# Engine (G4GC – GSL 2.0)

GENERAL		COOLING SYSTEM	
SPECIFICATIONS	EM-2	COMPONENTS	EM-83
TIGHTENING TORQUE	EM-6	ENGINE COOLANT REFILLING	
COMPRESSION	EM-8	AND BLEEDING	EM-84
TIMING BELT TENSION ADJUSTMENT	EM-8	RADIATOR CAP TESTING	EM-85
VALVE CLEARANCE INSPECTION AND		RADIATOR LEAKAGE TESTING	EM-85
VALVE CLEARANCE INSPECTION AND ADJUSTMENT	EM-11	REMOVAL	
TROUBLE - SHOOTING		WATER PUMP	EM-85
SPECIAL TOOLS	EM-20	THERMOSTAT	EM-86
		INSPECTION	
TIMING BELT		WATER PUMP	EM-86
COMPONENTS	EM-22	THERMOSTAT	EM-87
REMOVAL	EM-23	INSTALLATION	
INSPECTION	EM-27	WATER PUMP	EM-88
INSTALLATION	EM-27	THERMOSTAT	EM-88
CYLINDER HEAD ASSEMBLY		LUBRICATION SYSTEM	
COMPONENTS	EM-33	COMPONENTS	EM-89
REMOVAL		OIL AND FILTER	
DISASSEMBLY	EM-40	SELECTION OF ENGINE OIL	EM-92
INSPECTION	EM-41	REMOVAL	
REPLACEMENT	EM-46	DISASSEMBLY	EM-94
REASSEMBLY	EM-47	INSPECTION	EM-94
INSTALLATION	EM-48	REASSEMBLY	
		INSTALLATION	EM-96
ENGINE AND TRANSAXLE ASSEMBLY			
REMOVAL		INTAKE AND EXHAUST SYSTEM	
INSTALLATION	EM-61	COMPONENTS	
		INTAKE MANIFOLD	
ENGINE BLOCK		EXHAUST MANIFOLD	
COMPONENTS		MUFFLER	EM-100
DISASSEMBLY	EM-64	REMOVAL	
INSPECTION		INTAKE MANIFOLD	
REASSEMBLY	EM-77	EXHAUST MANIFOLD	EM-102

# **GENERAL**

# SPECIFICATIONS EE490A0A

Description	Specifications	Limit
General Type Number of cylinder Bore Stroke Total displacement Compression ratio Firing order	In-line, Double Overhead Camshaft 4 82mm (3.228in) 93.5mm (3.681in.) 1975cc (120.52cu.in.) 10.1 1-3-4-2	
Valve timing Intake valve Opens (ATDC) Closes (ABDC) Exhaust Opens (BBDC) Closes (ATDC)	11° 59° 42° 6°	
Valve Valve length Intake Exhaust Stem O.D. Intake Exhaust	114.34mm (4.5016in.) 116.8mm (4.598in.) 5.965 ~ 5.98mm (0.2348 ~ 0.2354in.) 5.950 ~ 5.965mm (0.2343 ~ 0.2348in.)	
Face angle thickness of valve head (Margin) Intake Exhaust	1.15mm (0.0452in.) 1.35mm (0.0531in.)	0.8mm (0.031in.) 1.0mm (0.039in.)
Valve stem to valve guide clearance Intake Exhaust	0.02 ~ 0.05mm (0.0008 ~ 0.0019in.) 0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)	0.10mm (0.0039in.) 0.13mm (0.0051in.)
Valve guide Installed dimension O.D Intake Exhaust Service oversize	46mm (1.811in.) 54.5mm (2.146in.) 0.05, 0.25, 0.50mm (0.002, 0.010, 0.020in.) oversize	
Valve seat Width of seat contact Intake Exhaust Seat angle Oversize	1.1 ~ 1.5mm (0.043 ~ 0.059in.) 1.3 ~ 1.7mm (0.051 ~ 0.066in.) 45° 0.3, 0.6mm (0.012, 0.024in.) oversize	
Valve spring Free length Load Installed height Squarences	48.86mm (1.9236in.) 18.8kg/39mm (41.45lb/1.535in.) 39mm (1.5354in.) 1.5° MAX.	

Description	Specifications	Limit
Valve clearance Cold (20°C[68°F]) Intake Exhaust	0.20mm (0.0079in.) 0.28mm (0.0110 in,)	0.12 ~ 0.28mm (0.0047 ~ 0.0110in.) 0.20 ~ 0.38mm (0.0079 ~ 0.0150in.)
Cylinder head Flatness of gasket surface Flatness of manifold mounting surface Oversize rework dimensions of valve seat hole Intake	Max. 0.03mm (0.0012in.) Max. 0.15mm (0.0059in.)	0.06mm (0.0024in.) 0.03mm (0.0012in.)
0.3mm (0.012in.) O.S. 0.6mm (0.024in.) O.S. Exhaust 0.3mm (0.012in.) O.S. 0.6mm (0.024in.) O.S. Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05mm (0.002in.) O.S 0.25mm (0.010in.) O.S	33.300 ~ 33.325mm (1.3110 ~ 1.3120in.) 33.600 ~ 33.625mm (1.3228 ~ 1.3238in.) 28.800 ~ 28.821mm (1.1338 ~ 1.1346in.) 29.100 ~ 29.121mm (1.1456 ~ 1.1465in.) 11.05 ~ 11.068mm (0.435 ~ 0.4357in.) 11.25 ~ 11.268mm (0.443 ~ 0.4436in.)	
0.50mm (0.020in.) O.S  Cylinder block Cylinder bore Out-of-round and taper of cylinder bore Clearance with piston (To set limits to new parts)	11.50 ~ 11.518mm (0.453 ~ 0.4535in.)  82.00 ~ 82.03mm (3.2283 ~ 3.2295in.)  Less than 0.01mm (0.0004in.)  0.02 ~ 0.04mm (0.0008 ~ 0.0016in.)	
Piston O.D (To set limits to new parts) Service oversize	81.97 ~ 82.00mm (3.2271 ~ 3.2283in.) 0.25, 0.50mm (0.010, 0.020in.) oversize	
Piston ring Side clearance No.1 No.2 End gap No.1 No.2	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.) 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.) 0.23 ~ 0.38mm (0.0090 ~ 0.0149in.) 0.45 ~ 0.60mm (0.0177 ~ 0.0236in.)	0.1mm (0.004in.)  1mm (0.039in.)  1mm (0.039in.)
Oil ring side rail Service oversize	0.20 ~ 0.60mm (0.0078 ~ 0.0236in.) 0.25, 0.50mm (0.010, 0.020in.) oversize	1mm (0.039in.)
Connecting rod Bend Twist Connecting rod big end to crankshaft side clearance	0.05mm (0.0020in.) or less 0.1mm (0.004in.) or less 0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	0.4mm (0.0157in.)
Connecting rod bearing Oil clearance (To seat limits to new parts) Undersize	0.024 ~ 0.042mm (0.0009 ~ 0.0016in.) 0.25mm (0.01in.)	

Description	Specifications	Limit
Camshaft Cam height Intake Exhaust Jourmal O.D.	44.618mm (1.7566in.) 44.518mm (1.7527in.) 28mm (1.1023in.)	44.518mm (1.7527in.) 44.418mm (1.7487in.)
Bearing oil clearance End play	0.02 ~ 0.061mm (0.0008 ~ 0.0024in.) 0.1 ~ 0.2mm (0.004 ~ 0.008in.)	0.1mm (0.0039in.)
Crankshaft Pin O.D. Journal O.D. Bend Out-of-round, taper of journal and pin End play Undersize rework dimension of pin 0.25mm (0.010in.) Undersize rework dimension of journal 0.25mm (0.010in.)	45mm (1.77in.) 57mm (2.244in.) 0.03mm (0.0012in.) or less 0.005mm (0.0002in.) or less 0.06 ~ 0.260mm (0.0023 ~ 0.010in.) 44.725 ~ 44.740mm (1.7608 ~ 1.7614in.) 56.727 ~ 56.742mm (2.2333 ~ 2.2339in.)	0.030mm (0.0012in.)
Crankshaft bearing Oil clearance	0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)	
Flywheel Runout	0.1mm (0.0039in.)	0.13mm (0.0051in.)
Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
<b>Coolant</b> Quantity	6 liter (6.3U.S qts, 5.2lmp. qts)	
Radiator Type	Pressurized corrugated fin type	
Radiator cap Main valve opening pressure Vacuum valve opening pressure	83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1kg/cm²) -7kpa (-100psi, -0.07kg/cm²) or less	
Thermostat Type Valve opening temperature Full-opening temperature	Wax pellet type with jiggle valve 82°C (177°F) 95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt Type	V-ribbed belt	
Engine coolant temperature sensor Type Resistance	Heat-sensitive thermistor type 2.31 $\sim$ 2.59K $\Omega$ at 20°C (68°F)	
Oil pump Clearance between outer circumference and front case. Front case tip clearance Side clearance Inner gear Outer gear Engine oil pressure at 1500 RPM [Oil temperature is 90 to 110°C (194 to 230°F)]	0.120 ~ 0.185mm (0.0049 ~ 0.0073in.)  0.025 ~ 0.069mm (0.0009 ~ 0.0027in.)  0.04 ~ 0.085mm (0.0016 ~ 0.0033in.)  0.04 ~ 0.09mm (0.0016 ~ 0.0035in.)  245KPa (2.5kg/cm², 35.5psi)	
·		

Description	Specifications	Limit
Relief spring Free height Load	43.8mm (1.725in.) 3.7±0.4kg at 40.1mm (3.15±0.88lb/1.578in.)	
Air cleaner Type Element	Dry type Unwoven cloth type	
Exhaust pipe Muffler Suspension system	Expansion resonance type Rubber hangers	

# SERVICE STANDRDS

Standard value	
Antifreeze	Maxture ratio of anti-freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

# TIGHTENING TORQUE

Item	Nm	kgf.cm	lbf.ft
Cylinder Block			
Front engine support bracket bolt and nut	35 ~ 50	350 ~ 500	25 ~ 37
Front roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear engine support bracket bolt	40 ~ 50	400 ~ 500	30 ~ 37
Engine Mounting			
Right mounting insulator (large) nut	90 ~ 110	900 ~ 1100	65 ~ 80
Right mounting insulator (small) nut	45 ~ 60	450 ~ 600	33 ~ 44
Right mounting bracket to engine	50 ~ 65	500 ~ 650	36 ~ 48
nuts and bolts			
Transmission mount insulator nut	90 ~ 110	900 ~ 1100	65 ~ 80
Transmission insulator bracket to	40 ~ 50	400 ~ 500	30 ~ 36
side member bolt			
Rear roll stopper insulator nut	50 ~ 65	500 ~ 650	36 ~ 48
Rear roll stopper bracket to center	40 ~ 50	400 ~ 500	30 ~ 36
member bolts			
Front roll stopper insulator nut	50 ~ 65	500 ~ 650	36 ~ 48
Front roll stopper bracket to center	40 ~ 50	400 ~ 500	30 ~ 36
member bolts.			
Main Moving			
Connecting rod cap nut	50 ~ 53	500 ~ 530	36 ~ 39
Crankshaft bearing cap bolt	28~32 + (60°~64°)	280~320 + (60°~64°)	20.6~23.6 + (60°~64°)
Fly wheel M/T bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Drive plate A/T bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Engine cover	4 ~ 6	40 ~ 60	3 ~ 4
Heat protector	15 ~ 20	150 ~ 200	11 ~15
Water pipe bracket bolts	12 ~ 15	120 ~ 150	9 ~ 11
Cooling system			
Alternator support bolt and nut	20 ~ 25	200 ~ 250	14 ~ 18
Alternator lock bolt	12 ~ 15	120 ~ 150	9 ~ 11
Alternator brance mounting bolt	20 ~ 27	200 ~ 270	15 ~ 20
Coolant pump pulley bolts	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolts	20 ~ 27	200 ~ 270	14 ~ 19
Coolant temperature sensor	20 ~ 40	200 ~ 400	15 ~ 30
Coolant inlet fitting nuts	15 ~ 20	150 ~ 200	11 ~ 14
Thermostat housing bolts and nuts	15 ~ 20	150 ~ 200	11 ~ 14
Lubrication system			
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Oil pan bolts	10 ~ 12	100 ~ 120	7 ~ 9
Oil pan drain plug	40 ~ 45	400 ~ 450	30 ~33
Oil screen bolts	15 ~ 22	150 ~ 220	11 ~16
Oil pressure switch	13 ~ 15	130 ~ 150	9.7 ~11

Item	Nm	kgf.cm	lbf.ft
Intake and Exhaust system			
Air cleaner body mounting bolts	8~ 10	80 ~ 100	6 ~ 7
Resonator mounting bolts	4 ~ 6	40 ~ 60	3 ~ 4
Intake manifold to cylinder head	16 ~ 23	160 ~ 230	12 ~ 17
nuts and bolts			
Intake manifold stay to cylinder	18 ~ 25	180 ~ 250	13 ~ 18
block bolts			
Throttle body to surge tank nuts	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold to cylinder head nuts	43 ~ 55	430 ~ 550	32 ~ 40
Exhaust manifold cover to exhaust	17 ~ 22	170 ~ 220	12.5 ~ 16
manifold bolts			
Oxygen sensor to front muffler	50 ~ 60	500 ~ 600	36 ~ 43
Oxygen sensor to exhaust manifold	50 ~ 60	500 ~ 600	36 ~ 43
Front exhaust pipe to exhaust	30 ~ 40	300 ~ 400	22 ~ 29
manifold nuts			
Front exhaust pipe bracket bolts	30 ~ 40	300 ~ 400	22 ~ 29
Front exhaust pipe to catalytic	40 ~ 60	400 ~ 600	29 ~ 43
converter bolts	40 45	400 450	
Main muffler hanger support	10 ~ 15	100 ~ 150	7 ~ 11
bracket bolts			
Cylinder head			
Cylinder head bolts - M10	25 + (60°~65°) +	250 + (60°~65°) +	18 + (60°~65°) +
	(60°~65°)	(60°~65°)	(60°~65°)
Cylinder head bolts - M12	30 + (60°~65°) +	300 + (60°~65°) +	22 + (60°~65°) +
	(60°~65°)	(60°~65°)	(60°~65°)
Intake manifold nuts	18 ~ 25	180 ~ 250	13 ~ 18
Exhaust manifold nuts	43 ~ 55	430 ~ 550	32 ~ 41
Cylinder head cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft bearing cap bolts	14 ~ 15	140 ~ 150	10 ~ 11
Oil control valve bolt	10 ~ 12	100 ~ 120	7.3 ~ 8.8
OCV Filter	41 ~ 51	410 ~ 510	30 ~ 37.6
CVVT unit to exhaust camshaft bolt	66 ~ 78	660 ~ 780	48.7~ 57.5
Rear plate bolts	8 ~ 10	80 ~ 100	6 ~ 7
Timing Belt			
Crankshaft pulley bolt	160 ~ 170	1600 ~ 1700	120 ~ 125
Camshaft sprocket bolt	100 ~ 120	1000 ~ 1200	74 ~ 89
Timing belt tensioner bolts	43 ~ 550	430 ~ 550	31 ~ 40
Timing belt cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Front case bolts	20 ~ 27	200 ~ 270	14 ~ 20
Timing belt idler bolt	43 ~ 55	430 ~ 550	31 ~ 40

M/T : Manual Transmission A/T : Automatic Transmission

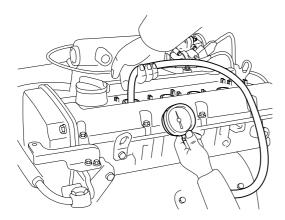
# COMPRESSION



# **NOTE**

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

- 1. Warm up and stop engine. Allow the engine to warm up to normal operating temperature.
- Remove ignition coils. (See EE group ignition)
- Remove spark plugs. Using a 16mm plug wrench, remove the 4 spark plugs.
- Check cylinder compression pressure.
  - Insert a compression gauge into the spark plug



ECKD001X

- Fully open the throttle.
- While cranking the engine, measure the compression pressure.



# MOTE

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

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



# **₩** NOTE

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

Compression pressure:

1,420kPa (14.5kgf/cm<sup>2</sup>, 206psi)

Minimum pressure:

1,270kPa (13kgf/cm², 184psi)

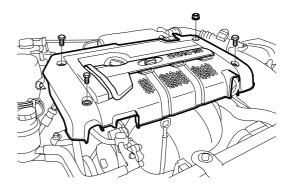
Difference between each cylinder:

100kPa (1.0kgf/cm², 15psi) or less

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

# TIMING BELT TENSION ADJUSTMENT

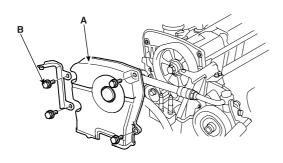
Remove the engine cover(A).

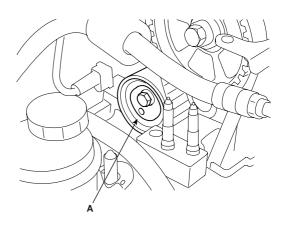


ECHE101A

Remove RH front wheel.

- 3. Remove the 4bolts(B) and timing belt upper cover(A).
- 5. Temperarily loosen tensioner pulley(A) by center bolt.

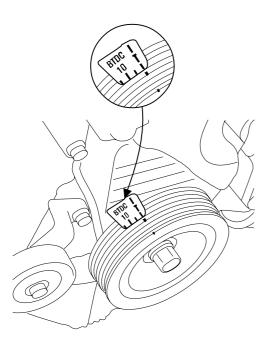




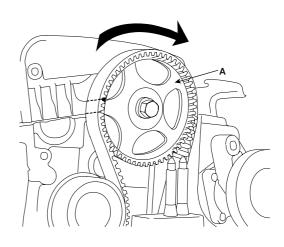
ECKD105A

ECKD109A

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



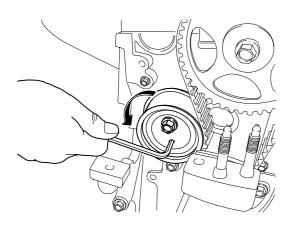
- 6. Timing belt tension adjusting.
  - 1) Rotate crankshaft in regular direction (clock wise view from front) through angle equivalent to two teeth (18°) of camshaft sprocket(A).



ECKD116B

ECKD106A

 Give tension to timing belt rotating tensioner in arrow direction tool and set timing belt not to give slack to tension side.



ACGE003A

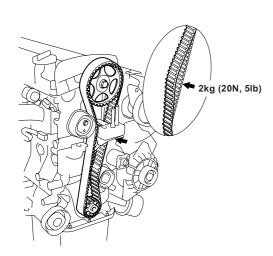
3) Tightening tensioner bolt.

# Tightening torque

Tensioner bolt

43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lbf.ft)

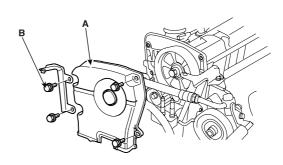
4) Recheck the belt tension, When the tension side of timing belt is pushed horizontally with a moderate force [approx. 2kg (20N, 5lb)], the timing belt cog end sags in approx. 4 ~ 6mm (0.16 ~ 0.24in.)



- 7. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
- 8. Install the timing belt upper cover(A) with 4bolts(B).

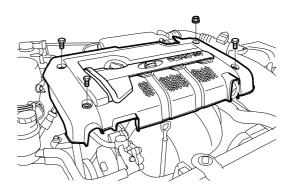
# Tightening torque

8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7lbf.ft)



ECKD105A

- 9. Install RH front wheel.
- 10. Install engine cover(A).



ECHE101A

# VALVE CLEARANCE INSPECTION AND ADJUSTMENT

MLA (MECHANICAL LASH ADJUSTER)

# **NOTE**

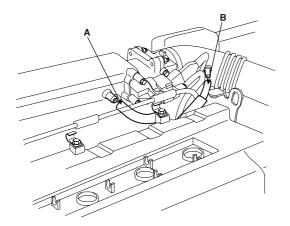
Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C) and cylinder head is installed on the cylinder block.

- 1. Remove the engine cover. (See page EM 8)
- 2. Remove the upper timing belt cover. (See page EM 9)
  - Loosen the upper timing cover bolts and then remove the cover.
- 3. Remove the cylinder head cover.
  - a. Disconnect the spark plug cables and do not pull on the spark plug by force.

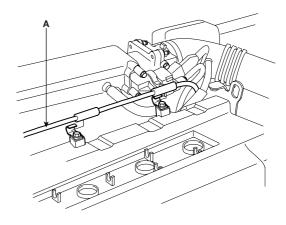
# **NOTE**

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

 Disconnect the P.C.V hose(A) and the breather hose(B) from the cylinder head cover.

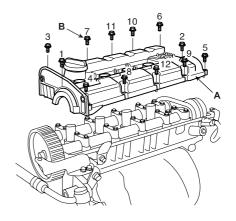


 Disconnect the accelerater cable(A) from the cylinder head cover.



ECKD111A

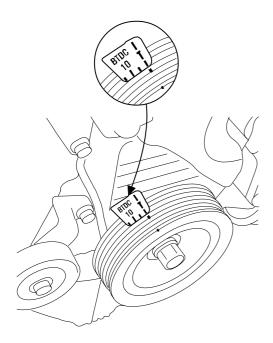
 Loosen the cylinder head cover bolts(B) and then remove the cover(A) and gasket.



ADIE002A

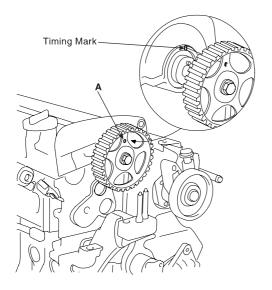
ECKD112A

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

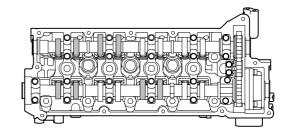


ECKD106A

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



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



EDKD888B

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

#### Valve clearance

Specification

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

Intake: 0.20mm (0.0079in.) Exhaust: 0.28mm (0.0110in.)

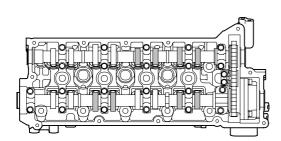
Limit

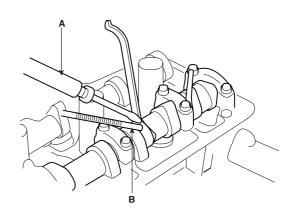
Intake :  $0.12 \sim 0.28$ mm ( $0.0047 \sim 0.0110$ in.) Exhaust :  $0.20 \sim 0.38$ mm ( $0.0079 \sim 0.0150$ in.)

b. Turn the crankshaft pulley one revolution ( $360^{\circ}$ ) and align the groove with timing mark "T" of the lower timing belt cover.

ECKD110B

- c. Check only valves indicated as shown. [NO. 4 cylinder: TDC/compression]. Measure the valve clearance. (See procedure in step (6))
- c. Remove the adjusting shim with a small screw driver(A) and magnet(B).

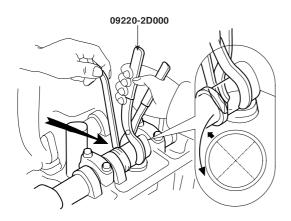




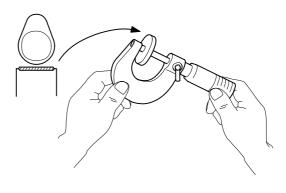
EDKB889C

EDKD888C

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



d. Measure the thickness of the removed shim using a micrometer.



EDKB889D

EDKB889B

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

# Valve clearance (Engine coolant temperature : 20°C)

T : Thickness of removed shim A : Measured valve clearance N : Thickness of new shim

Intake : N = T + [A - 0.20mm(0.0079in.)]Exhaust : N = T + [A-0.28mm (0.0110in.)]

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

# MOTE

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

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

# Valve clearance (Engine coolant tem-

perature : 20°C) [Specification]

Intake: 0.20mm (0.0079in.) Exhaust: 0.28mm (0.0110in.)

[Limit] (After adjusting valve clearance) Intake :  $0.17 \sim 0.23$ mm ( $0.0067 \sim 0.0091$ in.) Exhaust :  $0.25 \sim 0.31$ mm ( $0.0098 \sim 0.0122$ in.)

# Adjusting Shim Selection Chart (Intake)

(7801.0) 87.5 15 15 15 15 15 15 15 15 15 15 15 15 15	7
(FYOT.0) SY.S 4 75 75 75 75 (EYOT.0) 47.S 75 75 75 75 75 75 75 75 75 75 75 75 75	1   1   1   1   1   1   1   1   1   1
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# Adjusting Shim Selection Chart (Exhaust)

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(8680.0)7S.S (8680.0)8S.S (S060.0)6S.S (6060.0)0E.S (6060.0)1E.S	1 1 1 2 2 2	C1	ი ი ი ი	4	4 4 4 4 4 4 5 5 5 5 5	5 5 5 6	5 5 6 6 6	2 6 6		11 11 11 12	12 12 12	13 13 13	13 14 14 14 14	14 14 14 15 15	15 15 15 16	15 16 16 16	16 16 17 17 17	17 17 17 18 18 18	18 18 19	19 19 19 20	19 19 20 20 20 20 20 20	20 20 20	1					valve clearance (Co m (Spec.), 0.20 ~ 0.3	ile : The 2.24 mm shin red clearance is 0.450 m shim with a new No
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(0880.0)82.S (0080.0)82.S (0080.0)75.S (8080.0)85.S (S000.0)85.S (S000.0)85.S (S000.0)85.S (S000.0)85.S (S000.0)85.S	111122	1 2 2 2 2	ი ი ი ი	3 3 3 4 4 4	3 3 4 4 4 4 5 5 5 5 5 5 5	4 4 5 5 5 5 6	22222	2 2 6 6	10 10 10	10111111111	12 12 12 13	12 12 12 12 13 13 13	13 13 13 13 14 14 14 14	13 13 14 14 14 14 15 15	14 14 15 15 15 15 16	15 15 15 16 16 16 16 16 15 15 15 15 15 15 15 15 15 15 15 15 15	16 16 16 16 17 17 17	16 16 17 17 17 17 18 17 17 17 17 18 18 18	17 17 18 18 18 19 19	18 18 19 19 19 19 20	19 19 19 19 20 20 20 20	8 8						ntake valve clearance (Co 28 mm (Spec.), 0.20 ~ 0.:	xample : The 2.24 mm shin neasured clearance is 0.450 2.24 mm shim with a new Nc
(3880.0)4S.S. (3880.0)3S.S. (0680.0)3S.S. (4680.0)7S.S. (8680.0)8S.S. (S060.0)9S.S. (S060.0)0S.S. (3060.0)0S.S. (3060.0)0S.S. (3060.0)0S.S.	111122	1 2 2 2 2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2 3 3 3 4 4 4	3 3 3 4 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5	4 4 5 5 5 5 6	5 5 5 6 6 6	2 2 6 6	9 10 10 10	10111111111	11 12 12 12 13	11 12 12 12 12 13 13 13	12 13 13 13 14 14 14 14	13 13 13 14 14 14 14 15 15	14 14 15 15 15 15 16	1 14 15 15 15 15 16 16 16 16 15 15 15 15 15 15 15 15 15 16 16 16 16 17	5 15 16 16 16 16 17 17 17	16 16 16 17 17 17 17 18 18	17 17 17 18 18 18 18 19	18 18 18 19 19 19 20	19 19 19 19 20 20 20 20	19 20 20 20	020					Intake valve clearance (Cold) : 0.28 mm (Spec.), 0.20 ~ 0.38 mm (Limit)	Example: The 2.24 mm shim is installed, and the measured clearance is 0.450 mm. Replace the 2.24 mm shim with a new No. 11 shim.
(8780.0)52.S.G (2880.0)42.S.G (8880.0)32.S.G (0880.0)32.S.G (0890.0)75.S.G (8980.0)82.S.G (2000.0)92.S.G (2000.0)00.S.G (2000.0)17.S.G (2000.0)17.S.G (2000.0)17.S.G	111122	1 2 2 2 2	3 3 3 10 3 10	2 2 3 3 3 4 4 4	3 3 3 3 4 4 4 4 4 5 5 5 5 5 5 5 5 5 5 5	4 4 4 4 5 5 5 5 6	22222	2 2 6 6	9 9 10 10 10	10 10 10 10 11 11 11 11 12	11 11 11 11 12 12 12 13 13	11 12 12 12 12 13 13 13	12 13 13 13 14 14 14 14	13 13 13 13 14 14 14 14 15 15	14 14 14 15 15 15 15 16	14 14 15 15 15 15 16 16 16 16 17	5 15 16 16 16 16 17 17 17	16 16 16 16 17 17 17 17 18 18 18	17 17 17 18 18 18 18 19	18 18 18 19 19 19 20	19 19 19 19 20 20 20 20	19 19 20 20 20 20	2020	ā				Intake valve clearance (Co 0.28 mm (Spec.), 0.20 ~ 0.3	Example: The 2.24 mm shin measured clearance is 0.450 2.24 mm shim with a new No
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# TROUBLESHOOTING E6D36B0F

Symption	Suspect area	Remedy (See page)
Engine misfire with	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
abnormal internal lower engine noises.	Worn piston rings (Oil cousnmption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve	Stuck valves. (Carbon buidup on the valve stem)	Repair or replace as required
train noise.	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	<ul> <li>Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system.</li> <li>Coolant consumption may or may not cause the engine to overheat.</li> </ul>	<ul> <li>Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket.</li> <li>Repair or replace as required.</li> </ul>
Engine misfire with excessive oil	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
consumption	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	<ul><li>Inspect the cylinder for a loss of compression.</li><li>Repair or replace as required.</li></ul>
Engine noise on start-up, but only	Incorrect oil viscosity	Drain the oil.     Install the correct viscosity oil.
lasting a few seconds.	Worn crankshaft thrust bearing.	<ul><li>Inspect the thrust bearing and crankshaft.</li><li>Repair or replace as required.</li></ul>
Upper engine noise,	Low oil pressure	Repair or repalce as required.
regardless of engine speed.	Broken valve spring.	Replace the valve spring.
opood.	Worn or dirty valve lifters.	Replace the valve lifters.
	Stetched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	<ul><li>Inspect the camshaft lobes.</li><li>Replace the timing camshaft and valve lifters as required.</li></ul>
	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.

Symption	Suspect area	Remedy (See page)
Lower engine noise,	Low oil pressure.	Repair or required.
regardless of engine speed	Loose or damaged flywheel.	Repair or replace the flywheel.
эрсси	Damaged oil pan, contacting the oil pump screen.	<ul><li>Inspect the oil pan.</li><li>Inspect the oil pump screen.</li><li>Repair or replace as required.</li></ul>
	Oil pump screen loose, damaged or restircted.	<ul><li>Inspect the oil pump screen.</li><li>Repair or replace as required.</li></ul>
	Excessive piston-to-cylinder bore clearance.	<ul><li>Inspect the piston, piston pin and cylinder bore.</li><li>Repair as required.</li></ul>
	Excessive piston pin-to-piston clearance	<ul><li>Inspect the piston, piston pin and the connecting rod.</li><li>Repair or replace as required.</li></ul>
	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.
	Incorrect piston, piston pin and connecting rod installation	<ul> <li>Verify the piston pins and connecting rods are installed correctly.</li> <li>Repair as required.</li> </ul>
Engine noise under	Low oil pressure	Repair or replace as required.
load	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.

Symption	Suspect area	Remedy (See page)
Engine will not crank-crankshaft will not rotate	Hydraulically locked cylinder  Coolant/antifreeze in cylinder.  Oil in cylinder.  Fuel in cylinder	<ol> <li>Remove spark plugs and check for fluid.</li> <li>Inspect for broken head gasket.</li> <li>Inspect for cracked engine block or cylinder head.</li> <li>Inspect for a sticking fuel injector and/or leaking fuel regulator.</li> </ol>
	Broken timing chain and/or timing chain and/or timing chain gears.	<ol> <li>Inspect timing chain and gears.</li> <li>Repair as required.</li> </ol>
	Material in cylinder	Inspect cylinder for damaged components and/or foreign materials.     Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	<ol> <li>Inspect crankshaft and connecting rod bearing.</li> <li>Repair as required.</li> </ol>
	Bent or broken connecting rod.	<ol> <li>Inspect connecing rods.</li> <li>Repair as required.</li> </ol>
	Broken crankshaft	<ol> <li>Inspect crankshaft.</li> <li>Repair as required.</li> </ol>

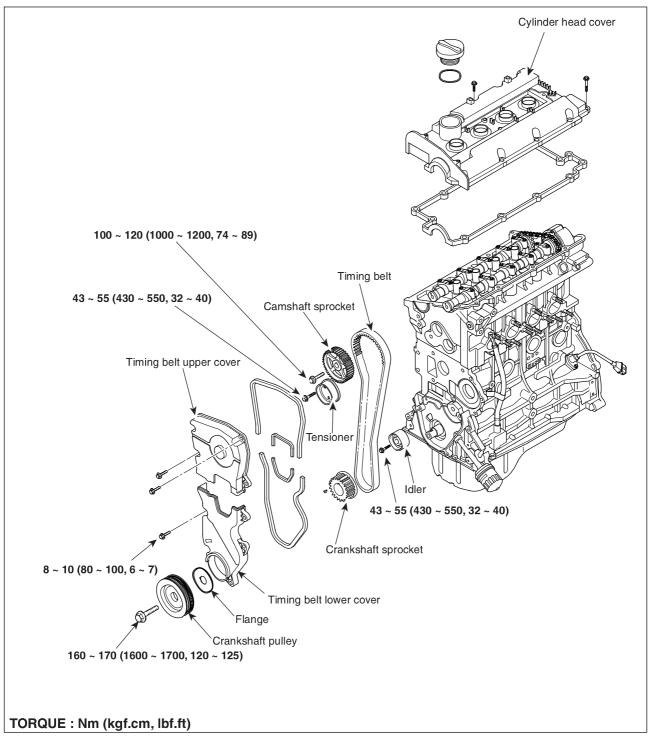
# SPECIAL TOOLS EC4DCBF2

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)	EDKA010A	Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)	Plier Stopper	Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)	EDDA005B	Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)	ECKA010B	Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)	ECKA010A	Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Valve spring compressor & adaptor (09222-28000, 09222-28100)		Removal and installation of the intake or exhaust valve
	EDDA005C	
Crankshaft rear oil seal installer (09231-21000)		Installation of the engine rear oil seal     Installation of the crankshaft rear oil seal
	EDDA005F	

# **TIMING SYSTEM**

# COMPONENT ED9C5674



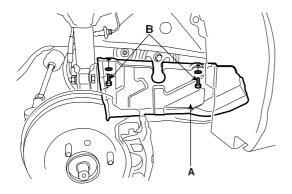
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TIMING SYSTEM EM -23

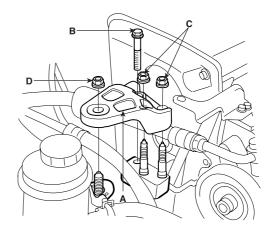
# REMOVAL EA165A14

Engine removal is not required for this procedure.

- 1. Remove the engine cover. (See page EM 8)
- 2. Remove RH front wheel.
- 3. Remove 2bolts(B) and RH side cover(A).



2) Remove the bolt(B), 3nuts(C, D) and engine mount bracket(A).

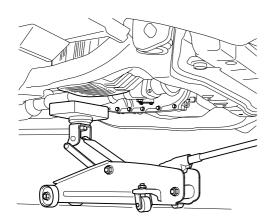


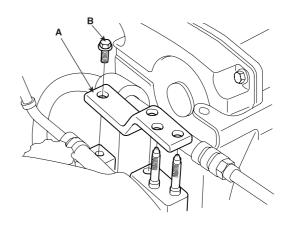
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3) Remove the bolt(B) and stay plate(A).

KXDSE16A

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





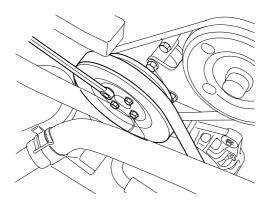
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**NOTE** 

Place wooden block between the jack and engine oil pan.

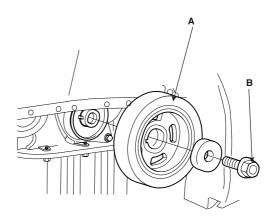
5. Temporarily loosen the water pump pulley bolts.



ECKD104B

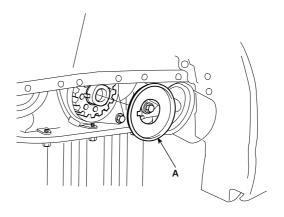
- 6. Remove alternator belt. (See EE group alternator)
- 7. Remove air compressor belt. (See HA group air compressor)
- 8. Remove power steering belt. (See ST group power steering pump)
- 9. Remove 4bolts and water pump pulley.
- 10. Remove the 4bolts and timing belt upper cover. (See page EM 9)
- 11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. (See page EM 9)

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



ECKD107A

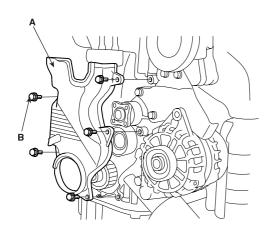
13. Remove the crankshaft flange(A).

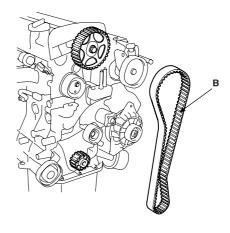


ECKD108A

TIMING SYSTEM EM -25

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





ECKD109B

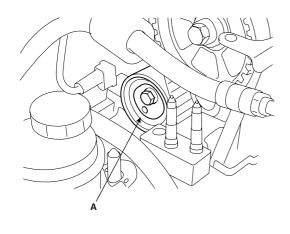
ECKD108B

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

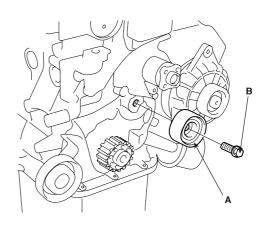


If the timing belt is reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

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

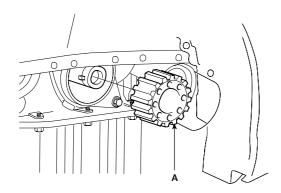


ECKD109A



ECKD109C

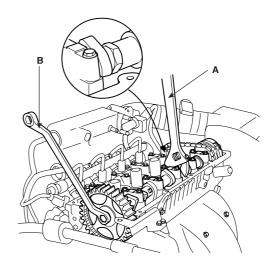
17. Remove the crankshaft sprocket(A).



ECKD110A

- 18. Remove the cylinder head cover.
  - 1) Remove the spark plug cable.
  - Remove the accelerator cable from the cylinder head cover. (See page EM - 11)
  - 3) Remove the PCV(Positive Crankcase ventilation) hose and breather hose. (See page EM 11)
  - 4) Remove the 12bolts and cylinder head cover. (See page EM 11)

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



ECKD114A



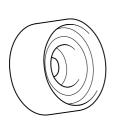
Be careful not to damage the cylinder head and valve lifter with the wrench.

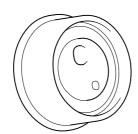
TIMING SYSTEM EM -27

# INSPECTION E1D945CE

# SPOCKETS, TENSIONER, IDLER

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





ECKD115A

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

# **TIMING BELT**

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

# **NOTE**

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

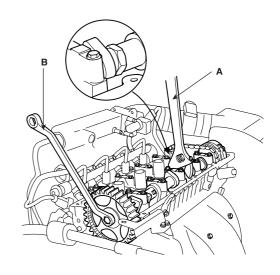
# INSTALLATION E708FC0E

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

# Tightening torque

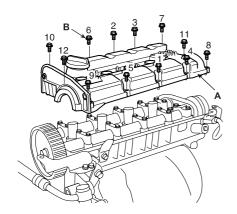
Camshaft sprocket bolt

100 ~ 120Nm (1000 ~ 1200kgf.cm, 74 ~ 89lbf.ft)



ECKD114A

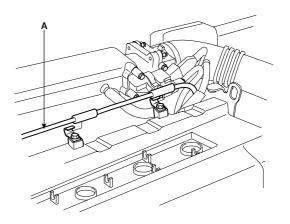
- 2. Install cylinder head cover.
  - 1) Install cylinder head cover(A) and 12bolts(B).



ADIE003A

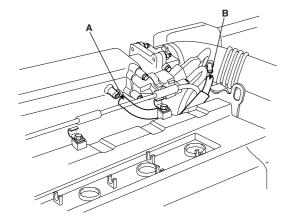
2) Install the PCV hose(A) and breather hose(B).

 Install the accelerator cable(A) from the cylinder head cover.

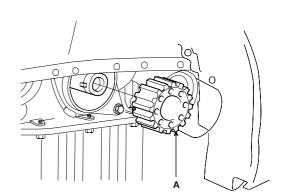


ECKD111A

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



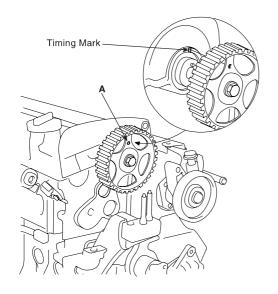
ECKD112A



ECKD110A

TIMING SYSTEM EM -29

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

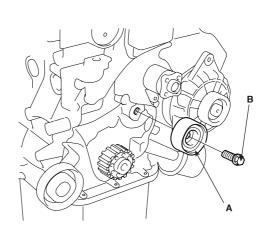


5. Install the idler pulley(A) and tighten the bolt(B) to the specified torque.

# Tightening torque

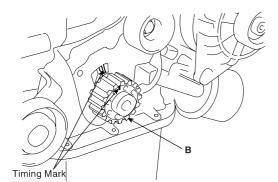
Idler pulley bolt

43 ~ 55Nm (430 ~ 550kgf.m, 32 ~ 40lbf.ft)

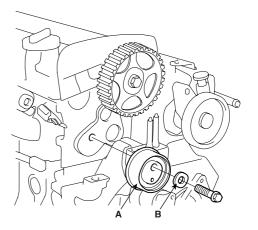


ECKD110B

ECKD109C



6. Temporarily install the timing belt tensioner(A) with plain washer(B).

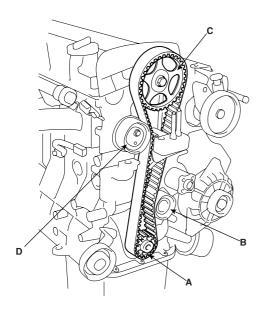


ECKD110C

ECKD116A

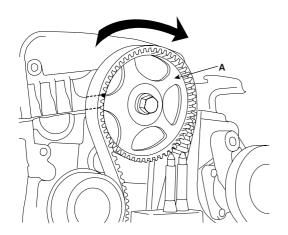
7. Install the timing belt so as not to give excessive slack at the center of the belt. Install the timing belt with the following procedure.

Crankshaft sprocket (A)  $\rightarrow$  Idler pulley (B)  $\rightarrow$  Camshaft sprocket (C)  $\rightarrow$  timing belt tensioner (D).

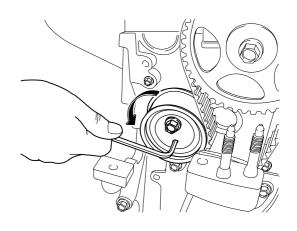


ECKD109D

- 8. Temporarily fasten tensioner pulley by center bolt to add force at belt.
- 9. Timing belt tension adjusting
  - Rotate crankshaft in regular direction (clock wise view from front) through angle equivalant to two teeth (18°) of camshaft sprocket(A).



2) Give tension to timing belt by rotating tensioner in direction of the arrow with tool and set timing belt not to give slack to tension side.



ACGE003A

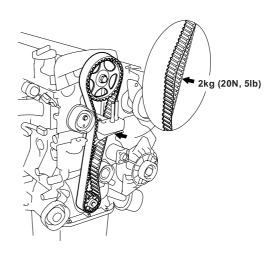
3) Tightening tensioner bolt.

# **Tightening torque**

Tensioner bolt

43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lbf.ft)

4) Recheck the belt tension. When the tension side of timing belt is pushed horizontally with a moderate force [approx. 2kg (20N, 5lb)], the timing belt cog end sags in approx. 4 ~ 6mm (0.16 ~ 0.24in.)



ECKD116B ECKD109E

TIMING SYSTEM EM -31

- 10. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
- 11. Install the timing belt lower cover(A) with 5 bolts(B).

Tightening torque
Timing belt cover bolt

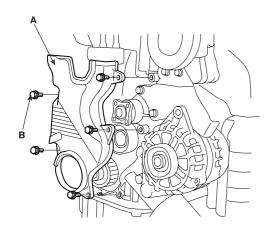
8 ~ 10Nm (80 ~100kg.cm, 6 ~ 7lbf.ft)

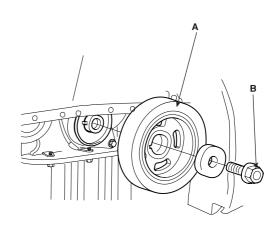
 Install the flange and crankshaft pulley(A).
 Make sure that crankshaft sprocket pin fits the small hole in the pulley.

# **Tightening torque**

Crankshaft pulley bolt

160 ~ 170Nm (1600 ~ 1700kgf.cm, 120 ~ 125lbf.ft)





ECKD107A

ECKD108B

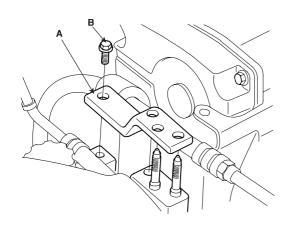
- 13. Install the timing belt upper cover with 4bolts. (See page EM 10)
- 14. Install the coolant pump pulley with 4bolts.
- 15. Install power steering belt. (See ST group power steering pump)
- 16. Install air compressor belt. (See HA group air comperssor)
- 17. Install alternator belt. (See EE group- alternator)

- 18. Install the engine mount bracket.
  - 1) Install the stay plate(A) with bolt(B).

# Tightening torque

Stay plate bolt

43 ~ 55Nm (430 ~ 550kgf.cm 32 ~ 40lbf.ft)



ECKD104A

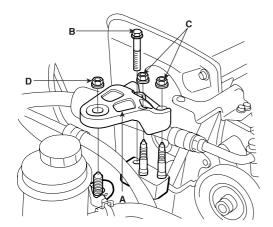
2) Install engine mount bracket(A) with 3nuts and bolt.

# **Tightening torque**

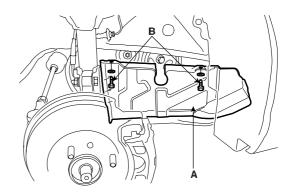
Bolt(B), Nuts(C)

50 ~ 60Nm (500 ~ 600kgf.ft, 37 ~ 48lbf.ft)

Nut(D): 60 ~ 80Nm (600 ~ 800kgf.m 44 ~ 59lbf.ft)



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



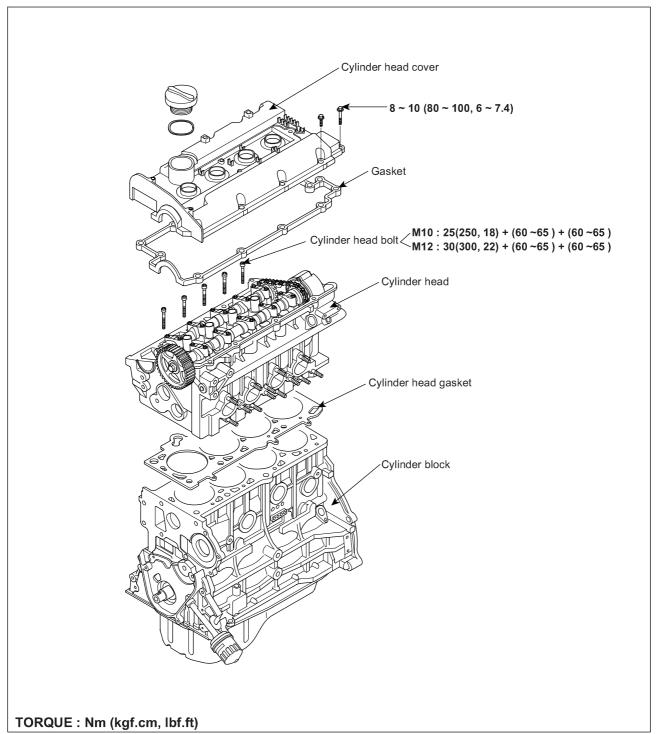
KXDSE16A

- 20. Install RH front wheel.
- 21. Install engine cover with 4bolts. (See page EM 10)

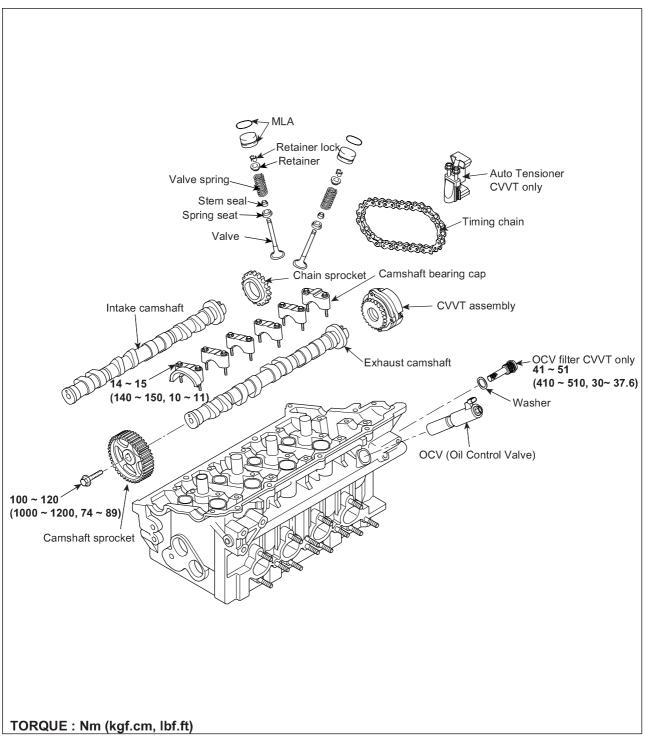
ECHE105A

# CYLINDER HEAD ASSEMBLY

# COMPONENTS EAFF5C56



ECKD002A



ECKD003A

# REMOVAL

EDB1594A

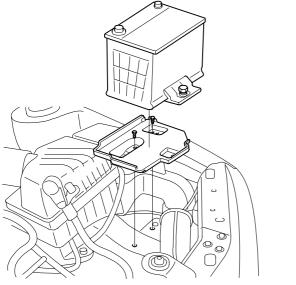
Engine removal is not required for this procedure.

# /! CAUTION

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

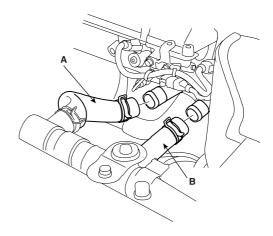
# **₩** NOTE

- · Mark all wiring and hoses to avoid misconnec-
- · Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (See page EM - 9)
- 1. Disconnect the negative terminal from the battery.



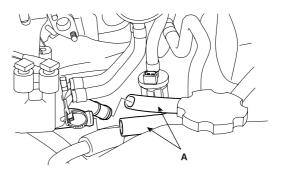
- ECKD201B
- Remove the engine cover. (See page EM 8)
- Drain the engine coolant. Remove the radiator cap to speed draining.

- 4. Remove the intake air hose and air cleaner assembly.
  - Disconnect the AFS connector.
  - Disconnect the breather hose from air cleaner 2) hose.
  - Remove the intake air hose and air cleaner assembly.
- Remove the upper radiator hose(A) and lower radiator hose(B).



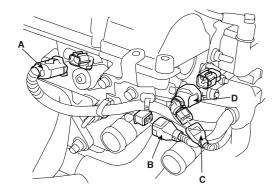
ECKD201A

Remove the heater hoses(A).

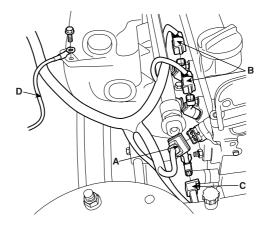


ECKD202A

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



- $7) \quad \text{CMP}(\text{Camshaft Position Sensor}) \ \text{connector}(A).$
- 8) Four fuel injector connectors(B).
- 9) Knock sensor connector(C).
- 10) Disconnect ground cable(D) from the intake manifold.

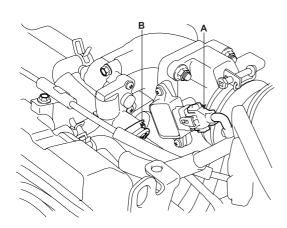


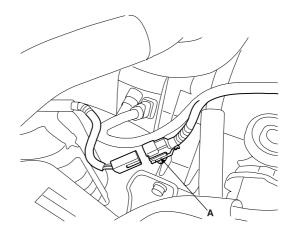
ECKD205A

11) Front heated oxygen sensor connector(A).

ECKD203A

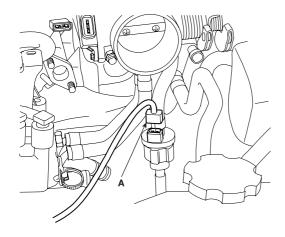
- 5) TPS(Throttle Position Sensor) connector(A).
- 6) ISA(Idle Speed Actuator) connector(B).

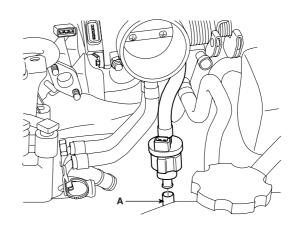




ECKD206A

- 12) PCSV(Purge Control Solenoid Valve) connector(A).
- 9. Remove the PCSV hose(A).



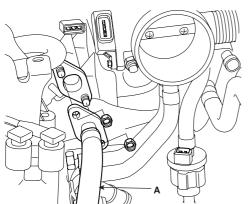


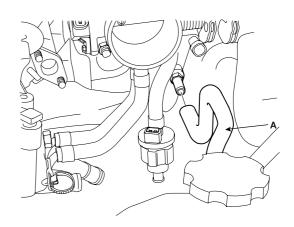
ECKD209A

ECKD207A

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







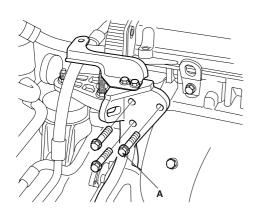
10. Remove the brake booster vacuum hose(A).

ECKD210A

ECKD208A

- 11. Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.
- 12. Remove the power steering pump. (See ST group power steering pump)

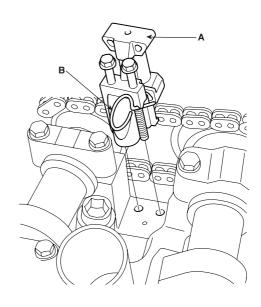
13. Remove the power steering pump bracket bolts(A).



ECKD211A

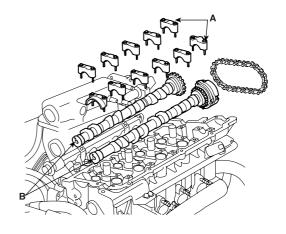
- 14. Remove the spark plug cable. (See EE group ignition)
- 15. Remove the PCV hose. (See page EM 11)
- 16. Remove the cylinder head cover. (See page EM 11)
- 17. Remove the timing belt. (See page EM 23)
- 18. Remove the exhaust manifold. (See page EM 102)
- 19. Remove the intake manifold. (See page EM 101)
- 20. Remove the camshaft sprocket. (See page EM 26)

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



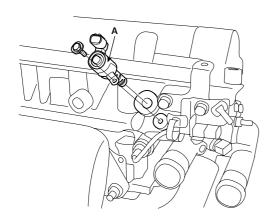
ECKD212A

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

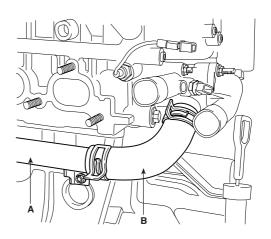


ECKD213A

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

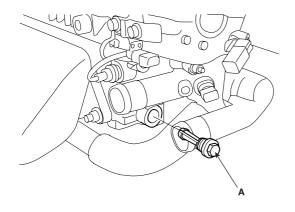


25. Remove the water hose(B) from the water pipe(A).

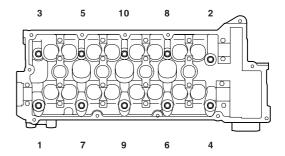


ACGE009A

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



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



ECKD215A

ECKD216A



## **CAUTION**

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

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

### ( CAUTION

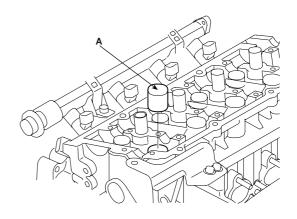
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

#### DISASSEMBLY E437D6BD



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

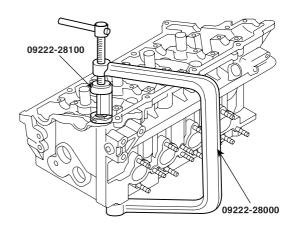
Remove MLAs(A).



ECKD217A

#### Remove valves.

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



ECKD218A

- 2) Remove the spring retainer.
- 3) Remove the valve spring.

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

### INSPECTION EE22AEEF

### **CYLINDER HEAD**

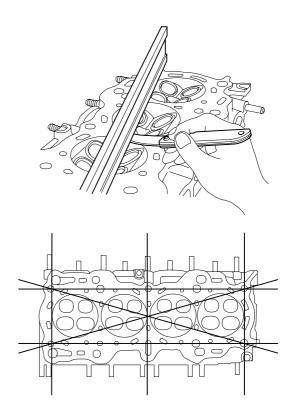
1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard: Less than 0.03mm(0.0012in.)

Limit: 0.05mm (0.0020in.)



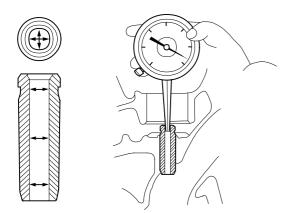
ECKD001H

2. Inspect for cracks.

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

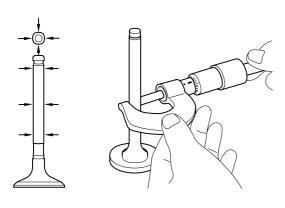
#### **VALVE AND VALVE SPRING**

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



ECKD219A

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



ECKD220A

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

Valve stem-to-guide clearance

[Standard]

Intake :  $0.02 \sim 0.05$ mm ( $0.0008 \sim 0.0020$ in.) Exhaust :  $0.035 \sim 0.065$ mm ( $0.0014 \sim 0.0026$ in.)

[Limit]

Intake: 0.1mm (0.0040in.) Exhaust: 0.13mm (0.0051in.)

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

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

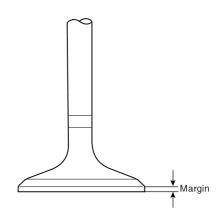
#### Margin

[Standard]

Intake: 1.15mm(0.0453in.) Exhaust: 1.35mm(0.0531in.)

[Limit]

Intake: 0.8mm(0.0315in.) Exhaust: 1.0mm(0.040in.)



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

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

Replace the seat if necessary.

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

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

#### Valve spring

[Standard]

Free height: 48.86mm (1.9236in.) Load: 18.8kg/39 mm (41.45lb/1.535in.)

[Limit]

Free height: -1.0mm(-0.0394in.)

Out-of-square: 3°

#### **CAMSHAFT**

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

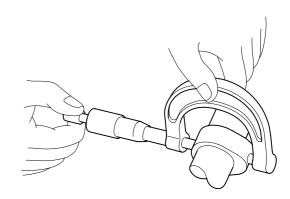
#### Cam height

[Standard value]

Intake: 44.618mm (1.7566in.) Exhaust: 44.518mm (1.7527in.)

[Limit]

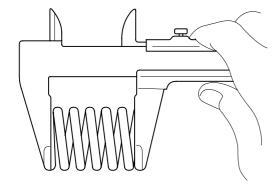
Intake: 44.518mm (1.7527in.) Exhaust: 44.418mm (1.7487in.)



ECKD223A

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

- 2. Inspect camshaft journal clearance.
  - 1) Clean the bearing caps and camshaft journals.
  - 2) Place the camshafts on the cylinder head.



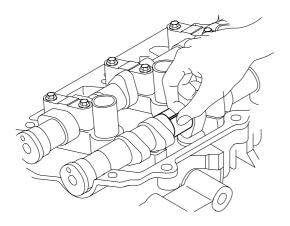
ECKD222A

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

If the oil clearance is greater than maximum, re-

place the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

Lay a strip of plastigage across each of the camshaft journal.



Inspect camshaft end play.

Remove the camshafts.

1) Install the camshafts. (See page EM - 50)

Completely remove the plastigage.

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

#### Camshaft end play

[Standard value] :  $0.1 \sim 0.2 \text{mm} (0.004 \sim 0.008 \text{in.})$ 

ECKD224A

4) Install the bearing caps. (See page EM - 50)



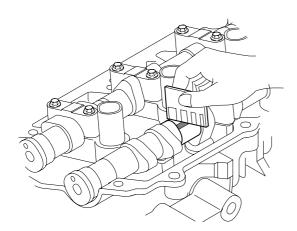
### CAUTION

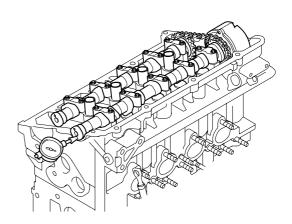
#### Do not turn the camshaft.

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

#### Bearing oil clearance

[Standard value]:  $0.02 \sim 0.061$ mm ( $0.0008 \sim 0.0024$ in.) [Limit]: 0.1mm (0.0039in.)





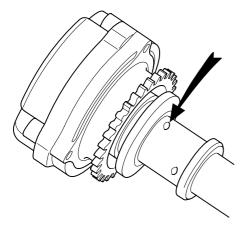
ECKD226A

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

3) Remove the camshafts.

#### **CVVT ASSEMBLY**

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

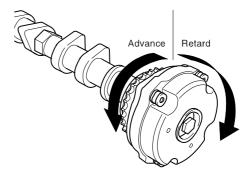


EDKD270B

- 3) Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm², 14psi) to the port of the camshaft. (Perform this order to release the lock pin for the maximum delay angle locking.)
- **NOTE**

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

4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand. Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



BCGE010A

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

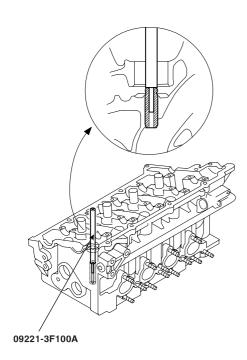
Standard: Movable smoothly in the range about 20°

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

#### REPLACEMENT EDD51F66

#### **VALVE GUIDE**

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

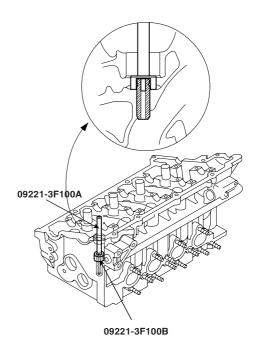


ECHE600A

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

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

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



ECHE600B

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

#### REASSEMBLY E4AEFFED

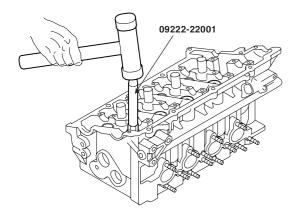


Thoroughly clean all parts to be assembled. Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces. Replace oil seals with new ones.

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



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

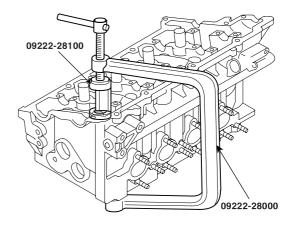


ECKD229A

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

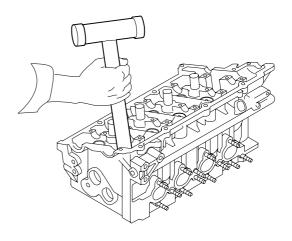
### **NOTE**

Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer. 4) Using the SST(09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



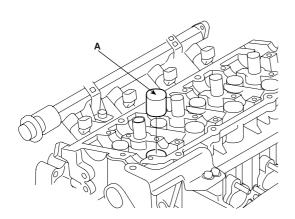
ECKD218A

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



ECKD230A

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

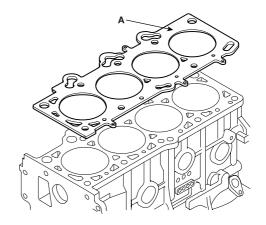


ECKD217A

### INSTALLATION EBOAOCEF

### **NOTE**

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No.1 piston at TDC. (See page EM 9)
- 1. Install the cylinder head gasket(A) on the cylinder block.



ECKD231A

## **NOTE**

Be careful of the installation direction.

- 2. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
- 3. Install cylinder head bolts.
  - 1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.

2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

#### **Tightening torque**

M10:

25Nm (250kgf.cm, 18lbf.ft) +  $(60^{\circ} \sim 65^{\circ})$  +  $(60^{\circ} \sim 65^{\circ})$ 

M12:

30Nm (300kgf.cm, 22lbf.ft) +  $(60^{\circ} \sim 65^{\circ})$  +  $(60^{\circ} \sim 65^{\circ})$ 

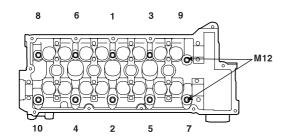


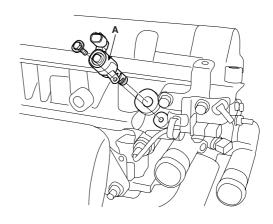
Always use a new OCV filter gasket. Keep clean the OCV filter.

5. Install OCV(A).

### Tightening torque

10 ~ 12Nm(100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)





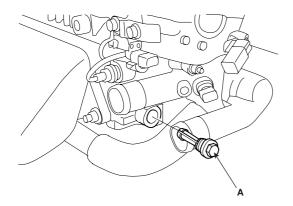
ECKD214A

ECKD232A

### Install OCV filter(A).

#### Tightening torque

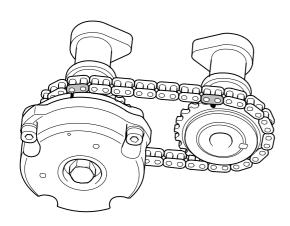
41 ~ 51Nm (410 ~ 510kgf.cm, 30 ~ 37.6lbf.ft)



### CAUTION

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

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

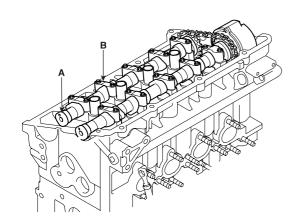


ECKD233A

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

### Tightening torque

14 ~ 15Nm (140 ~ 150kgf.cm, 10 ~ 11lbf.ft)

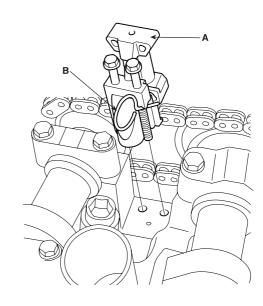


ECKD234A

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

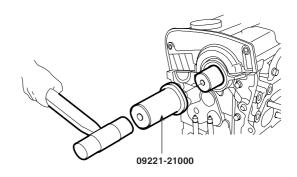
#### Tightening torque

8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7.4lbf.ft)



ECKD212A

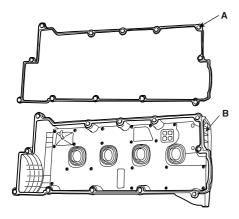
- 4) Remove the auto tensioner stopper pin(B).
- 7. Check and adjust valve clearance. (See page EM 11)
- 8. Using the SST(09221-21000), install the camshaft bearing oil seal.



ECKD235A

9. Install the camshaft sprocket. (See page EM - 27)

- 10. Install the timing belt. (See page EM 27)
- 11. Install the cylinder head cover.
  - Install the cylinder head cover gasket(A) in the groove of the cylinder head cover(B).



ECKD236A

### **NOTE**

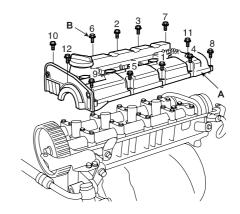
- Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.
- When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.
- 2) Apply liquid gasket to the head cover gasket at the corners of the recess.



- Use liquid gasket, loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket
- After assembly, wait at least 30 minutes before filling the engine with oil.
- Install the cylinder head cover(A) with the 12bolts(B). Uniformly tighten the bolts in several passes.

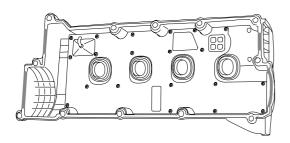
### Tightening torque

8 ~ 10Nm (80 ~ 100kgf.cm, 6 ~ 7.4lbf.ft)



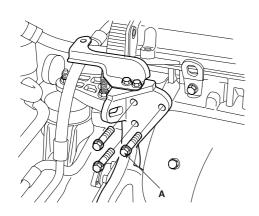
ADIE003A

- 12. Install the intake manifold.
- 13. Install the exhaust manifold.
- 14. Install the PCV. (See page EM 28)
- 15. Install the spark plug cable. (See EE group ignition)

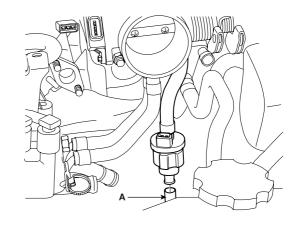


16. Install the power steering pump bracket bolts(A).

Tightening torque 35 ~ 50Nm (350 ~ 500kgf.cm, 26 ~ 37lbf.ft)



20. Install the PCSV hose(A).

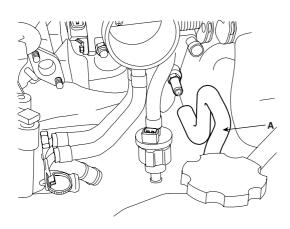


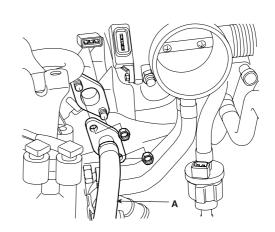
ECKD209A

21. Install the fuel inlet hose(A).

ECKD211A

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

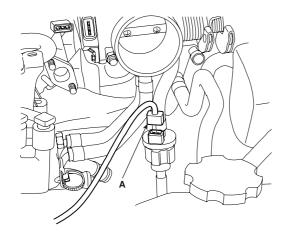




ECKD208A

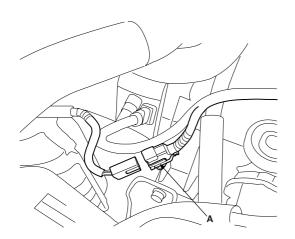
ECKD210A

- Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
  - 1) PCSV connector(A).



ECKD207A

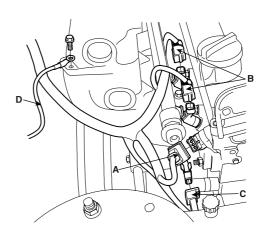
2) Front heated oxygen sensor connector(A).



ECKD206A

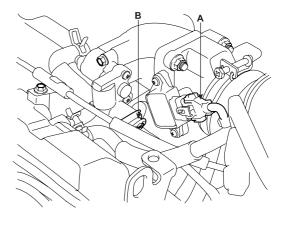
- 3) Connect the ground cable to the intake manifold(D).
- 4) Knock sensor connector(C).
- 5) Four fuel injector connectors(B).

6) CMP connector(A).



ECKD205A

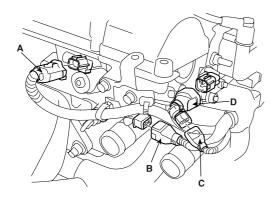
- 7) ISA connector(B).
- 8) TPS connector(A).



EDQF197A

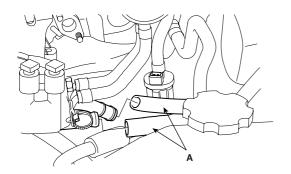
- 9) Ignition coil connector(D).
- 10) ECT sensor connector(C).
- 11) Oil temperature sensor connector(B).

12) OCV connector(A).

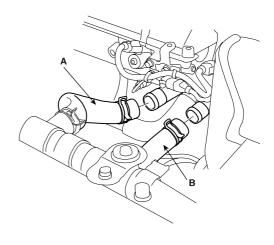


ECKD203A

23. Install the heater hoses(A).



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



ECKD201A

- 25. Install the intake air hose and air cleaner assembly.
- 26. Install the engine cover. (See page EM 10)
- 27. Connect the negative terminal to the battery.
- 28. Filll with engine coolant.
- 29. Start the engine and check for leaks.
- 30. Recheck engine coolant level and oil level.

ECKD202A

### **ENGINE AND TRANSAXLE ASSEMBLY**

#### REMOVAL EDFA091F

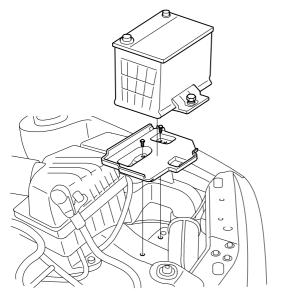


### / CAUTION

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

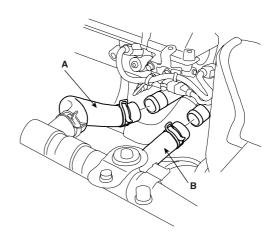
### **₩** NOTE

- · Mark all wiring and hoses to avoid misconnec-
- · Inspection the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No.1 piston is at top dead center. (See page EM - 9)
- 1. Disconnect the neagative terminal from the battery.



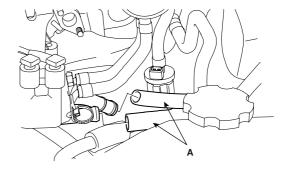
- ECKD201B
- 2. Remove the engine cover.
- Drain the engine coolant. Remove the radiator cap to speed draining.
- Remove the intake air hose and air cleaner assembly.
  - 1) Disconnect the AFS connector.
  - Disconnect the breather hose from air cleaner hose.
  - Remove the intake air hose and air cleaner.

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



ECKD201A

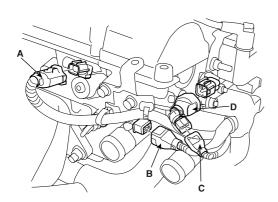
Remove the heater hoses(A).



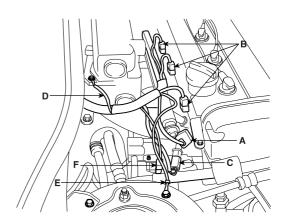
ECKD202A

- Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
  - 1) OCV(Oil Control Valve) connector(A).
  - Oil temperature sensor connector(B).
  - ECT(Engine Coolant Temperature) sensor(C) connector.

4) Ignition coil connector(D).

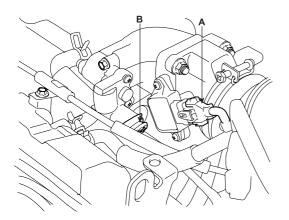


11) Compressor switch(F).

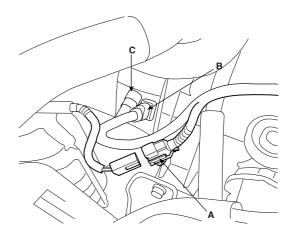


ECKD203A

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



- 12) Front heated oxygen sensor(A) connector.
- 13) CKP sensor(B) connector.
- 14) Oil pressure switch(C) connector.



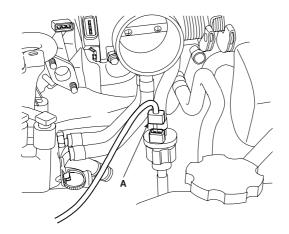
EDQF197A

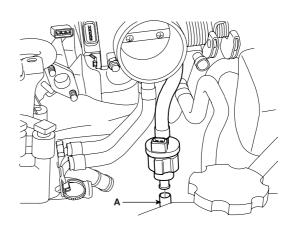
- 7) CMP(Camshaft Position Sensor) connector(A).
- 8) Four fuel injector connectors(B).
- 9) Knock sensor connector(C).
- 10) Disconnect ground cable(D) from the intake manifold.

ACGE056A

ACGE006A

- 15) PCSV(Purge Control Solenoid Valve)(A) connector.
- 9. Remove the PCSV hose(A).

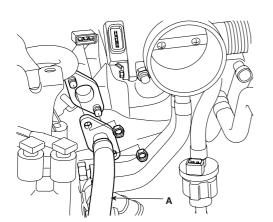




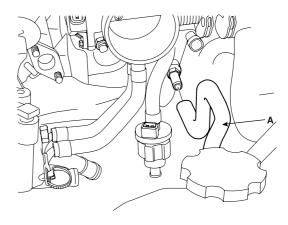
ECKD209A

ECKD207A

8. Remove the fuel inlet from delivery pipe(A).



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

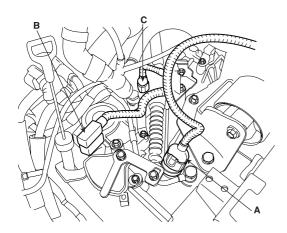


ECKD210A

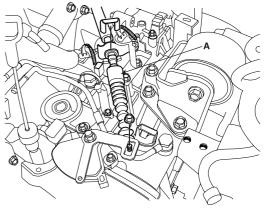
ECKD208A

- 11. Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.
- 12. Remove the power steering pump. (See page ST group power steering pump)
- 13. Remove the battery body bracket.

- 14. Disconnect the transaxle wire harness connector.
  - a. Disconnect the inhibitor switch connector(A).
  - b. Disconnect the transaxle range connector(B).
  - c. Disconnect the input shaft speed connector(C).



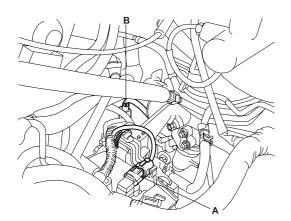
15. Remove the control cable(A) transaxle range switch.



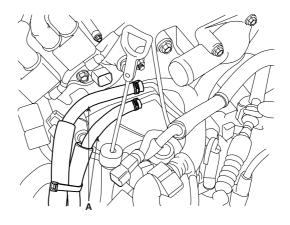
EDQF018A

EDQF035A

- I. Disconnect the output shaft speed connector(A).
- e. Disconnect the vehicle speed sensor connector(B).



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



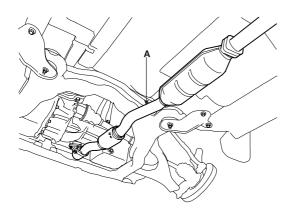
EDQF034A

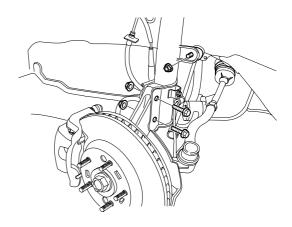
EDQF031A

- 17. Remove the under cover.
- 18. Remove the front exhaust pipe(A).

(See SS griup - front strut)

20. Remove the front strut lower mounting bolts and nuts.

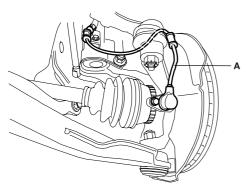




EDQF023A

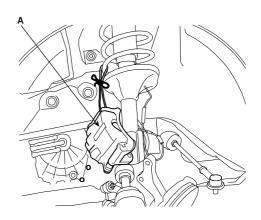
EDQF192A

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



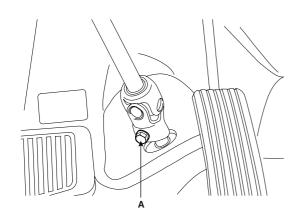
KXDSE03A

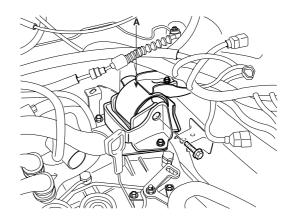
21. Remove the caliper and hang the caliper assembly(A).



ECKD612A

- 22. Remove the steering u-joint mounting bolt(A). (See ST group steering)
- 25. Remove the transaxle mounting bracket(A).

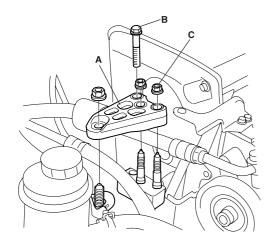




EDQF016A

ECKD616A

- 23. Install the jack for supporting engine and transaxle assembly.
- 24. Remove the engine mounting bracket(A).



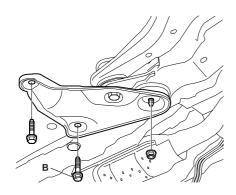
ECKD103A

26. Remove the sub frame mounting bolts and nuts.

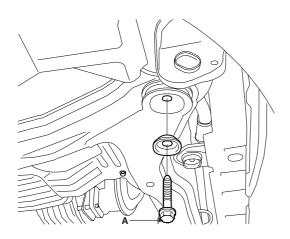
#### **Tightening torque**

A: 160 ~ 180Nm (1600 ~ 1800kgf.cm, 118 ~ 133lbf.ft)

B: 70 ~ 90Nm (700 ~ 900kgf.cm, 52 ~ 66lft.ft)



EDOF001A



ECKD618A

#### 27. Jack up the vehicle.

#### INSTALLATION ECIDBOCB

Installation is in the reverse order of removal.

Perform the following:

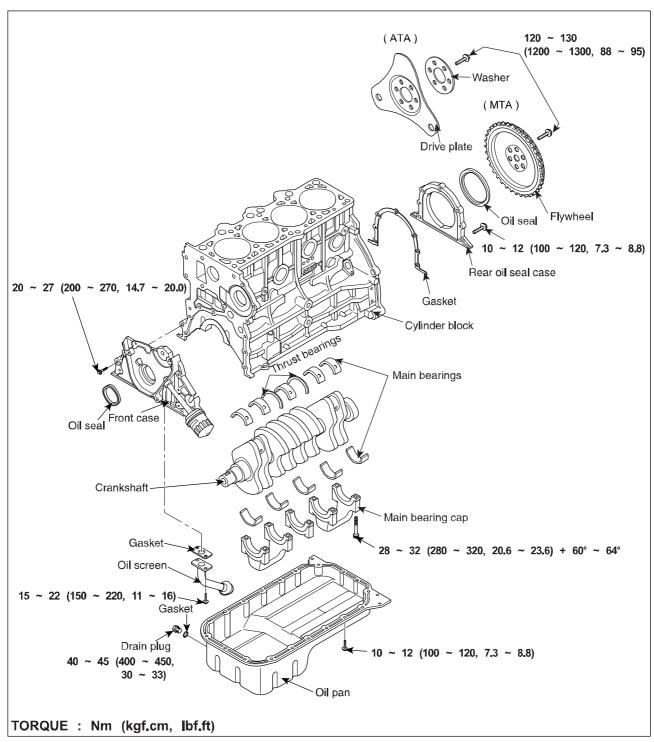
- · Adjust the shift cable.
- · Adjust the throttle cable.
- · Refill the engine with engine oil.
- Refill the transaxle with fluid.
- · Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper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

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

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

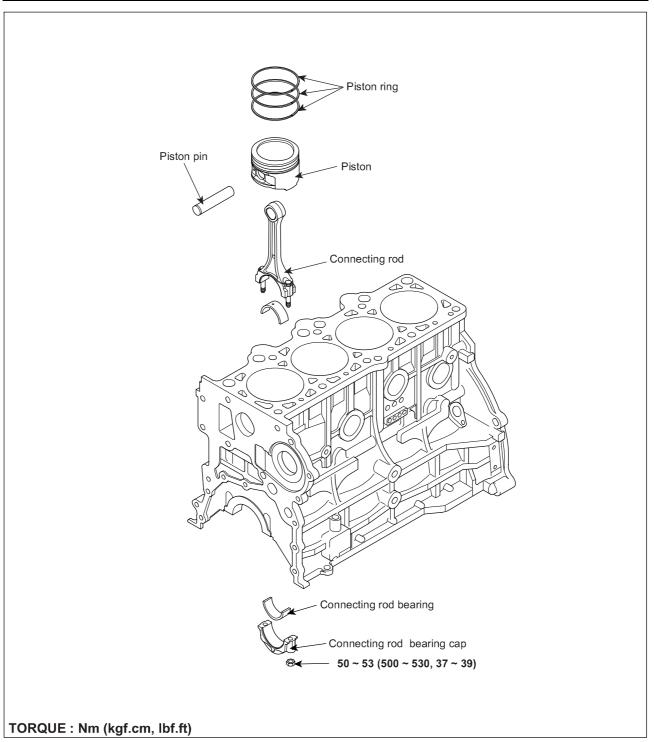
## **ENGINE BLOCK**

### COMPONENTS E3E04B86



ECKD004A

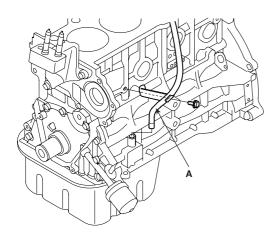
ENGINE BLOCK EM -63



ECKD005A

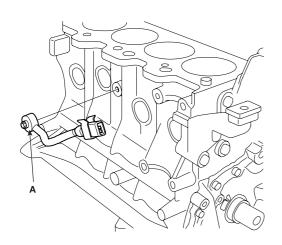
### DISASSEMBLY E0A2AFBC

- 1. M/T : remove flywheel.
- 2. A/T : remove drive plate.
- 3. Install engine to engine stand for disassembly.
- 4. Remove timing belt. (See page EM 23)
- 5. Remove cylinder head. (See page EM 35)
- 6. Remove oil level gauge assembly(A).

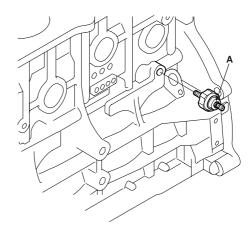


ECKD301A

7. Remove knock sensor(A).

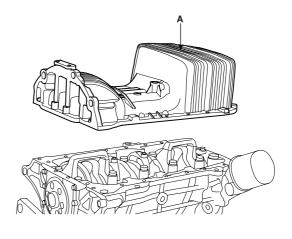


8. Remove oil pressure sensor(A).



ECKD303A

- 9. Remove water pump. (See page EM 85)
- 10. Remove oil pan(A).



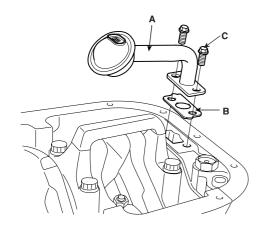
ECKD304A

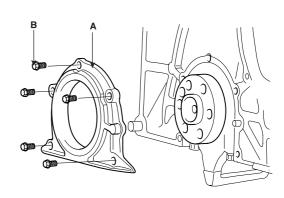
ECKD302A

ENGINE BLOCK EM -65

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

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





ECKD305A

- 12. Check the connecting rod end play. (See page EM 66)
- 13. Remove the connecting rod caps and check oil clearance. (See page EM 67)
- 14. Remove piston and connecting rod assemblies.
  - 1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
  - Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

### **NOTE**

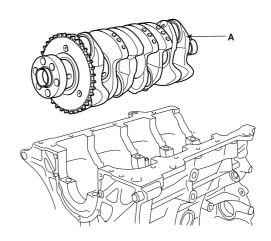
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- 15. Remove front case. (See page EM 93)

ECKD306A

- 17. Remove crankshaft bearing cap and check oil clearance. (See page EM 69)
- 18. Check the crankshaft end play. (See page EM 71)
- 19. Lift the crankshaft(A) out of the engine, being careful not to damage journals.



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



ECKD307A

- 20. Check fit between piston and piston pin. Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.
- 21. Remove piston rings.
  - Using a piston ring expender, remove the 2 compression rings.
  - 2) Remove 2 side rails and the spacer by hand.

### MOTE

Arrange the piston rings in the correct order only.

22. Disconnect connecting rod from piston.

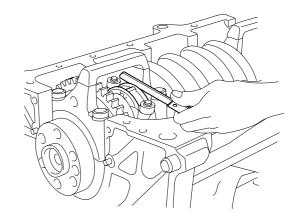
#### INSPECTION ECSFCA1F

#### **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:  $0.1 \sim 0.25 \text{mm} (0.004 \sim 0.010 \text{in.})$ 

Maximum end play: 0.4mm(0.016in.)



ECKD308A

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

#### Tightening torque

50 ~ 53Nm (500 ~ 530kgf.cm, 36.9 ~ 39lbf.ft)



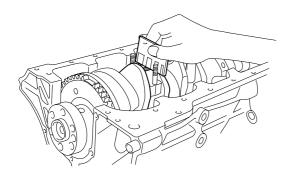
Do not turn the crankshaft.

**ENGINE BLOCK** EM -67

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

#### Standard oil clearance

 $0.024 \sim 0.042$ mm $(0.0009 \sim 0.0017$ in.)



ECKD309A

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



### /! CAUTION

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

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

### MOTE

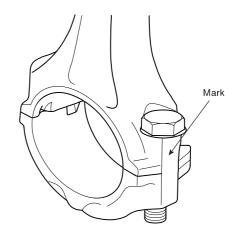
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.



### / CAUTION

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

#### CONNECTING ROD MARK LOCATION

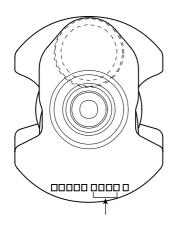


BDQE003A

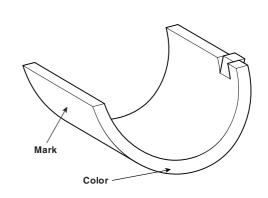
#### DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
а	А	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
b	В	48.006 ~ 48.012mm (1.8899 ~ 1.8902in.)
С	С	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

#### **CRANKSHAFT PIN MARK LOCATION**



# PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)



ECKD311A

#### **DISCRIMINATION OF CRANKSHAFT**

CLSASS	MARK	OUTSIDE DIAMETER OF PIN
I	1	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	2	44.952 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	3	44.946 ~ 44.952mm (1.7695 ~ 1.7698in.)

ECKD313A

#### DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
А	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
В	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
С	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
D	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

**ENGINE BLOCK** EM -69

#### 11) Selection

CRANKSHAFT INDENTIFICATION MARK	CONNECT- ING ROD IDENTIFICA- TION MARK	ASSEMBING CLASSIFI- CATION OF BEARING
I (YELLOW)	a (WHITE)	D (YELLOW)
	b (NONE)	C (GREEN)
	c (YELLOW)	B (NONE)
	a (WHITE)	C (GREEN)
II (NONE)	b (NONE)	B (NONE)
	c (YELLOW)	A (BLACK)
III (WHITE)	a (WHITE)	B (NONE)
	b (NONE)	A (BLACK)
	c (YELLOW)	AA (BLUE)

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

#### Tightening torque

 $30Nm (300kgf.cm, 22lbf.ft) + 60^{\circ} \sim 65^{\circ}$ 

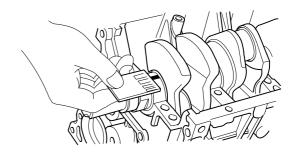


Do not turn the crankshaft.

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

Standard oil clearance

 $0.028 \sim 0.046$ mm ( $0.0011 \sim 0.0018$ in.)



ECKD001I

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.

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.



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



### ( CAUTION

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

#### **CONNECTING RODS**

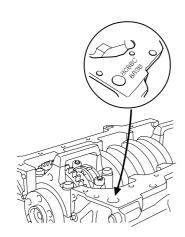
- When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
- Replace the connecting rod if it is damaged on the thrust faces at either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

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

#### Crankshaft bore mark location

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

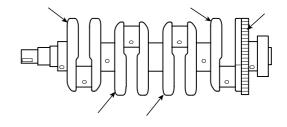
Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.



#### DISCRIMINATION OF CYLINDER BLOCK

CALSS	MARK	INSIDE DIAMETER
а	А	61.000 ~ 61.006mm (2.4015 ~ 2.4018in.)
b	В	61.006 ~ 61.012mm (2.4018 ~ 2.4020in.)
С	С	61.012 ~ 61.018mm (2.4020 ~ 2.4023in.)

#### CRANKSHAFT JOURNAL MARK LOCATION



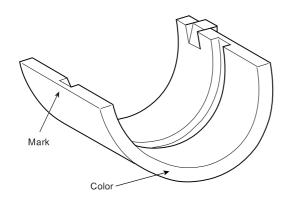
ECKD312B

#### **DISCRIMINATION OF CRANKSHAFT**

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	YELLOW	56.956 ~ 56.962mm (2.2423 ~ 2.2426in.)
II	NONE	56.948 ~ 56.956mm (2.2420 ~ 2.2423in.)
III	WHITE	56.942 ~ 56.948mm (2.2418 ~ 2.2420in.)

ENGINE BLOCK EM -71

# PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



ECKD316A

#### **DISCRIMINATION OF CRANKSHAFT BEARING**

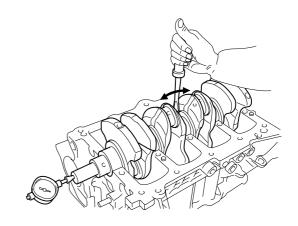
CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
А	BLACK	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
В	NONE	2.008 ~ 2.011mm (0.0790 ~ 0.0791in.)
С	GREEN	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	YELLOW	2.002 ~ 2.005mm (0.0788 ~ 0.0789in.)

#### **SELECTION**

CRANKSHAFT IDENTIFICATION MARK	CRANK- SHAFT BORE IDENTIFICA- TION MARK	ASSEM- BLING CLAS- SIFICATION OF BEARING
I (YELLOW)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (NONE)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (WHITE)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

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



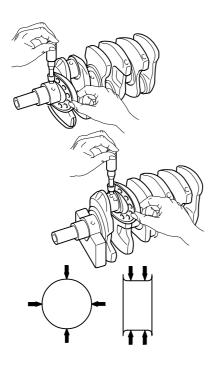
ECKD001B

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

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

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

Main journal diameter : 57mm (2.165in.) Crank pin diameter : 45mm (1.77in.)



ECKD001E

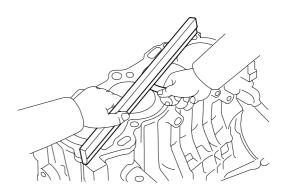
#### CYLINDER BLOCK

- Remove gasket material.
   Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- Clean cylinder block
   Using a soft brush and solvent, thoroughly clean the
   cylinder block.

Inspect top surface of cylinder block for flatness.
 Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

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

Limit: 0.05 mm (0.0020 in.)



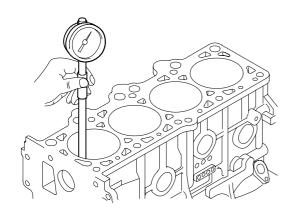
ECKD001L

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

ENGINE BLOCK EM -73

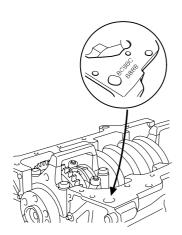
Inspect cylinder bore diameter
 Using a cylinder bore gauge, measure the cylinder bore diameter at position in the thrust and axial directions.

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



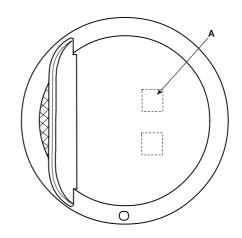
ECKD318A

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



Class	Cylinder bore inner diameter	Size code
А	82.00 ~ 82.01mm (3.228~ 3.2287in.)	А
В	82.01 ~ 82.02mm (3.2287~ 3.2291in.)	В
С	82.02 ~ 82.03mm (3.2291~ 3.2295in.)	С

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



ECKD320B



Stamp the grade mark of basic diameter with rubber stamp.

Class	Piston outer diameter	Size code
А	81.97 ~ 81.98mm (3.2271 ~ 3.2275in.)	Α
В	81.98 ~ 81.99mm (3.2275 ~ 3.2279in.)	None
С	81.99 ~ 82.00mm (3.2279 ~ 3.2283in.)	С

8. Select the piston related to cylinder bore class.

ECKD314A

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

#### **BORING CYLINDER**

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

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



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

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

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

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



# / CAUTION

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

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

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



# NOTE

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

#### **PISTON AND RINGS**

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



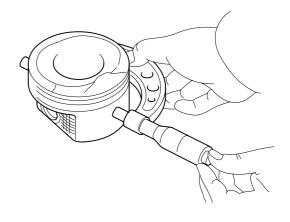
MOTE

Do not use a wire brush.

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

#### Standard diameter

81.97 ~ 82.00mm (3.2272 ~ 3.2283in.)



ECKD001D

ENGINE BLOCK EM -75

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

# Piston-to-cylinder clearance

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

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

# Piston ring side clearance

No. 1:  $0.04 \sim 0.08$ mm ( $0.0016 \sim 0.0031$ in.) No. 2:  $0.03 \sim 0.07$ mm ( $0.0012 \sim 0.0028$ in.)

Limit

No. 1: 0.1mm (0.004in.) No. 2: 0.1mm (0.004in.)



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 on page EM - 73 If the bore is over the service limit, the cylinder block must be rebored. (See page EM - 74)

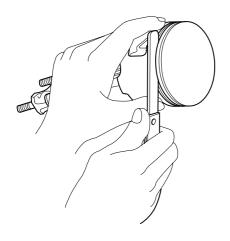
# Piston ring end gap

Standard

No.1 :  $0.23 \sim 0.38$ mm (0.0091  $\sim 0.0150$ in.) No.2 :  $0.45 \sim 0.60$ mm (0.0177  $\sim 0.0236$ in.)

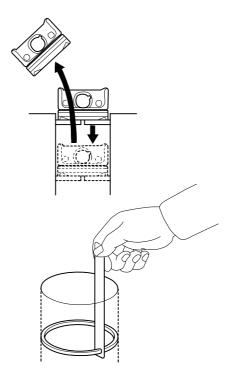
Limit

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



ECKD001G

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



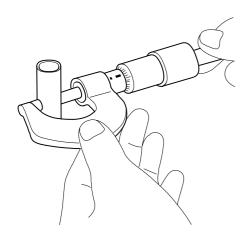
ECKD001K

# **PISTON PINS**

1. Measure the diameter of the piston pin.

# Piston pin diameter

20.001 ~ 20.006mm (0.7874 ~ 0.7876in.)



ECKD001Z

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

# Piston pin-to-piston clearance

0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

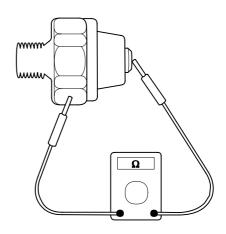
Check the difference between the piston pin diameter and the connecting rod small end diameter.

# Piston pin-to-connecting rod interference 0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

#### **OIP PRESSURE SWITCH**

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

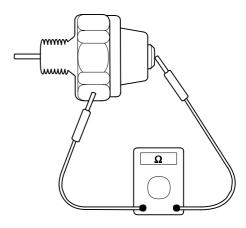
If there is no continuity, replace the oil pressure switch.



ECKD001W

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

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

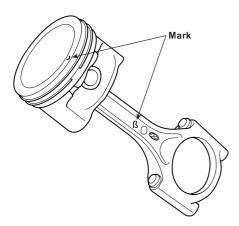


ENGINE BLOCK EM -77

# REASSEMBLY EFF6CDF3

# **NOTE**

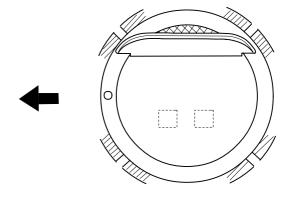
- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.
- 1. Assemble piston and connecting rod.
  - 1) Use a hydraulic press for installation.
  - The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



BDQE001A

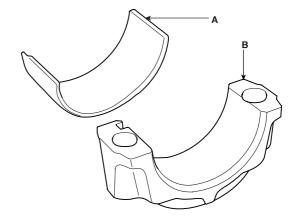
- 2. Install piston rings.
  - 1) Install the oil ring spacer and 2 side rails by hand.
  - 2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

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



ECKD321A

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



ECKD322A

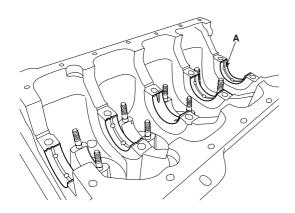
Install main bearings.



# MOTE

Upper 1,2,4,5 bearings have an oil groove of oil holes; Lower bearings do not.

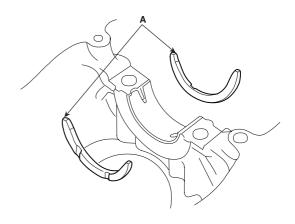
Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).



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

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

ing outward.



ECKD324A

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

# Tightening torque

Main bearing cap bolt 28  $\sim$  32Nm (280  $\sim$  320kgf.cm, 20.6  $\sim$  $23.6lb.ft) + 60^{\circ} \sim 64^{\circ}$ 



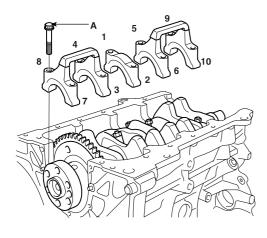
# NOTE

- The main bearing cap bolts are tightened in 2 progressive steps.
- · If any of the bearing cap bolts in broken or deformed, replace it.
- 1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

**ENGINE BLOCK** EM -79

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

Tightening torque: 30Nm (300kgf.cm, 22lbf.ft)



ECHE200A

- Retighten the bearing cap bolts by 60°~65° in the numerical order shown.
- Check that the crankshaft turns smoothly.
- 9. Check crankshaft end play. (See page EM 71)
- 10. Install piston and connecting rod assemblies.

# **NOTE**

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

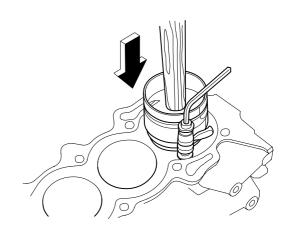
- Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
- 2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
- 3) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.

Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts: 50 ~ 53Nm (500 ~ 530kgf.cm, 36.9 ~ 39lbf.ft)



# **NOTE**

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

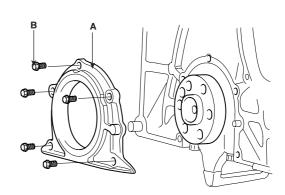


ECKD001F

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

# Tightening torque

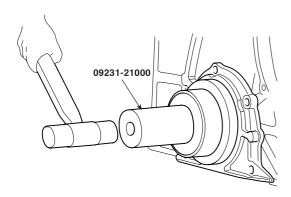
10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)



# MOTE

Check that the mating surfaces are clean and dry.

- 12. Install rear oil seal.
  - 1) Apply engine oil to a new oil seal lip.
  - Using SST(09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



ECKD326A

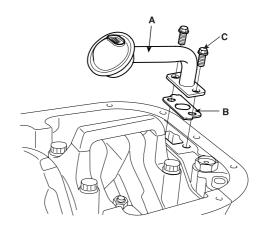
13. Install front case. (See page EM - 99)

14. Install oil screen.

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

# **Tightening torque**

15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lbf.ft)



ECKD305A

# 15. Install oil pan.

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

# **MOTE**

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

 Apply liquid gasket as an even bead, centered between the edges of the mating surface. Use liquid gasket MS 721-40A or equivalent.

# MOTE

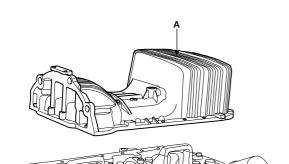
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling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

ENGINE BLOCK EM -81

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

# Tightening torque

10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)



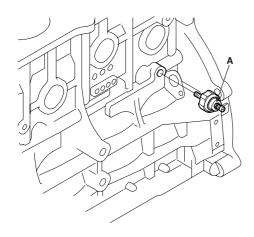


ECKD304A

- 16. Install water pump. (See page EM 88)
- 17. Install oil pressure sensor.
  - 1) Apply adhesive to 2 or 3 threads. Adhesive: MS 721-39(B) or equivalent.
  - 2) Install the oil pressure sensor (A).

# Tightening torque

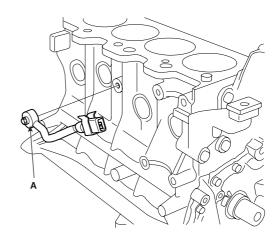
15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lbf.ft)



18. Install knock sensor(A).

# Tightening torque

17 ~ 27Nm (170 ~ 270kgf.cm, 12.5 ~ 20lbf.ft)

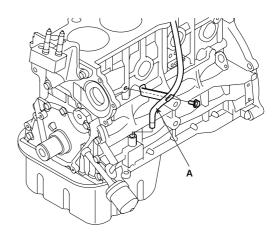


ECKD302A

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

# Tightening torque

12 ~ 15Nm (120 ~ 150kgf.cm, 9 ~ 11lbf.ft)



ECKD303A ECKD301A

- 20. Install cylinder head. (See page EM 48)
- 21. Install timing belt. (See page EM 27)
- 22. Remove engine stand.
- 23. A/T : Install drive plate.

# Tightening torque

120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)

24. M/T : Install flywheel.

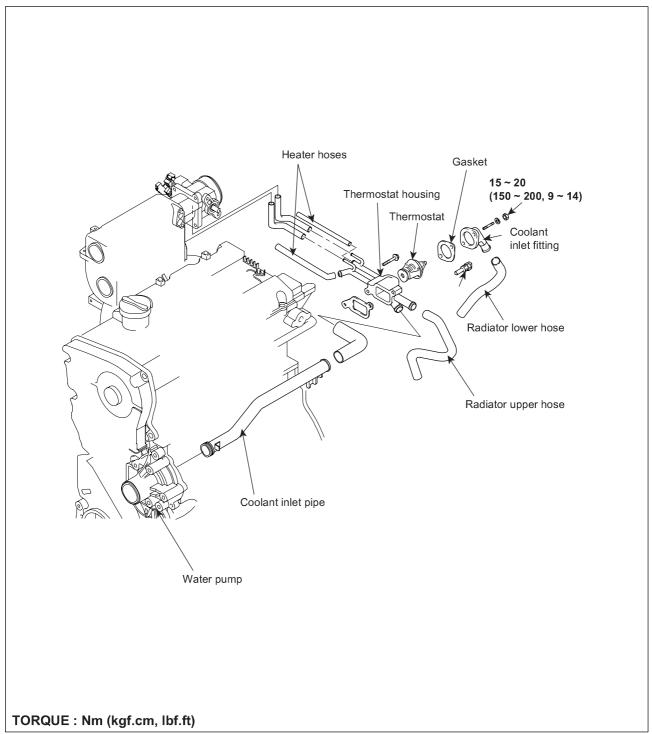
# **Tightening torque**

120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)

COOLING SYSTEM EM -83

# **COOLING SYSTEM**

# COMPONENT E80DAED3



ECKD012A

# **ENGINE COOLANT REFILLING AND** BLEEDING E4F4EB98

# **WARNING**

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

# CAUTION

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

- Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
- Remove radiator cap.
- Loosen the drain plug, and drain the coolant.
- Tighten the radiator drain plug(A) securely. 4.
- Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
- Fill fluid mixture with coolant and water(4: 6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

# **NOTE**

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



# /!\ CAUTION

- Do not mix different brands tifreeze/coolants.
- Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.
- Start the engine and run coolant circulates. When the cooling fan operates and coolant curculates, refill coolant through the radiator cap.
- Repeat 7 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.

- Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
- 10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
- 11. Stop the engine and wait coolant gets cool.
- 12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

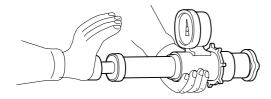


Recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

COOLING SYSTEM EM -85

#### **CAP TESTING**

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



ECKD501X

- Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi)
- 3. Check for a drop in pressure.
- 4. If the pressure drops, replace the cap.

# **TESTING**

- 1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.
- Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm² 14 ~ 18psi).
- Inspect for engine coolant leaks and a drop in pressure.
- 4. Remove the tester and reinstall the radiator cap.



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

### REMOVAL EA21BA67

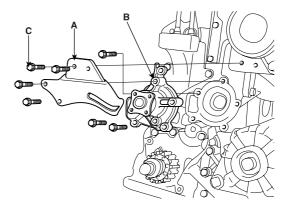
# WATER PUMP

1. Drain the engine coolant.



System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

- 2. Remove drive belts.
- 3. Remove the timing belt. (See page EM 23)
- 4. Remove the timing belt idler. (See page EM 25)
- 5. Remove the water pump.
  - 1) Remove the 4 bolts and pump pulley.
  - 2) Remove the 2 bolts(C), then remove the alternator brace(A).
  - 3) Remove the water pump(B) and gasket.



ECKD501A

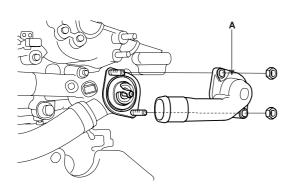
# **THERMOSTAT**



# MOTE

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.

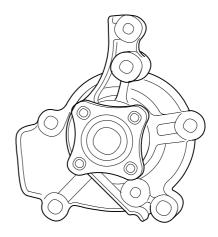
- Drain engine coolant so its level is below thermostat.
- Remove water inlet(A), gasket and thermostat.



#### **INSPECTION** EE14792C

# WATER PUMP

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



ECKD503A

ECKD501B

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

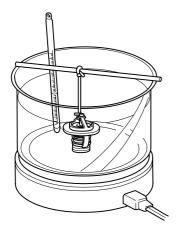


A small amount of "weeping" from the bleed hole is normal.

COOLING SYSTEM EM -87

# **THERMOSTAT**

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



ECKD503B

2. Check the valve opening temperature.

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

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

3. Check the valve lift.

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

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

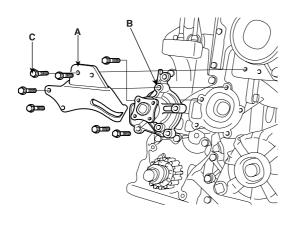
# INSTALLATION EC133513

# WATER PUMP

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

# **Tightening torque**

20 ~ 27Nm (200 ~ 270kgf.cm, 15 ~ 20lbf.ft)

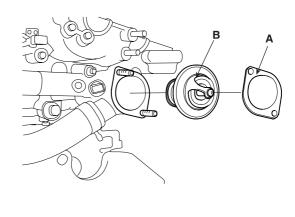


ECKD501A

- 2) Install the alternator brace(A) with the 2 bolts(C).
- 3) Install the 4 bolts and pump pulley.
- 2. Install the timing belt idler. (See page EM 29)
- 3. Install the timing belt. (See page EM 27)
- 4. Install drive belts.
- 5. Fill with engine coolant.
- 6. Start engine and check for leaks.
- 7. Recheck engine coolant level.

#### **THERMOSTAT**

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

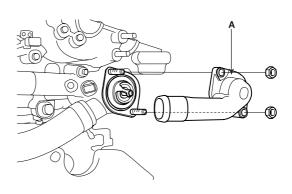


ECKD510A

Install water inlet(A).

# Tightening torque

15 ~ 20Nm (150 ~ 200kgf.cm, 9 ~ 14lbf.ft)

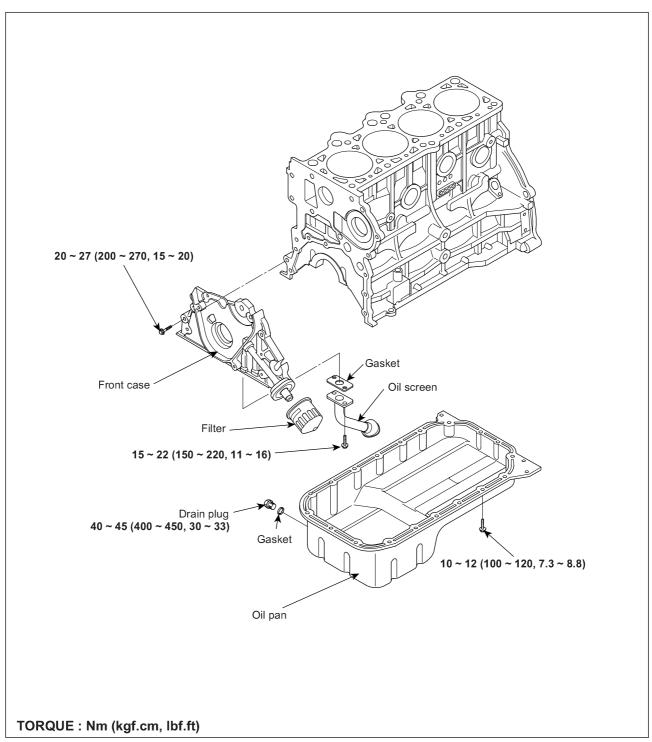


ECKD501B

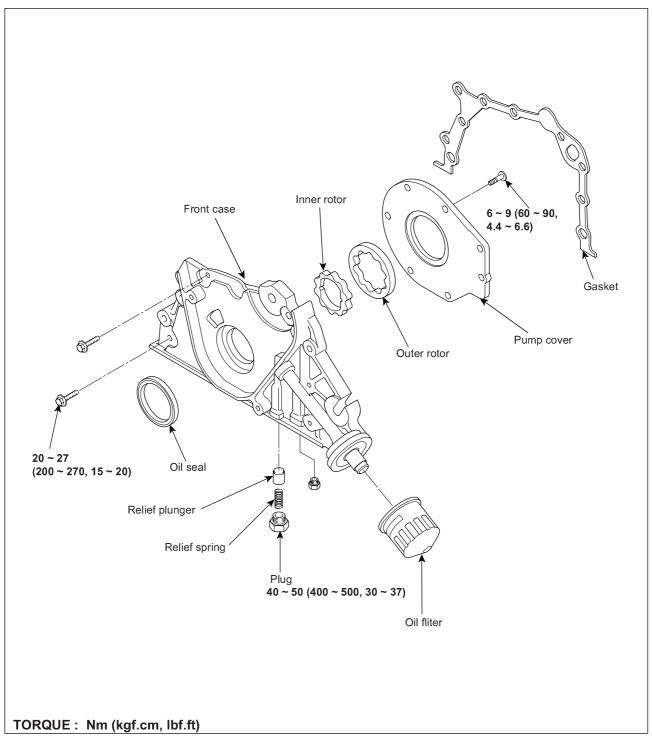
- 3. Fill with engine coolant.
- 4. Start engine and check for leaks.

# **LUBRICATION SYSTEM**

# COMPONENT E2A4EA3F



ECKD006A



ECKD007A

**LUBRICATION SYSTEM** EM -91

# OIL AND FILTER ECF1A5FC



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

# Tightening torque

40 ~ 45Nm (400 ~ 450kgf.cm, 30 ~ 33lbf.ft)

b. Fill with fresh engine oil

#### Capacity

W/Oil filter change: 4.0l (4.23U.S.qts, 3.52Imp qts) W/O Oil filter change: 3.7I (3.90U.S.qts, 3.26Imp qts)

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

#### INSPECTION

- 1. Check engine oil quality
  - Check the oil for deterioration, entry of water, discoloring or thinning.
  - If the quality is visibly poor, replace the oil.
- Check engine oil level.

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

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



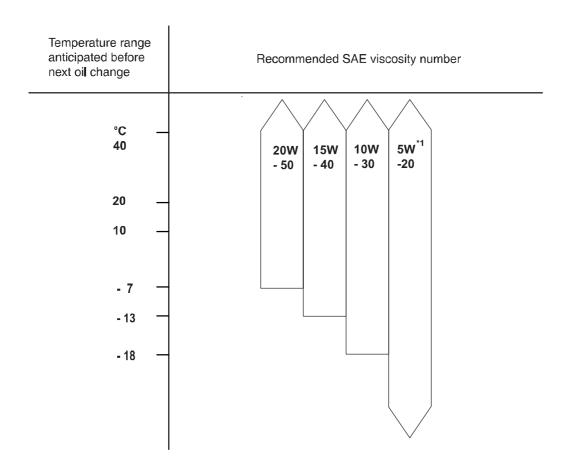
# **NOTE**

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

# SELECTION OF ENGINE OIL

Recommended ILSAC classification : GF3 OR ABOVE Recommended API classification : SJ / SL OR ABOVE

Recommended SAE viscosity grades:



\*1 : Recommended regardless of environment.

If not available, refer to the recommended SAE viscosity numbers.

LC8F002A

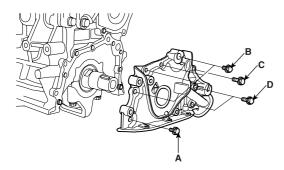


For best performance and maximum protection of all types of operation, select only those lubricants which .

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

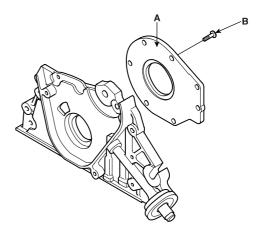
# REMOVAL E8BDE9D1

- 1. Drain engine oil.
- 2. Remove the drive belts.
- Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover. (See page EM - 9)
- 4. Remove the timing belt. (See page EM 23)
- 5. Remove the oil pan and oil screen. (See page EM 64, 65)
- 6. Remove the front case.



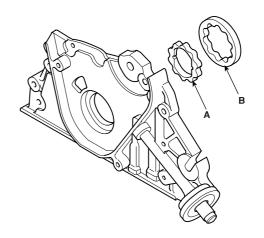
ECKD411A

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



ECKD401A

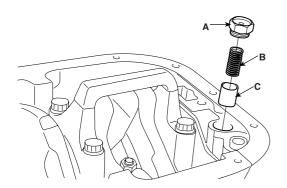
2) Remove the inner(A) and outer(B) rotors.



ECKD402A

# DISASSEMBLY E65B43FC

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



ECKD403A

# INSPECTION EDACC2F5

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

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

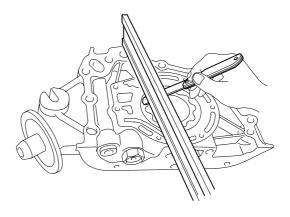
# Standard value

Free height: 43.8mm (1.724 in.)

Load: 3.7±0.4kg/40.1mm (8.14±0.88lb/1.579 in.)

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

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



ECKD404A

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case. Inspect rotor tip clearance.
 Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

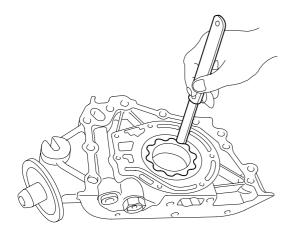
# Tip clearance

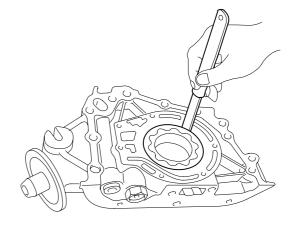
 $0.025 \sim 0.069 \text{ mm} (0.0010 \sim 0.0027 \text{ in.})$ 

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

# **Body clearance**

 $0.12 \sim 0.185 \text{ mm}(0.0047 \sim 0.0073 \text{ in.})$ 





ECKD405A

ECKD406A

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

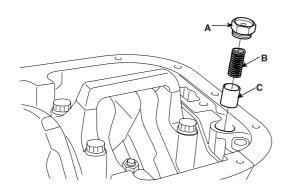
If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

# REASSEMBLY E158FA78

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

# **Tightening torque**

40 ~ 50Nm (400 ~ 500kgf.cm, 30 ~ 37lbf.ft)



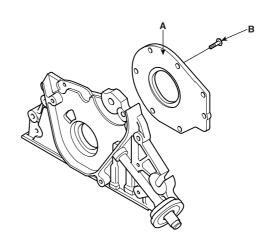
ECKD403A

# INSTALLATION EC494CD5

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

# Tightenig torque

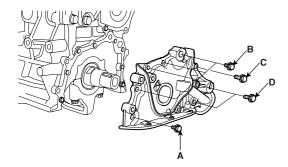
6 ~ 9Nm (60 ~ 90kgf.cm, 4.4 ~ 6.6lbf.ft)



ECKD401A

2. Check that the oil pump turns freely.

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



ECKD411A

Body length

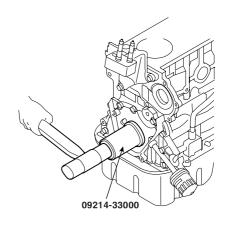
(A): 25mm (0.98in) (B): 20mm (0.787in) (C): 38mm (1.496in) (D): 45mm (1.771in)

# Tighttening torque

20 ~ 27Nm (200 ~ 270kg.cm, 14.5 ~ 19.8lb.ft)

4. Apply a light coat of oil to the seal lip.

5. Using the SST(09214-33000), install the oil seal.



ECHE600C

- 6. Install the oil screen. (See page EM 80)
- 7. Install the oil pan. (See page EM 81)

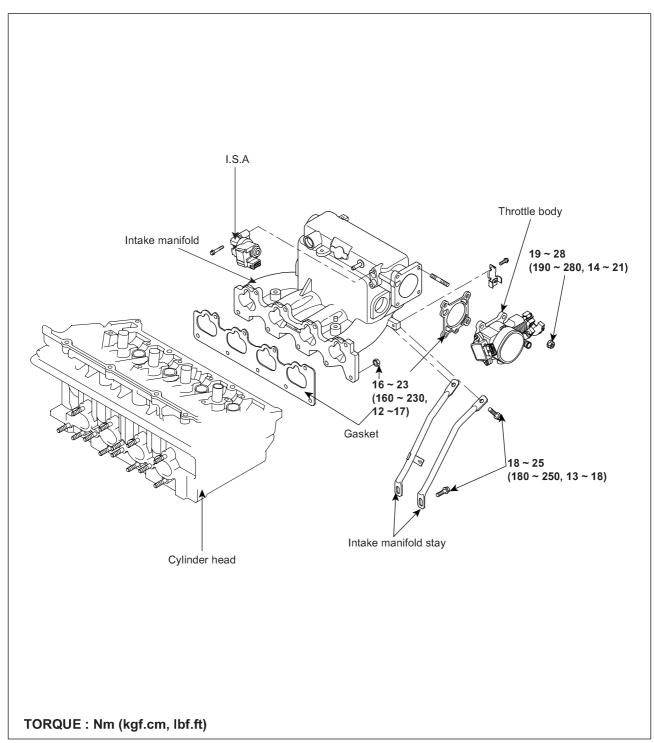


Clean the oil pan gasket mating surfaces.

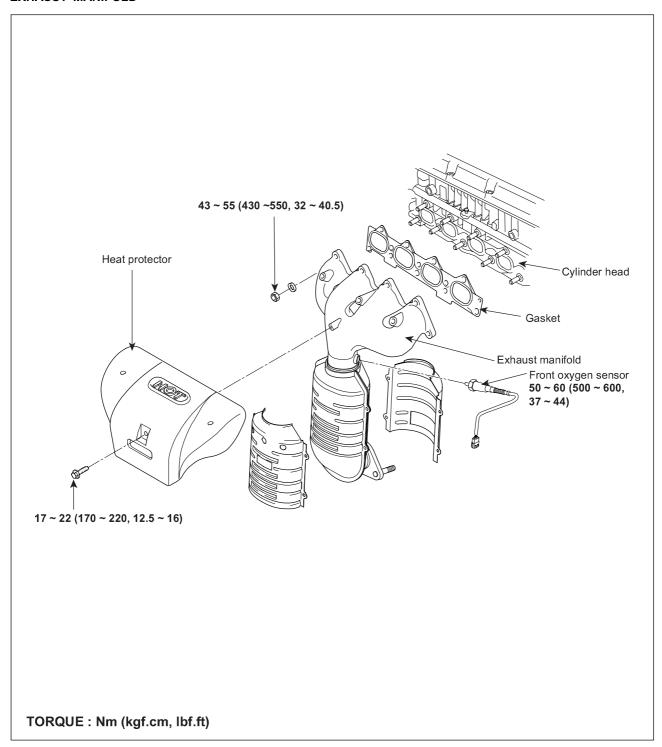
# INTAKE AND EXHAUST SYSTEM

COMPONENT E26D8E3D

**INTAKE MANIFOLD** 

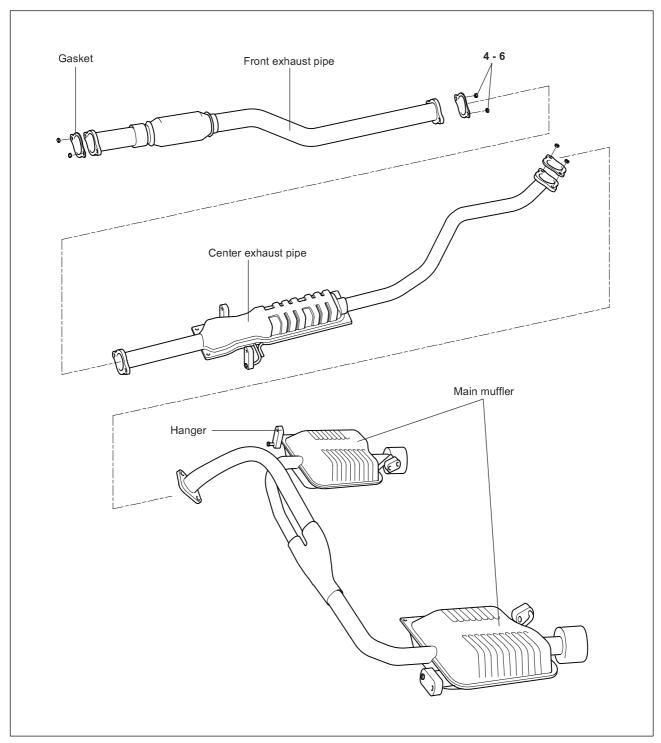


# **EXHAUST MANIFOLD**



ECKD009A

# MUFFLER

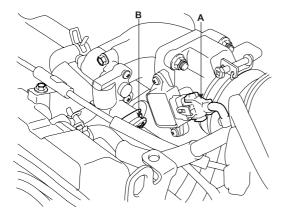


ECOC170A

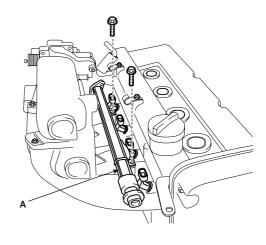
# REMOVAL EC8D02FD

# INTAKE MANIFOLD

- 1. Remove the engine cover. (See page EM 8)
- Disconnect the TPS connector(A) and ISA connector(B).



5. Remove the delivery pipe(A).

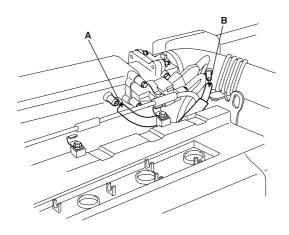


ACGE030A

6. Remove the heater hoses(A), PCSV(B), and brake vacuum hose(C).

EDQF197A

3. Remove the PCV hose(A) and breather hose(B).

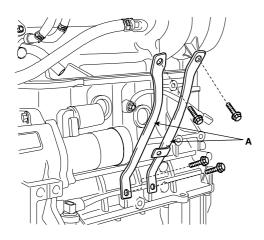


ACGE031A

ECKD112A

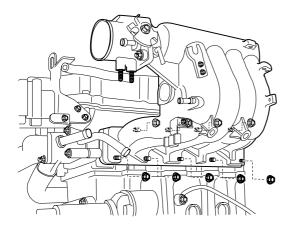
Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.

7. Remove the intake manifold stay(A).



ACGE032A

8. Remove the intake manifold.

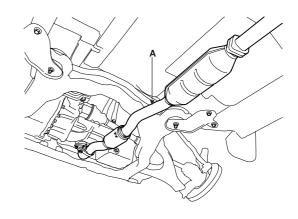


ACGE033A

9. Installation is in the reverse order of removal.

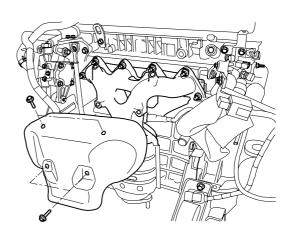
# **EXHAUST MANIFOLD**

- 1. Remove the engine cover. (See page EM 8)
- 2. Remove the front oxygen sensor connector.
- 3. Remove the front muffler(A).



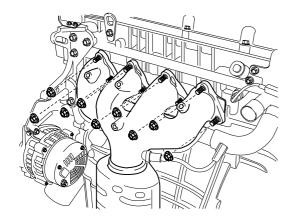
EDQF192A

4. Remove the heat protector.



EDQF195A

# 5. Remove the exhaust manifold.



ACGE035A