.
- 7) Measure the thickness of the removed tappet using a micrometer.



EDKE889D

- 8) Calculate the thickness of a new tappet so that the valve clearance comes within the specified value.
- 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 - 0.30mm (0.0118in.)]

9) Select a new tappet with a thickness as close as possible to the calculated value.

MNOTICE

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

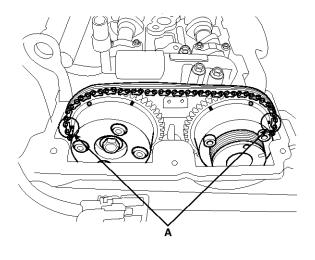
10) Place a new tappet on the cylinder head.

MNOTICE

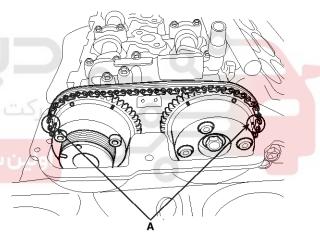
Apply engine oil at the selected tappet on the side and top surface.

- 11) Install the intake and exhaust camshaft.
- 12) Install the bearing caps. (Refer to Cylinder head assembly in this Group)
- 13) Install the timing chain. (Refer to Timing system in this Group)

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



SVIEM9010D



SVIEM9011D

15) Recheck the valve clearance.

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

[Specification]

Intake : $0.17 \sim 0.23$ mm ($0.0067 \sim 0.0090$ in.) Exhaust : $0.27 \sim 0.33$ mm ($0.0106 \sim 0.0129$ in.)

Engine Mechanical System

Troubleshooting

Symptom	Suspect area	Remedy	
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or damaged engine drive plate.	Replace the crankshaft and bearings as required. Repair or replace the drive plate as required.	
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.	
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required.	
Engine misfire with abnormal valve tra- in noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required.	
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.	
	Worn camshaft lobes.	Replace the camshaft and valve lifters.	
Engine misfire with coolant consumption.	 Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system Coolant consumption may or may not cause the engine to overheat. 	ne block for damage to the coolant passages and/or a faulty head gasket.	
Engine misfire with excessive oil consumption.	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.	
عمیرکاران خودرو در ایران	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	 Inspect the cylinder for a loss of compression. Repair or replace as required. 	
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity.	Drain the oil.•Install the correct vis- cosity oil.	
	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft.Repair or replace as required.	

EM-15

Symptom	Suspect area	Remedy
Upper engine noise,regardless of engi-	Low oil pressure.	Repair or replace as required.
ne speed.	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/ or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	 Inspect the camshaft lobes. Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
Lower engine noise, regardless of engi-	Low oil pressure.	Repair as required.
ne speed.	Loose or damaged drive plate.	Repair or replace the drive plate.
سامانه (مسئولیت محدود) عمیرکاران خودرو در ایران	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, piston pin and cylinder bore.Repair as required.
	Excessive piston pin-to-piston clearance.	 Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. The connecting rod bearings. The connecting rods. The crankshaft pin journals.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. The crankshaft bearings. The crankshaft main journals. The cylinder block.
	Incorrect piston, piston pin and connecting rod installation	 Verify the piston pins and connecting rods are installed correctly. Repair as required.

Engine Mechanical System

Symptom	Suspect area	Remedy
Engine noise under load.	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required: The connecting rod bearings. The connecting rods. The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. The crankshaft bearings. The crankshaft main journals. The cylinder block.
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 and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
سامانه (مسئولیت محدود)	Material in cylinder. Broken valve Piston material Foreign material	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
عمیرکاران خودرو در ایران	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair as required.
	Broken crankshaft.	Inspect crankshaft. Repair as required.

EM-17

Special Service Tools

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-3C100)		Installation of the front oil seal
Ping gear stopper	KDRF233A	Removal and installation of crankshaft pulley
Ring gear stopper (09231-2B100)		bolt
	SHDEM6201D	
Ring gear stopper (09231-3D100)		Removal and installation of crankshaft pulley bolt.
	SVGEM1001D	
Torque angle adapter (09221-4A000)	LCAC030A	Installation of bolts & nuts needing an angular method
Valve stem seal remover	0	Removal of the valve stem seal
(09222-29000)	VADDEGGGG	
	KDRF232A	

Engine Mechanical System

Tool (Number and name)	Illustration	Use
Valve stem seal installer (09222-3C100)	LCAC030D	Installation of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3K100)	A B	Removal and installation of the intake or exhaust valves A: 09222-3K000 B: 09222-3K100 (holder)
	ECRF003A	
Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)	B	Installation of the crankshaft rear oil seal A: 09231-3C200 B: 09231-H1100
(مسئولیت محدود)	ACRF003A	ů O
Oil pan remover (09215-3C000)	ولین سامانه در ایرالی تعمیرک	Removal of oil pan
	KDRF219A	

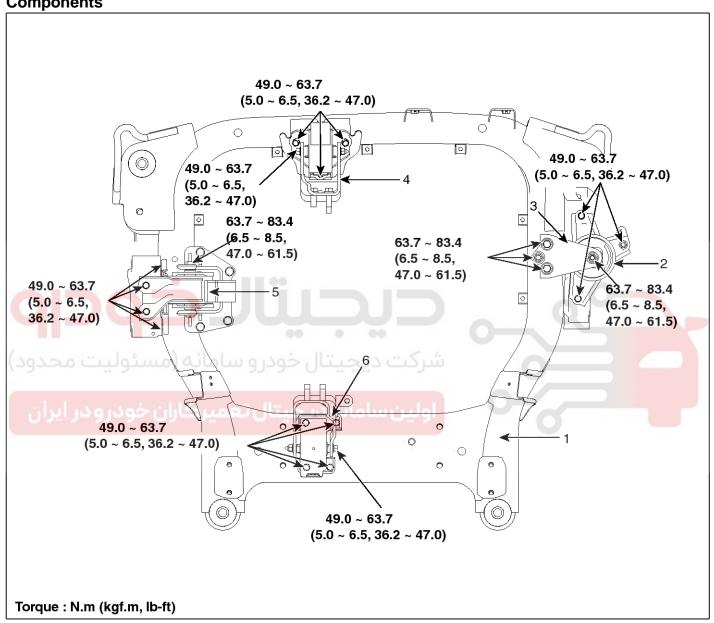
Engine And Transmission Assembly

EM-19

Engine And Transmission Assembly

Engine Mounting

Components



SVGM20016L

- 1. Sub frame
- 2. Engine mounting bracket
- 3. Engine mounting support bracket

- 4. Front roll mounting bracket
- 5. Transaxle mounting bracket
- 6. Rear roll mounting bracket

Engine Mechanical System

Engine And Transmission Assembly

Removal

CAUTION

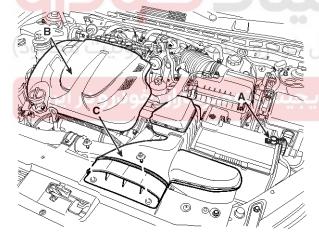
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

MOTICE

- · Mark all wiring and hoses to avoid misconnection.
- For release the fuel system pressure before remove the engine assembly, start the engine without fuel pump relay. And then turn off the ignition switch after engine stops.
- 1. Disconnect the battery negative terminal (A).

Tightening torque:

- (-) terminal: 7.8 \sim 9.8 N.m (0.8 \sim 1.0 kgf.m, 5.8 \sim 7.2 lb-ft)
- 2. Remove the engine cover (B).
- 3. Remove the air duct (C).



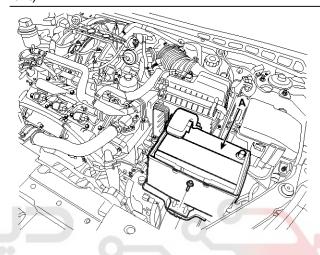
SVGM20001D

4. Disconnect the battery positive terminal, and then remove the battery (A).

Tightening torque:

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

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



SVGM20003D

- 5. Disconnect the breather hose (A) and the BARO (Barometric pressure) sensor connector (B).
- 6. Remove the air intake hose clamp (C), and then remove the air cleaner assembly (D).

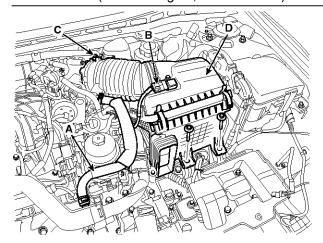
Tightening torque

Hose clamp bolt:

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

Air cleaner assembly bolts:

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



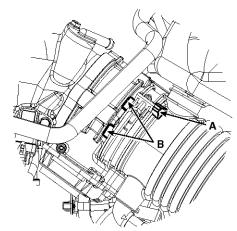
SVGM20004D

Engine And Transmission Assembly

EM-21

MOTICE

Assembling direction of clamp hose must conform to directions of under illustration.

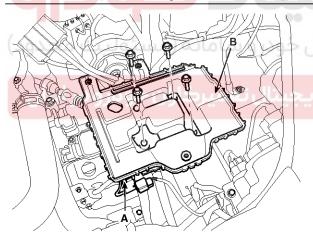


SVGM20050D

7. Remove the battery tray (B) after disconnecting the front connector mounting clip (A).

Tightening torque:

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

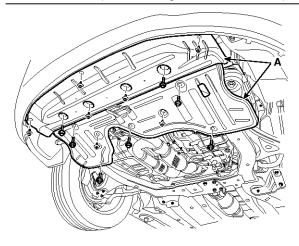


SVGM10004D

8. Remove the under cover (A).

Tightening torque:

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



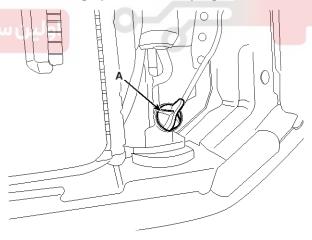
SVGM20002D

9. Loosen the drain plug (A), and drain the coolant. Open the radiator cap to make rapid draining.

WARNING

Never remove the radiator cap when the engine is hot.

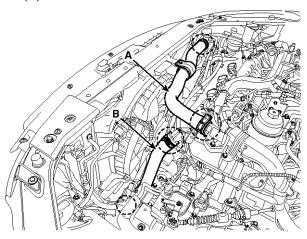
Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.



SVGM10041D

Engine Mechanical System

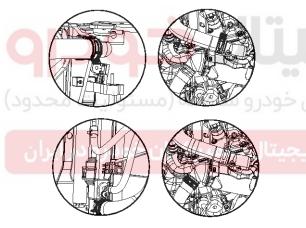
10. Remove the radiator upper hose (A) and lower hose (B).



SVGM20005D

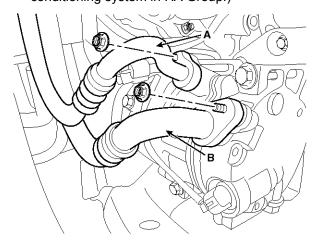
MOTICE

Install the radiator hoses as shown illustrations.



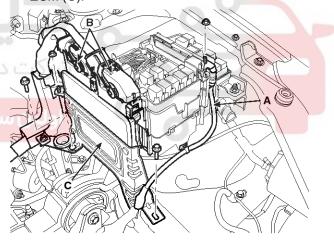
SVGM20017D

11. Recover the refrigerant and then remove the high pressure pipe and low pressure pipe. (Refer to Air conditioning system in HA Group.)



SVGM10112D

- 12. Disconnect the (+) cable (A) from the junction box.
- 13. Disconnect the connectors (B), and then remove the ECM (C).

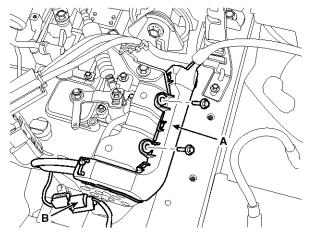


SVGM20039D

Engine And Transmission Assembly

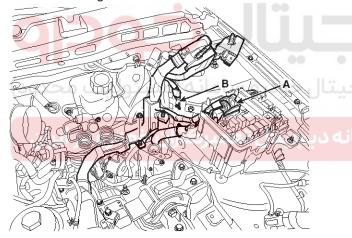
EM-23

14. Disconnect the front connector (B), and then remove the wiring protector (A).



SVGM10009D

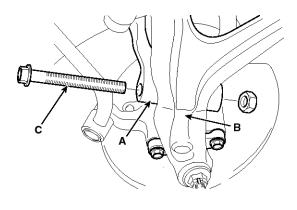
15. Disconnect the junction box connector (A) and the ground bolts (B) and then remove the engine wirings from the engine room.



SVGM20006D

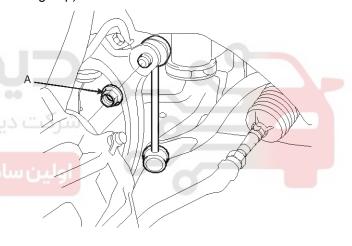
- 16. Remove the transaxle wire harness connectors and control cable from the transaxle. (Refer to AT group)
- 17. Remove the front wheels.

18. Remove the lower arms (A). (Refer to SS group)



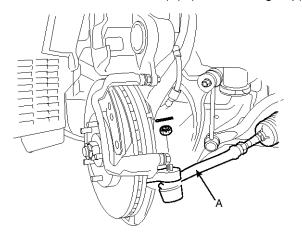
KHBF110C

19. Remove the stabilizer bar links (A). (Refer to SS group)



STGEM7030D

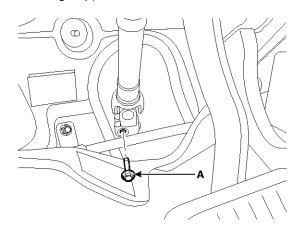
20. Remove the tie rod ends (A). (Refer to ST group)



STGEM7031D

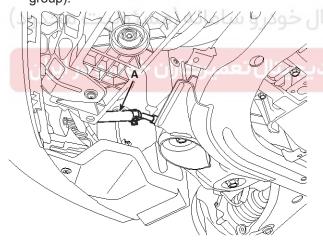
Engine Mechanical System

- 21. Disconnect the drive shafts from the axle hubs. (Refer to DS group)
- 22. Remove the steering u-joint mounting bolt (A). (Refer to ST group)

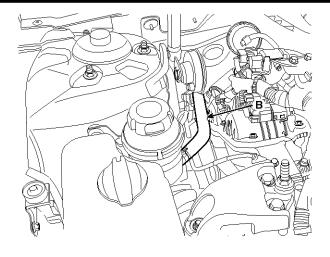


SYFEM0101D

23. Disconnect the power steering fluid return hose (A) for drain the fluid, and remove the hose that connecting between the power steering pump assembly and the fluid reservoir tank. (Refer to ST group).

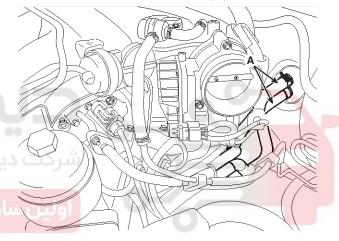


SYFEM0008D



SVGM20018D

24. Disconnect the heater hoses (A).



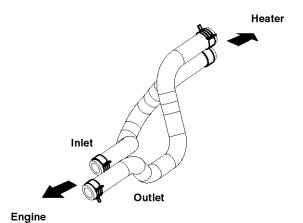
SVGM20019D

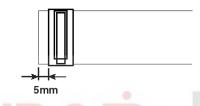
Engine And Transmission Assembly

EM-25

MOTICE

Install the heater hoses as shown illustrations.

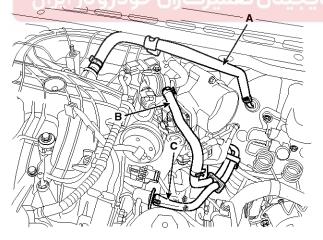






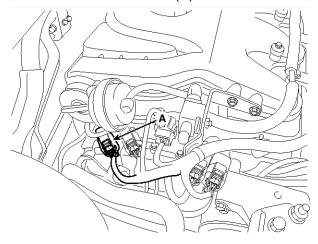
(\) SVGM20020D

25. Disconnect the brake booster vacuum hose (A), the PSCV hose (B) and the fuel hose (C).

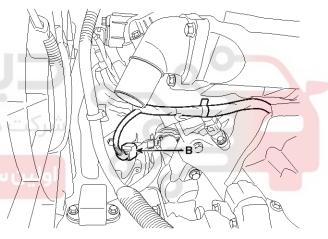


SVGM20008D

26. Disconnect the RH rear oxygen sensor connector (A), LH rear oxygen sensor connector (B) and then remove the front muffler (C).



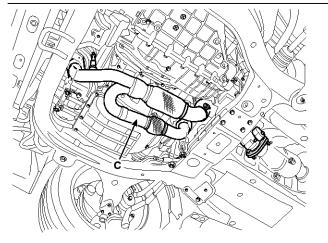
SVGM20041D



SVGM20042D

Tightening torque:

 $39.2 \sim 58.8 \text{ N.m} (4.0 \sim 6.0 \text{ kgf.m}, 28.9 \sim 43.4 \text{ lb-ft})$



SVGM20009D

27. Support the sub frame (A) with a floor jack, and then remove the sub frame and stay bolts & nuts.

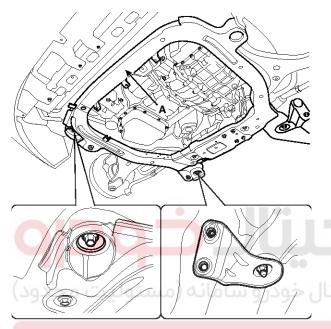
Tightening torque:

Sub frame mounting bolts & nuts:

156.9 \sim 176.5 N.m (16.0 \sim 18.0 kgf.m, 115.7 \sim 130.2 lb-ft)

Stay bolts & nuts:

44.1 \sim 58.8 N.m (4.5 \sim 6.0 kgf.m, 32.5 \sim 43.4 lb-ft)



SVGM10014D

MOTICE

- After removing the sub frame mounting bolt, the engine and transaxle assembly may fall downward, and so support them securely with floor jack.
- Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.

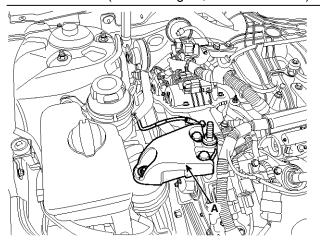
Engine Mechanical System

28. Disconnect the ground cable, and then remove the engine mounting bracket (A).

Tightening torque:

Bolts & Nuts

 $63.8 \sim 83.4 \text{ N.m} (6.5 \sim 8.5 \text{ kgf.m}, 47.0 \sim 61.5 \text{ lb-ft})$

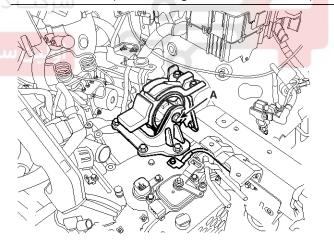


SVGM20014[

29. Disconnect the ground cable, and then remove the transaxle mounting bracket through bolt (A).

Tightening torque:

63.8 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)

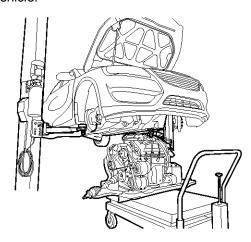


SYFEM0011D

Engine And Transmission Assembly

EM-27

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



SVGM20038D

ACAUTION

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

نه دیجیتال تعمیرکاران خودرو در ایران

Installation

Installation is in the reverse order of removal.

Perform the following:

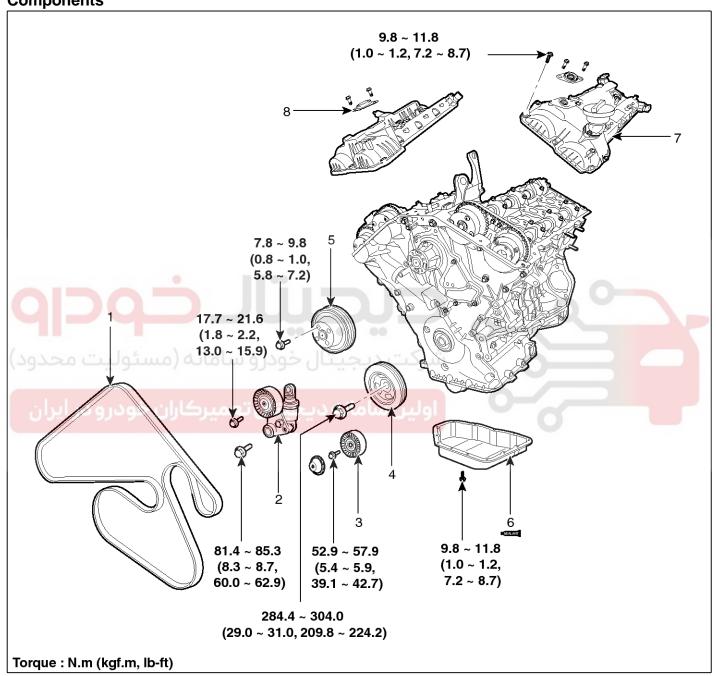
- · Adjust a shift cable.
- · Refill engine with engine oil.
- · Refill a transaxle with fluid.
- · Refill power steering fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Place a heater control knob on "HOT" position.
- Clean battery posts and cable terminals and assemble.
- Inspect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

Engine Mechanical System

Timing System

Timing Chain

Components



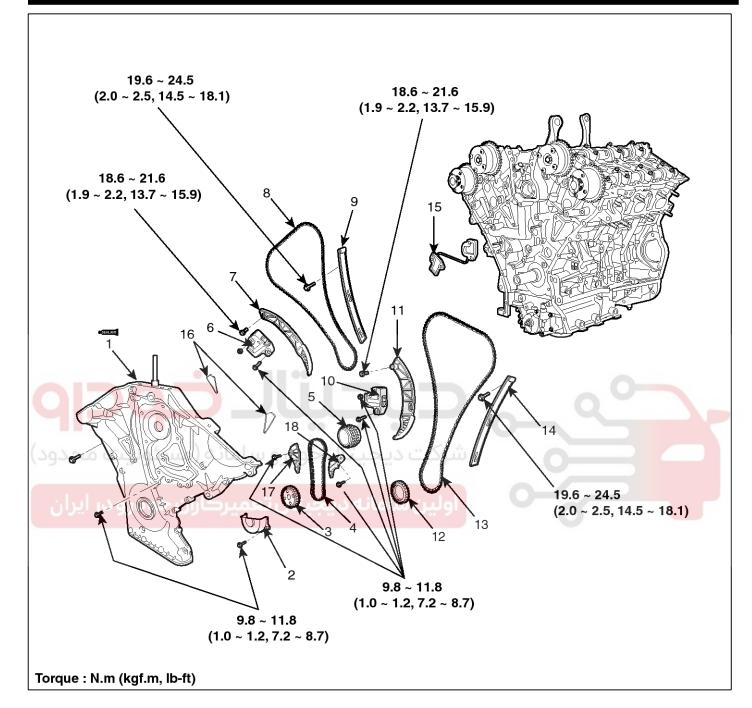
SVGM20021L

- 1. Drive belt
- 2. Drive belt tensioner
- 3. Idler
- 4. Crank shaft pulley

- 5. Water pump pulley
- 6. Oil pan
- 7. Cylinder head cover
- 8. OCV cap

Timing System

EM-29



SVGM20022L

- 1. Timing chain cover
- 2. Oil pump chain cover
- 3. Oil pump sprocket
- 4. Oil pump chain
- 5. Crankshaft sprocket
- 6. Timing chain auto tensioner
- 7. Timing chain tensioner arm
- 8. Timing chain
- 9. Timing chain guide
- 10. Timing chain auto tensioner
- 11. Timing chain tensioner arm
- 12. Crankshaft sprocket

- 13. Timing chain
- 14. Timing chain guide
- 15. Tensioner adapter
- 16. Gasket
- 17. Oil pump chain guide
- 18. Oil pump tensioner assembly

Engine Mechanical System

Removal

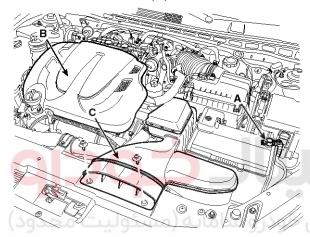
ACAUTION

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

MOTICE

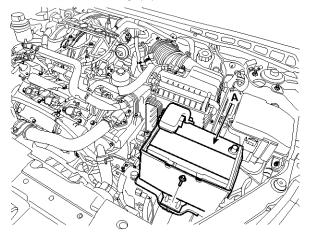
Mark all wiring and hoses to avoid misconnection.

- 1. Disconnect the battery negative terminal (A).
- 2. Remove the engine cover (B).
- 3. Remove the air duct (C).



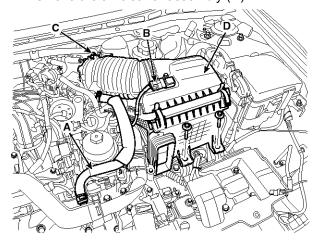
SVGM20001D

4. Disconnect the battery positive terminal, and then remove the battery (A).



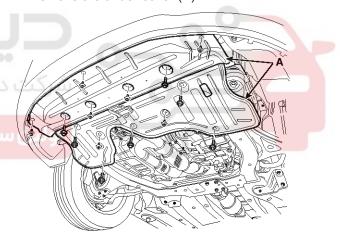
SVGM20003D

- 5. Disconnect the breather hose (A) and the BARO (Barometric pressure) sensor connector (B).
- 6. Remove the air intake hose clamp (C), and then remove the air cleaner assembly (D).



SVGM20004D

7. Remove the under cover (A).



SVGM20002D

Timing System

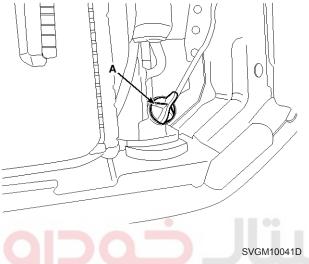
EM-31

8. Loosen the drain plug (A), and drain the coolant. Open the radiator cap to make rapid draining.

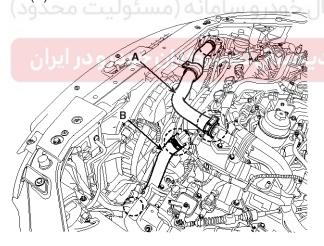
WARNING

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.

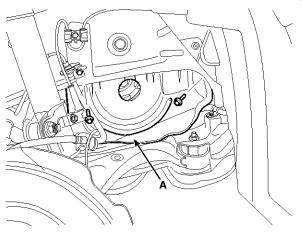


 Remove the radiator upper hose (A) and lower hose (B).



SVGM20005D

10. Remove the RH front wheel and the side cover (A).



SVGM20015D

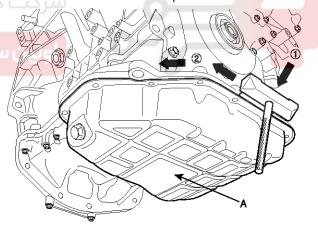
11. Drain the engine oil and then install the drain plug with a new gasket.

Tightening torque:

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

12. Remove the lower oil pan (A).

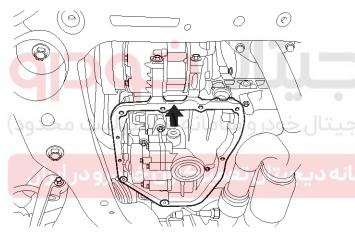
Insert the blade of SST(09215-3C000) between the upper oil pan and lower oil pan. Cut off applied sealer and remove the lower oil pan.



SNFM17001N

MOTICE

- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of arrow.
- After tapping the SST with a plastic hammer along the direction of arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not use the SST as a prybar.
 Hold the tool in position (on gasket line) and tap in with a light hammer.
- Be careful not to damage the contact surfaces of Upper oil pan and lower oil pan.
- Be careful not to damage the contact surfaces of Upper oil pan and lower oil pan.
- 13. Install the jack to the edge of upper oil pan (A) to support the engine.



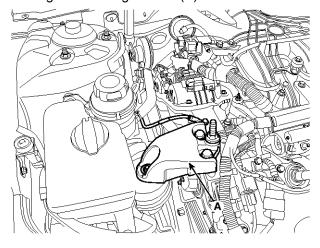
SNFM18025N

MOTICE

Insert the rubber block between jack and upper oil pan.

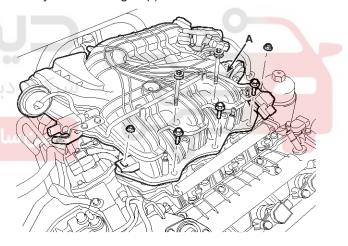
Engine Mechanical System

14. Disconnect the ground cable, and then remove the engine mounting bracket (A).



SVGM20014D

15. Disconnect the wiring connectors and then remove the surge tank (A). (Refer to Intake and exhaust system in this group)



SCMM20115L

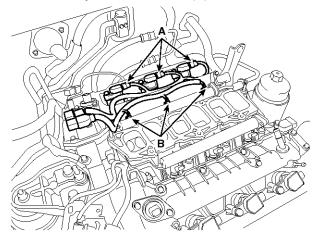
MNOTICE

Cover the inlet of intake manifold with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

Timing System

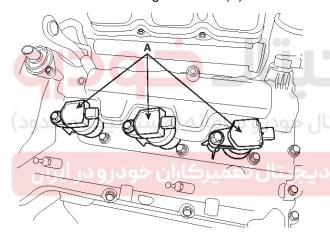
EM-33

16. Disconnect the RH ignition coil connectors (A) and the RH injector connectors (B).

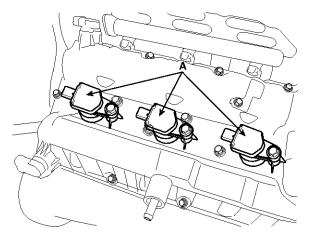


SCMM20134L

17. Remove the LH/RH ignition coils (A).

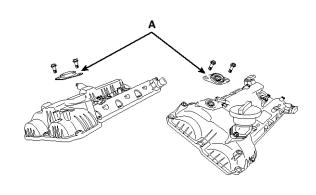


SBHEM8050D



SBHEM8051D

18. Remove the exhaust OCV cap (A), and then remove the LH, RH cylinder head covers.

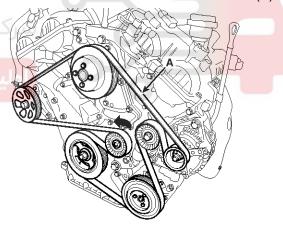


SBKM19180D

MNOTICE

Cover the cylinder head with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

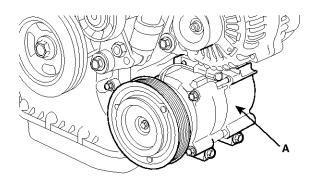
19. To release the tension, turn the drive belt tensioner counterclockwise then remove the drive belt (A).



SCMM20007L

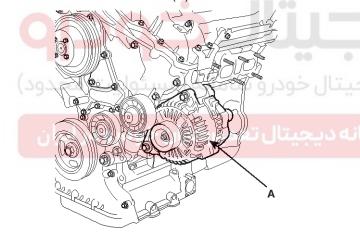
Engine Mechanical System

- 20. Lift up the engine assembly slightly by using a jack to get access to the side of engine.
- 21. Remove the air conditioner compressor (A). (Refer to HA group)



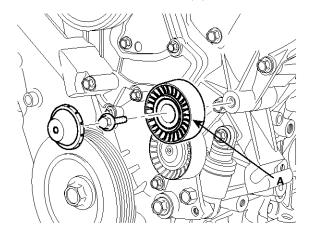
SBHEM8101D

22. Remove the alternator (A).



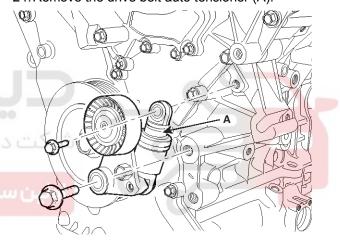
KDRF104A

23. Remove the drive belt idler (A).



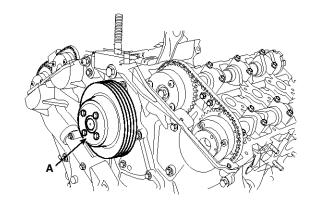
KDRF105A

24. Remove the drive belt auto tensioner (A).



KDRF106A

25. Remove the water pump pulley (A).



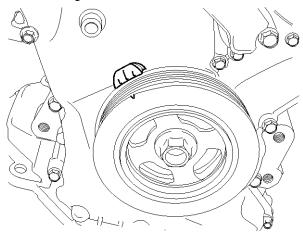
STGM29030D

Timing System

EM-35

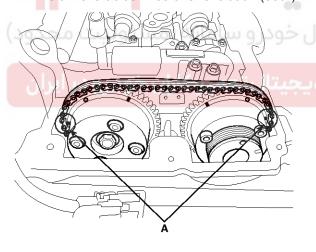
26. Set No.1 cylinder to TDC/compression.

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

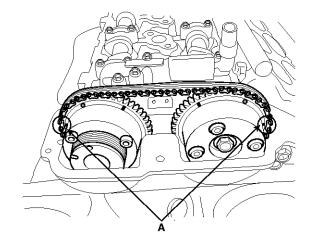


SVIEM9009D

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



SVIEM9010D

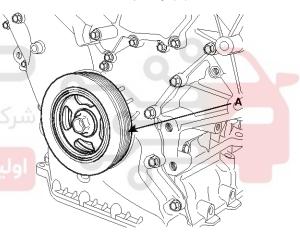


SVIEM9011D

MOTICE

Do not rotate engine counterclockwise.

27. Remove the crankshaft pulley (A).



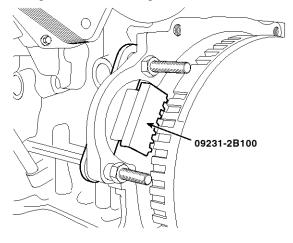
KDRF109A

Engine Mechanical System

MOTICE

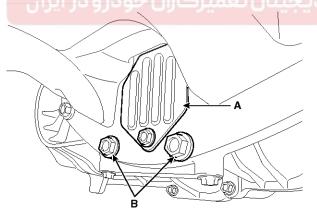
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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



SVGM20026D

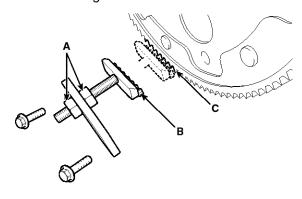
- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
 - 1. Remove the front muffler. (Refer to Intake And Exhaust system)
- 2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).



SVGM21001D

3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in

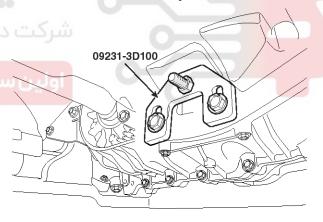
4. Fasten the two transaxle mounting bolts in the original mounted holes.



the ring gear (C) teeth.

SVGM21003D

5. Install the SST (09231-3D100) using the two mounting bolts. Tighten the bolts and nuts of the holder securely.

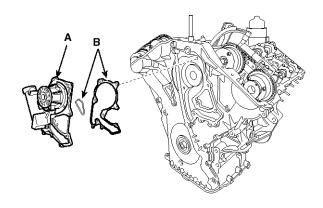


SVGM21002D

Timing System

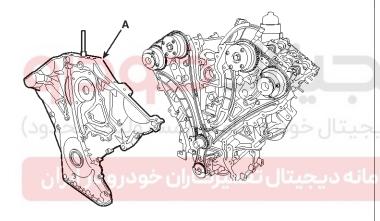
EM-37

28. Remove the water pump (A) and gasket (B).



SCMM20124L

29. Remove the timing chain cover (A).



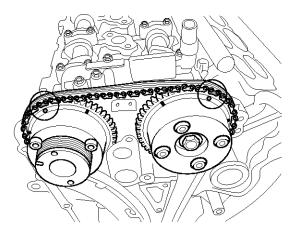
SCMM20123L

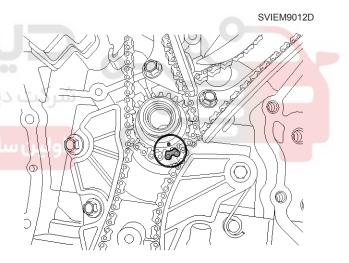
ACAUTION

Be careful not to damage the contact surfaces of cylinder block, cylinder head and timing chain cover.

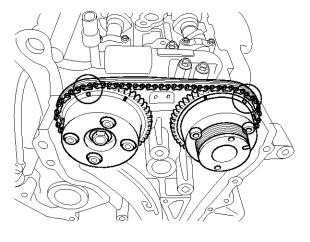
MNOTICE

Before removing the timing chain, mark the RH/LH timing chain with an identification based on the location of the sprocket because the identification mark on the chain for TDC (Top Dead Center) can be erased.



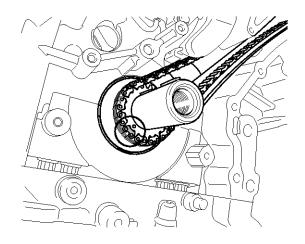


KDRF129A



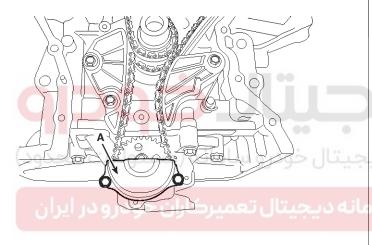
SVIEM9013D

Engine Mechanical System



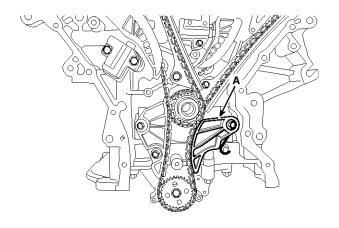
SBHEM8074D

30. Remove the oil pump chain cover (A).



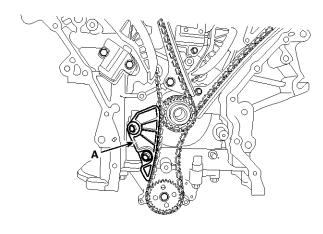
SCMM20016L

31. Remove the oil pump chain tensioner assembly (A).



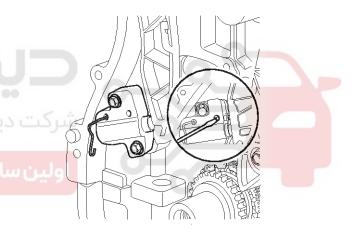
SCMM20015L

32. Remove the oil pump chain guide (A).



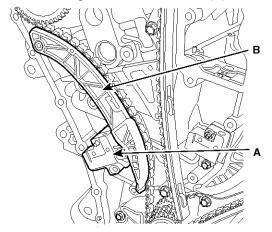
SCMM20014L

33. Install a set pin after compressing the RH timing chain tensioner.



KCRF105A

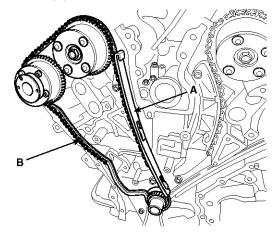
34. Remove the RH timing chain auto tensioner (A) and the RH timing chain tensioner arm (B).



KDRF117A

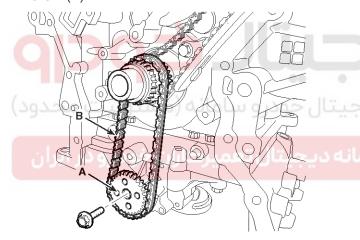
EM-39

35. Remove the RH timing chain guide (A) and RH timing chain (B).



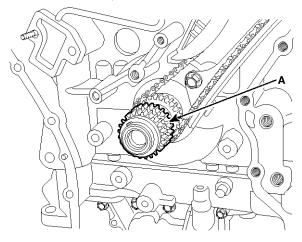
SBHEM8065D

36. Remove the oil pump chain sprocket (A) and oil pump chain (B).



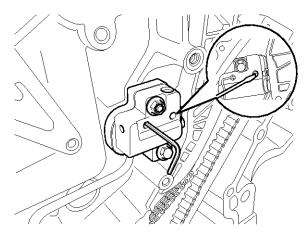
SCMM20013L

37. Remove the crankshaft sprocket (A) (O/P & RH camshaft drive).



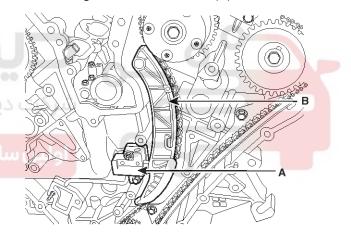
KDRF122A

38. Install a set pin after compressing the LH timing chain tensioner.



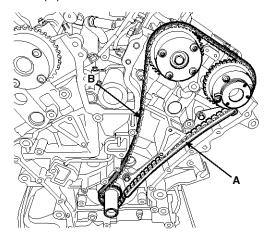
SBHEM8066D

39. Remove the LH timing chain auto tensioner (A) and LH timing chain tensioner arm (B).



STGM29031D

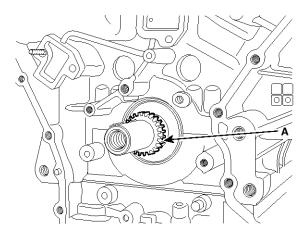
40. Remove the LH timing chain guide (A) and LH timing chain (B).



SBHEM8067D

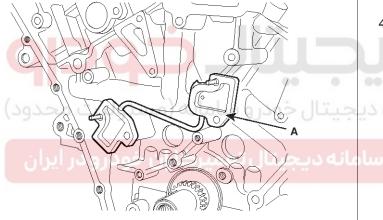
Engine Mechanical System

41. Remove the crankshaft sprocket (A). (LH camshaft drive).



KDRF126A

42. Remove the tensioner adapter assembly (A).



KDRF127A

Inspection

Sprockets, Chain Tensioner, Chain Guide, Chain Tensioner Arm

- Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary
- 2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage. Replace as necessary.
- 3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

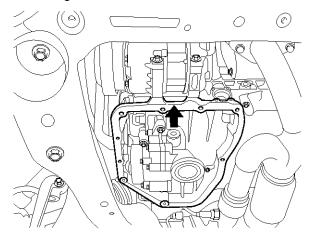
Drive belt, Idler, Belt tensioner pulley

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

EM-41

Installation

1. Install the jack to the edge of upper oil pan to support the engine.

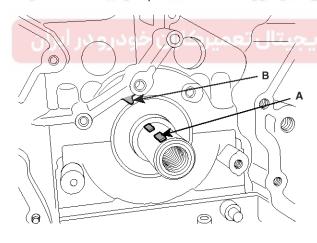


SNFM18025N

MOTICE

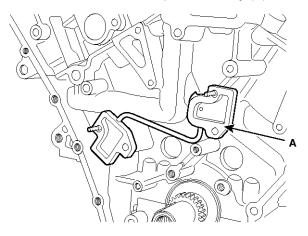
Insert the rubber block between jack and upper oil pan.

2. The key (A) of crankshaft should be aligned with the timing mark (B) of timing chain cover. As a result of this, the piston of No.1 cylinder is placed at the top dead center on compression stroke.



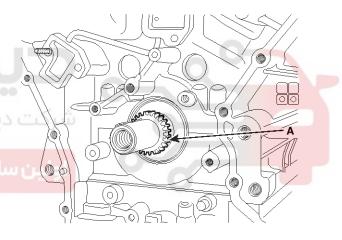
KDRF128A

3. Install the tensioner adapter assembly (A).



KDRF127A

4. Install the crankshaft sprocket (A). (LH camshaft drive).



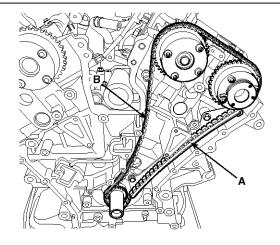
KDRF126A

Engine Mechanical System

5. Install the LH timing chain guide (A) and LH timing chain (B).

Tightening torque:

19.6 \sim 24.5N.m (2.0 \sim 2.5kgf.m, 14.5 \sim 18.1lb-ft)

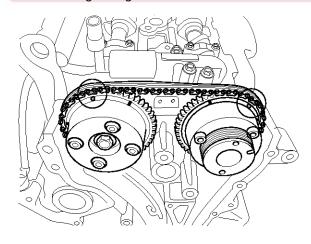


SBHEM8067D

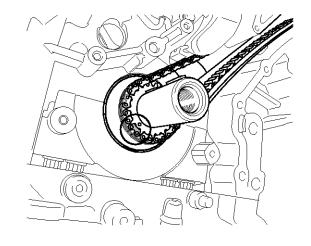
MOTICE

To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure. Crankshaft sprocket \rightarrow Timing chain guide \rightarrow Exhaust camshaft sprocket \rightarrow Intake camshaft sprocket.

The timing mark of each sprockets should be matched with timing mark (color link) of timing chain at installing timing chain.



SVIEM9013D

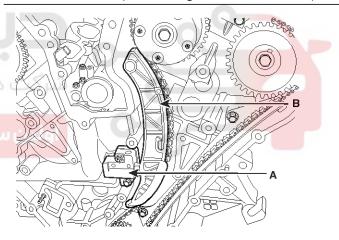


SBHEM8074D

6. Install the LH timing chain auto tensioner (A) and LH timing chain tensioner arm (B).

Tightening torque

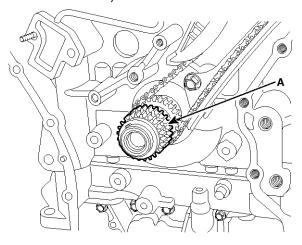
A: 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft) B: 18.6 ~ 21.6N.m (1.9 ~ 2.2kgf.m, 13.7 ~ 15.9lb-ft)



STGM29031D

EM-43

7. Install the crankshaft sprocket (A) (O/P & RH camshaft drive).

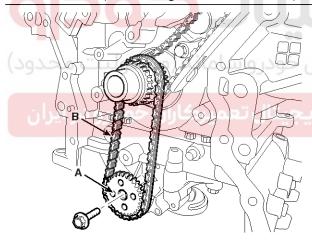


KDRF122A

8. Install the oil pump chain sprocket (A) and oil pump chain (B).

Tightening torque:

 $18.6 \sim 21.6$ N.m $(1.9 \sim 2.2$ kgf.m, $13.7 \sim 15.9$ lb-ft)

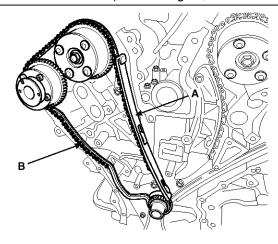


SCMM20013L

9. Install the RH timing chain guide (A) and RH timing chain (B).

Tightening torque:

A: $19.6 \sim 24.5$ N.m $(2.0 \sim 2.5$ kgf.m, $14.5 \sim 18.1$ lb-ft)



SBHEM8065D

MNOTICE

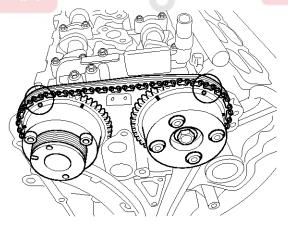
To install the timing chain with no slack between each shaft (cam, crank), follow the below procedure.

Crankshaft sprocket → Timing chain guide → Intake

camshaft sprocket → Exhaust camshaft sprocket.

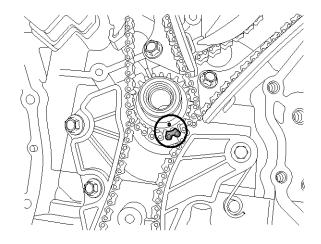
The timing mark of each sprockets should be

matched with timing mark (color link) of timing chain at installing timing chain.



SVIEM9012D

Engine Mechanical System

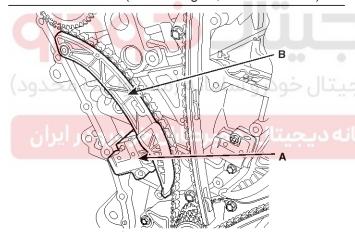


KDRF129A

10. Install the RH timing chain auto tensioner (A) and the RH timing chain tensioner arm (B).

Tightening torque

A: $9.8 \sim 11.8$ N.m ($1.0 \sim 1.2$ kgf.m, $7.2 \sim 8.7$ lb-ft) B: $18.6 \sim 21.6$ N.m ($1.9 \sim 2.2$ kgf.m, $13.7 \sim 15.9$ lb-ft)

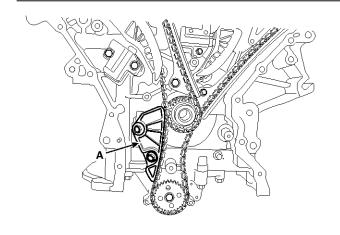


KDRF117A

11. Install the oil pump chain guide (A).

Tightening torque:

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

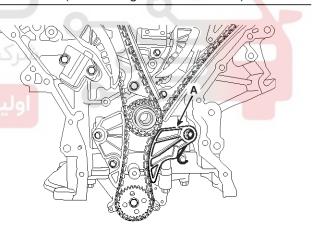


SCMM20014L

12. Install the oil pump chain tensioner assembly (A).

Tightening torque:

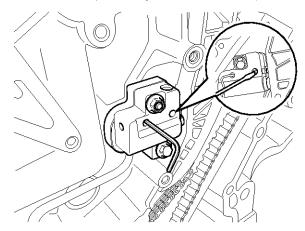
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



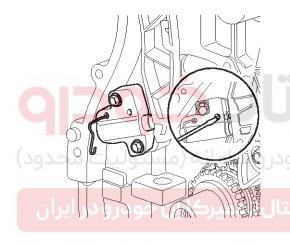
SCMM20015L

EM-45

13. Pull out the pins of hydraulic tensioner (LH & RH).



SBHEM8066D

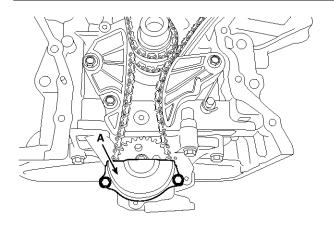


KCRF105A

14. Install the oil pump chain cover (A).

Tightening torque:

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



SCMM20016L

15. After rotating the crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.

MNOTICE

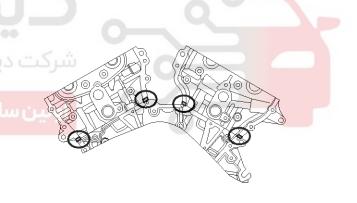
Always turn the crankshaft clockwise.

Turning the crankshaft counter clockwise before building up oil pressure in the hydraulic timing chain tensioner may result in the chain disengaging from the sprocket teeth.

16. Install the timing chain cover.

- The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and lower oil pan) must be free of engine oil and etc.
- 2) Before assembling the timing chain cover, the liquid sealant TB 1217H should be applied on the gap between cylinder head and cylinder block. The part must be assembled within 5 minutes after sealant was applied.

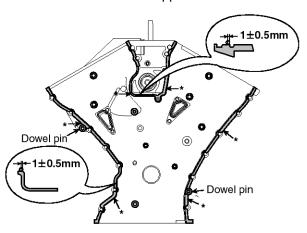
Bead width: 2.5mm(0.1in.)



KDRF134A

After applying liquid sealant TB1217H on timing chain cover. The part must be assembled within 5 minutes after sealant was applied.

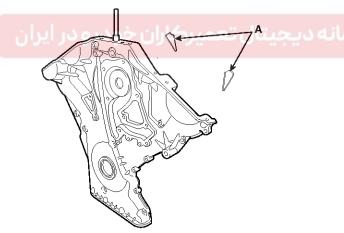
Sealant should be applied without discontinuity.



SVGM20027L

MNOTICE

- Fill the T-joint area (6EA *) with sealant.
- Apply sealant all around the dowel pin hole (2EA).
- 4) Install the new gasket (A) to the timing chain cover.



SCMM20060L

MNOTICE

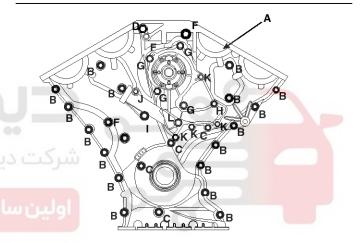
During timing cover installation, care not to take off applied sealant on the timing cover by contact with other parts.

Engine Mechanical System

5) The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover to be in exact position.

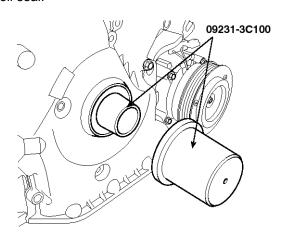
Tightening torque

B(17) :18.6 \sim 21.6N.m (1.9 \sim 2.2kgf.m, 13.7 \sim 15.9lb-ft) C(4) :9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft) D(2) :58.8 \sim 68.8N.m (6.0 \sim 7.0kgf.m, 43.4 \sim 50.6lb-ft) F(2) :24.5 \sim 26.5N.m (2.5 \sim 2.7kgf.m, 18.1 \sim 19.5lb-ft) G(4) :21.6 \sim 23.5N.m (2.2 \sim 2.4kgf.m, 15.9 \sim 17.4lb-ft) H(1) :9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft) I(1) :9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft) J(1) :9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft) K(4) :9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft) L(1):21.6 \sim 26.5N.m (2.2 \sim 2.7kgf.m, 15.9 \sim 19.5lb-ft) - New bolt



SXMM20009L

- 6) Running the engine or performing a pressure test should not be performed within 30 minutes of assembly.
- 17. Using SST(09231-3C100), install timing chain cover oil seal.



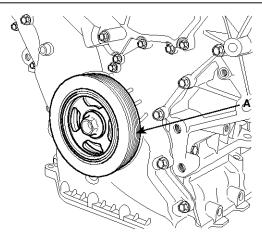
SENEM8026D

EM-47

18. Install the crankshaft pulley (A).

Tightening torque:

284.4 ~304.0N.m (29.0~31.0kgf.m, 209.8~224.2lb-ft)

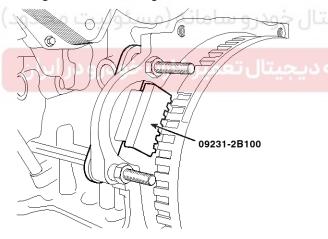


KDRF109A

MOTICE

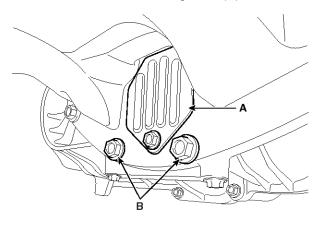
There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

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



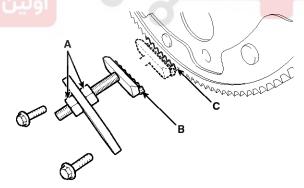
SVGM20026D

- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
 - 1. Remove the front muffler. (Refer to Intake And Exhaust system)
 - 2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).



SVGM21001D

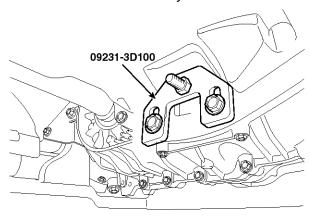
- 3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
- 4. Fasten the two transaxle mounting bolts in the original mounted holes.



SVGM21003D

Engine Mechanical System

5. Install the SST (09231-3D100) using the two mounting bolts. Tighten the bolts and nuts of the holder securely.



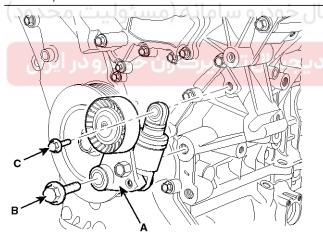
SVGM21002D

19. Install the drive belt auto tensioner (A).

Tightening torque

Bolt (B) :81.4 ~ 85.3N.m (8.3 ~ 8.7kgf.m, 60.0 ~ 62.9lb-ft)

Bolt (C) :17.7 ~ 21.6N.m (1.8 ~ 2.2kgf.m, 13.0 ~ 15.9lb-ft)

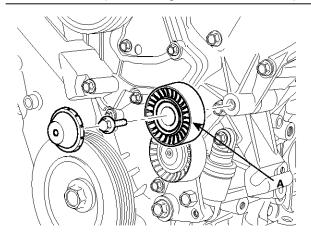


SENEM8020D

20. Install the drive belt idler (A).

Tightening torque

52.9 ~ 57.9N.m (5.4 ~ 5.9kgf.m, 39.1 ~ 42.7lb-ft)

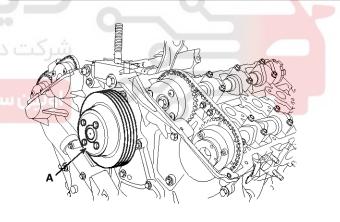


KDRF105A

21. Install the water pump pulley (A).

Tightening torque:

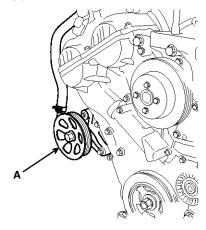
 $7.8 \sim 9.8$ N.m (0.8 ~ 1.0 kgf.m, $5.8 \sim 7.2$ lb-ft)



STGM29030D

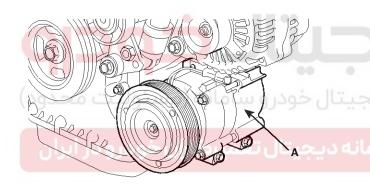
EM-49

22.Install the power steering pump (A). (Refer to ST group)



SCMM20037L

23.Install the air conditioner compressor (A). (Refer to HA group)

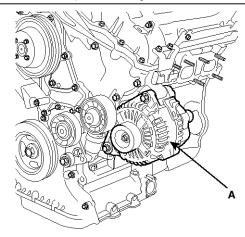


SBHEM8101D

24. Install the alternator (A). (Refer to EE group)

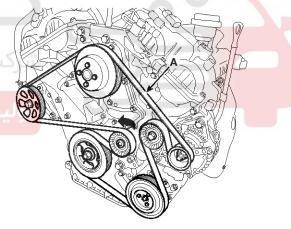
Tightening torque:

26.5 \sim 33.3N.m (2.7 \sim 3.4kgf.m, 19.5 \sim 24.6lb-ft)



KDRF104A

25. Rotate the auto tensioner counter - clockwise. With the tensioner turned, install the drive belt (A) on auto tensioner and then release the tensioner.



SCMM20007L

26. Install the LH/RH cylinder head cover (A).

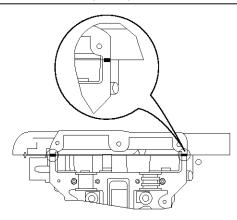
ACAUTION

- Install the cylinder head cover under the exhaust OCV cap is removed.
- To prevent engine oil leakage, surely install the exhaust OCV cap after installing the cylinder head cover.
- The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.

Engine Mechanical System

2) After applying sealant(TB1217H), it should be assembled within 5 minutes.

Bead width: 2.5mm(0.1in.)

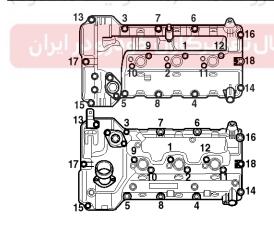


SBHEM8095D

- 3) Running the engine or performing a pressure test should not be performed within 30 minutes of assembly.
- 4) Install the cylinder head cover bolts as following method.

Tightening torque:

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



SBHEM8096D

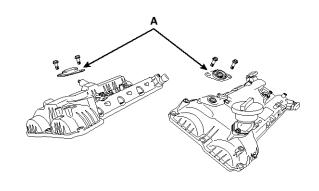
ACAUTION

Do not reuse cylinder head cover gasket.

5) Install the exhaust OCV cap (A).

Tightening torque:

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

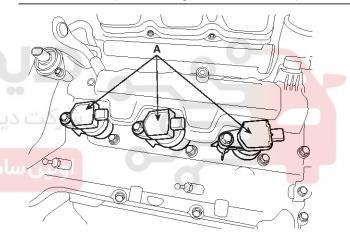


SBKM19180D

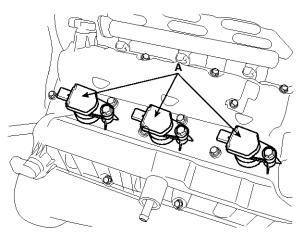
27. Install the LH/RH ignition coils.

Tightening torque:

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



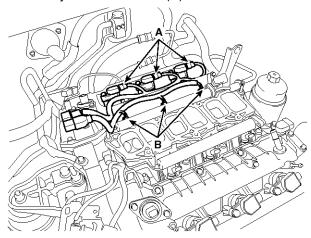
SBHEM8050D



SBHEM8051D

EM-51

28. Connect the RH ignition coil connectors (A) and the RH injector connectors (B).

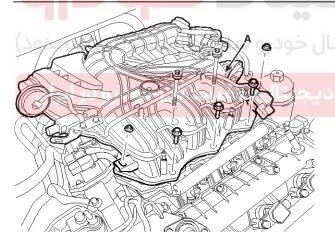


SCMM20134L

29. Install the surge tank (A) and then connect the wiring connectors (Refer to Intake and exhaust system in this group)

Tightening torque:

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



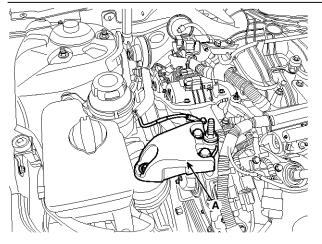
SCMM20115L

30.Install the engine mounting bracket (A) and then connect the ground cable.

Tightening torque:

Bolts & Nuts

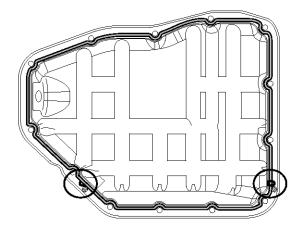
 $63.8 \sim 83.4 \text{ N.m} (6.5 \sim 8.5 \text{ kgf.m}, 47.0 \sim 61.5 \text{ lb-ft})$



SVGM20014D

- 31. Remove the jack under the upper oil pan.
- 32. Install the lower oil pan (A).
 - 1) Using a gasket scraper, remove all the packing material from the gasket surfaces.
 - 2) Before assembling the oil pan, the liquid sealant TB 1217H should be applied on oil pan. The part must be assembled within 5 minutes after the sealant was applied.

Bead width: 2.5mm(0.1in.)



KDRF136A

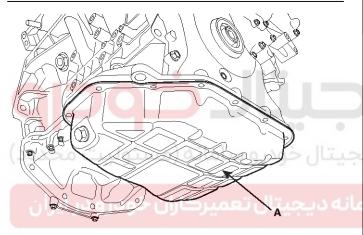
Engine Mechanical System

CAUTION

- Clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant.
- When applying sealant gasket, sealant must not protrud into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes
- Install the oil pan (A).
 Uniformly tighten the bolts in several passes.

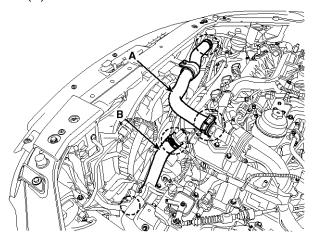
Tightening torque:

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



STGM29034D

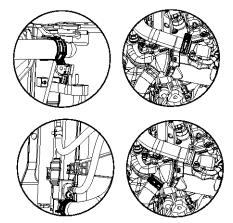
33.Install the radiator upper hose (A) and lower hose (B).



SVGM20005D

MNOTICE

Install the radiator hoses as shown illustrations.

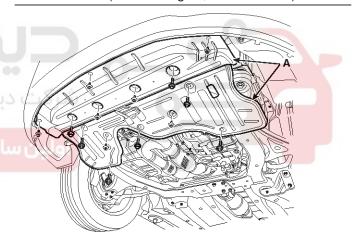


SVGM20017D

34. Install the under cover (A).

Tightening torque:

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



SVGM20002D

EM-53

35. Install the side cover (A) and the RH front wheel.

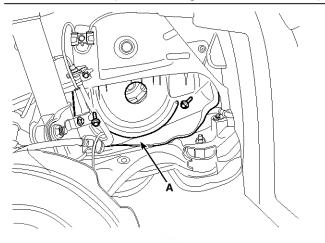
Tightening torque:

Side cover bolts:

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

Wheel nuts:

 $88.3 \sim 107.9 \text{ N.m}$ (9.0 $\sim 11.0 \text{ kgf.m}$, 65.1 $\sim 79.6 \text{ lb-ft}$)



SVGM20015D

- 36. Install the air cleaner assembly (D) and the air intake hose clamp (C).
- 37. Connect the breather hose (A) and the BARO(Barometric pressure) sensor connector (B).

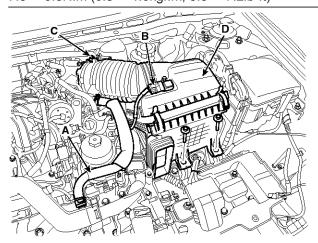
Tightening torque

Hose clamp bolt:

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

Air cleaner assembly bolts:

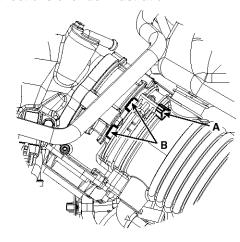
 $7.8 \sim 9.8$ N.m (0.8 ~ 1.0 kgf.m, $5.8 \sim 7.2$ lb-ft)



SVGM20004D

MNOTICE

Assembling direction of clamp hose must conform to directions of under illustration.



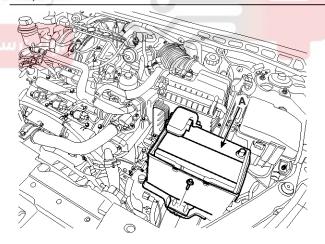
SVGM20050D

38.Install the battery (A) and then connect the battery positive terminal.

Tightening torque:

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

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



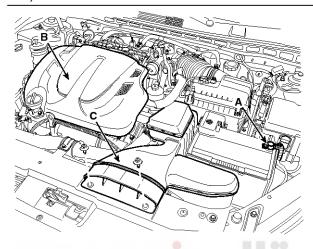
SVGM20003D

Engine Mechanical System

- 39. Install the air duct (C).
- 40. Install the engine cover (B).
- 41. Connect the battery negative terminal (A).

Tightening torque:

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



SVGM20001D

MOTICE

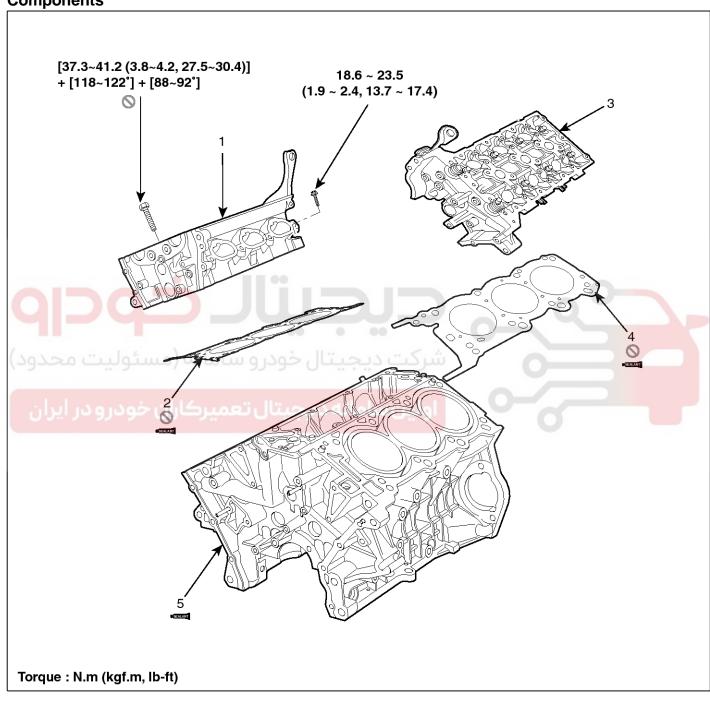
- Refill engine oil.
- Clean the battery posts and cable terminals with sandpaper. Assemble and then apply grease to prevent corrosion.
- Inspect for fuel leakage.
 - After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
 - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel lines.
- Refill 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 the engine and let it cool down. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
 - Put radiator cap on tightly, then run the engine again and check for leaks.

EM-55

Cylinder Head Assembly

Cylinder Head

Components

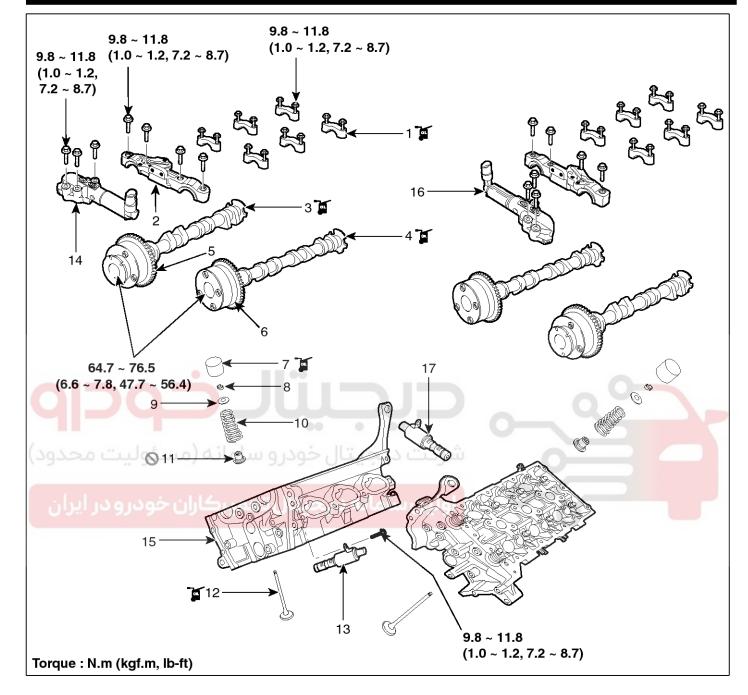


SVGM20028L

- 1. RH Cylinder head
- 2. RH Cylinder head gasket
- 3. LH Cylinder head

- 4. LH Cylinder head gasket
- 5. Cylinder block

Engine Mechanical System



SVGM20029L

- 1. Camshaft bearing cap
- 2. Camshaft thrust bearing cap
- 3. Exhaust camshaft
- 4. Intake camshaft
- 5. Exhaust CVVT assembly
- 6. Intake CVVT assembly
- 7. Mechanical lash adjuster (MLA)
- 8. Retainer lock
- 9. Retainer
- 10. Valve spring
- 11. Valve stem seal
- 12. Valve

- 13. RH Exhaust camshaft OCV
- 14. RH Intake camshaft OCV
- 15. Cylinder head
- 16. LH Exhaust camshaft OCV
- 17. LH Intake camshaft OCV

EM-57

Removal

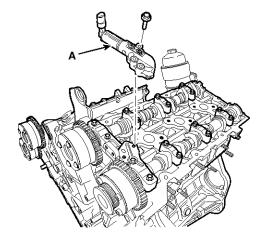
CAUTION

- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature (20°C [68°F]) 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.

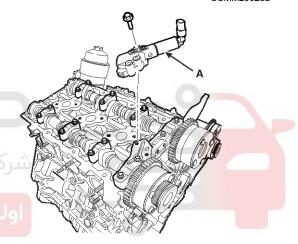
MOTICE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.
- 1. Remove the intake manifold and exhaust manifolds. (Refer to Intake and exhaust system in this group)
- 2. Remove the timing chain. (Refer to Timing system in this group)
- 3. Remove the water temperature control assembly. (Refer to Cooling system in this group)

4. Remove the LH/RH exhaust camshaft OCV (A).



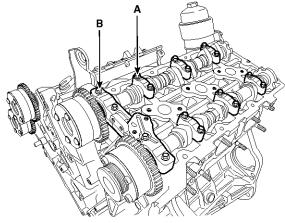
SCMM20025L



SCMM20026L

Engine Mechanical System

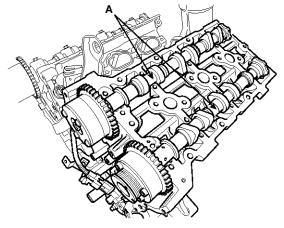
5. Remove the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).



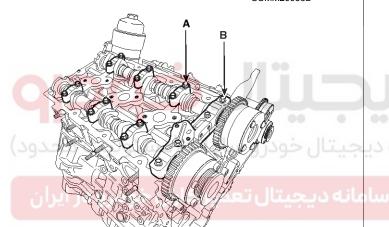
SCMM20035L



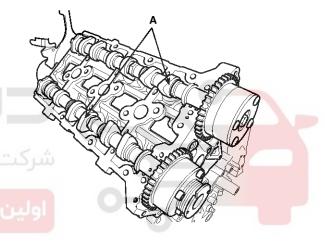
6. Remove the LH/RH camshaft assembly (A).



SBHEM8072D



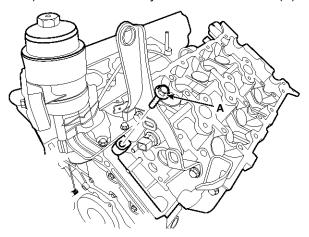
SCMM20036L



SBHEM8073D

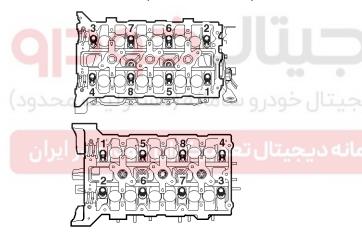
EM-59

- 7. Remove the LH/RH cylinder heads.
 - 1) Remove the RH cylinder head rear bolt (A).



SCMM20027L

2) Uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence shown.

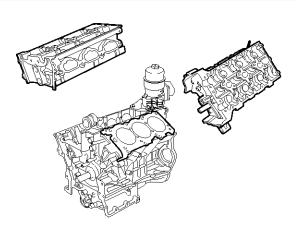


STGM29037D

ACAUTION

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

3) Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.



SCMM20125L

ACAUTION

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

4) Remove the cylinder head gaskets.

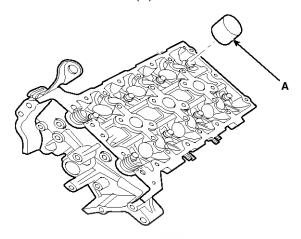
Engine Mechanical System

Disassembly

MNOTICE

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

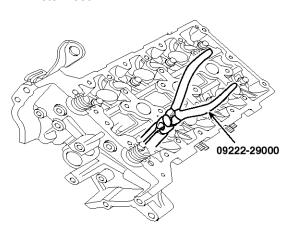
1. Remove the MLAs (A).



SCMM20038L

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

- 2) Remove the spring retainer.
- 3) Remove the valve spring.
- 4) Remove the valve.
- 5) Using the SST(09222-29000), remove the valve stem seal.



SCMM20040L

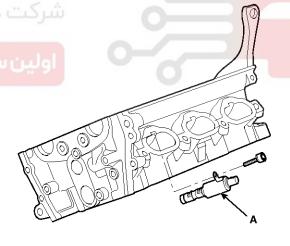
MNOTICE

Do not reuse old valve stem seals.

3. Remove the intake camshaft OCV (A).



SCMM20039L



SCMM20041L

EM-61

Inspection

Cylinder Head

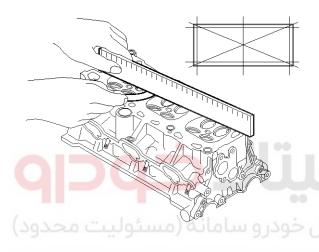
1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard : Less than 0.05mm(0.002in.) [Less than 0.02mm(0.0008in.)/150x150] Flatness of manifold gasket surface

Standard : Less than 0.03mm(0.001in)/110x110



EDQF160A

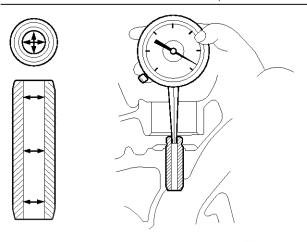
Inspect for cracks.
 Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve And Valve Spring

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

Valve guide I.D.

Intake / Exhaust : $5.500 \sim 5.512$ mm ($0.216 \sim 0.217$ in.)

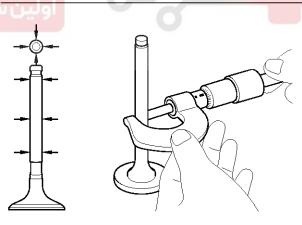


ECBF034A

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

Valve stem O.D.

Intake : $5.465 \sim 5.480$ mm (0.2151 ~ 0.2157 in.) Exhaust : $5.458 \sim 5.470$ mm (0.2149 ~ 0.2153 in.)



KCRF227A

Subtract the valve stem diameter measurement from the valve guide inside diameter

 Check the valve seats

Valve stem-to-guide clearance

measurement.

[Standard]

Intake : $0.020 \sim 0.047$ mm ($0.0008 \sim 0.0018$ in.) Exhaust : $0.030 \sim 0.054$ mm ($0.0012 \sim 0.0021$ in.)

[Limit]

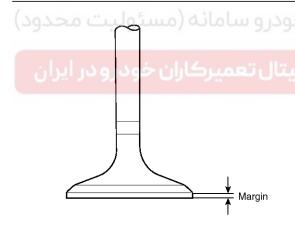
Intake: 0.07mm (0.0027in.) Exhaust: 0.09mm (0.0035in.)

- 2. Inspect valves.
 - Check the valve is ground to the correct valve face angle.
 - Check that the surface of the 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: $1.56 \sim 1.86$ mm (0.06142 ~ 0.07323 in.) Exhaust: $1.73 \sim 2.03$ mm (0.06811 ~ 0.07992 in.)



ECKD221A

4) Check the valve length.

Length

Intake: 105.27mm (4.1445in) Exhaust: 105.50mm (4.1535in)

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

Engine Mechanical System

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

If the valve seat is worn, replace cylinder head.

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

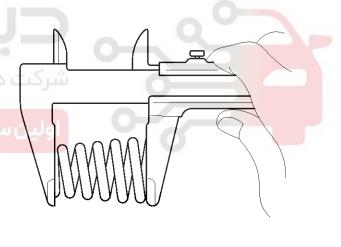
- 4. Inspect valve springs.
 - Using a steel square, measure the out-of-square of the valve spring.
 - 2) Using vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

Free height: 45.5mm (1.7913in.)

Out-of-square: 1.5°



SXMM20005L

EM-63

MLA

1. Inspect MLAs.

Using a micrometer, measure the MLA outside diameter.

MLA O.D.

Intake/Exhaust:

 $34.964 \sim 34.980$ mm $(1.3765 \sim 1.3771$ in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

Tappet bore I.D.

Intake/Exhaust:

 $35.000 \sim 35.025$ mm $(1.3779 \sim 1.3789$ in.)

3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

MLA to tappet bore clearance

[Standard]

Intake/Exhaust : $0.020 \sim 0.061$ mm($0.0008 \sim 0.0024$ in.)

[Limit]

Intake/Exhaust: 0.07mm(0.0027in.)

Camshaft

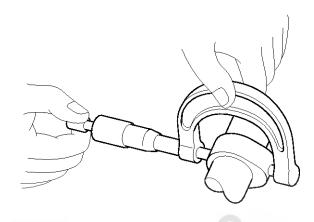
Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

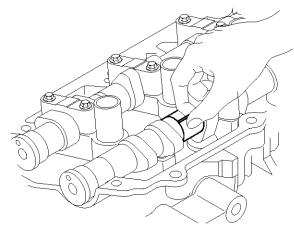
Intake: 47.2mm (1.8582in.) Exhaust: 45.8mm (1.8031in.)



KCRF206A

If the cam lobe height is less than standard, 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 journals.



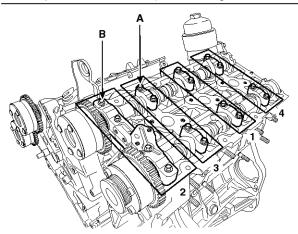
KCRF207A

Install the bearing cap (A) and thrust bearing cap
 (B) with specified torque. (Refer to Cylinder head in this group)

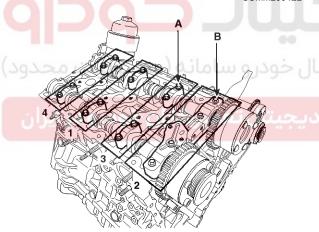
Tightening torque:

1st step: 5.8N.m (0.6kgf.m, 4.3lb-ft)

2nd step : 9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft)







SCMM20043L



Do not turn the camshaft.

Engine Mechanical System

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

Bearing oil clearance

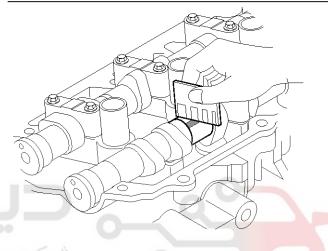
[Standard value]

Intake

No.1 journal : $0.020 \sim 0.057$ mm ($0.0008 \sim 0.0022$ in.) No.2,3,4 journal : $0.030 \sim 0.067$ mm ($0.0012 \sim 0.0026$ in.)

Exhaust

No.1 journal : 0.027 \sim 0.057mm (0.0010 \sim 0.0022in.) No.2,3,4 journal : 0.030 \sim 0.067mm (0.0012 \sim 0.0026in.)



KCRF208A

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

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

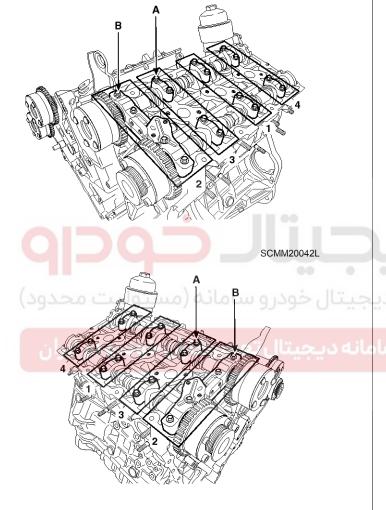
EM-65

- 3. Inspect the camshaft end play.
 - 1) Install the camshafts.
 - 2) Install the bearing cap (A) and thrust bearing cap(B) with specified torque.

Tightening torque:

1st step: 5.8N.m (0.6kgf.m, 4.31lb-ft)

2st step : 9.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft)

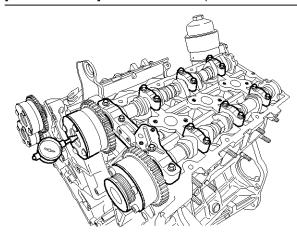


SCMM20043L

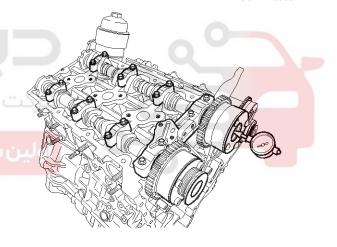
3) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

[Standard value] : $0.02 \sim 0.18$ mm($0.0008 \sim 0.0071$ in.)



SCMM20055L



SCMM20056L

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

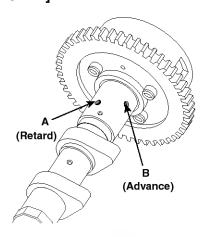
4) Remove the camshafts.

Engine Mechanical System

CVVT Assembly

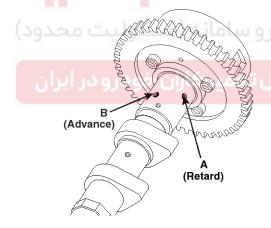
- 1. Inspect the CVVT assembly.
 - 1) Check that the CVVT assembly will not turn.
 - 2) Apply vinyl tape to the retard hole except the one indicated by the arrow in the illustration.

[Intake CVVT]



SBKM19050L

[Exhaust CVVT]



SBKM19162L

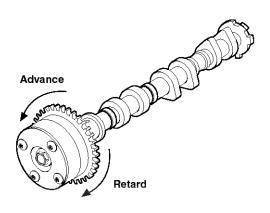
 Wrap tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm², 21psi) to the port of the camshaft.

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

MOTICE

To reduce oil splashing during pressurizing with air gun, shield the nozzle tip with a shop rag. Wipe off any splashed oil after checking. 4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand.



SVIEM9101L

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

Standard: The normal movable range is approximately 30° before the lock pin.

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

EM-67

Reassembly

MNOTICE

Thoroughly clean all parts to be assembled.

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

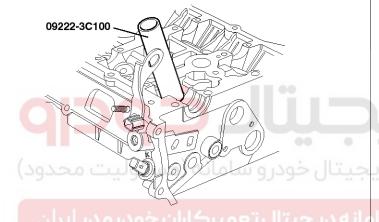
Replace oil seals with new ones.

- 1. Install the valves.
 - 1) Using the SST(09222-3C100), push in a new oil seal.

MOTICE

Do not reuse old valve stem seals.

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



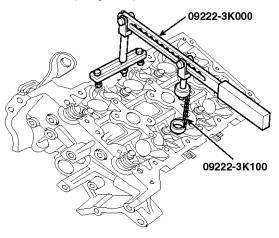
KCRF120E

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

MOTICE

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

3) Using the SST(09222 - 3K000, 09222-3K100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



SCMM20039L

- 4) Lightly tap the end of each valve stem two or three times with a soft hammer or the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.
- 2. Install the MLAs.

Check that the MLA rotates smoothly by hand.



SCMM20038L

MOTICE

MLA can be reinstalled in its original position.

However, the valve lash clearances must be rechecked and adjusted accordingly before the cylinder head is installed onto the cylinder block.

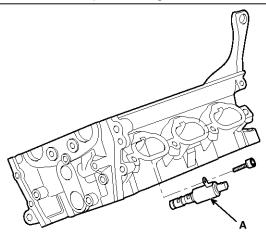
Refer to General information in EM section for Valve Clearance checking and adjustment procedure.

Engine Mechanical System

Install the OCV(A).

Tightening torque

 $9.80 \sim 11.76$ Nm ($1.0 \sim 1.2$ kgf.m, $7.23 \sim 8.68$ lb-ft)



SCMM20041L

MOTICE

- Install OCV with gray colored connector into RH
 bank.
- Install OCV with black colored connector into LH bank.

خودرو سامانه (مسئولـCAUTION)د

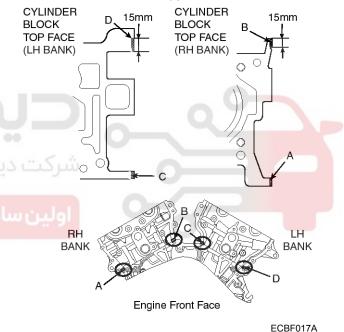
- · Do not reuse the OCV when dropped.
- · Keep the OCV clean.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine while holding the OCV yoke.

Installation

MOTICE

- Thoroughly clean all parts to be assembled.
- · Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC.
- 1. Install the cylinder head.
 - a. The sealant locations on cylinder head and cylinder block must be free of engine oil and ETC.
 - b. Apply sealant on cylinder block top face before assembling cylinder head gaskets.

The part must be assembled within 5 minutes after sealant was applied.



EM-69

MNOTICE

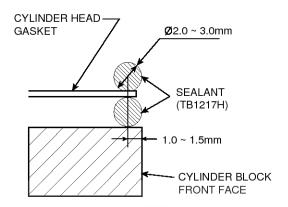
Refer to below illustration to apply the sealant.

Bead width:

2.0~3.0 mm (0.078 ~ 0.118 in.)

Sealant locations:

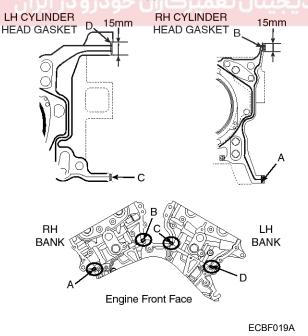
1.0~1.5mm (0.039 \sim 0.059 in.) from block surface Recommended sealant : Liquid sealant TB1217H



ECBF018A

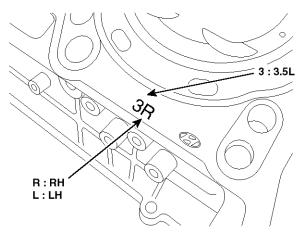
 Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block.

The part must be assembled within 5 minutes after sealant was applied.



MNOTICE

Be careful of the installation direction.

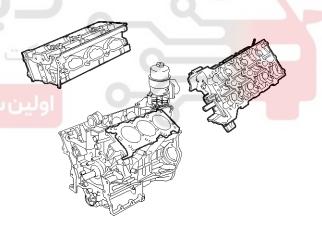


SCMM20057L

d. Install the cylinder head.

MNOTICE

Remove the extruded sealant after assembling cylinder heads.



SCMM20125L

Engine Mechanical System

- 2. Install cylinder head bolts.
 - 1) Do not apply engine oil on the threads and under the heads of the cylinder head bolts.
 - 2) Using SST(09221-4A000), install and tighten the cylinder head bolts and plate washers, in several passes, in the sequence shown.

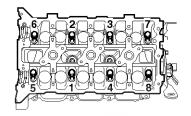


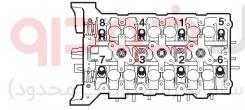
Always use a new cylinder head bolts.

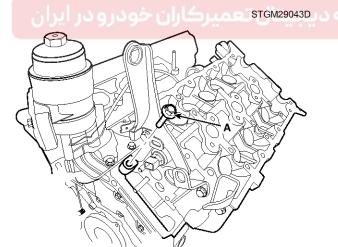
Tightening torque

Head bolt: 37.3~41.2N.m (3.8~4.2kgf.m, 27.5~30.4lb-ft) + (118~122°) + (88~92°)

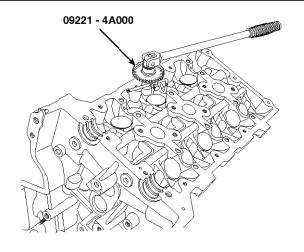
Bolt (A):18.6 \sim 23.5Nm (1.9 \sim 2.4kgf.m, 13.7 \sim 17.4lb-ft)







SCMM20027L

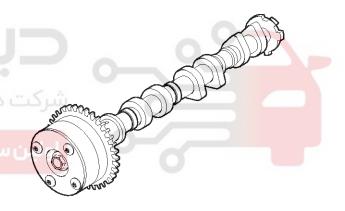


SXMM20006L

3. Install the CVVT assembly.

Tightening torque:

64.7 ~ 76.5N.m (6.6 ~ 7.8kgf.m, 47.7 ~ 56.4lb-ft)



SVIEM9102D

♠CAUTION

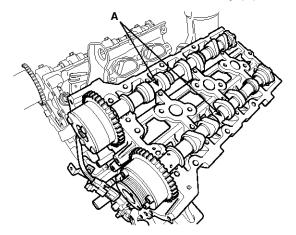
Install camshaft-inlet to dowel pin of CVVT assembly.

At this time, attend not to be installed to oil hole of camshaft-inlet.

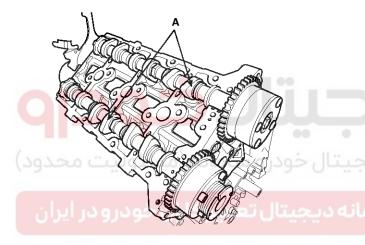
- Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.
- Do not rotate CVVT assembly when camshaft is installed to dowel pin of CVVT assembly.

EM-71

4. Install the LH/RH camshaft assembly (A).



SBHEM8072D

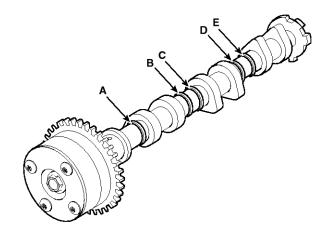


SBHEM8073D

ACAUTION

- Apply a light coat of engine oil on camshaft journals.
- Assemble the key groove of camshaft rear side to the same level of head top surface.
- Be careful the right, left bank, intake, exhaust side before assembling.

Intake Camshaft



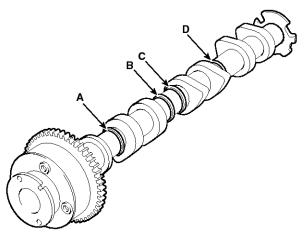
SCMM10013N

As for camshaft identification, refer to the table below.

Displac - ement	Outer diameter	
	LH	RH
Intake camshaft	A: 27mm (1.0630in.)	A: 27mm (1.0630in.)
	B: 27mm (1.0630in.)	B: 27mm (1.0630in.)
	C: 30mm (1.1811in.)	C : 30mm (1.1811in.)
	D: 30mm (1.1811in.)	D : 27mm (1.0630in.)
ا اولین ب	E: 27mm (1.0630in.)	E: 30mm (1.1811in.)

Engine Mechanical System

Exhaust Camshaft



SCMM10014N

As for camshaft identification, refer to the table below.

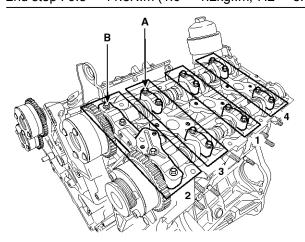
Displace-	Outer diameter	
ment	LH	RH
Exhaust camshaft	A: 27mm (1.0630in.)	A: 27mm (1.0630in.)
	B: 27mm (1.0630in.)	B: 27mm (1.0630in.)
	C: 30mm (1.1811in.)	C: 30mm (1.1811in.)
	D: 27mm (1.0630in.)	D: 30mm (1.1811in.)

5. Install the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).

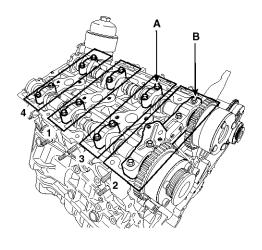
Tightening torque

1st step: 5.8N.m (0.6kgf.m, 4.3lb-ft)

2nd step : 9.8 \sim 11.8N.m (1.0 \sim 1.2kgf.m, 7.2 \sim 8.7lb-ft)



SCMM20042L



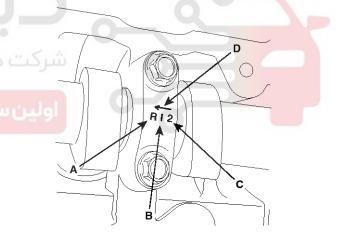
SCMM20043L

ACAUTION

Be sure to install the thrust bearing cap bolts and the bearing cap bolts in the correct place.

MOTICE

Be careful the right, left bank, intake, exhaust side before assembling.



STGM29045D

A: L(LH),R(RH)

B: I(Intake), E(Exhaust)

C: Journal number

D: Front mark

CAUTION

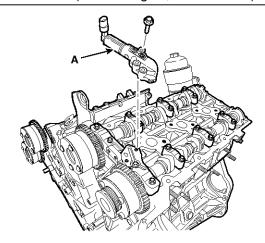
Rotate the crankshaft not to contact the valves to the pistons by making the pistons below 10mm(0.3937in.) from the top of cylinder block.

EM-73

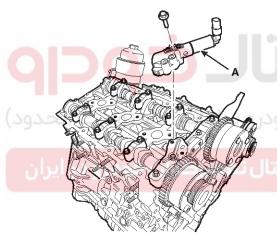
6. Install the LH/RH exhaust camshaft OCV (A).

Tightening torque:

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



SCMM20025L



SCMM20026L

- 7. Install the water temperature control assembly. (Refer to Cooling system in this group)
- 8. Install the timing chain. (Refer to Timing system in this group)

9. Install the intake manifold and exhaust manifolds. (Refer to Intake and exhaust system in this group)

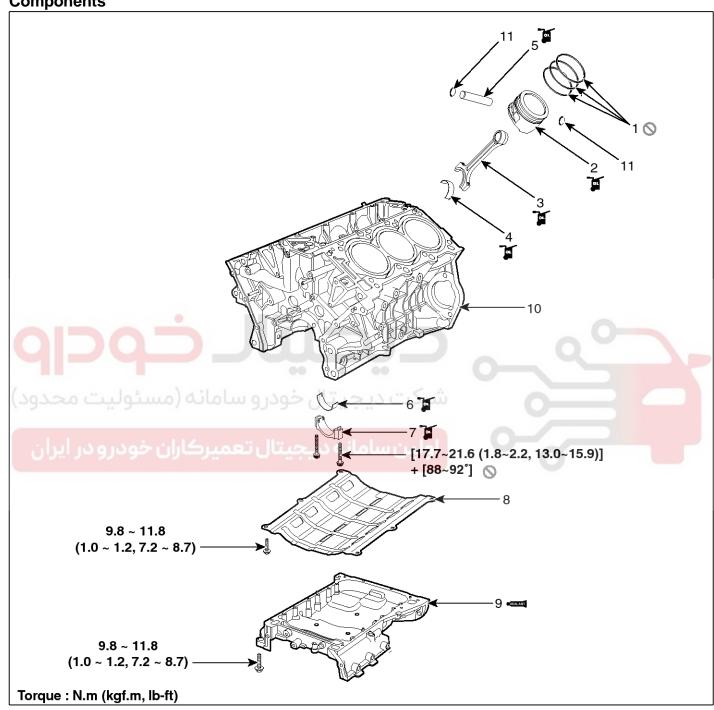
MOTICE

- Refill engine oil.
- Clean the battery posts and cable terminals with sandpaper. Assemble and then apply grease to prevent corrosion.
- Inspect for fuel leakage.
 - After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
 - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel lines.
- Refill 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 the engine and let it cool down. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
 - Put radiator cap on tightly, then run the engine again and check for leaks.

Engine Mechanical System

Cylinder Block

Components

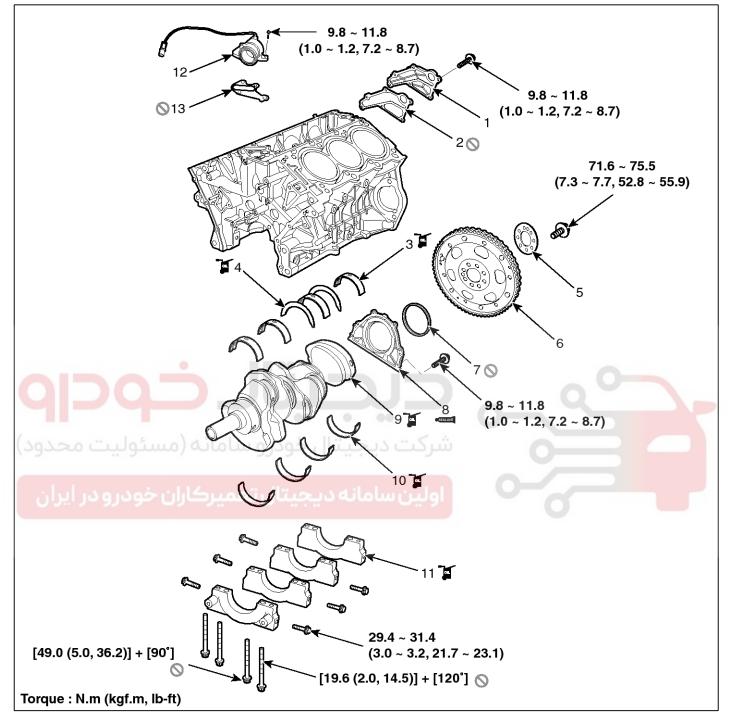


SVGM20031L

- 1. Piston ring
- 2. Piston
- 3. Connecting rod
- 4. Connecting rod upper bearing
- 5. Piston pin
- 6. Connecting rod lower bearing
- 7. Connecting rod bearing cap
- 8. Baffle plate

- 9. Upper oil pan
- 10. Cylinder block
- 11. Snap ring

EM-75



SVGM20032L

- 1. Oil drain cover
- 2. Oil drain cover gasket
- 3. Crank shaft upper bearing
- 4. Thrust bearing

- 5. Adapter plate
- 6. Drive plate
- 7. Rear oil seal
- 8. Rear oil seal case

- 9. Crankshaft
- 10. Crankshaft lower bearing
- 11. Main bearing cap
- 12. Oil cover
- 13. Oil cover gasket

Engine Mechanical System

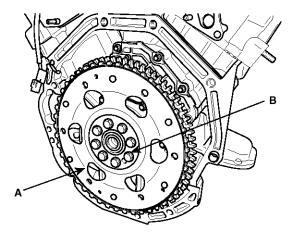
Disassembly

ACAUTION

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

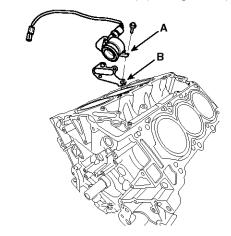
MNOTICE

- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing chain before removing the cylinder head.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center.
- Engine removal is required for this procedure.
- Remove the engine assembly from the vehicle. (Refer to Engine and transaxle assembly in this group)
- 2. Attach the engine to engine stand for disassembly.
- 3. Remove the intake manifold and exhaust manifold. (Refer to Intake and exhaust system in this group)
- 4. Remove the timing chain. (Refer to Timing system in this group)
- 5. Remove the water temperature control assembly. (Refer to Cooling system in this group)
- 6. Remove the cylinder head. (Refer to Cylinder head in this group)
- 7. Remove the oil pump. (Refer to Lubrication system in this group)
- 8. Remove the oil filter assembly. (Refer to Lubrication system in this group)
- 9. Remove the drive plate (A) and adapter plate (B).



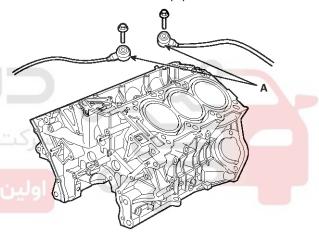
SBHEM8079D

10. Remove the oil cover (A) and gasket (B).



SCMM20019L

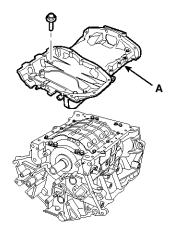
11. Remove the knock sensor (A).



SCMM20045L

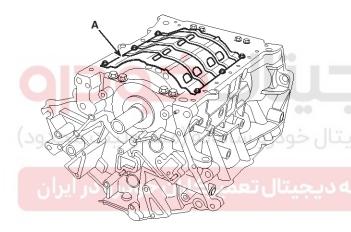
EM-77

12. Remove the upper oil pan (A).



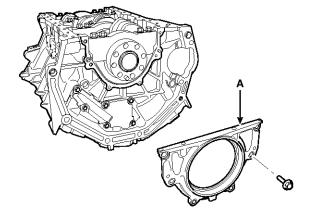
SCMM20046L

13. Remove the baffle plate (A).



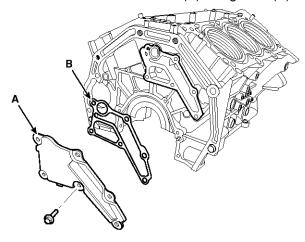
SCMM20022L

14. Remove the rear oil seal case (A).



SCMM20024L

15. Remove the oil drain cover (A) and gasket (B).



SCMM20023L

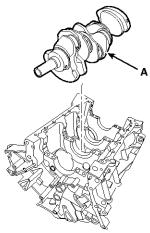
- 16. Check the connecting rod end play.
- 17. Check the connecting rod cap oil clearance.
- 18. Remove the piston and connecting rod assemblies.
 - 1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
 - 2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

MOTICE

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- 19. Remove the crankshaft main bearing cap and check oil clearance.
- 20. Check the crankshaft end play.

Engine Mechanical System

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



SCMM20021L

MOTICE

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

22. Remove the oil jets (A).



SCMM20049L

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

MNOTICE

Arrange the piston rings in the correct order only.

24. Disconnect the connecting rod from the piston.

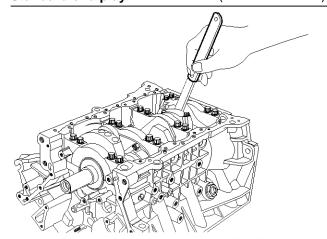
Remove the snap ring at both ends of piston pin. And push the piston pin to seperate and connecting rod.

Inspection

Connecting Rod And Crankshaft

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

Standard end play : $0.1 \sim 0.25 \text{mm} (0.004 \sim 0.010 \text{in.})$



KDRF211A

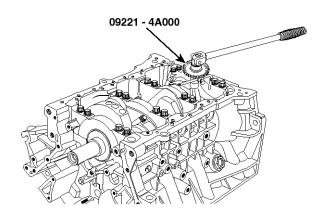
- If out-of-tolerance, install a new connecting rod.
- If still out-of-tolerance, replace the crankshaft.
- Check the connecting rod bearing oil clearance.
 - 1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
 - Remove 2 connecting rod cap bolts.
 - 3) Remove the connecting rod cap and bearing half.
 - 4) Clean the crank pin and bearing.
 - 5) Place plastigage across the crank pin.

EM-79

6) Reinstall the bearing half and cap, and torque the bolts.

Tightening torque

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



KDRF225A

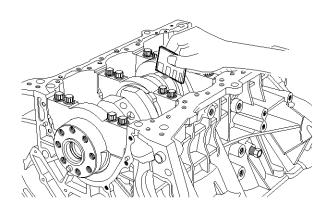
MOTICE

Do not turn the crankshaft.

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

Standard oil clearance

 $0.038 \sim 0.056$ mm $(0.0015 \sim 0.0022$ in.)



KDRF212A

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

⚠CAUTION

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

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

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.

Connecting Rod Mark Location



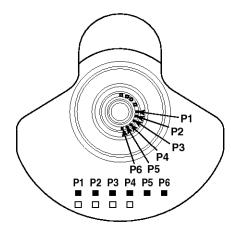
EDQF196A

Identification Of Connecting Rod

Class Mark		Inside Diameter	
0	а	58.000 ~ 58.006mm (2.2834 ~ 2.2837in.)	
1	b	58.006 ~ 58.012mm (2.2837 ~ 2.2839in.)	
2	С	58.012 ~ 58.018mm (2.2839 ~ 2.2842in.)	

Engine Mechanical System

Crankshaft Pin Mark Location Identification Of Crankshaft

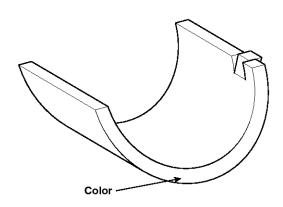


SBHEM8112D

Discrimination Of Crankshaft

Class	Mark	Outside Diameter Of Pin	
1 or A		54.966 ~ 54.972mm (2.1640 ~ 2.1642in.)	
	2 or B	54.960 ~ 54.966mm (2.1638 ~ 2.1640in.)	
ااا	3 or C	54.954 ~ 54.960mm (2.1635 ~ 2.1638in.)	

Place Of Identification Mark (Connecting Rod Bearing)



ECRF021A

Identification Of Connecting Rod Bearing

Class	Mark	Thickness Of Bearing
Е	Blue	$1.514 \sim 1.517$ mm (0.0596 ~ 0.0597 in.)
D	Black	$1.511 \sim 1.514$ mm (0.0595 \sim 0.0596in.)
С	Brown	1.508 \sim 1.511mm (0.0594 \sim 0.0595in.)
В	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
А	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

11) Selection

		Connecting Rod Identification Mark		
		0(a)	1(b)	2(c)
	1 or A	A (Yellow)	B (Green)	C (Brown)
Crankshaft Indentifica- tion Mark	2 or B	B (Green)	C (Brown)	D (Black)
	3 or C	C (Brown)	D (Black)	E (Blue)

- 3. Check the connecting rod.
 - When reinstalling, check the cylinder numbers on the connecting rods and the caps. When installing a new connecting rod, the notches for bearing fixing on the connecting rods and caps should face the same direction.
 - If one or both edge of the connecting rod thrust surface is damaged, replace the rod. If the inner surface of the rod is damaged or rough, also replace it.
 - 3) Using a connecting rod aligner, measure the bent or torsion of the rod. If the measurement is near the specification, adjust the rod with a press. If the rod is bent or twisted excessily, replace it.

Allowable bend of connecting rod 0.05mm/100mm (0.0020in./3.9370in.)

Allowable twist of connecting rod

0.1mm/100mm (0.0039in./3.9370in.)

MNOTICE

When assembling the rod without a bearing, there should be no difference.

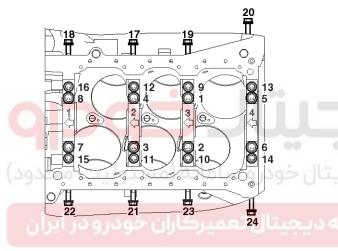
EM-81

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

Tightening torque

49.0Nm(5.0 kgf.m, 36.2lb-ft) + 90° 19.6Nm(2.0 kgf.m, 14.5lb-ft)+ 120°

 $29.4 \sim 31.4 \text{Nm} (3.0 \sim 3.2 \text{ kgf.m}, 21.7 \sim 23.1 \text{lb-ft})$



SCMM20047L

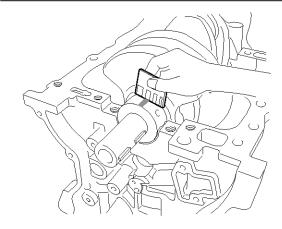
MOTICE

Do not turn the crankshaft.

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

Standard oil clearance

 $0.022 \sim 0.040$ mm ($0.0009 \sim 0.0016$ in.)



KCRF170A

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

CAUTION

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

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

MOTICE

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

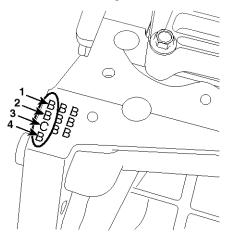
ACAUTION

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.

Crankshaft bore mark location

Letters have been stamped on the block as a mark for the size of each of the 4 main journal bores.

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



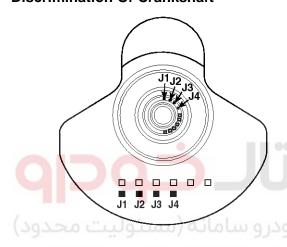
ECBF038A

Engine Mechanical System

Discrimination Of Cylinder Block

Class	Mark	Inside Diameter
а	А	73.500 ~ 73.506mm (2.8937 ~ 2.8939in.)
b	В	73.506 ~ 73.512mm (2.8939 ~ 2.8942in.)
С	С	73.512 ~ 73.518mm (2.8942 ~ 2.8944in.)

Crankshaft Journal Mark Location Discrimination Of Crankshaft

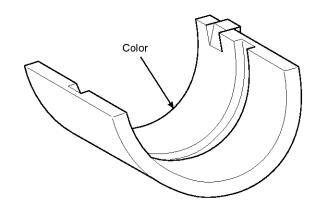


SBHEM8114D

Discrimination Of Crankshaft

Class	Mark	Outside Diameter Of Journal
I	1 or A	68.954 ~ 68.960mm (2.7147 ~ 2.7150in.)
П	2 or B	68.948 ~ 68.954mm (2.7145 ~ 2.7147in.)
III	3 or C	68.942 ~ 68.948mm (2.7142 ~ 2.7145in.)

Place Of Identification Mark (Crankshaft Bearing)



ECRF022A

Discrimination Of Crankshaft Bearing

	Class Mark		Thickness Of Bearing		
	Е	Blue	2.277 ~ 2.280mm (0.0896 ~ 0.0897in.)		
×	D	Black	2.274 ~ 2.277mm (0.0895 ~ 0.0896in.)		
7	مسرکت	Brown	2.271 ~ 2.274mm (0.0894 ~ 0.0895in.)		
	اولین	Green	2.268 ~ 2.2 <mark>71mm</mark> (0.0893 ~ 0.0894in.)		
	Α	Yellow	2.265 ~ 2.268mm (0.0892 ~ 0.0893in.)		

Selection

		Crankshaft Bore Identification Mark		
a(A) b(B) c				
Crankshaft Identificat- ion Mark	1 or A	A (Yellow)	B (Green)	C (Brown)
	2 or B	B (Green)	C (Brown)	D (Black)
	3 or C	C (Brown)	D (Black)	E (Blue)

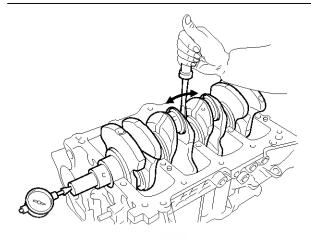
EM-83

5. Check crankshaft end play.

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

Standard end play

 $0.10 \sim 0.28$ mm (0.0039 ~ 0.0110 in.)



KCRF211A

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

Thrust bearing thickness

2.41 ~ 2.45mm(0.0949 ~ 0.0964in.)

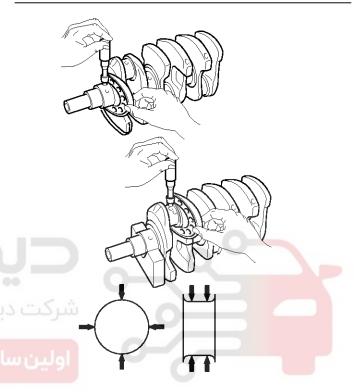
Inspect main journals and crank pins
 Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)

Crank pin diameter:

54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)



ECKD001E

Engine Mechanical System

Cylinder Block

1. Remove the gasket material.

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

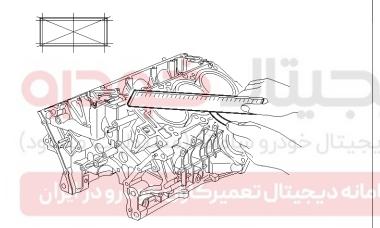
2. Clean the cylinder block

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

3. Inspect the top surface of the 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(0.0020 in.), Less than 0.02mm(0.0008in.) / 150 x 150



SCMM20135L

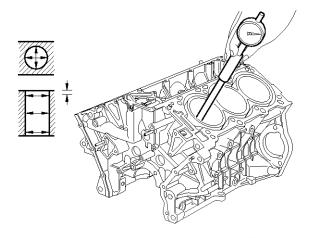
Inspect cylinder bore diameter
 Visually check the cylinder for vertical scratchs.
 If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

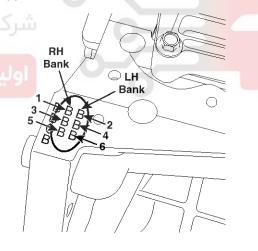
Standard diameter

92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)



SCMM20136L

Check the cylinder bore size code on the cylinder block.

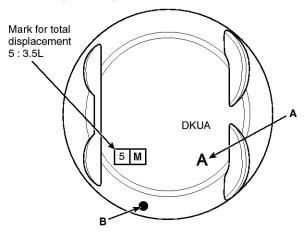


ECBF002A

Class	Size code	Cylinder bore inner diameter
А	А	92.00 ~ 92.01mm (3.6220 ~ 3.6224in.)
В	В	92.01 ~ 92.02mm (3.6224 ~ 3.6228in.)
С	С	92.02 ~ 92.03mm (3.6228 ~ 3.6232in.)

EM-85

7. Check the piston size code(A) and the front mark(B) on the piston top face.



SCMM20048L

Class	Size code	Piston outer diameter
А	А	91.96 ~ 91.97mm (3.6204 ~ 3.6208in.)
В	В	91.97 ~ 91.98mm (3.6208 ~ 3.6212in.)
حدود)	ئولي <mark></mark> ت م	91.98 ~ 91.99mm (3.6212 ~ 3.6216in.)

8. Select the piston related to cylinder bore class.

Clearance: 0.03 ~ 0.05mm(0.0012 ~ 0.0020in.)

Boring Cylinder

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

Identification Mark	Size	
0.1	0.1 mm (0.004 in)	
0.25	0.25 mm (0.010 in)	

MNOTICE

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

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

New bore size = piston O.D + 0.03 to 0.05mm (0.0012 to 0.0020in) (clearance between piston and cylinder) - 0.01mm (0.0004in) (honing margin.)

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

ACAUTION

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

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

Standard: $0.03 \sim 0.05$ mm ($0.0012 \sim 0.0020$ in)

MOTICE

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

Engine Mechanical System

Piston And Rings

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

MNOTICE

Do not use a wire brush.

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

Standard diameter

91.96 ~ 91.99mm (3.6204 ~ 3.6216in.)

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

Piston-to-cylinder clearance

 $0.03 \sim 0.05$ mm ($0.0012 \sim 0.0020$ in.)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

Standard

No.1 : $0.04 \sim 0.08$ mm ($0.0015 \sim 0.0031$ in.) No.2 : $0.04 \sim 0.08$ mm ($0.0015 \sim 0.0031$ in.) Oil ring : $0.06 \sim 0.15$ mm ($0.0024 \sim 0.0059$ in.)

Limit

No.1: 0.1mm (0.004in.) No.2: 0.1mm (0.004in.) Oil ring: 0.2mm (0.008in.)



ECKD001D



ECKD001G

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

EM-87

5. Inspect piston ring end gap.

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

Piston ring end gap

Standard

No.1 : 0.17 \sim 0.32mm (0.0067 \sim 0.0126in.) No.2 : 0.37 \sim 0.52mm (0.0145 \sim 0.0204in.) Oil ring : 0.20 \sim 0.50mm (0.0078 \sim 0.0196in.)

Limit

No.1: 0.6mm (0.0236in.) No.2: 0.7mm (0.0275in.) Oil ring: 0.8mm (0.0315in.)

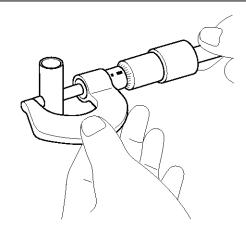


Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter

21.097 ~ 22.000mm (0.8305 ~ 0.8661in.)



ECKD001Z

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

Piston pin-to-piston clearance

 $0.004 \sim 0.013$ mm ($0.00015 \sim 0.00051$ in.)

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

Piston pin-to-connecting rod interference $0.005 \sim 0.019$ mm ($0.00019 \sim 0.00074$ in.)

Engine Mechanical System

Reassembly

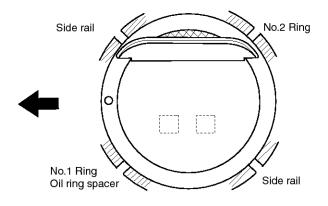
MOTICE

- Thoroughly clean all parts to be 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 the connecting rod.
 - 1) Install the piston pin with snap ring 2EA and check the snap ring assembly thoroughly.
 - The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



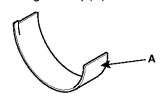
انه دیجیتال تعمیرکاران خودرو در ایران

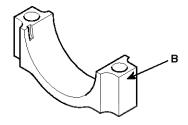
- 2. Install the piston rings.
 - 1) Install the oil ring spacer and 2 side rails by hand.
 - Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
 - 3) Position the piston rings so that the ring ends are as shown.



SVIEM9052L

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





SGHEM7013N

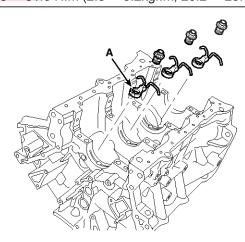
ACAUTION

When reassembling the connecting rods and the caps, ensure te front marks on then and the number of cylinder.

4. Install the oil jets (A).

Tightening torque

27.5 ~ 31.3 N.m (2.8 ~ 3.2kgf.m, 20.2 ~ 23.1lb-ft)



SCMM20049L

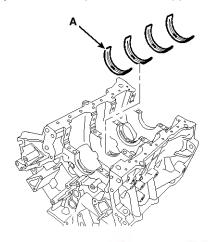
EM-89

5. Install the main bearings.

MOTICE

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

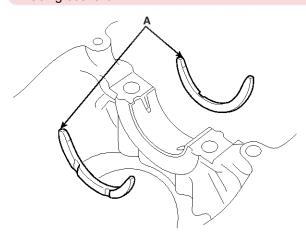
1) Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings(A).



SCMM20020L

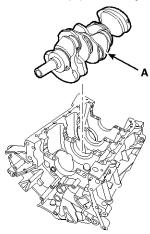
- Align the bearing claw with the claw groove of the main bearing cap, and push in the 4 lower bearings.
- 6. Install the thrust bearings.

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



ECKD324A

7. Place the crankshaft(A) on the cylinder block.



SCMM20021L

- 8. Place the main bearing caps on cylinder block.
- 9. Install the main bearing cap bolts.
 - 1) Install and uniformly tighten the bearing cap bolts, in several passes, in the sequence shown.

Tightening torque

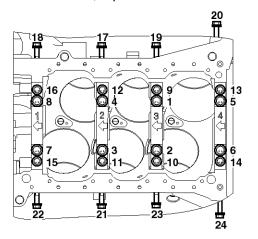
Main bearing cap bolt

49.0N.m (5.0 kgf.m, 36.2lb-ft) + 90° (1 ~ 8) 19.6N.m (2.0 kgf.m, 14.5lb-ft) + 120° (9 ~ 16)

29.4 \sim 31.4N.m (3.0 \sim 3.2 kgf.m, 21.7 \sim 23.1lb-ft) (17 \sim 24)

MOTICE

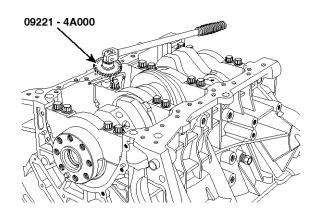
- Always use new main bearing cap bolts.
- If any of the bearing cap bolts are broken or deformed, replace it.



SCMM20047L

Engine Mechanical System

Use the SST(09221-4A000), install main bearing cap bolts.



KDRF224A

- 2) Check that the crankshaft turns smoothly.
- 10. Check crankshaft end play.
- 11. Install the piston and connecting rod assemblies.

MOTICE

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

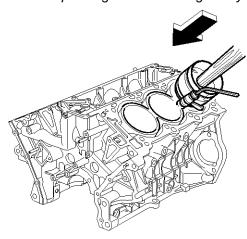
- Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
- 2) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
- 3) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

 $17.7\sim21.6$ N.m $(1.8\sim2.2$ kgf.m, $13.0\sim15.9$ lb-ft) + $(88\sim92^{\circ})$

MOTICE

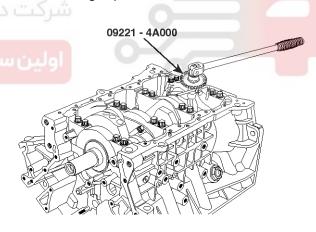
- Always use new connecting rod bearing cap bolts.
- Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



SCMM20137L

MOTICE

Use SST(09221-4A000), install connecting rod bearing cap bolts.



KDRF225A

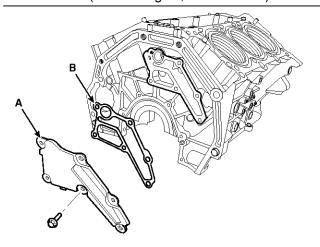
EM-91

12. Check the connecting rod end play.

13. Install the oil drain cover(A) with a new gasket (B).

Tightening torque

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

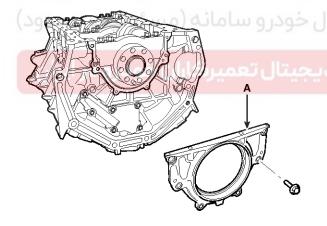


SCMM20023L

14. Install the rear oil seal case(A).

Tightening torque

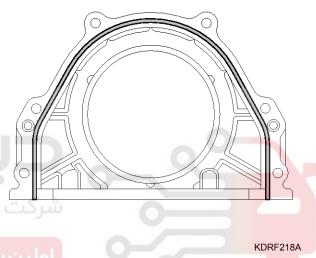
9.8 ~ 11.8Nm (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



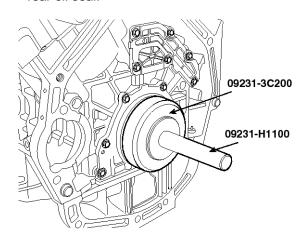
SCMM20024L

MOTICE

- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant
- Before assembling rear oil seal case, the liquid sealant TB1217H should be applied to the rear oil seal case.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



15. Using the SST(09231-3C200, 09231-H1100), install rear oil seal.



KDRF237A

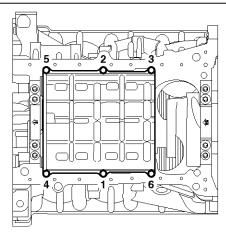
Engine Mechanical System

16. Install the baffle plate.

Install and uniformly tighten the baffle plate bolts, in several passes, in the sequence shown.

Tightening torque

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



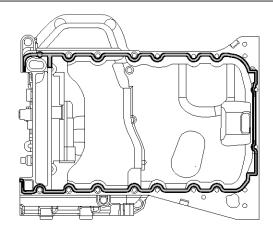
SBHEM8116D

17. Install the upper oil pan.

- a. Using a gasket scraper, remove all the old gasket meterial from the gasket surfaces.
- b. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan.

The part must be assembled within 5 minutes after the sealant was applied.

Bead width: 2.5mm (0.1in.)



KDRF130A

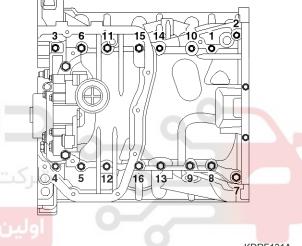
MOTICE

- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant
- When applying sealant gasket, sealant must not protrud into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.
- c. Install the upper oil pan.

Uniformly tighten the bolts in several passes.

Tightening torque

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

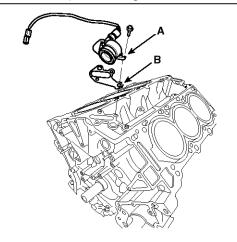


KDRF131A

18. Install the oil cover (A) and gasket (B).

Tightening torque

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



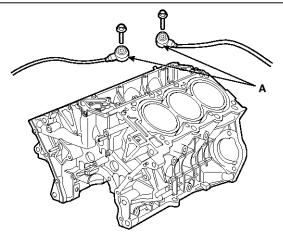
SCMM20019L

EM-93

19. Install the knock sensor (A).

Tightening torque

 $15.7 \sim 23.5$ Nm ($1.6 \sim 2.4$ kgf.m, $11.6 \sim 17.3$ lb-ft)

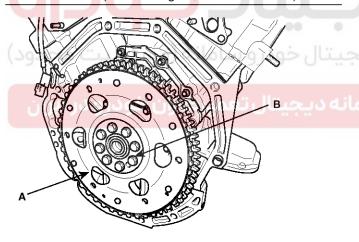


SCMM20045L

20. Install the drive plate (A) and adapter plate (B).

Tightening torque:

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



SBHEM8079D

- 21.Install the oil filter assembly. (Refer to Lubrication system in this group)
- 22.Install the oil pump. (Refer to Lubrication system in this group)
- 23. Install the cylinder head. (Refer to Cylinder head in this group)
- 24. Install the water temperature control assembly. (Refer to Cooling system in this group)
- 25.Install the timing chain. (Refer to Timing system in this group)
- 26. Install the intake manifold and exhaust manifold. (Refer to Intake and exhaust system in this group)
- 27.Install the engine assembly to the vehicle. (Refer to Engine and transaxle assembly in this group)



Engine Mechanical System

Cooling System

Coolant

Replacement And Air Bleeding

ACAUTION

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.

MOTICE

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

- 1. Make sure the engine and radiator are cool to the touch.
- 2. Remove the radiator cap.
- 3. Loosen the drain plug, and drain the coolant.
- 4. Tighten the radiator drain plug securely.
- 5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
- 6. Fill the radiator with water through the radiator cap and tighten the cap.

MOTICE

To most effectively bleed the air, pour the water slowly and press on the upper / lower radiator hoses.

- Start the engine and allow to come to normal operating temperature. Wait for the cooling fans to turn on several times. Accelerate the engine to aid in purging trapped air. Shut engine off.
- 8. Wait until the engine is cool.
- 9. Repeat steps 1 to 8 until the drained water runs clear.

10. Fill fluid mixture with coolant and water(5 : 5) (Tropical region – 4:6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

MNOTICE

- · Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 35% minimum. Coolant concentrations less than 35% may not provide sufficient protection against corrosion or freezing.
- Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

CAUTION

- Do not mix different brands of antifreeze/coolants.
- Do not use additional rust inhibitors or antirust products; they may not compatible with the coolant.
- 11. Start the engine and run coolant circulates.
- 12. When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
- 13. Repeat step.11 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.
- 14. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
- 15. Run the vehicle under idle until the cooling fan operates 2 \sim 3 times.
- 16. Stop the engine and wait coolant gets cool.
- 17. Repeat 10 to 15 until the coolant level doesn't fall any more, bleed air out of the cooling system.

MOTICE

As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

Coolant capacity:

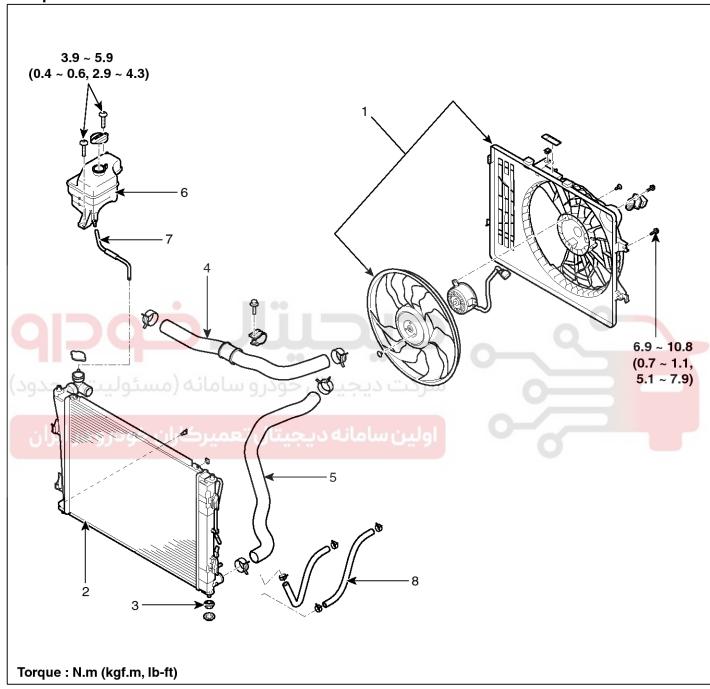
8.4L (8.9Us.qts, 7.4 Imp.qts)

Cooling System

EM-95

Radiator

Components



SVGM20051L

- 1. Cooling fan assembly
- 2. Radiator
- 3. Mounting insulator
- 4. Radiator upper hose

- 5. Radiator lower hose
- 6. Coolant reservoir tank
- 7. Over flow hose
- 8. ATF cooler hose

Engine Mechanical System

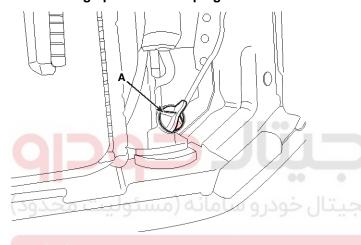
Removal and Installaton

- 1. Disconnect the battery negative terminal.
- 2. Remove the air cleaner assembly.
- 3. Remove the under cover.
- 4. Remove the battery and battery tray.
- 5. Loosen the drain plug (A), and drain the coolant. Open the radiator cap to make rapid draining.

WARNING

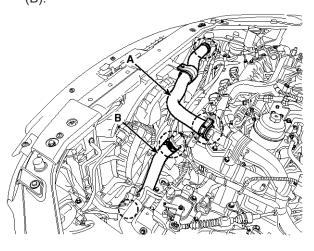
Never remove the radiator cap when the engine is hot.

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



SVGM10041D

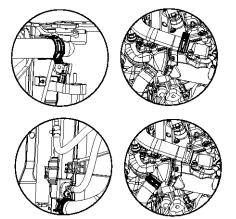
Remove the radiator upper hose (A) and lower hose (B).



SVGM20005D

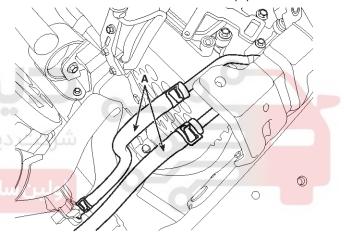
MNOTICE

Install the radiator hoses as shown illustrations.



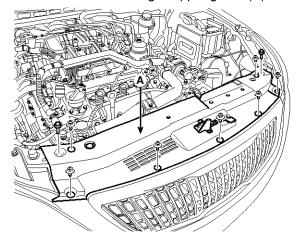
SVGM20017D

7. Disconnect the ATF cooler hoses (A).



SVGM10010D

8. Remove the radiator grill upper guard (A).

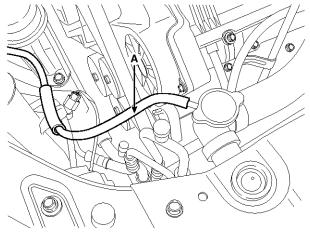


SVGM20010D

Cooling System

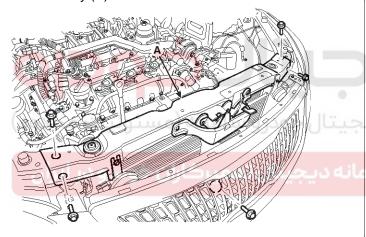
EM-97

9. Disconnect the over flow hose (A).



SVGM10026D

10. Remove the radiator upper mounting bracket assembly (A)

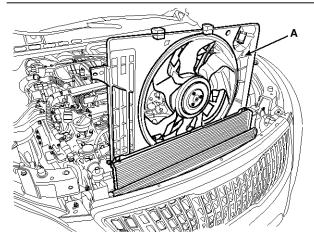


SVGM20011D

11. Remove the cooling fan assembly (A).

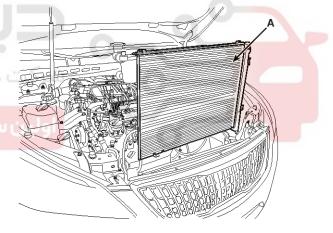
Tightening torque:

 $6.9 \sim 10.8 \text{ N.m} (0.7 \sim 1.1 \text{ kgf.m}, 5.1 \sim 7.9 \text{ lb-ft})$



SVGM20012D

12. Separate the condenser from the radiator and then pull radiator up and remove it from engine room.



SVGM20013D

- 13. Installation is in the reverse order of removal.
- 14. Fill the radiator with coolant and check for leaks.

MOTICE

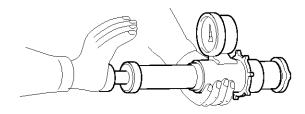
- Bleed air from the cooling system.
 - Start engine and let it run until it warms up. (Until the radiator fan operates 3 or 4 times.)
 - Turn off engine and let it cool down. Check the coolant level and add coolant if needed.
 This will allow trapped air to be removed from the cooling system.
 - Put the radiator cap on tightly, then run engine again and check for leaks.

Engine Mechanical System

Inspection

Radiator Cap Testing

1. Remove the radiator cap, wet its seal with engine coolant, and 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.

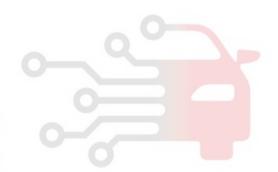
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Radiator Leakage Test

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

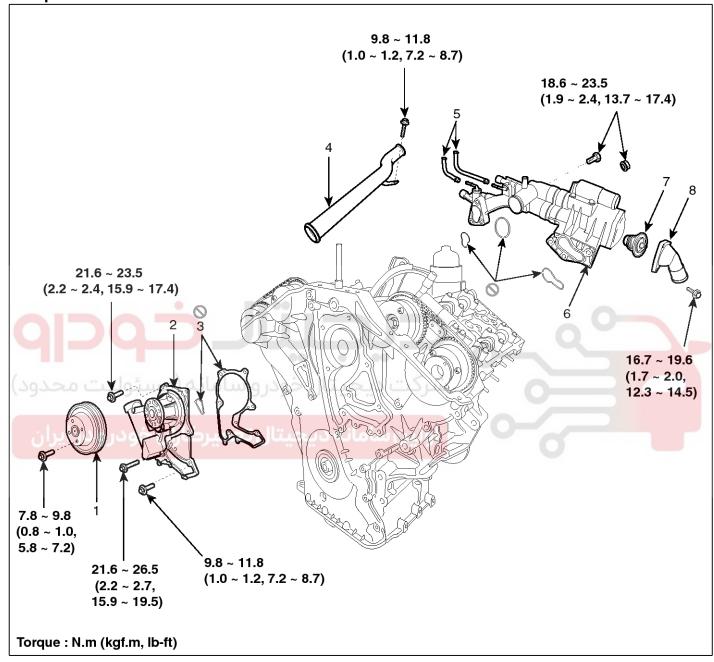


Cooling System

EM-99

Water pump

Components



SVGM20035L

- 1. Water pump pulley
- 2. Water pump
- 3. Water pump gasket
- 4. Water pipe

- 5. Throttle body coolant hose & pipe
- 6. Water temperature control assembly
- 7. Thermostat
- 8. Water inlet fitting

Engine Mechanical System

Removal

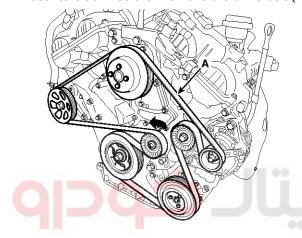
Water Pump

1. Loosen the drain plug, and drain the engine coolant.

ACAUTION

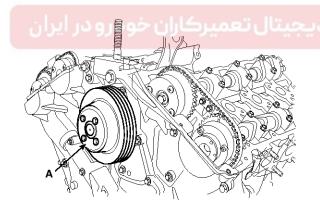
Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

2. To release the tension, turn the drive belt tensioner counterclockwise then remove the drive belt (A).



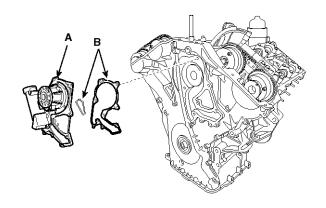
SCMM20007L

3. Remove the water pump pulley (A).



STGM29030D

4. Remove the water pump (A) and gaskets (B).



SCMM20124L

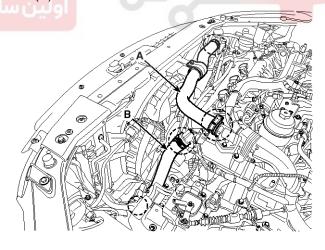
Water Temperature Control Assembly

ACAUTION

 To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

MNOTICE

- Mark all wiring and hoses to avoid misconnection.
- 1. Disconnect the battery negative cable.
- 2. Loosen the drain plug and drain the engine coolant.
- Remove the radiator upper hose (A) and lower hose
 (B).

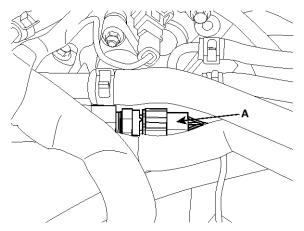


SVGM20005D

Cooling System

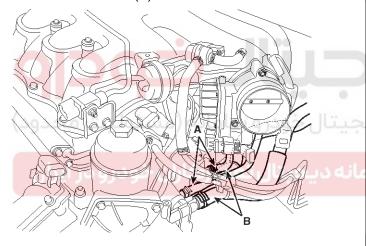
EM-101

4. Disconnect the WTS & gauge unit connector (A)



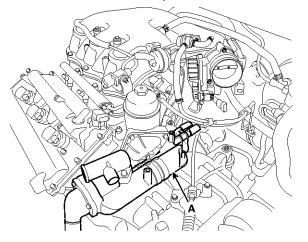
KDRF163A

5. Disconnect the throttle body coolant hoses (A) and the heater hoses (B).



SCMM20140L

6. Remove the water temperature control assembly (A).

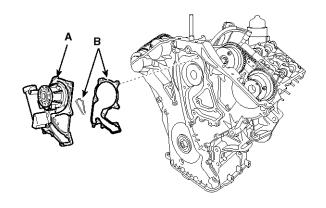


SXMM29038L

Installation

Water Pump

1. Install the water pump (A) with the new gaskets (B).



SCMM20124L

MNOTICE

- Clean the contact face before assembly.
- Always use a new bolt (L) and gaskets (B).

Tightening torque

G(4):

21.6 ~ 23.5N.m (2.2 ~ 2.4kgf.m, 15.9 ~ 17.4lb-ft)

H(1):

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

I(1):

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

J(1):

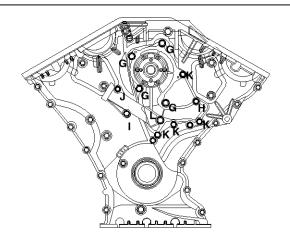
 $9.8 \sim 11.8$ N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

K(4):

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

_(1):

21.6 \sim 26.5N.m (2.2 \sim 2.7kgf.m, 15.9 \sim 19.5lb-ft)- New bolt



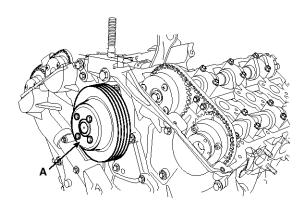
SXMM20007L

Engine Mechanical System

2. Install the water pump pulley (A).

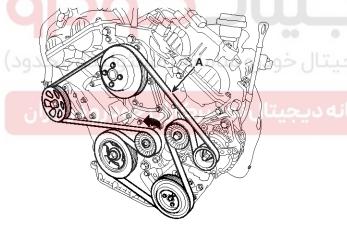
Tightening torque:

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



STGM29030D

3. Rotate the auto tensioner counter - clockwise. With the tensioner turned, install the drive belt (A) on auto tensioner and then release the tensioner.



SCMM20007L

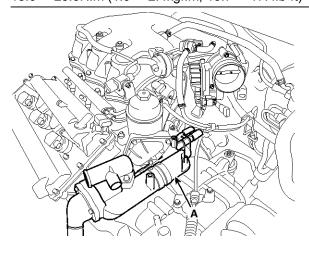
4. Fill the radiator with coolant and check for leaks.

Water Temperature Control Assembly

1. Install the water temperature control assembly (A)

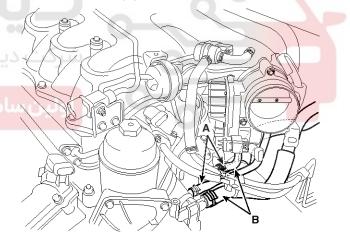
Tightening torque:

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



SXMM29038L

2. Connect the throttle body coolant hoses (A) and the heater hoses (B).



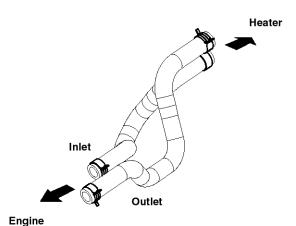
SCMM20140L

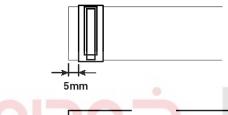
Cooling System

EM-103

MOTICE

Install the heater hoses as shown illustrations.

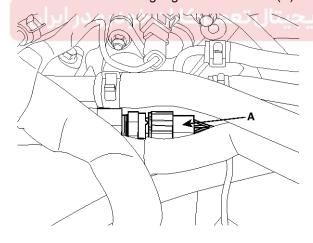






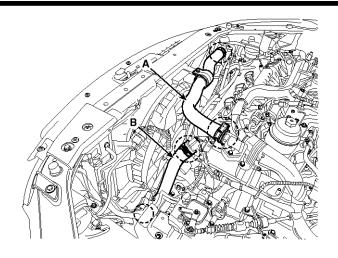
(مسئولیت محدود) SVGM20020D

3. Connect the WTS & gauge unit connector (A).



KDRF163A

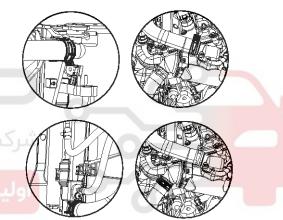
4. Install the radiator upper hose (A) and the lower hose (B).



SVGM20005D

MNOTICE

Install the radiator hoses as shown illustrations.



SVGM20017D

5. Fill the radiator with coolant and check for leaks.

MNOTICE

- Refill engine coolant.
- Refill 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 the engine and let it cool down.
 Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
 - Put radiator cap on tightly, then run the engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.

Engine Mechanical System

Troubleshooting

	Symptoms	Pos	sible Causes	Remedy
Coolant lea- kage	From the bleed hole of the water	Visually check	Check leaks after about ten-minute warming up.	If coolant still leaks, replace a water pump.
	pump			If leakage stops, reuse the water pump (Do not replace the pump with a new one).
	From gaskets or bolts		Check the tightening of the water pump mounti- ng bolts.	Retighten the mounting bolts.
			Check damage of gask- ets or inflow of dust.	Replace the gasket and clean dust off.
	From outer surfa- ce of water pump		Check the material or any cracks of the water pump.	Poor material. If any crack fo- und, replace the water pump .
Noise	From bearingsFrom mechanical seals	Inspection with a stethoscope	After starting the engin- e, check noise with a stethoscope.	If there is no noise, reuse the water pump(do not repla- ce it).
9 =	Impeller interfere- nce	ــــيار	~ ⊂تر	If there is any noise from the water pump, remove the drive belt and recheck.
ک محدود)	امانه (مسئولیت	moving a drive belt	After removing a water pump and a drive belt, check noise again.	If there is noise, reuse the water pump. Check other drive line parts.
در ایران	میرکاران خودرو	نەدىجىتال تع	اولین ساما	If there is no noise, replace the water pump with a new one.
		Inspection after removing a water pump	After removing a water pump and a drive belt, check noise again.	If there is any interference between them, replace the water pump with a new one.
Overheating	Damaged impellerLoosened impellerr	Loosened impeller	Corrosion of the impell- er wing	Check engine coolant. Poor coolant quality / Maintenance check
			Impeller seperation fro- m the shaft	Replace the water pump.

Cooling System

EM-105

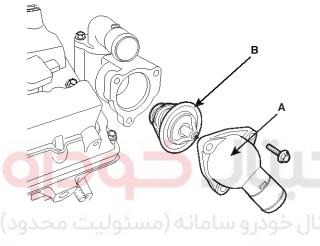
Thermostat

Removal

MOTICE

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

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

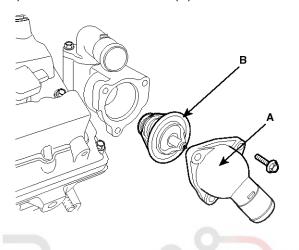


KDRF195A

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Installation

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



KDRF195A

2. Install the water inlet fitting (A).

Tightening torque:

 $16.7 \sim 19.6$ N.m $(1.7 \sim 2.0$ kgf.m, $12.3 \sim 14.5$ lb-ft)

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

Engine Mechanical System

Troubleshooting

Symptoms		Possible Causes		Remedy
Coolant leak- age	From the thermost- at 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 re- use the thermostat.
Cooled excessively	Low heater performance (cool air blowed-out) Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	Insufficient coolant or le- akage.	After refilling coolant, re- check.
		GDS check & Starting engine	 Check DTCs Check connection of the fan clutch or the fan motor. If the fan clutch is always connected, there will be a noise at idle. 	 Check the engine coolant sensor, wiring and connectors. Replace the components
		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	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.	 After removing the thermostat, check it works properly. Check the thermostat opens at the valve opening temperature. 	Replace the thermostat, if it doesn't work properly .

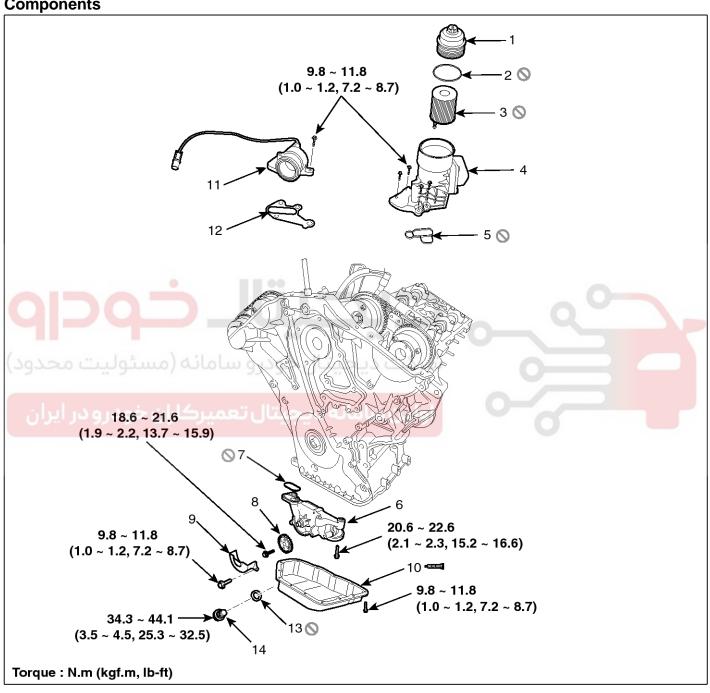
Lubrication System

EM-107

Lubrication System

Oil Pump

Components



SVGM20037L

- 1. Oil filter cap
- 2. O-ring
- 3. Oil filter element
- 4. Oil filter body
- 5. Gasket

- 6. Oil pump
- 7. O-ring
- 8. Oil pump sprocket
- 9. Oil pump chain cover
- 10. Lower oil pan

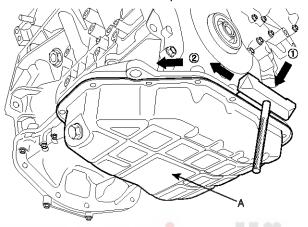
- 11. Oil cover
- 12. Oil cover gasket
- 13. Drain plug gasket
- 14. Drain plug

Engine Mechanical System

Removal Oil Pump

- 1. Drain the engine oil.
- 2. Remove the lower oil pan (A).

Insert the blade of SST(09215-3C000) between the upper oil pan and lower oil pan. Cut off applied sealer and remove the lower oil pan.

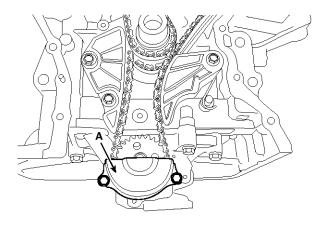


SNFM17001N

MOTICE

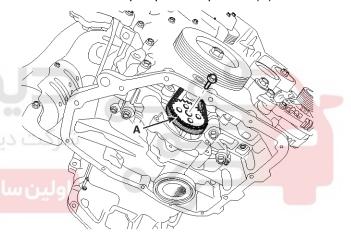
- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of arrow.
- After tapping the SST with a plastic hammer along the direction of arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
- Do not use the SST as a prybar.
 Hold the tool in position (on the gasket line) and tap in with a light hammer.
- Be careful not to damage the contact surfaces of Upper oil pan and lower oil pan.

3. Remove the oil pump chain cover (A).



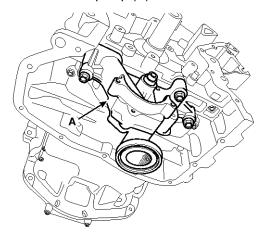
SCMM20016L

4. Remove the oil pump chain sprocket (A).



SCMM20018L

5. Remove the oil pump (A).



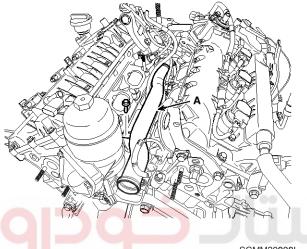
SCMM20017L

Lubrication System

EM-109

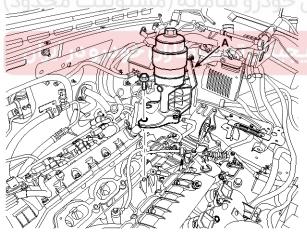
Oil Filter Assembly

- 1. Remove the water temperature control assembly. (Refer to Cooling system in this group)
- 2. Remove the intake manifold. (Refer to Intake and exhaust system in this group)
- 3. Wait for 5 minutes after loosening the oil filter cap to drain well the oil in the oil filter.
- 4. Remove the water pipe (A).



SCMM20008L

5. Remove the oil filter body (A).



SCMM20009L

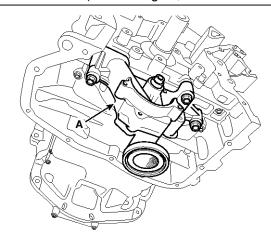
Installation

Oil Pump

1. Install the oil pump (A).

Tightening torque:

 $20.6 \sim 22.6 \text{N.m}$ (2.1 $\sim 2.3 \text{kgf.m}$, $15.2 \sim 16.6 \text{lb-ft}$)



SCMM20017L

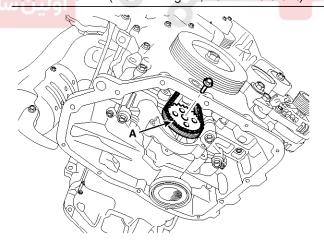
MNOTICE

Always use a new O-ring.

2. Install the oil pump sprocket (A) and the oil pump chain on the oil pump.

Tightening torque:

18.6 ~ 21.6N.m (1.9 ~ 2.2kgf.m, 13.7 ~ 15.9lb-ft)



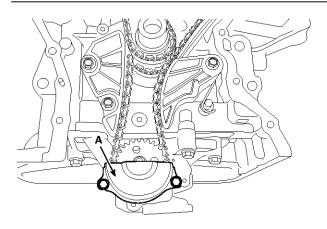
SCMM20018L

Engine Mechanical System

3. Install the oil pump chain cover (A).

Tightening torque:

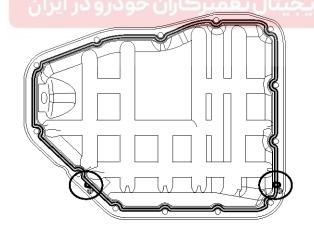
 $9.8 \sim 11.8$ N.m ($1.0 \sim 1.2$ kgf.m, $7.2 \sim 8.7$ lb-ft)



SCMM20016L

- 4. Install the lower oil pan (A).
 - 1) Using a gasket scraper, remove all the old packing material from the gasket surfaces.
 - 2) Before assembling the oil pan, the liquid sealant TB 1217H should be applied on oil pan. The part must be assembled within 5 minutes after the sealant was applied.

Bead width: 2.5mm(0.1in.)



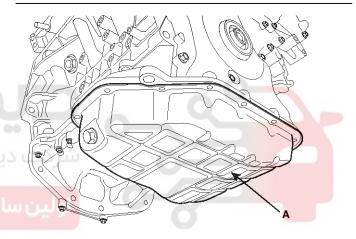
KDRF136A

CAUTION

- Clean the sealing face before assembling two parts.
- Remove harmful foreign matters on the sealing face before applying sealant.
- When applying sealant gasket, sealant must not protrud into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes
- Install the oil pan (A).
 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)



STGM29034D

5. After assembly, wait at least 30 minutes before filling the engine with oil.

Lubrication System

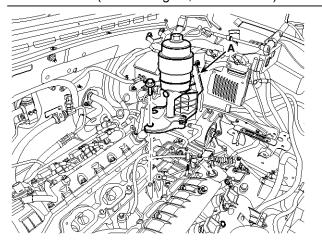
EM-111

Oil Filter Assembly

1. Install the oil filter body.

Tightening torque:

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



SCMM20009L

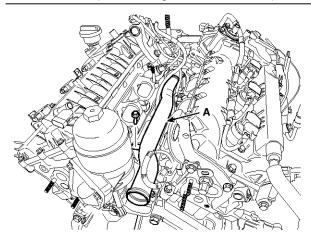
ACAUTION

- All rubber gaskets must not be damaged by assembling parts.
- Always use a new oil seal (B).

2. Install the water pipe (A).

Tightening torque:

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



SCMM20008L

- 3. Install the intake manifold. (Refer to Intake and exhaust system in this group)
- Install the water temperature control assembly.
 (Refer to Cooling system in this group)

ولین سامانه دیجیتال تعمیرکاران خودرو در ایران

شرکت دیجیتال خودرو سامانه (مسئولیت محدود

Engine Mechanical System

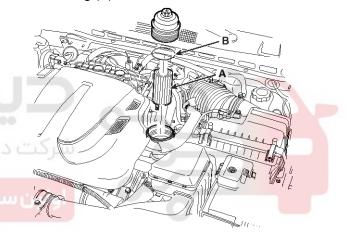
Engine Oil

Replacement

CAUTION

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Exercise caution in order to minimize the length and frequency of contact of your skin to used oil.
 Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.
- Park the car on level ground.
 Start the engine and let it warm up.
- Turn the engine off and open the hood.Remove the engine cover.
- 3. Wait for 5 minutes after loosening the oil filter cap to drain well the oil in the oil filter.

- 4. Drain engine oil.
 - 1) Remove the oil filler cap.
 - 2) After lifting the car, remove the oil drain plug and drain oil into a container.
- 5. Replace the oil filter.
 - 1) Disconnect the oil filter cap from the oil filter body.
 - 2) Remove the oil filter element.
 - 3) Check and clean the oil filter installation surface.
 - 4) Check the part number and shape of a new oil filter is same as old one.
 - 5) Install a new oil filter element (A) and a new O-ring (B).



SVGM20036D

- 6) Apply clean engine oil to the new O-rings. Lightly screw the oil filter cap into place, and tighten it until the O-ring contacts the seat.
- 7) Finally tighten it again by specified tightening torque.

Tightening torque:

35.0N.m (3.57kgf.m, 25.8lb-ft)

Lubrication System

EM-113

- 6. Fill new engine oil.
 - 1) Install the oil drain plug with a new gasket.

Tightening torque:

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

2) Fill with new engine oil, while check the oil level on the dipstick.

Capacity

Total: 6.0 L (6.34 US qt, 5.27 Imp qt)
Oil pan: 5.5 L (5.81 US qt, 4.83 Imp qt)
Drain and refill including oil filter:
5.2 L (4.49 US qt, 4.57 Imp qt)

ACAUTION

- Fill a half oil of the total amount first and do the rest again after about one minute later.
- Do not fill oil over the 'F' line, checking the level with the oil level gauge.
- 3) Install the oil filler cap and the oil dipstick.
- 7. Start the engine and check to be sure no oil is leaking from the drain plug or oil filter.
- 8. Recheck the engine oil level.

Inspection

- Check the engine oil quality. Check the oil deterioration, addition of water or coolant, discoloring or thinning. If the quality is visibly poor, replace the oil.
- 2. Check the engine oil level.

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

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

MNOTICE

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





Engine Mechanical System

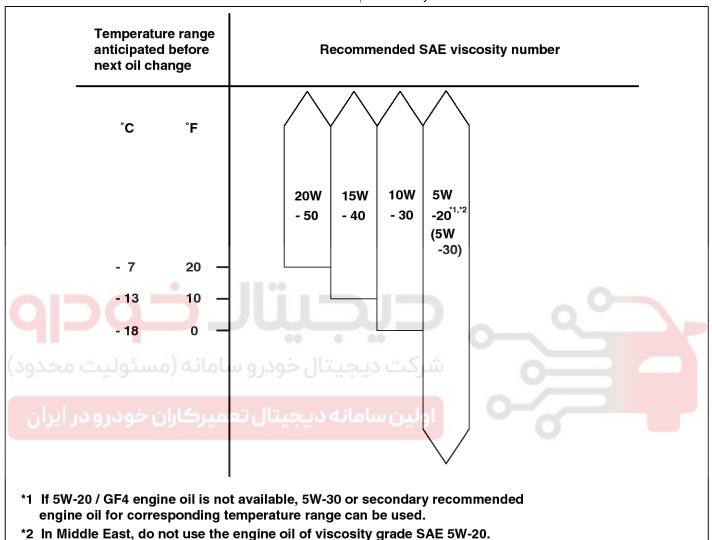
Selection Of Engine Oil

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.

Lubrication System

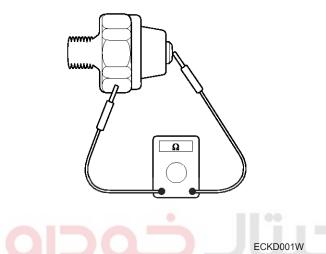
EM-115

Oil Pressure Switch

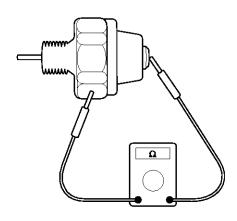
Inspection

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

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



Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.



ECKD001Y

3. If there is no continuity when a 50 kpa (7psi) is applied through the oil hole the switch is operaing properly. Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

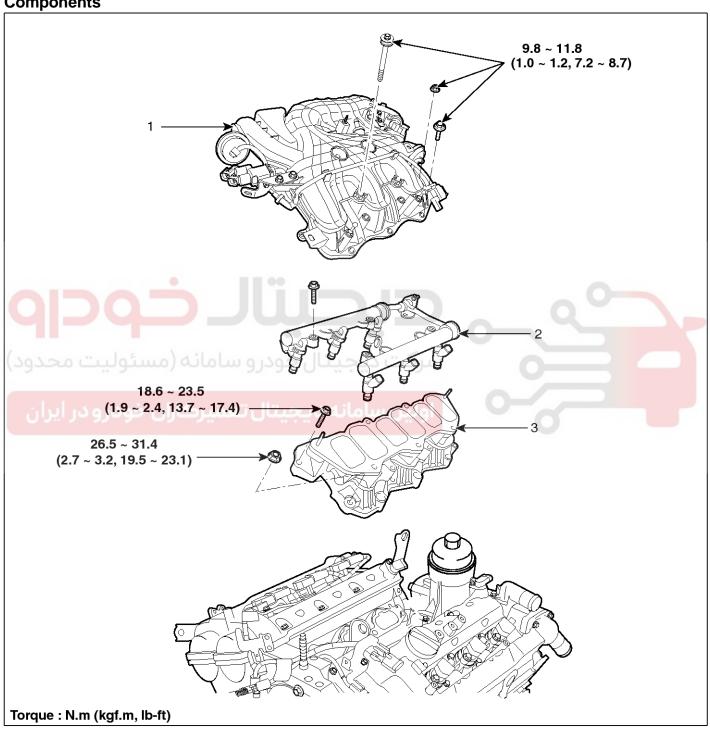
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Engine Mechanical System

Intake And Exhaust System

Intake Manifold

Components



SVGM20047L

- 1. Surge tank
- 2. Delivery pipe

- 3. Intake manifold
- 4. Intake manifold gasket

EM-117

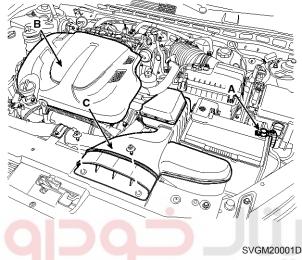
Removal and Installation

1. Disconnect the battery negative terminal (A).

Tightening torque:

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

- 2. Remove the engine cover (B).
- 3. Remove the air duct (C).

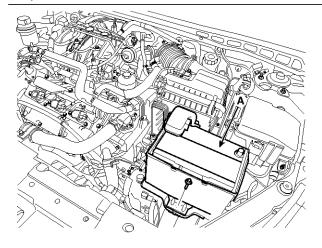


4. Disconnect the battery positive terminal, and then remove the battery (A).

Tightening torque:

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

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



SVGM20003D

- 5. Disconnect the breather hose (A) and the BARO(Barometric pressure) sensor connector (B).
- 6. Remove the air intake hose clamp (C), and then remove the air cleaner assembly (D).

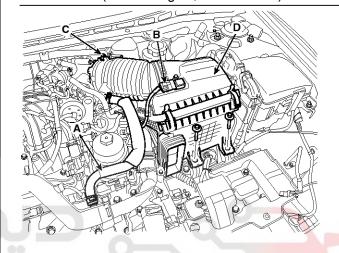
Tightening torque

Hose clamp bolt:

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

Air cleaner assembly bolts:

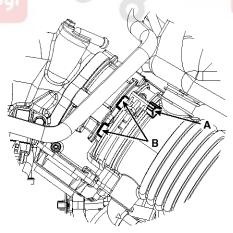
 $7.8 \sim 9.8$ N.m ($0.8 \sim 1.0$ kgf.m, $5.8 \sim 7.2$ lb-ft)



SVGM20004D

MOTICE

Assembling direction of clamp hose must conform to directions of under illustration.



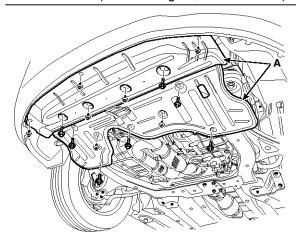
SVGM20050D

Engine Mechanical System

7. Remove the under cover (A).

Tightening torque:

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



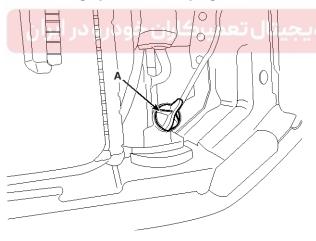
SVGM20002D

8. Loosen the drain plug (A), and drain the coolant. Open the radiator cap to make rapid draining.

WARNING

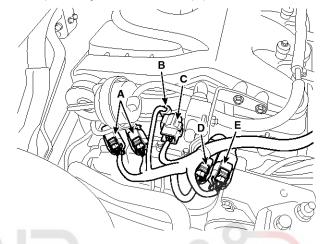
Never remove the radiator cap when the engine is hot.

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



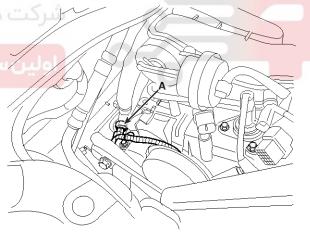
SVGM10041D

- 9. Disconnect the wiring connectors, harness clamps and hoses from the engine.
 - 1) RH front, rear oxygen sensor connector (A)
 - 2) RH exhaust camshaft OCV connector (B)
 - 3) VIS connector (C)
 - 4) RH ignition coil connector (D)
 - 5) RH injector connector (E)



SVGM20023D

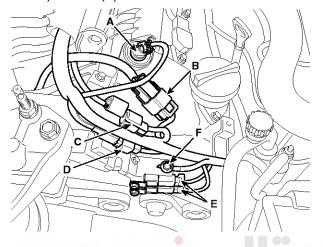
6) Power steering pump oil pressure switch (A)



SVGM20007D

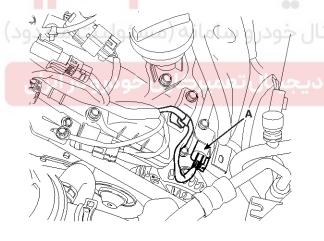
EM-119

- 7) LH exhaust camshaft OCV connector (A)
- 8) LH/RH intake camshaft OCV connector (B)
- 9) Oil pressure switch connector (C)
- 10) Knock sensor connector (D)
- 11) Condenser connectors (E)
- 12) Ground (F)



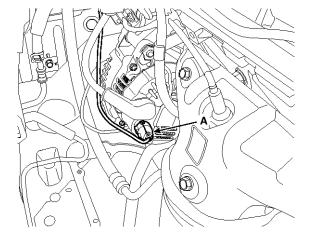
SVGM20024D

13) Disconnect LH front oxygen sensor connector (A).



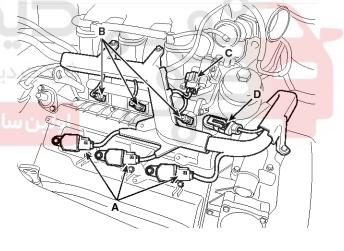
SXMM20002L

14) Disconnect alternator connector (A).



SCMM20054L

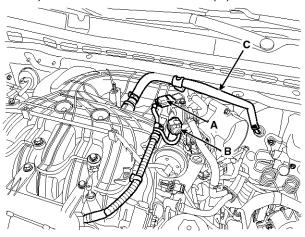
- 15) LH ignition coil connectors (A)
- 16) LH injector connectors (B)
- 17) VIS connector (C)
- 18) LH intake CMPS connector (D)



SCMM20110L

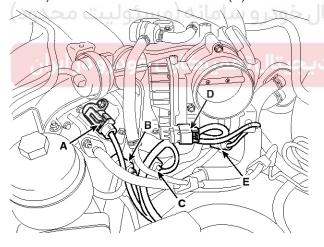
Engine Mechanical System

- 19) MAP sensor connector (A)
- 20) PSCV connector (B)
- 21) Brake booster vacuum hose (C)



SVGM20025D

- 22) RH intake CMPS connector (A)
- 23) Knock sensor connector (B)
- 24) OTS connector (C)
- 25) ETC connector (D)
- 26) RH exhaust CMPS connector (E)

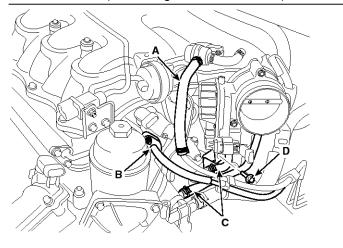


SCMM20107L

- 10. Disconnect the PCSV hose (A), the fuel hose (B), the throttle body coolant hoses (C).
- 11. Remove the throttle body mounting bolt (D).

Tightening torque:

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

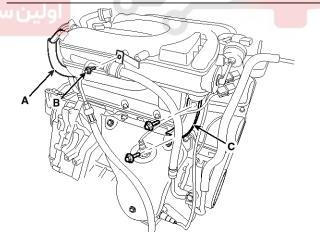


SCMM20141I

12. Disconnect the PCV hose (A) and then remove the power steering oil hose mounting bolt (B) and the surge tank stay (C).

Tightening torque:

- (B): 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)
- (C): $27.5 \sim 31.4$ N.m (2.8 ~ 3.2 kgf.m, $20.3 \sim 23.1$ lb-ft)



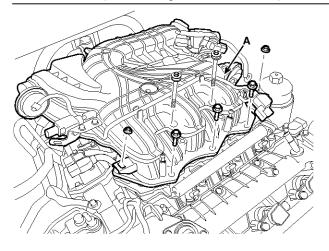
SVGM20043D

EM-121

13. Remove the surge tank (A).

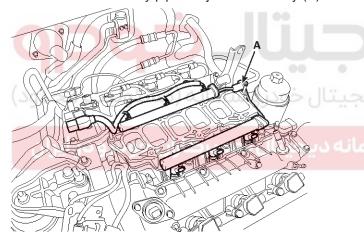
Tightening torque:

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



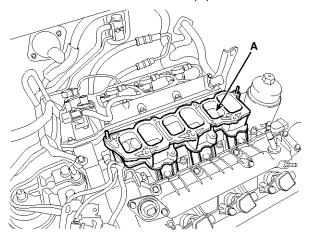
SCMM20115L

14. Remove the delivery pipe & injector assembly (A).



SCMM20117L

15. Remove the intake manifold (A).



SCMM20118L

MOTICE

Cover the cylinder head intake port with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

16. Installation is reverse order of removal.

MOTICE

Tighten the intake manifold bolts and nuts, in several passes as below.

Tightening torque

Step 1: 3.9 \sim 5.9N.m (0.4 \sim 0.6kgf.m, 2.9 \sim 4.3lb-ft)

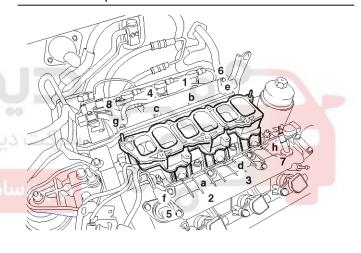
Step 2:Nut- 18.62 \sim 23.52N.m (1.9 \sim 2.4kgf.m,

13.74~17.36lb-ft)

Bolt -26.5 ~ 31.4N.m (2.7~3.2kgf.m, 19.5~23.1lb-ft)

Step 3: Repeat 2nd step twice or more.

a - h : 1st step order $1 \sim 8$: 2nd step order

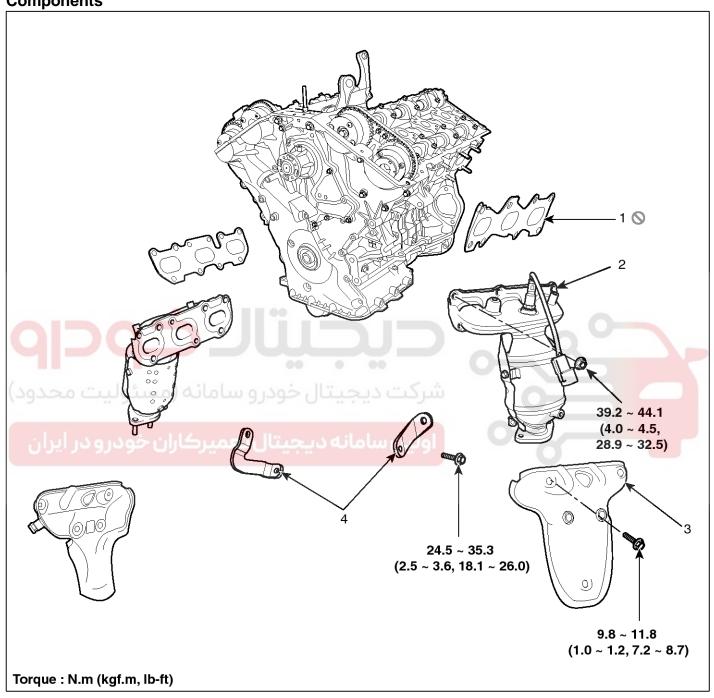


SCMM20143L

Engine Mechanical System

Exhaust Manifold

Components



SVGM20044L

- 1. Gasket
- 2. Exhaust manifold

- 3. Heat protector
- 4. Exhaust manifold stay

EM-123

Removal and Installation

ACAUTION

To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

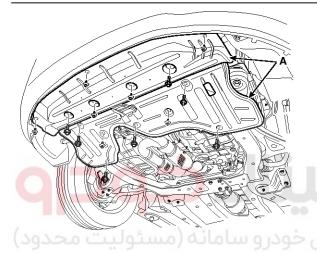
MNOTICE

Mark all wiring and hoses to avoid misconnection.

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

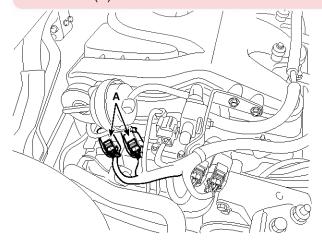
Tightening torque:

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



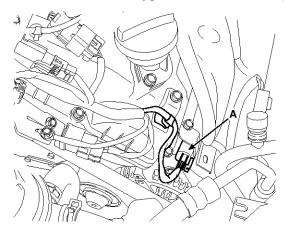
SVGM20002D

3. Disconnect the RH front, rear oxygen sensor connector (A)



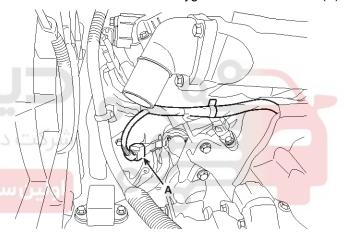
SXMM29036L

4. Disconnect LH front oxygen sensor connector (A).



SXMM20002L

5. Disconnect the LH rear oxygen sensor connector (A)

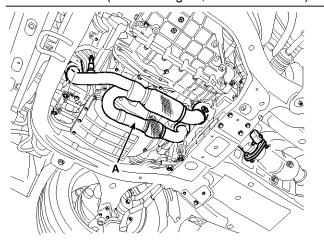


SCMM20053L

6. Remove the front muffler (A).

Tightening torque:

 $39.2 \sim 58.8 \text{ N.m} (4.0 \sim 6.0 \text{ kgf.m}, 28.9 \sim 43.4 \text{ lb-ft})$



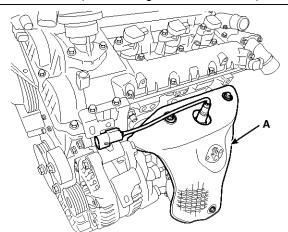
SVGM20045D

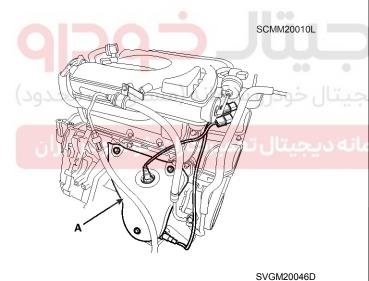
Engine Mechanical System

- 7. Remove the cooling fan assembly. (Refer to Cooling system in this group)
- 8. Remove the LH/RH exhaust manifold heat protector (A)

Tightening torque:

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





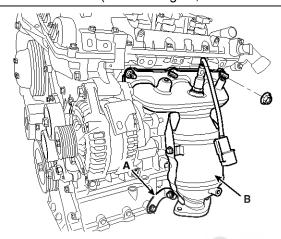
9. Remove the exhaust manifolds stays (A),and then remove the exhaust manifolds (B).

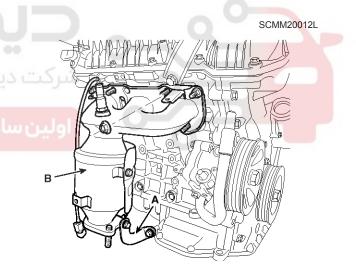
Tightening torque:

Stay bolts:

24.5 \simeq 35.3N.m (2.5 \simeq 3.6kgf.m, 18.1 \simeq 26.0lb-ft) Manifold nuts :

 $39.2 \sim 44.1 \text{ N.m} (4.0 \sim 4.5 \text{ kgf.m}, 28.9 \sim 32.5 \text{ lb-ft})$





SCMM20011L

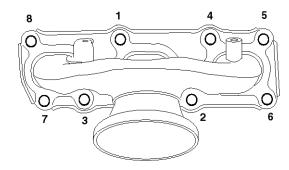
EM-125

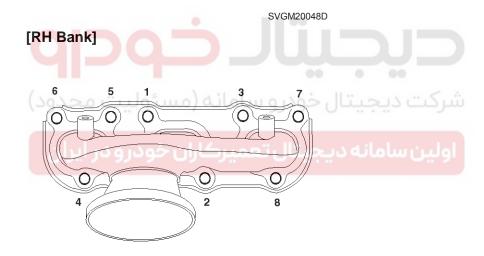
10. Installation is reverse order of removal.

MNOTICE

Tighten the exhaust manifold nuts in the following sequence.

[LH Bank]





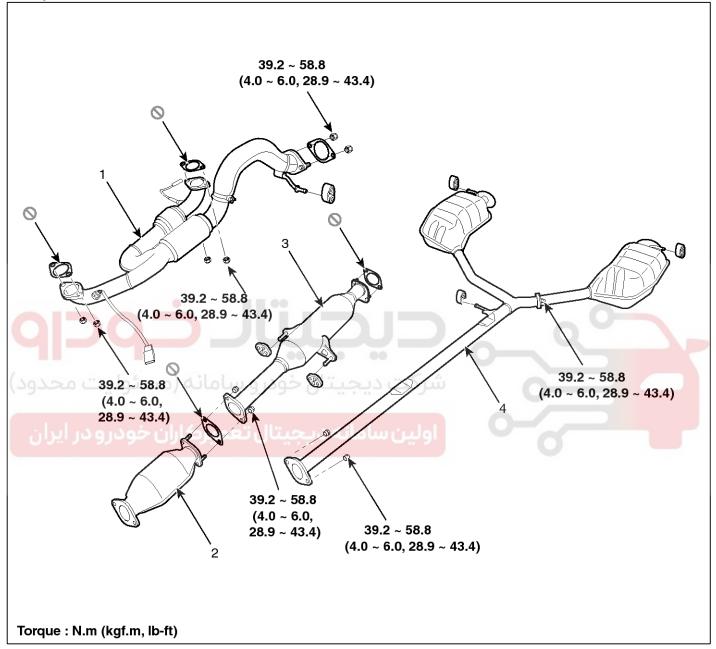


SVGM20049D

Engine Mechanical System

Muffler

Components



SVGM20040L

- 1. Front muffler
- 2. Catalytic converter

- 3. Center muffler
- 4. Main muffler

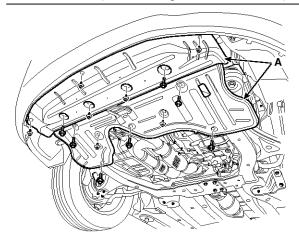
EM-127

Removal and Installation

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

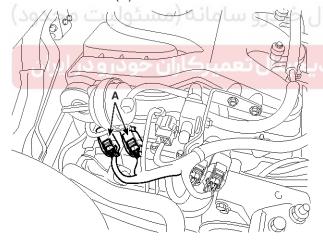
Tightening torque:

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



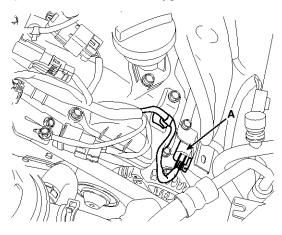
SVGM20002D

- 3. Remove the front muffler.
 - Disconnect the RH front, rear oxygen sensor connector (A).



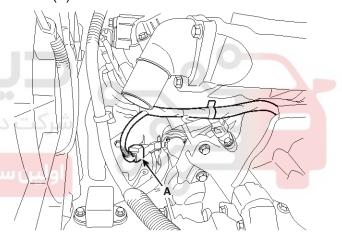
SXMM29036L

2) Disconnect LH front oxygen sensor connector (A).



SXMM20002L

3) Disconnect the LH rear oxygen sensor connector (A).



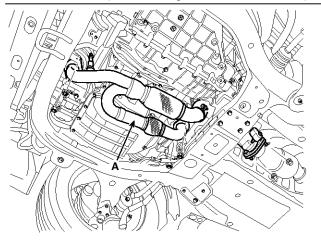
SCMM20053L

Engine Mechanical System

4) Remove the front muffler.

Tightening torque:

 $39.2 \sim 58.8 \text{ N.m} (4.0 \sim 6.0 \text{ kgf.m}, 28.9 \sim 43.4 \text{ lb-ft})$

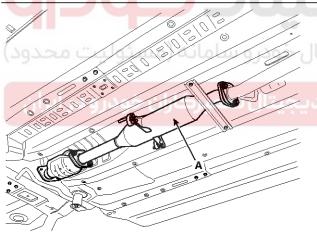


SVGM20045D

4. Remove the center muffler (A).

Tightening torque:

 $39.2 \sim 58.8 \text{ N.m} (4.0 \sim 6.0 \text{ kgf.m}, 28.9 \sim 43.4 \text{ lb-ft})$

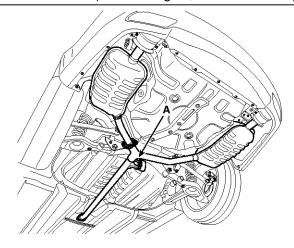


SVGM10030D

5. Remove the main muffler (A).

Tightening torque:

 $39.2 \sim 58.8 \text{ N.m} (4.0 \sim 6.0 \text{ kgf.m}, 28.9 \sim 43.4 \text{ lb-ft})$



SVGM10031D

6. Installation is reverse order of removal.

