ENGINE SPECIFICATION & SERVICE MANUAL

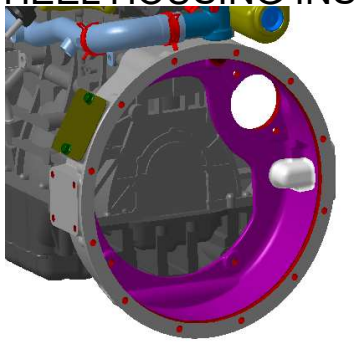
2006. 11.

HYUNDAI MOTOR COMPANY

TITLE

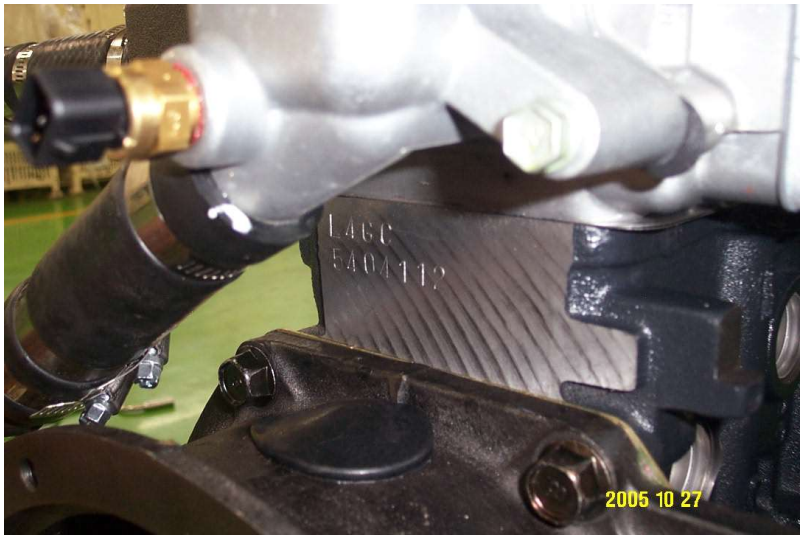
1. General information

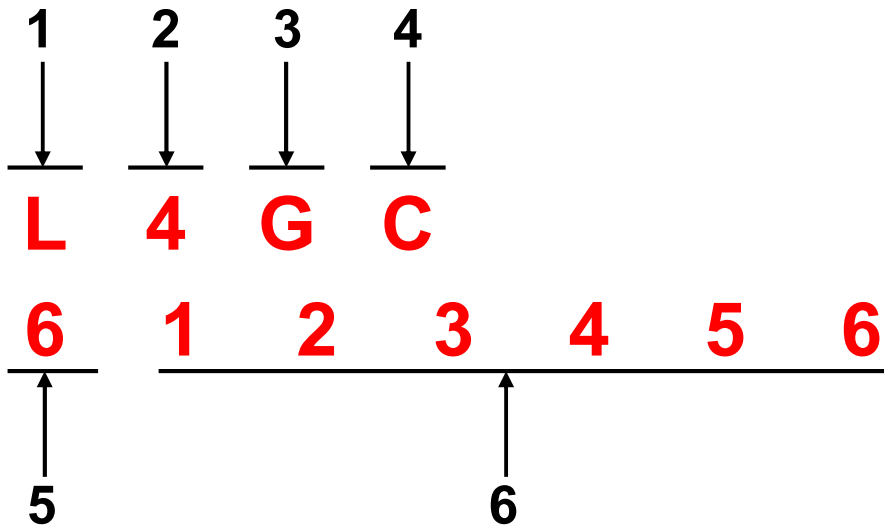
Zenith Engine code

Total displacement	ENGINE CODE	LOOSE PARTS	REMARKS
1.0	MD99	39210-02640 O2 SENSOR	
1.6	XP99	28765-34050 GASKET 39210-22610 O2 SENSOR 25212-26000 V-RIBBED BELT	
2.0	XE85	23212-23P00 RING GEAR-FLY WHEEL 28751-26300 GASKET 39210-23600 O2 SENSOR	FLYWHEEL HOUSING INSTALL 
	XE86	28751-26300 GASKET 36100-23C00 STARTER ASSY 36210-23600 O2 SENSOR	FLYWHEEL INSTALL 

1. General information

1. ENGINE IDENTIFICATION NUMBER





1.Engine fuel
- G : Gasoline
- L : LPG

2.Engine range
- 4 : 4 cycle 4 cylinder

3.Engine development order
- H : Epsilon engine
- E : Alpha engine
- G : Beta engine

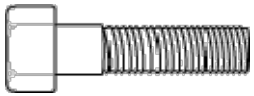
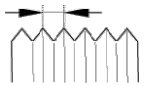
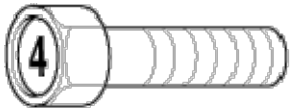
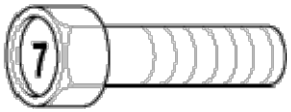
4.Engine capacity
- E : 999 cc (Epsilon)
- D : 1,599 cc (Alpha)
- C : 1,957 cc (Beta)

5.Production year
- 5 : 2005, 6 : 2006

6.production sequence number
- 000001 ~ 999999

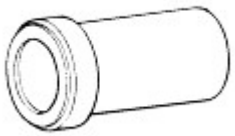
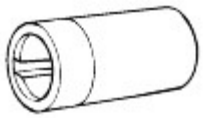
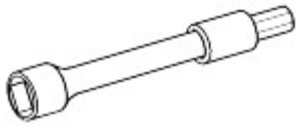
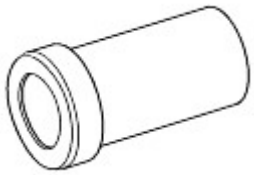
1. General information

2. TIGHTENING TORQUE TABLE OF STANDARD PARTS

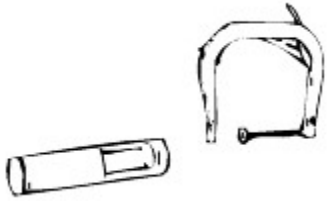
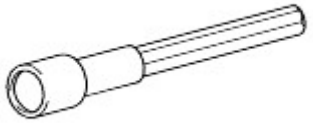
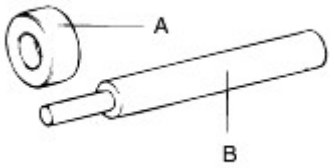
Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kgf.cm, lb.ft)	
		Head Mark 4	Head Mark 7
			
M5	0.8	3 ~ 4 (30 ~ 40, 2.2 ~ 2.9)	5 ~ 6 (50 ~ 60, 3.6 ~ 4.3)
M6	1	5 ~ 6 (50 ~ 50, 3.6 ~ 4.3)	9 ~ 11 (90 ~ 110, 6.5 ~ 8.0)
M8	1.25	12 ~ 15 (120 ~ 150, 9 ~ 11)	20 ~ 25 (200 ~ 250, 14.5 ~ 18.0)
M10	1.25	25 ~ 30 (250 ~ 300, 18 ~ 22)	30 ~ 50 (300 ~ 500, 22 ~ 36)
M12	1.25	35 ~ 45 (350 ~ 450, 25 ~ 33)	60 ~ 80 (600 ~ 800, 43 ~ 58)
M14	1.5	75 ~ 85 (750 ~ 850, 54 ~ 61)	120 ~ 140 (1,200 ~ 1,400, 85 ~ 100)
M16	1.5	110 ~ 130 (1,100 ~ 1,300, 80 ~ 94)	180 ~ 210 (1,800 ~ 2,100, 130 ~ 150)
M18	1.5	160 ~ 180 (1,600 ~ 1,800, 116 ~ 130)	260 ~ 300 (2,600 ~ 3,000, 190 ~ 215)
M20	1.5	220 ~ 250 (2,200 ~ 2,500, 160 ~ 180)	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)
M22	1.5	290 ~ 330 (2,900 ~ 3,300, 210 ~ 240)	480 ~ 550 (4,800 ~ 5,500, 350 ~ 400)
M24	1.5	360 ~ 420 (3,600 ~ 4,200, 260 ~ 300)	610 ~ 700 (6,100 ~ 7,000, 440 ~ 505)

1. General information

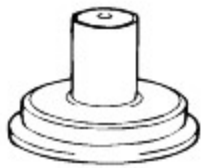
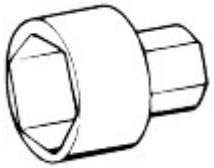
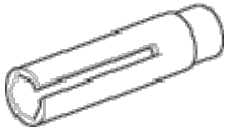
SPECIAL TOOLS

Too name	PART NO			Illustration	Use
	1.0	1.6	2.0		
Crankshaft front oil seal installer	09231-22100	09214-32000	09214-32000		Installation of the crankshaft front oil seal (use with 09231 - 11001)
Crankshaft front oil seal guide	09231-11001	09214-32100	09214-32100		Installation of the crankshaft front oil seal (use with 09214-22100)
Cylinder head bolt wrench	09221-21000	-			Removal and tightening of the cylinder head bolt
Camshaft oil seal installer	09221-21000	09221-21000	09221-21000		Installation of the camshaft oil seal (use with 09221-21100)

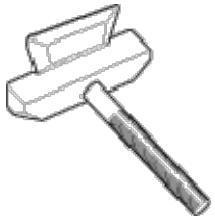
1. General information

Too name	PART NO			Illustration	Use
	1.0	1.6	2.0		
Camshaft oil seal guide	09221-21100				Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
Valve spring remover and installer	09222-22100	09222-28000 09222-28100	09222-28000 09222-28100		Removal and installation of the intake or exhaust valve
Valve stem oil seal installer	09222-22001	09222-22001	09222-22001		Installation of the vale stem oil seal
Valve guide installer/ remover	09221-22000 A/B	09221-26000 09221-3F100 (A)	09221-22000 A/B		Removal and installation of the valve guide

1. General information

Too name	PART NO			Illustration	Use
	1.0	1.6	2.0		
Crankshaft rear oil seal installer	09231-21000	09231-21000	09231-21000		1) Installation of the engine rear oil seal 2) Installation of the crankshaft rear oil seal
Oil pressure switch wrench	09260-32000	-	-		Removal and installation of the oil pressure switch
Oil filter wrench	09915-47341	-	-		Removal and installation of the oil filter
Water temperature sensor socket wrench	-	09221-25100	-		Removal and installation of water temperature sensor

1. General information

Too name	PART NO			Illustration	Use
	1.0	1.6	2.0		
Oil pan remover		09215-3C000			Removal of oil pan
Torque angle adapter		09221-4A000			Installation of bolts & nuts needing an angular method

1. General information

3. LUBRICANTS

1) RECOMMENDED LUBRICANTS

Parts		Specifications		
		1.0	1.6	2.0
Engine oil	API Classification	SG or Above (for Europe) SE or Above (Except Europe)	SD or Above (Except Europe) SE or Above (for Europe)	SH or Above
Cooling system		High quality ethylene glycol - Concentration level 40-50%		

2) LUBRICANTS CAPACITIES

Description		Capacities		
		1.0	1.6	2.0
Engine oil	Oil pan	2.8 (2.96, 2.46)	3.0 (3.17, 2.64)	3.55 (3.75, 3.12)
	Oil filter	0.2 (0.21, 0.18)	0.3 (0.32, 0.26)	0.3 (0.32, 0.26)
	Total	3.0 (3.17, 2.64)	3.3 (3.49, 2.90)	3.85 (4.07, 3.39)
Cooling system		3.0 (3.17, 2.64)	3.0 (3.17, 2.64)	3.0 (3.17, 2.64)

liter (U.S. qus., Imp.qts.)

1. General information

3) Periodic check and service chart

○ Check, adjust or lubricate ● replace

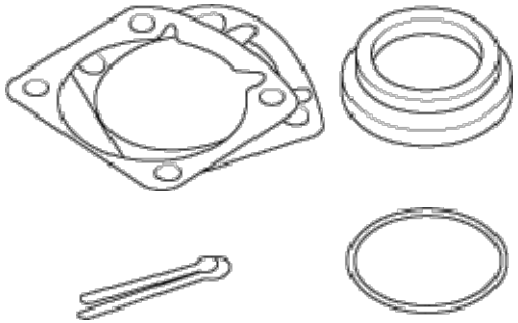
CHECK AND SERVICE ITEM		CHECK AND SERVICE INTER VALS							
		DAILY	EVERY 10,000KM (250 hours)	EVERY 20,000KM (500 hours)	EVERY 40,000KM (1,000 hours)	EVERY 80,000KM (2,000 hours)	EVERY 100,000KM (2,500 hours)	EVERY 160,000KM (3,000 hours)	EVERY 200,000KM (4,000 hours)
ENGINE OIL & FILTER		○	●						
DIRVE BELT (ALT,W/PUMP)			○						
FUEL INJECTOR						○			●
PCV HOSE				○					
PCV VALVE					○				
CRANKCASE BREATHER HOSE				○					
O2 SENSOR						●			
TIMING BELT	1.0				○	●			
	1.6					○		●	
	2.0						○		●
SPARK PLUG	1.0 & 1.6				● (Ni)				
	2.0						● (Pt)		
IGNITION COIL							●		

1. General information

4) REPLACEMENT

If removed, the following parts should always be replaced with new ones.

- Oil seals
- Gaskets
- O-rings
- Lock washers
- Cotter pins (split pins)
- Plastic nuts



2. Mechanical system

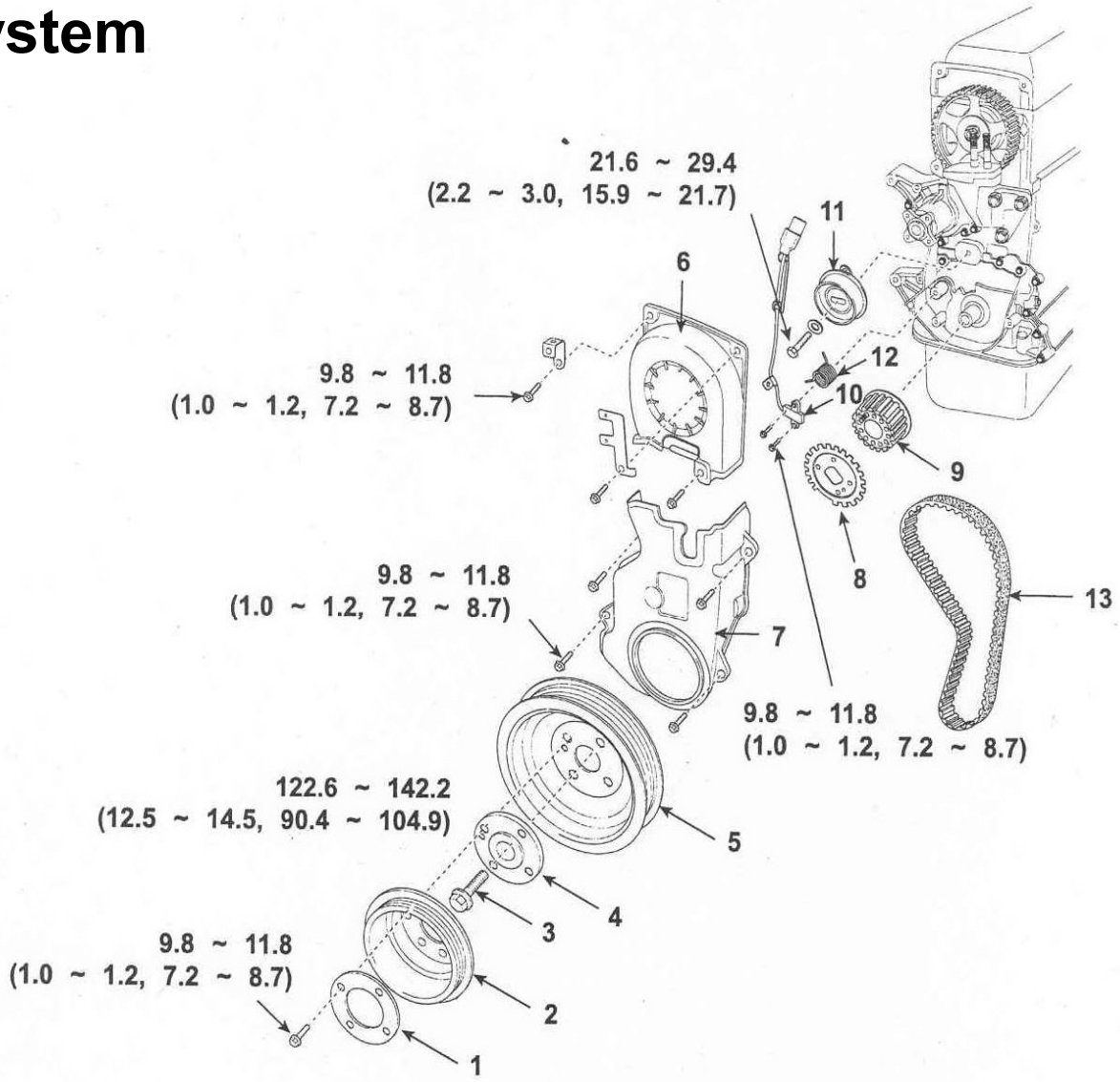
1. General information

Description		Specifications			Limit
		1.0 SOHC	1.6 DOHC	2.0 DOHC	
General					
Type		In-line, SOHC	In-line, DOHC		
Number of cylinders		4			
Bore		66.0 mm	76.5mm	82mm	
Stroke		73.0 mm	87mm	93.5mm	
Total displacement		999cc	1,599 cc	1975 cc	
Compression ratio		9.7 : 1	10.0 : 1	9.4 : 1	
Firing order		1-3-4-2			
Valve timing					
Intake valve	Opens (BTDC)	5°	5°	2°	
	Closes (ABDC)	35°	35°	16°	
Exhaust valve	Opens (BBDC)	43°	43°	6°	
	Closes (ATDC)	5°	5°	2°	

2. Mechanical system

2. Timing system

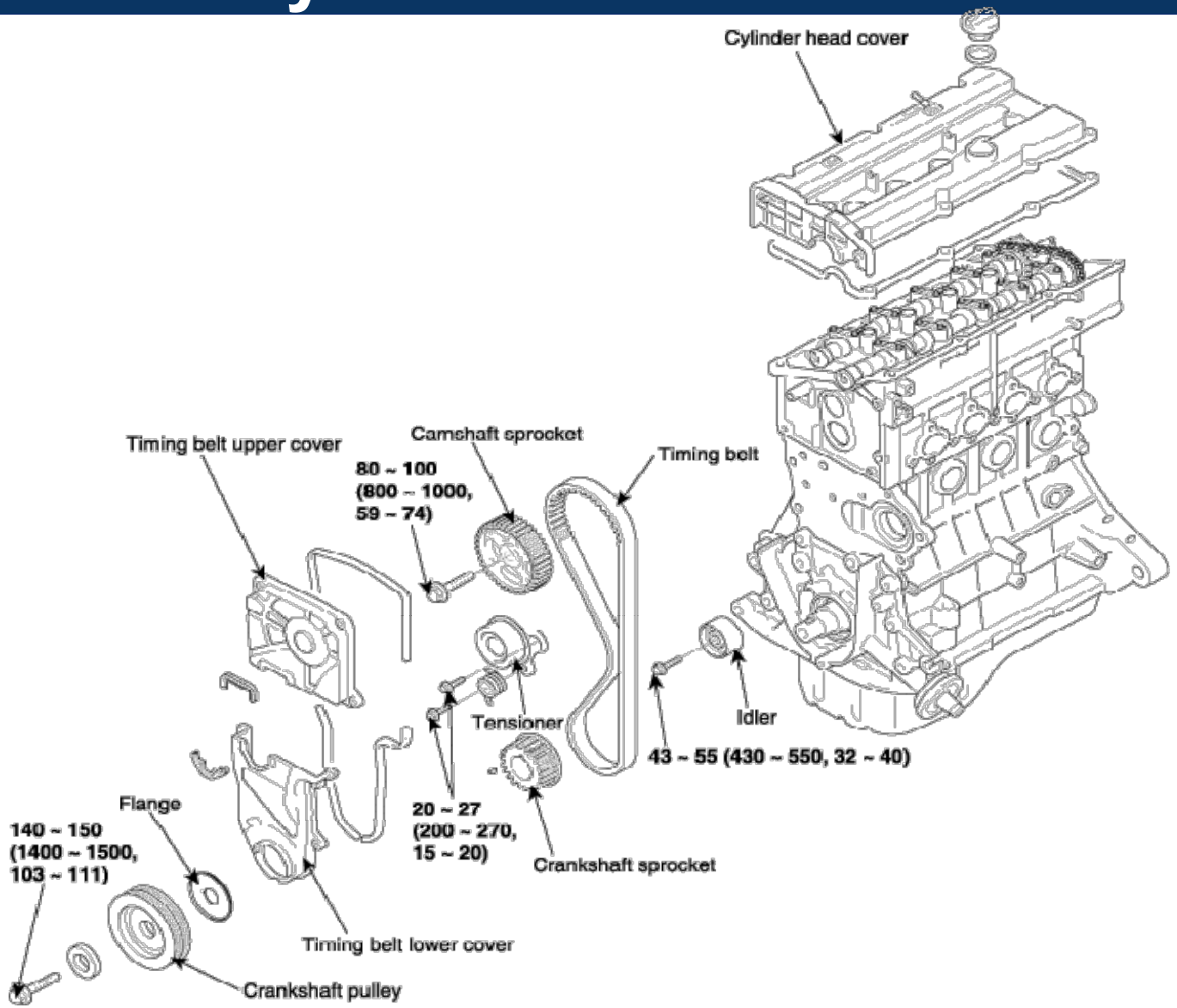
1.0 ENGINE



TORQUE : N·m (kg·m, lb·ft)

2. Mechanical system

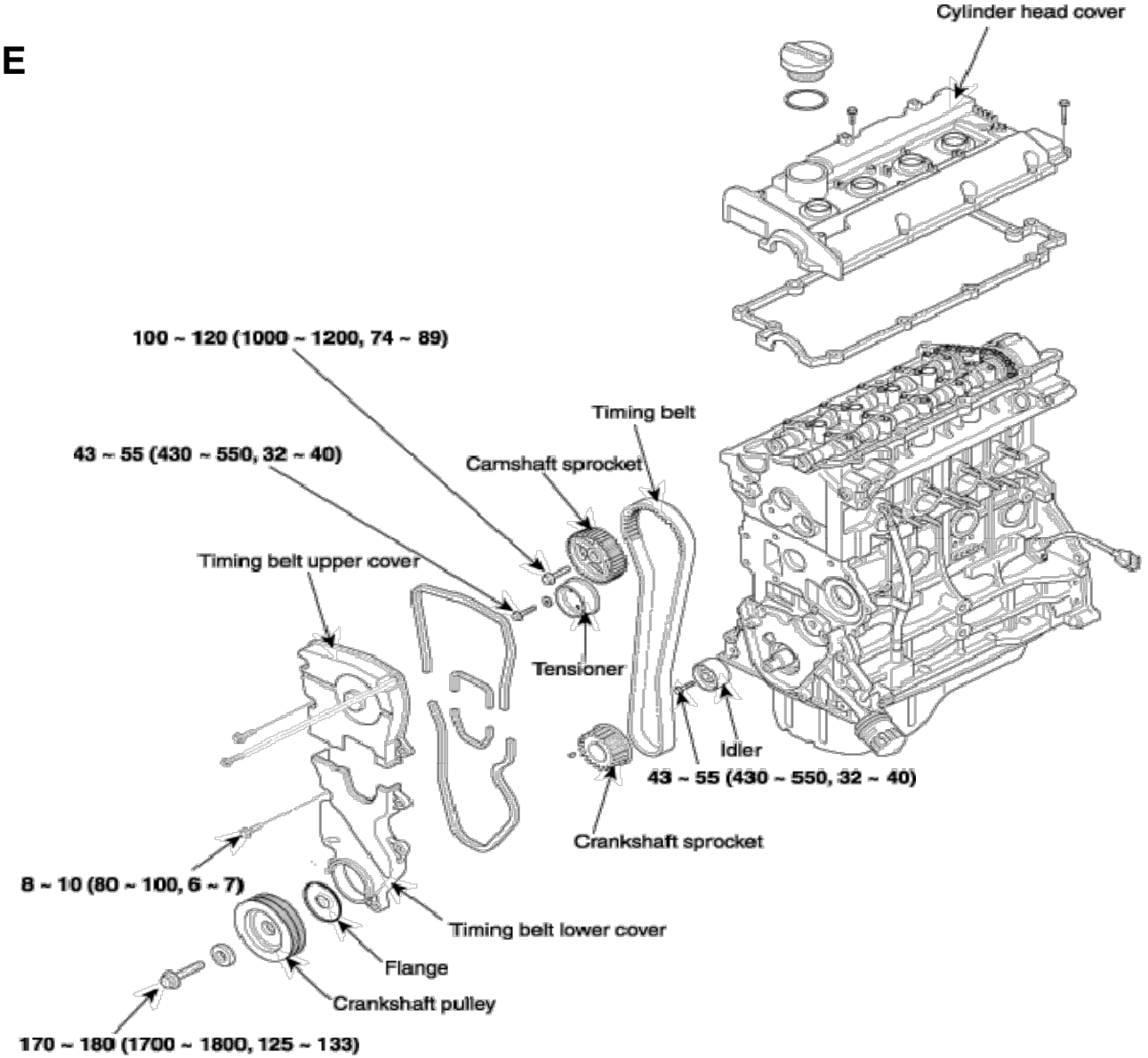
1.6 ENGINE



TORQUE : Nm (kgf·cm, lbf·ft)

2. Mechanical system

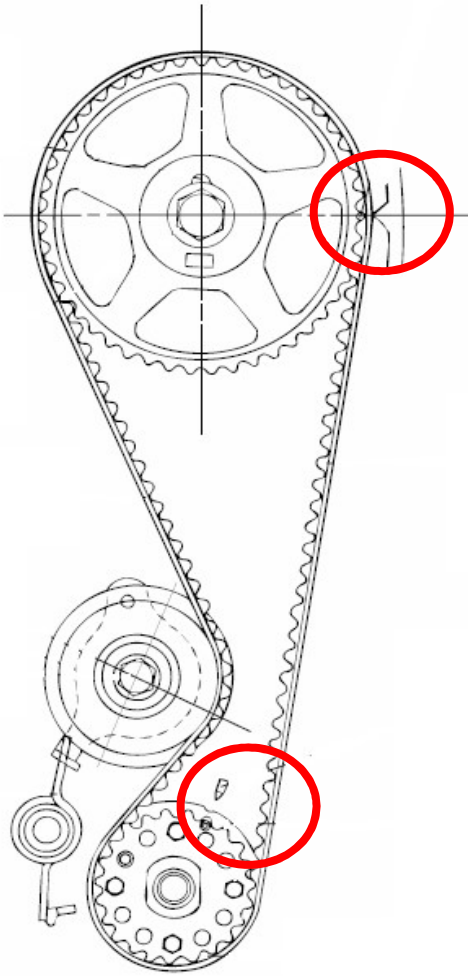
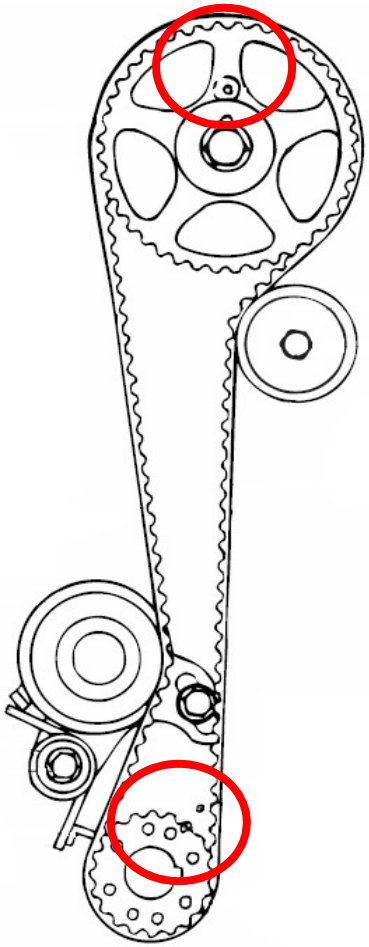
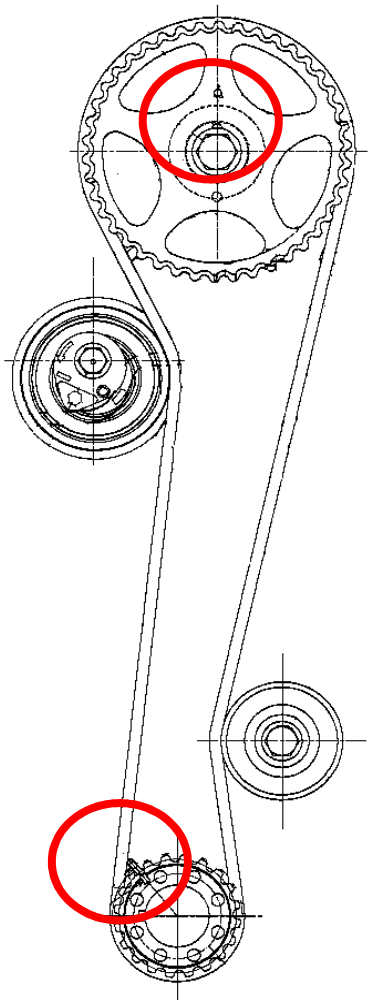
2.0 ENGINE



TORQUE : Nm (kgf.cm, lbf.ft)

2. Mechanical system

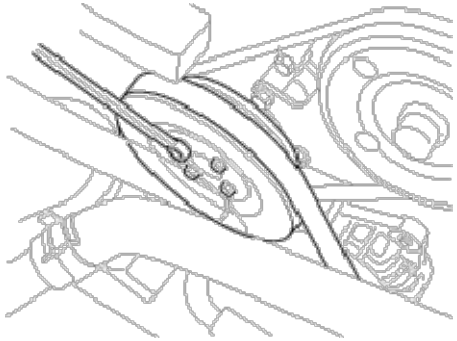
1) Timing marks

1.0	1.6	2.0
		

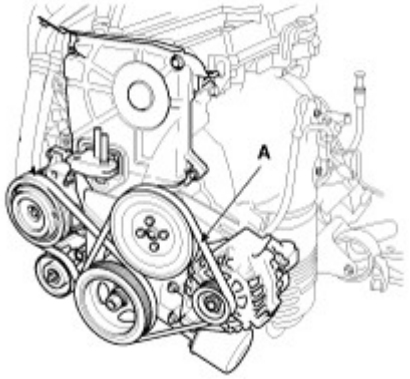
2. Mechanical system

2) REMOVAL

(1) Temporarily loosen the water pump pulley bolts.

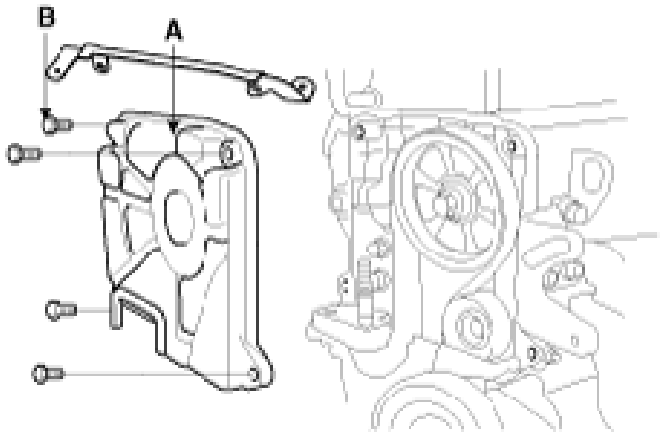


(2) Remove the alternator drive belt (A).

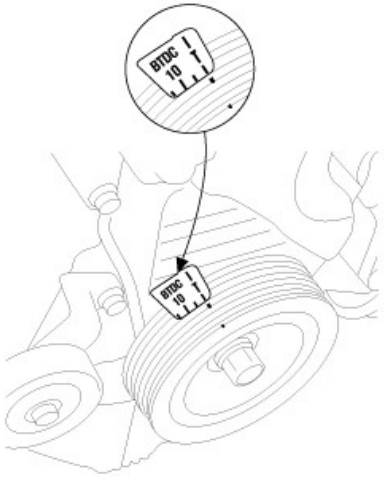


(3) Remove the 4 bolts and water pump pulley.

(4) Remove the 4 bolts (B) and timing belt upper cover (A).

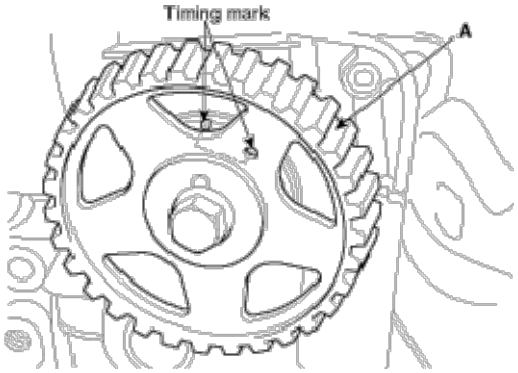


(5) Turn the crankshaft pulley, and align its groove with timing mark “T”of the timing belt cover.

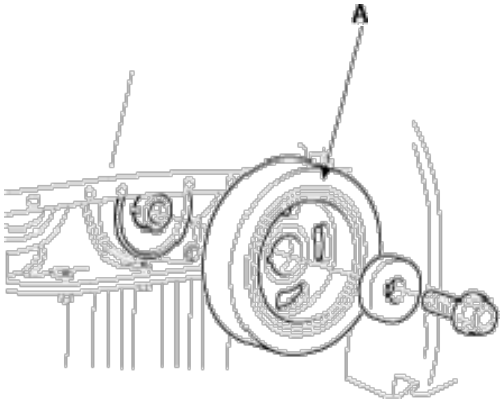


2. Mechanical system

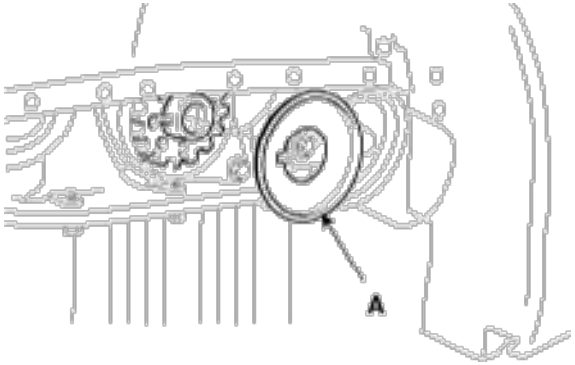
(6) Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover.



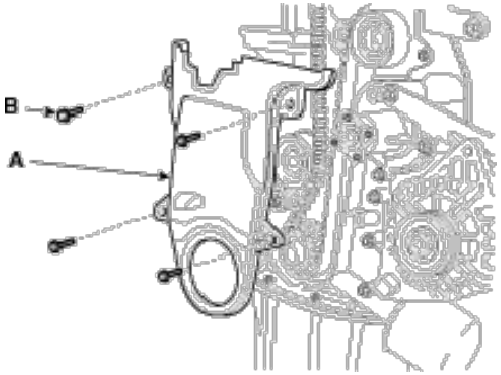
(7) Remove the crankshaft pulley bolt and crankshaft pulley (A).



(8) Remove the crankshaft flange (A).

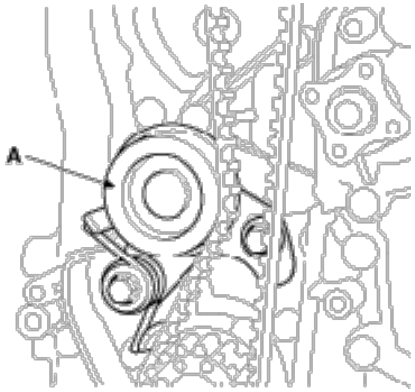


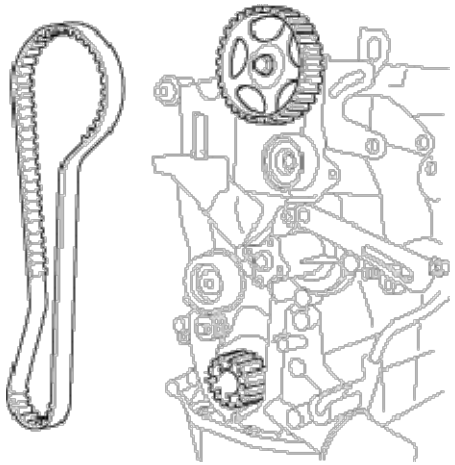
(9) Remove the 4 bolts (B) and timing belt lower cover (A).



2. Mechanical system

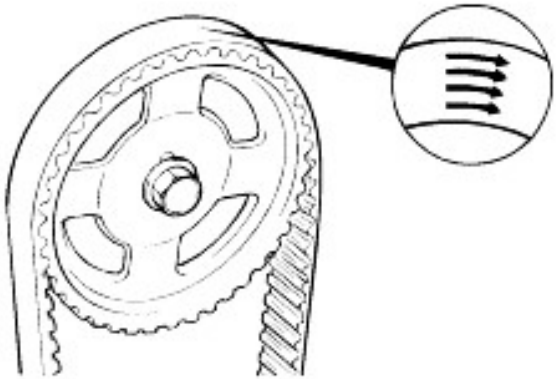
(10) Remove the timing belt tensioner (A) and timing belt.





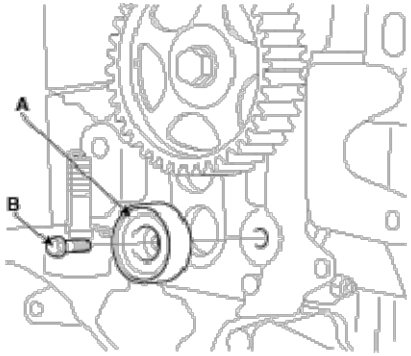
NOTE

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

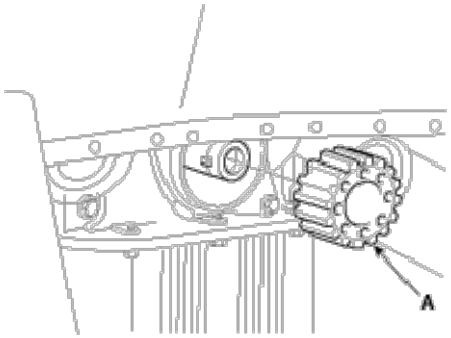


2. Mechanical system

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

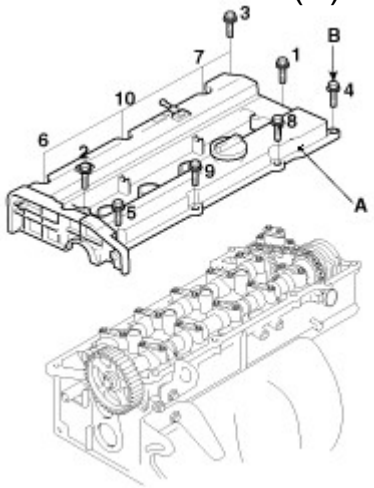


(12) Remove the crankshaft sprocket (A).



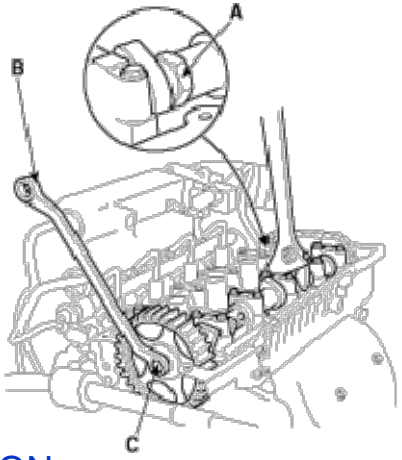
(13) Remove the cylinder head cover.

① Remove the ignition coil.
② Remove the PCV (Positive Crankcase Ventilation) hose and the breather hose from the cylinder head cover.
③ Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



(14) Remove the camshaft sprocket.

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



CAUTION

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

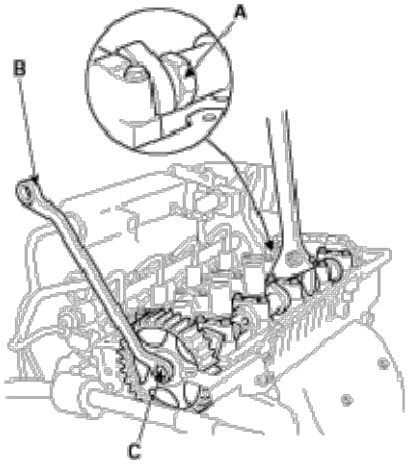
2. Mechanical system

3) REASSEMBLY

(1) Install the camshaft sprocket and tighten the bolt to the specified torque.

① Temporarily install the camshaft sprocket bolt (C).

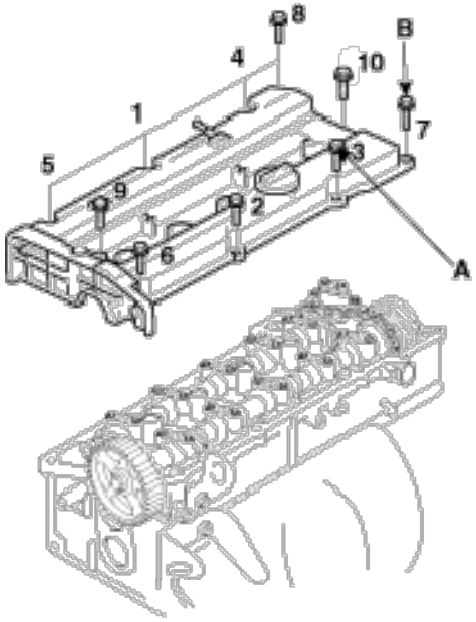
② Hold the portion (A) of the camshaft with a hexagonal wrench, and tighten the bolt (C) with a wrench (B) .



Tightening torque :78.5 ~ 98.1N.m (8.0 ~ 10.0kgf.m, 57.9 ~ 72.3lb-ft)

(2) Install the cylinder head cover.

① Install the cylinder head cover (A) and Bolts (B).
Tightening torque :7.8 ~ 9.8N.m
(0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

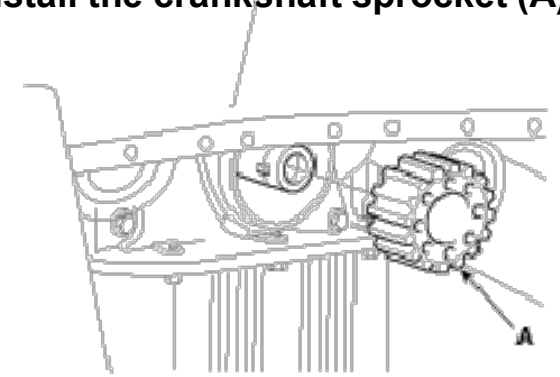


② Install the PCV (Positive Crankcase Ventilation) hose and breather hose to the cylinder head cover.

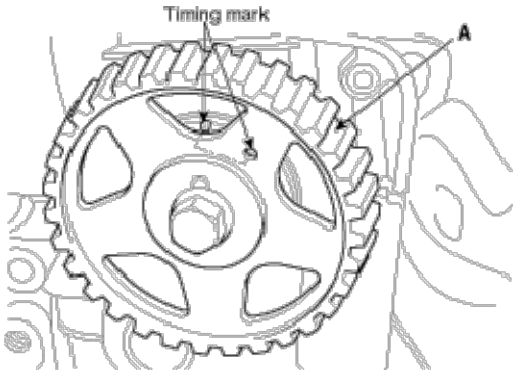
③ Install the ignition coil.

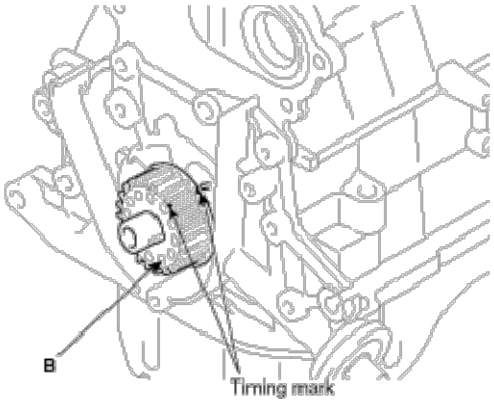
2. Mechanical system

(3) Install the crankshaft sprocket (A).



(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.

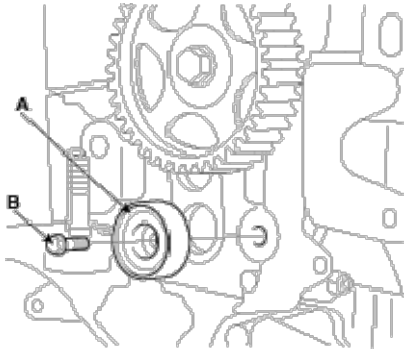




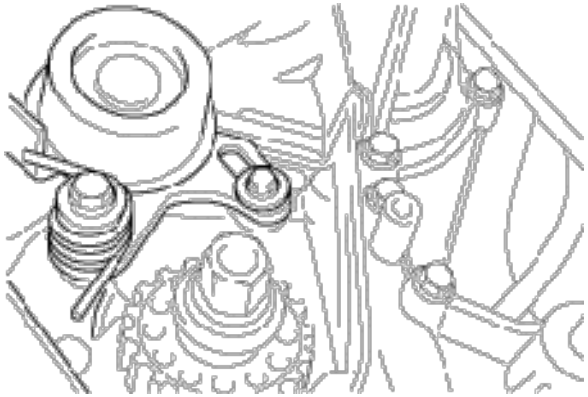
2. Mechanical system

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

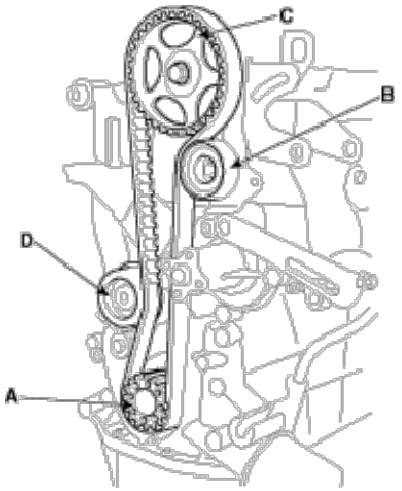
① Tightening torque :42.2 ~ 53.9N.m (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lb-ft)



(6) Temporarily install the timing belt tensioner(A).



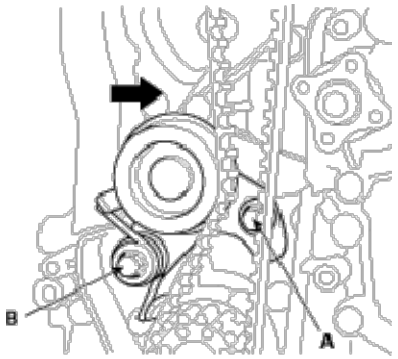
(7) Install the belt so as not give slack at each center of shaft.
Use the following order when installing timing belt.
Crankshaft sprocket (A) →idler pulley (B) →camshaft procket (C) →timing belt tensioner (D).



2. Mechanical system

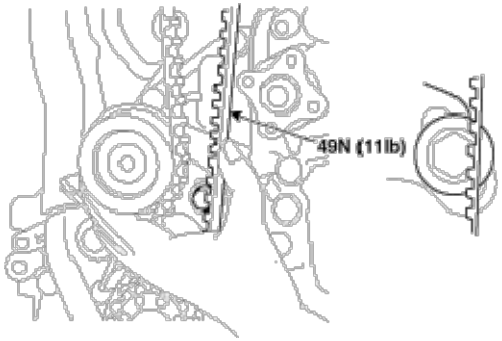
(8) Adjust the timing belt tension.

① Give tension to timing belt using the tensioner's elasticity after loosening the mounting bolt (A,B).



② After checking the alignment between each sprocket and each timing belt tooth, tighten the mounting bolt (A) and (B) one by one.
Tightening torque :19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

③ Then recheck the belt tension.
Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is aprox. 1/2 of the tensioner mounting bolt head radius(across flats) away from the bolt head center.

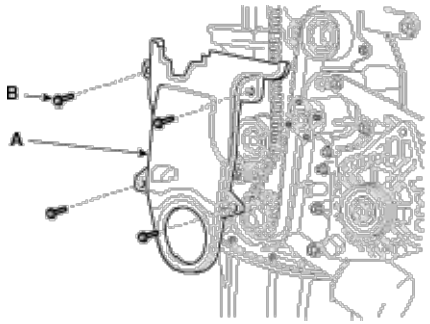


2. Mechanical system

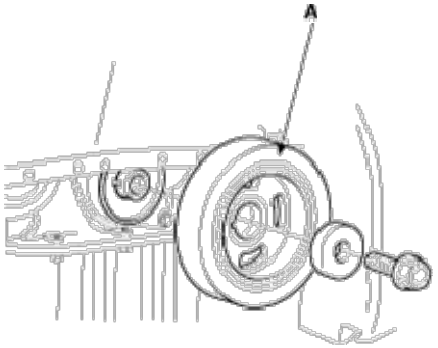
(9) Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.

(10) Install the timing belt lower cover (A) with 5 bolts (B).

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



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



Tightening torque : 137.3 ~ 147.1N.m
(14.0 ~ 15.0kgf.m, 101.3 ~ 108.5lb-ft)

(12) Install the timing belt upper cover with 4 bolts.

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

(13) Install the water pump pulley and 4 bolts.

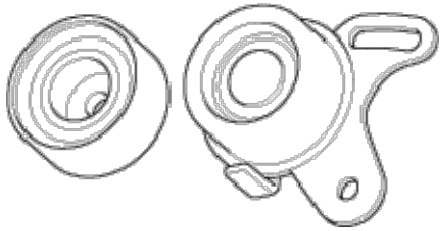
(14) Install the alternator drive belt.

2. Mechanical system

4) INSPECTION

(1) SPROCKETS, TENSIONER, IDLER

① Check the camshaft sprocket, crankshaft sprocket, tensioner pulley and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.



② Inspect the tensioner pulley and the idler pulley for easy and smooth rotation and check for play or noise.Replace as necessary.

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

5) TIMING BELT

When the engine is overhauled or belt tension adjusted, check the carefully.
If any of the following flaws are evident, replace the belt.

NOTE

1. Do not bend, twist or turn the timing belt inside out.

① Check the belt for oil or dust deposits.Replace, if necessary.

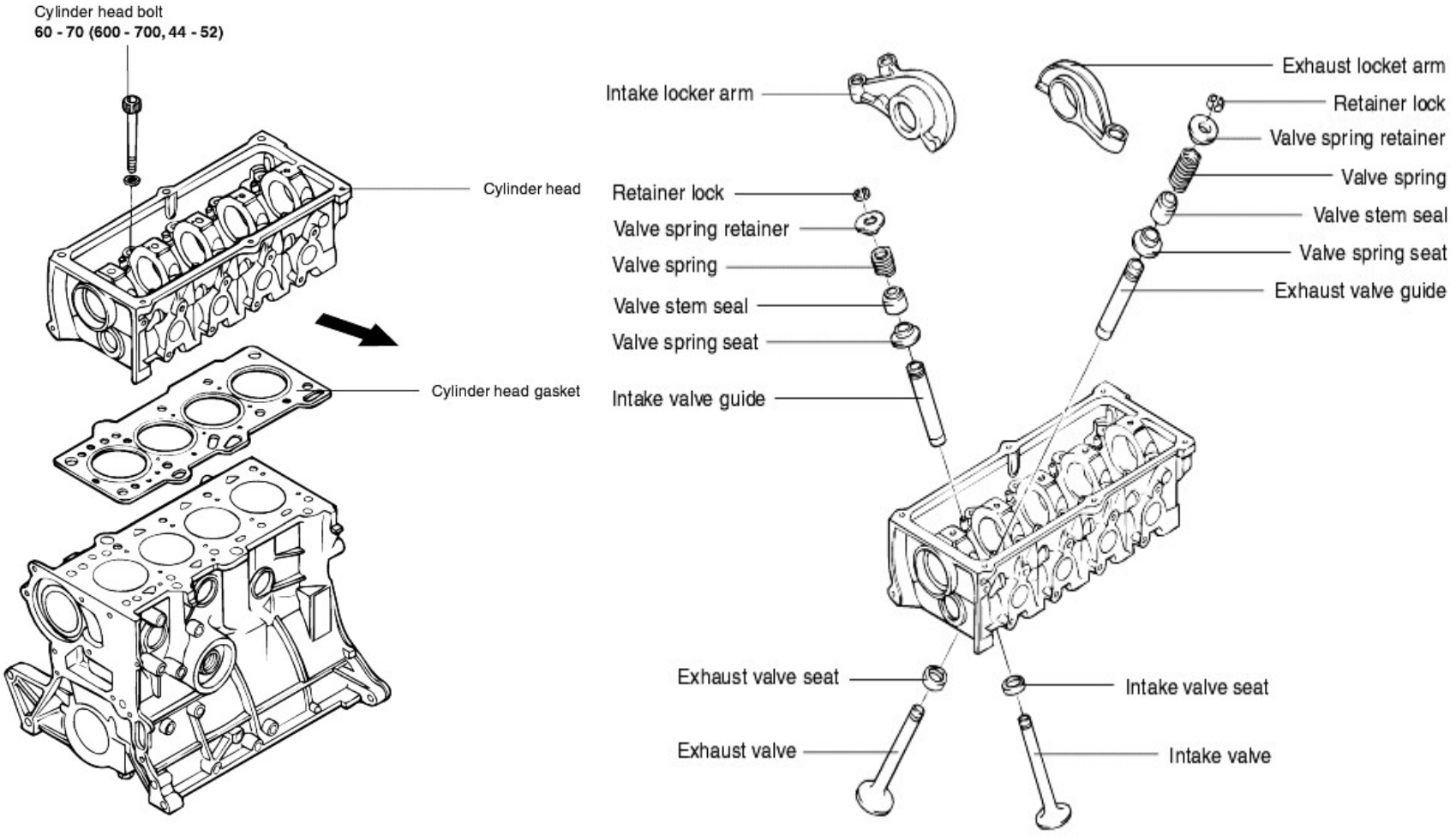
② Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.

2. Do not allow timing belt to come into contact with oil, water and steam.

2. Mechanical system

3. Cylinder head

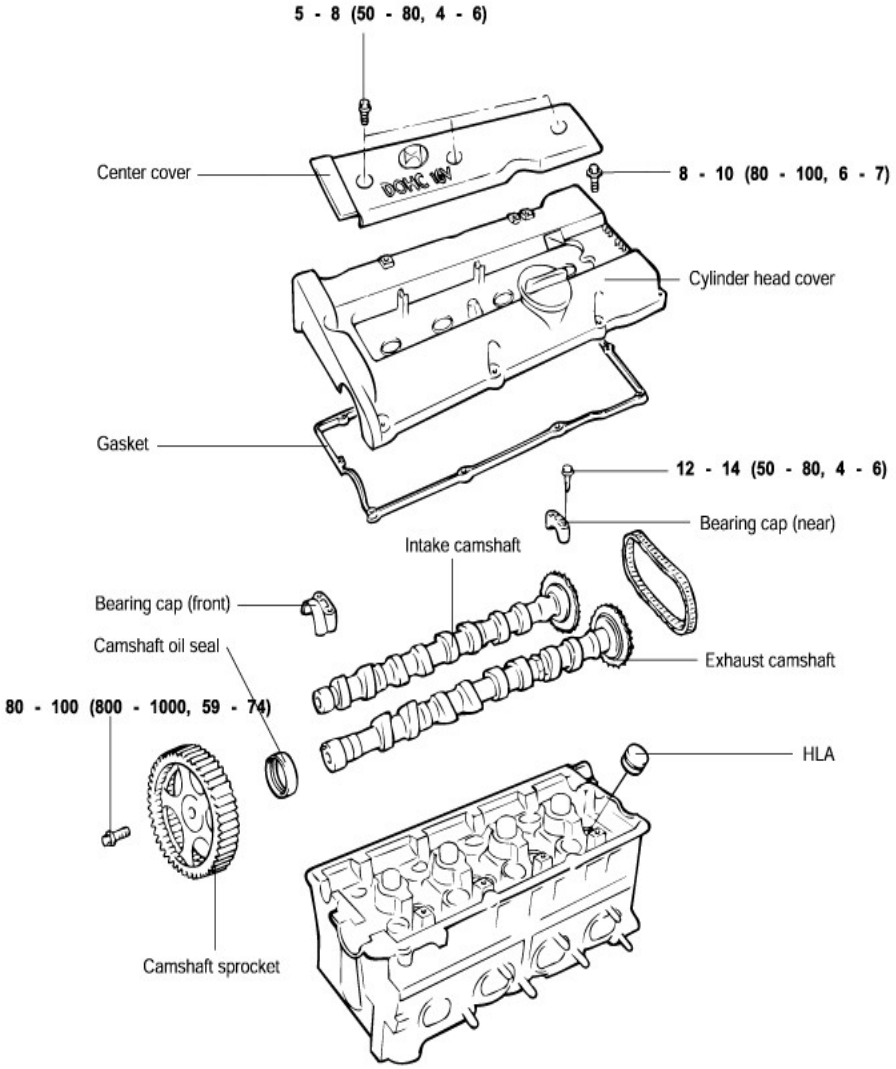
COMPONENTS(1.0 eng)



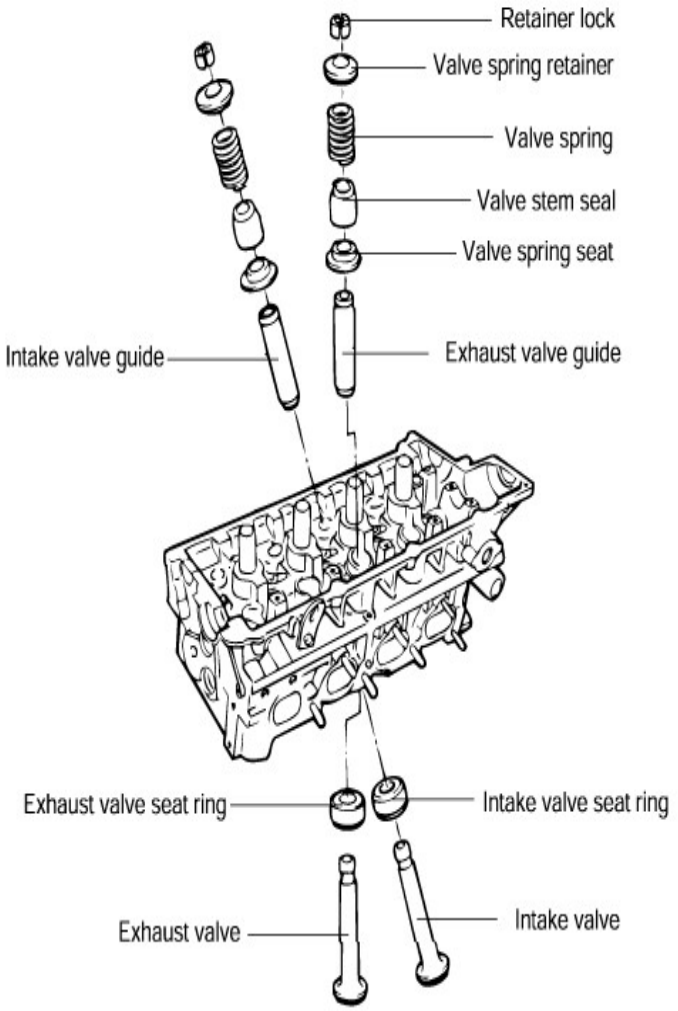
TORQUE : Nm (kg.cm, lb.ft)

2. Mechanical system

COMPONENTS (1.6 eng)



TORQUE : N.m (kg.cm, lb.ft)

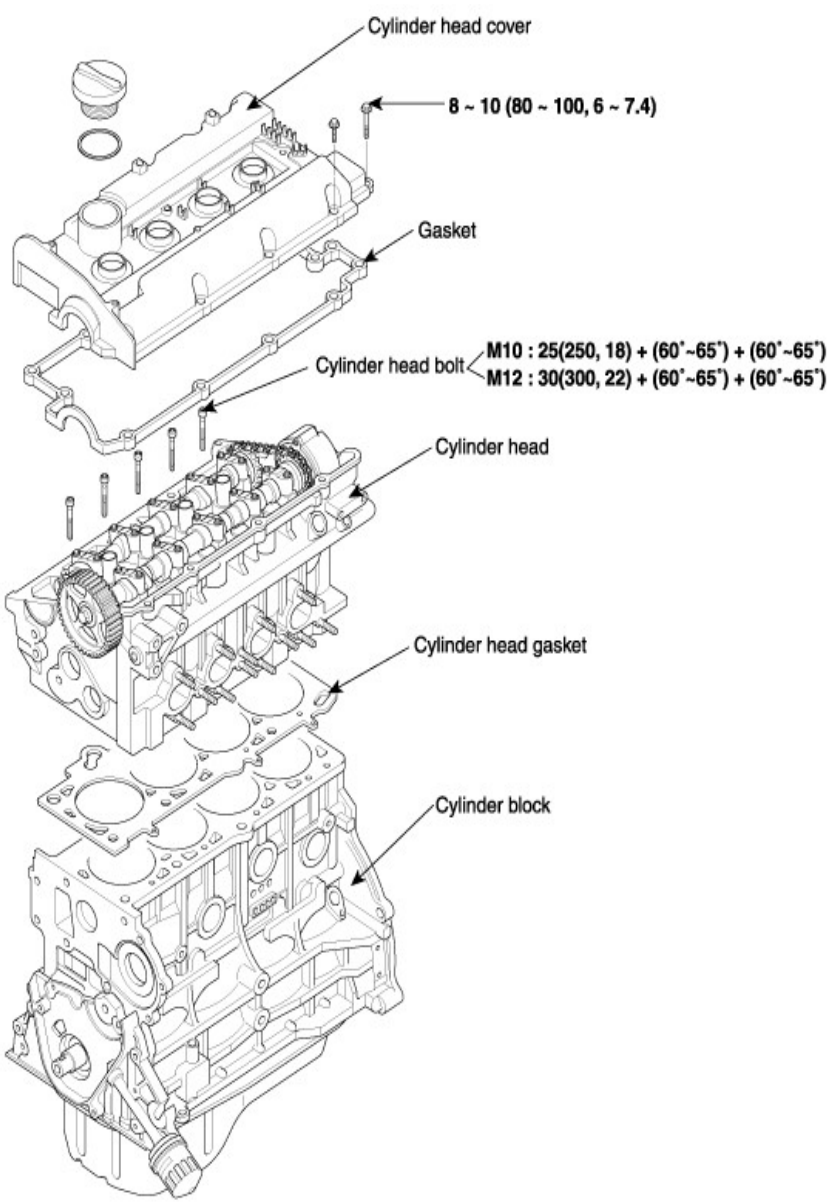


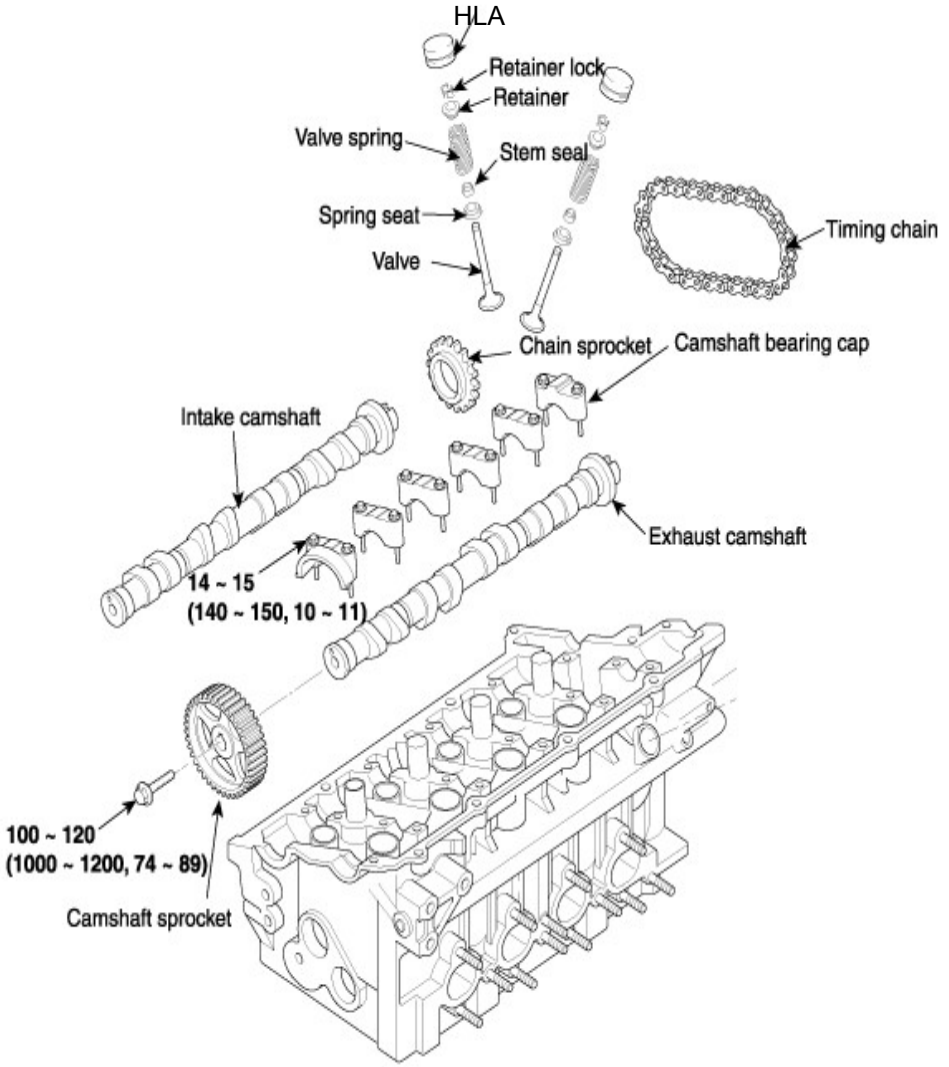
TORQUE : Nm (kg.cm, lb.ft)

*Replace the seal with new one after removal

2. Mechanical system

COMPONENTS (2.0 eng)





TORQUE : Nm (kgf.cm, lbf.ft)

2. Mechanical system

1) REMOVAL

Engine removal is required for this procedure.

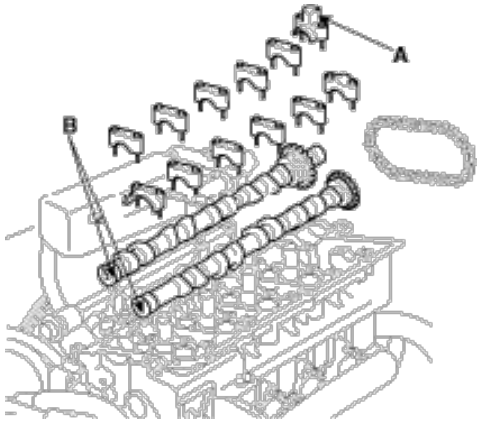
CAUTION

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

NOTE

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

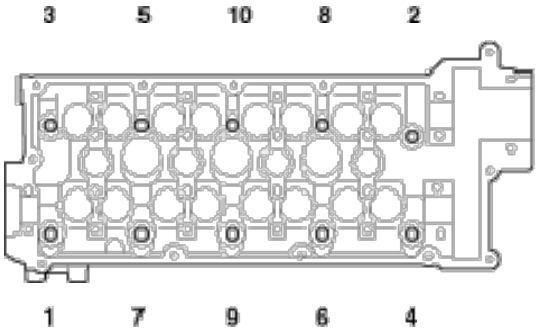
(1) Remove the ignition coil.
(2) Remove the exhaust manifold.
(3) Remove the intake manifold.
(4) Remove the timing belt.
(5) Remove the cylinder head cover.
(6) Remove the camshaft sprocket.
(7) Remove the camshaft bearing caps (A) and camshafts (B).



2. Mechanical system

(8) Remove the cylinder head bolts, then remove the cylinder head.

① Using 8mm hexagon wrench, uniformly loosen
and remove the 10 cylinder head bolts, in several passes,
in the sequence shown.



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

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

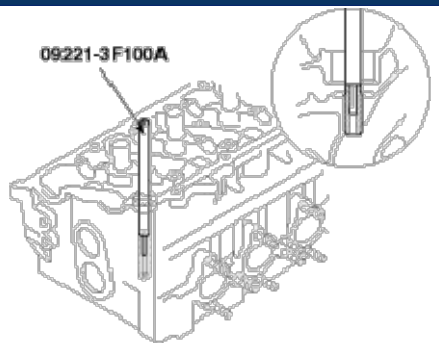
CAUTION
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

2. Mechanical system

2) REPLACEMENT

(1) VALVE GUIDE

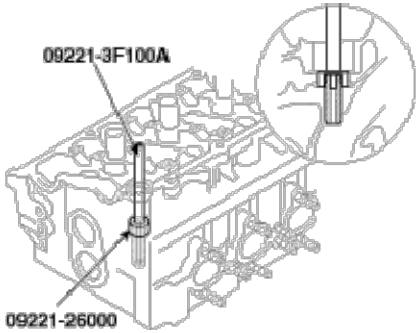
① Using the SST(09221 - 3F100A), with draw the old valve guide toward the bottom of cylinder head.



② Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.

③ Using the SST (09221-3F100A, 09221-26000), press-fit the valve guide.
The valve guide must be press-fitted from the upper side of the cylinder head.
Keep in mind that the intake and exhaust valve guides are different in length.

Valve guide length (mm)		
engine	Intake	Exhaust
1.0	46	48
1.6	36.5	39.5
2.0	39	43



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.

2. Mechanical system

VALVE GUIDE OVERSIZE

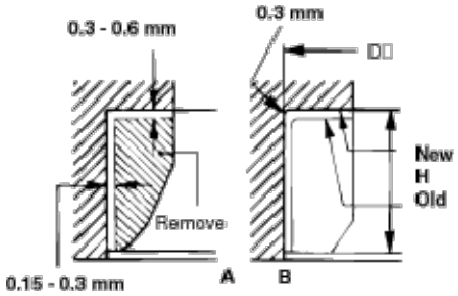
Item	Oversize [mm (in)]	Size mark	inner dia. Of cylinder head [mm (in)]		Remarks
			1.0	1.6 & 2.0	
cylinder head	STD	-	10.000 ~ 10.015 (0.3937 ~ 0.3943)	11.000 ~ 11.018 (0.4331 ~ 0.4338)	
	0.05 (0.002) OS	5	10.050 ~ 10.068 (0.3957 ~ 0.3964)	11.050 ~ 11.068 (0.4350 ~ 0.4357)	
	0.25 (0.010) OS	25	10.250 ~ 10.268 (0.4035 ~ 0.4043)	11.250 ~ 11.268 (0.4429 ~ 0.4436)	
	0.50 (0.020) OS	50	10.500 ~ 10.518 (0.4134 ~ 0.4141)	11.500 ~ 11.518 (0.4528 ~ 0.4535)	

Item	Oversize [mm (in)]	Size mark	Valve guide outer diameter [mm (in)]		Remarks
			1.0	1.6 & 2.0	
Valve guide	STD	-	10.050 ~ 11.060 (0.3957 ~ 0.3961)	11.050 ~ 11.060 (0.4350 ~ 0.4354)	
	0.05 (0.002) OS	5	10.100 ~ 10.110 (0.3976 ~ 0.3980)	11.100 ~ 11.110 (0.4370 ~ 0.4374)	
	0.25 (0.010) OS	25	10.300 ~ 10.310 (0.4055 ~ 0.4059)	11.300 ~ 11.310 (0.4449 ~ 0.4453)	
	0.50 (0.020) OS	50	10.550 ~ 10.560 (0.4154 ~ 0.4157)	11.550 ~ 11.560 (0.4547 ~ 0.4551)	

2. Mechanical system

(2) VALVE SEAT RING

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



② Enlarge the seat ring hole of cylinder head so that matches the specified cylinder head hole inner diameter of new valve seat ring.

③ Heat the cylinder head to about 250°C(480°F) and press-fit an oversize seat ring for the cylinder head hole size.

④ Using lapping compound, lap the valve to the new seat.

2. Mechanical system

VALVE SEAT RING OVERSIZE

Item	Over size [mm (in.)]	Size mark	inner diameter of cylinder head [mm (in)]		
			1.0	1.6	2.0
Intake of head	STD	-	24.000 ~ 24.021 (0.949 ~ 0.9457)	30.400 ~ 30.421 (1.1968 ~ 1.1977)	33.000 ~ 33.025 (1.2992 ~ 1.300)
	0.3(0.012)OS	30	24.300 ~ 24.321 (0.9567 ~ 0.9575)	30.700 ~ 30.721 (1.2087 ~ 1.2095)	33.300 ~ 33.325 (1.3110 ~ 1.3120)
	0.6(0.024)OS	60	24.600 ~ 24.621 (0.9685 ~ 0.9693)	31.000 ~ 31.021 (1.2205 ~ 1.2213)	33.600 ~ 33.625 (1.3228 ~ 1.3238)
Exhaust of head	STD	-	29.000 ~ 29.021 (1.1417 ~ 1.1426)	27.000 ~ 27.021 (1.0630 ~ 1.0638)	28.500 ~ 28.521 (1.1220 ~ 1.1228)
	0.3(0.012)OS	30	29.300 ~ 29.321 (1.1535 ~ 1.1544)	27.300 ~ 27.321 (1.0748 ~ 1.0756)	28.800 ~ 28.021 (1.1338 ~ 1.1346)
	0.6(0.024)OS	60	29.600 ~ 29.621 (1.1654 ~ 1.1662)	27.600 ~ 27.621 (1.0866 ~ 1.0874)	29.100 ~ 29.121 (1.1456 ~ 1.1465)

2. Mechanical system

VALVE SEAT RING OVERSIZE

Item	Over size [mm (in.)]	Size mark	Seat ring outer diameter [mm (in)]		
			1.0	1.6	2.0
Intake	STD	-	24.125 ~ 24.145 (1.2004 ~ 1.2010)	30.490 ~ 30.505 (1.2004 ~ 1.2010)	33.09 ~ 33.105 (1.2004 ~ 1.2010)
	0.3(0.012) OS	30	24.425 ~ 24.445 (1.2122 ~ 1.2128)	30.790 ~ 30.805 (1.2122 ~ 1.2128)	33.39 ~ 33.405 (1.2122 ~ 1.2128)
	0.6(0.024) OS	60	24.725 ~ 24.745 (1.2240 ~ 1.2246)	31.090 ~ 31.105 (1.2240 ~ 1.2246)	33.69 ~ 33.705 (1.2240 ~ 1.2246)
Exhaust	STD	-	29.125 ~ 29.145 (1.0667 ~ 1.0675)	27.095 ~ 27.115 (1.0667 ~ 1.0675)	28.59 ~ 28.605 (1.0667 ~ 1.0675)
	0.3(0.012) OS	30	29.425 ~ 29.445 (1.0785 ~ 1.0793)	27.395 ~ 27.415 (1.0785 ~ 1.0793)	28.89 ~ 28.905 (1.0785 ~ 1.0793)
	0.6(0.024) OS	60	29.725 ~ 29.745 (1.0904 ~ 1.0911)	27.695 ~ 27.715 (1.0904 ~ 1.0911)	29.19 ~ 29.205 (1.0904 ~ 1.0911)

2. Mechanical system

VALVE SEAT RING OVERSIZE

Item	Over size [mm (in.)]	Size mark	Seat ring height [mm (in)]		
			1.0	1.6	2.0
Intake	STD	-	5.900 ~ 6.100 (0.1890 ~ 0.1969)	4.800 ~ 5.000 (0.1890 ~ 0.1969)	7.200 ~ 7.400 (0.1890 ~ 0.1969)
	0.3(0.012) OS	30	6.200 ~ 6.300 (0.2008 ~ 0.2087)	5.100 ~ 5.300 (0.2008 ~ 0.2087)	7.500 ~ 7.700 (0.2008 ~ 0.2087)
	0.6(0.024) OS	60	6.500 ~ 6.700 (0.2126 ~ 0.2205)	5.400 ~ 5.600 (0.2126 ~ 0.2205)	7.800 ~ 8000 (0.2126 ~ 0.2205)
Exhaust	STD	-	5.900 ~ 6.100 (0.1890 ~ 0.1969)	5.900 ~ 6.100 (0.2323 ~ 0.2402)	7.600 ~ 7.800 (0.2323 ~ 0.2402)
	0.3(0.012) OS	30	6.200 ~ 6.300 (0.2008 ~ 0.2087)	6.200 ~ 6.400 (0.2441 ~ 0.2520)	7.900 ~ 8.100 (0.2441 ~ 0.2520)
	0.6(0.024) OS	60	6.500 ~ 6.700 (0.2126 ~ 0.2205)	6.500 ~ 6.700 (0.2559 ~ 0.2638)	8.200 ~ 8.400 (0.2559 ~ 0.2638)

2. Mechanical system

3) INSTALLATION

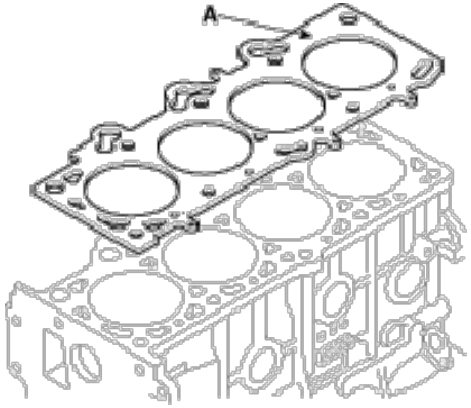
NOTE

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

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

NOTE

Be careful of the installation direction.



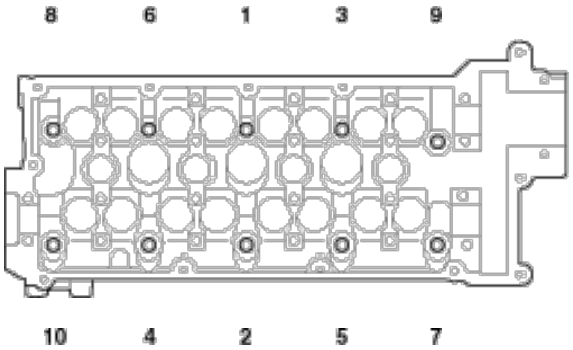
(2) Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.

2. Mechanical system

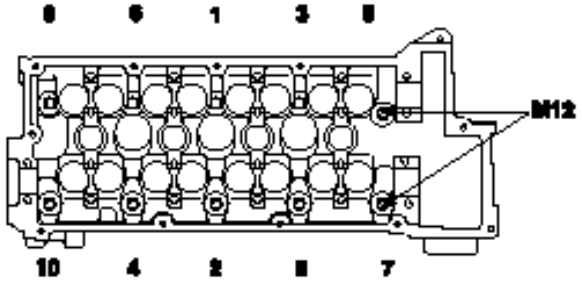
(3) Install the cylinder head bolts.

(1) Apply a light coat if engine oil on the threads and under the heads of the cylinder head bolts.

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



1.0 & 1.6



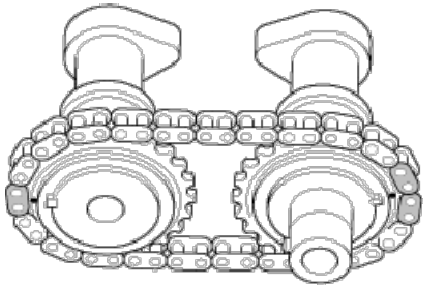
2.0

Engine	Tightening torque
1.0	When cold: 60 ~ 70N.m (6.0 ~ 7.0kgf.m, 43 ~ 51.0lb-ft) When hot: 70 ~ 75N.m (7.0 ~ 7.5kgf.m, 51 ~ 54.0lb-ft)
1.6	29.4N.m (3.0kgf.m, 21.7lb-ft) + 90° → Release all bolts → 29.4N.m (3.0kgf.m, 21.7lb-ft) + 90° Tightening torque
2.0	M10: 25N.m + (2.5kgf.m , 18lb-ft) + (60˚ ~ 65˚) + (60˚ ~ 65˚) M12: 30N.m + (3.0kgf.m , 22lb-ft) + (60˚ ~ 65˚) + (60˚ ~ 65˚)

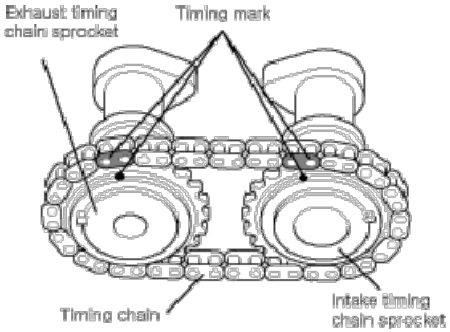
2. Mechanical system

(4) Install the camshafts.

Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

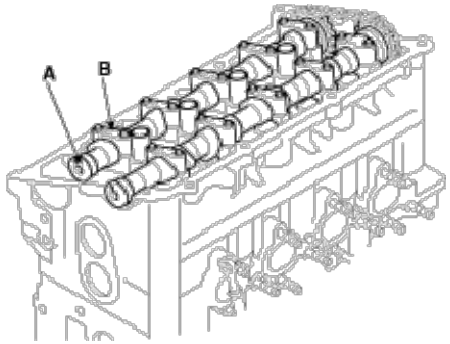


1.6 ENGINE



2.0 ENGINE

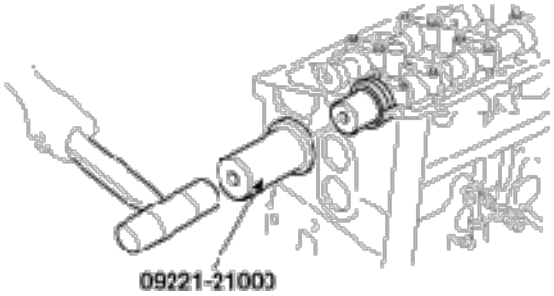
(5) Install the camshaft (A) and bearing caps (B).



Engine	Tightening torque
1.0	----------
1.6	11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)
2.0	14 ~ 15N.m (1.4 ~ 1.5kgf.m, 10 ~ 11lb-ft)

2. Mechanical system

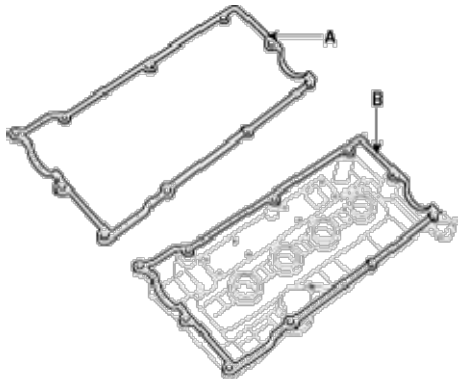
(6) Using the SST (09221 - 21000), install the camshaft bearing oil seal.



(7) Install the camshaft sprocket.

(8) Install the cylinder head cover.

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



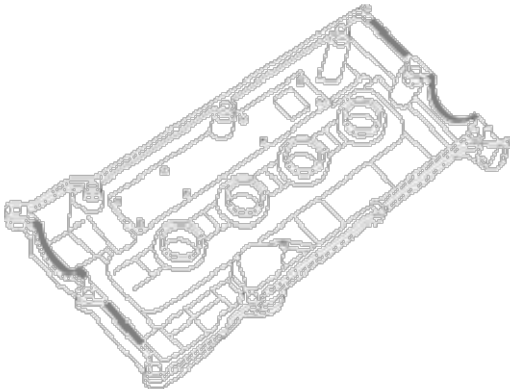
NOTE

1.Before installing the cylinder head cover gasket, thoroughly clean the cylinder head cover and the groove.

2. When installing, make sure the cylinder head cover gasket is seated securely in the corners of the recesses with no gap.

2. Mechanical system

② Apply liquid gasket to the head cover gasket at the corners of the recess.



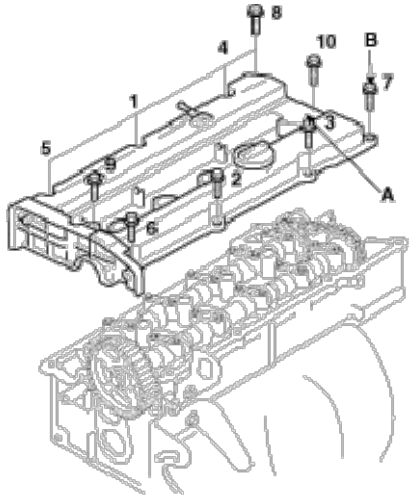
NOTE

1. Use liquid gasket, loctite No. 5999.
2. Check that the mating surfaces are clean and dry before applying liquid gasket.
3. After assembly, wait at least 30 minutes before filling the engine with oil.

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

① Pre-tighten all bolts by 3.9~4.9N.m (0.4~0.5kgf.m, 2.9~3.6lb-ft) and then tighten by the specified torque

② Tightening torque :7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



(10) Install the timing belt.

(11) Install the intake manifold.

(12) Install the exhaust manifold.

(13) Install the ignition coil.

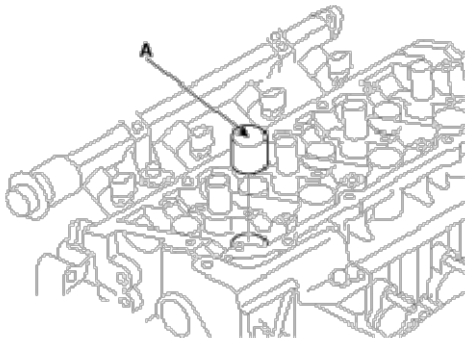
2. Mechanical system

4) DISASSEMBLY

NOTE

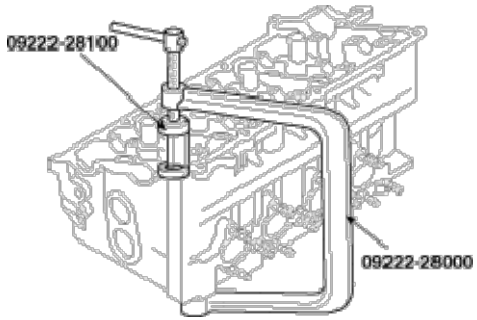
Identify HLA (Hydraulic Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

(1) Remove the HLAs (A).



(2) Remove the valves.

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



② Remove the spring retainer.

③ Remove the valve spring.

④ Remove the valve.

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

⑥ Using a magnetic finger, remove the spring seat.

2. Mechanical system

5) INSPECTION

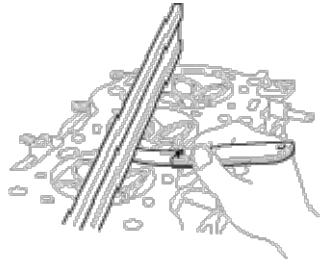
(1) CYLINDER HEAD

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.

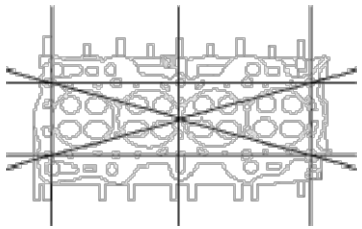
Flatness of cylinder head gasket surface Standard

	1.0	1.6	2.0
max	0.05mm(0.002in)	0.03mm (0.0012in)	0.03mm (0.0012in)
limit	0.1mm(0.004in)	0.05mm (0.0020in)	0.06mm (0.0024in)



Flatness of manifold mating surface Standard

	1.0	1.6	2.0
max	0.15mm (0.0059in)	0.15mm (0.0059in)	0.15mm (0.0059in)
limit	0.3mm (0.0012in)	0.20mm (0.0079in)	0.3mm (0.012in)



② Inspect for cracks.

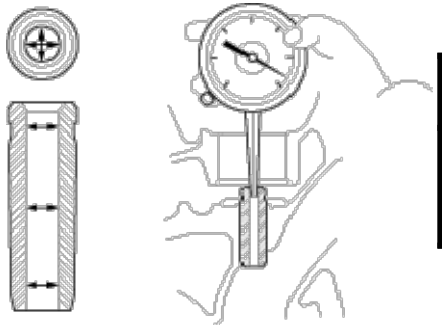
Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

2. Mechanical system

(2) VALVE AND VALVE SPRING

① Inspect the valve stems and valve guides.

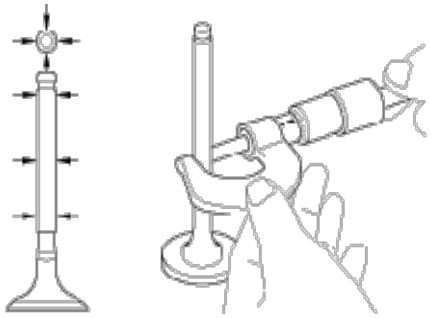
- Using a caliper gauge, measure the inner diameter of valve guide.



Valve guide inner diameter

1.0	1.6 & 2.0
5.5000 ~ 5.512mm (0.2362 ~ 0.2368in)	6.000 ~ 6.015mm (0.2362 ~ 0.2368in)

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



Valve stem outer diameter

	1.0	1.6	2.0
Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in)	5.955 ~ 5.970mm (0.2344 ~ 0.2350in)	5.965 ~ 5.980mm (0.2348 ~ 0.2354in)
Exhaust	5.430 ~ 5.45mm (0.2137 ~ 0.2145in)	5.935 ~ 5.950mm (0.2337 ~ 0.2343in)	5.930 ~ 5.950mm (0.2337 ~ 0.2343in)

2. Mechanical system

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

Valve stem- to-guide clearance

		1.0	1.6	2.0
Standard	Intake	0.02 ~ 0.047mm (0.0008 ~ 0.0019in)	0.03 ~ 0.06mm (0.0012 ~ 0.0024in)	0.02 ~ 0.05mm (0.0008 ~ 0.0020in)
	Exhaust	0.05 ~ 0.082mm (0.0020 ~ 0.0032in)	0.05 ~ 0.08mm (0.0020 ~ 0.0031in)	0.035 ~ 0.065mm (0.0014 ~ 0.0026in)
Limit	Intake	0.10mm (0.0039in)	0.10mm (0.0039in)	0.10mm (0.0039in)
	Exhaust	0.15mm (0.0059in)	0.15mm (0.0059in)	0.3 mm (0.0051in)

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

2. Mechanical system

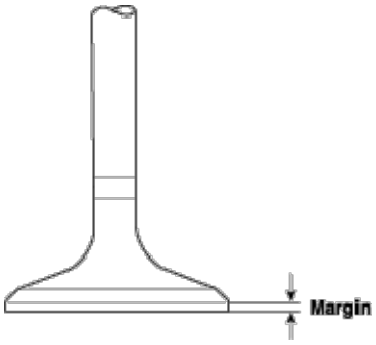
② **Inspect the valves.**

- Check the valve is ground to the correct valve face angle.
- Check that the surface of valve for wear. If the valve face is worn, replace the valve.
- Check the valve head margin thickness.

  If the margin thickness is less than minimum, replace the valve.

Margin

		1.0	1.6	2.0
Standard	Intake	1.1mm (0.0433in)	1.1mm (0.0433in)	1.15 mm(0.0452in)
	Exhaust	1.2mm (0.0472in)	1.3mm (0.0512in)	1.35 mm(0.0531in)
Limit	Intake	0.5 mm(0.0196in)	0.8mm (0.0315in)	0.8 mm (0.0315in)
	Exhaust	0.9 mm(0.0354in)	1.0mm (0.0394in)	1.0 mm (0.0394in)



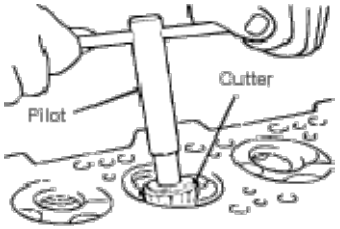
- Check the surface of valve stem tip for wear.

  If the valve stem tip is worn, replace the valve.

2. Mechanical system

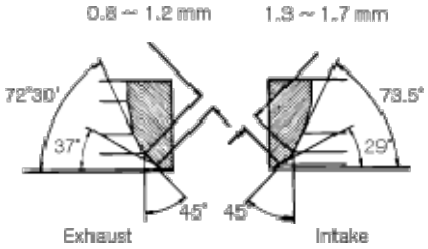
③ **Inspect the valve seats.**

-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.



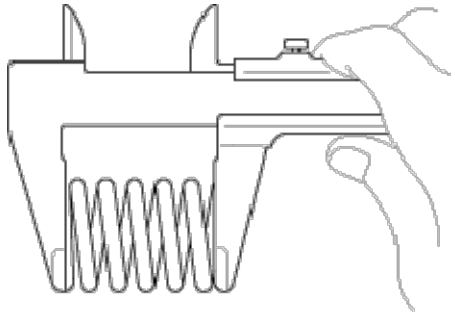
④ Inspect the valve springs.

- Using a steel square, measure the out-of-square of valve spring.
- Using a vernier calipers, measure the free length of valve spring.

Valve spring Standard

	1.0	1.6	2.0
Free height	40.5mm (1.5945in)	44mm (1.7323in)	48.86mm (1.9236in)
Load	15.6kg/32.0mm (34.4lb/1.2598in) 33.3kg/24.5mm (73.4lb/0.9646in)	21.6kg/35.0mm (47.6lb/1.3780in) 45.1kg/27.2mm (99.4lb/1.0709in)	18.3kg/39mm (40.3lb/1.535in)
Out of square	Less than 1.5°Limit Out	Less than 1.5°Limit Out	Less than 1.5°Limit Out

2. Mechanical system



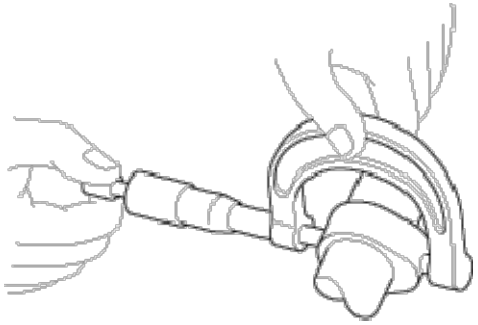
If the loads is not as specified, replace the valve spring.

(3) CAMSHAFT

① Inspect the cam lobes.
② Using a micrometer, measure the cam lobe height.

Cam height

	Intake	Exhaust
1.0	33.941 ~ 34.141mm (1.3363 ~ 1.3441in)	34.055 ~ 34.255mm(1.3407 ~ 1.3486in)
1.6	43.348 ~ 43.548mm (1.7066 ~ 1.7145in)	43.748 ~ 43.948mm(1.7223 ~ 1.7302in)
2.0	42.9 ~ 43.1mm (1.6889 ~ 1.6968in)	42.9 ~ 43.1mm (1.6889 ~ 1.6968in)

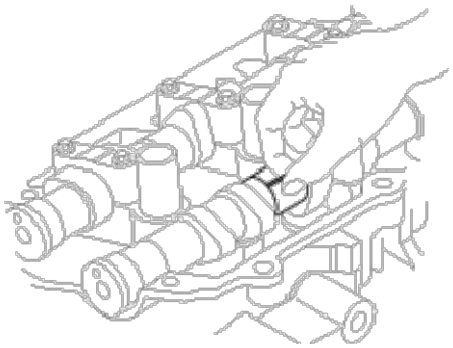


If the cam lobe height is less than specified, replace the camshaft.

2. Mechanical system

③ Inspect the camshaft journal clearance.

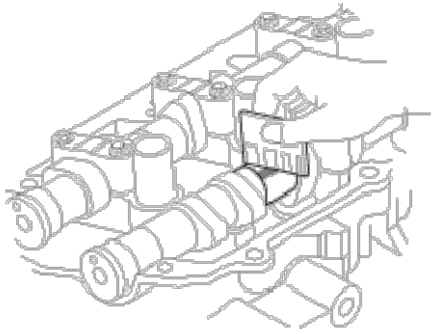
- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of plastic gauge across each of the camshaft journal.



- Install the bearing caps and tighten the bolts with specified torque.

CAUTION
Do not turn the camshaft.

- Remove the bearing caps.
- Measure the plastic gauge at its widest point.



Bearing oil clearance Standard

1.0	0.045 ~ 0.085mm (0.0018 ~ 0.0033in)
1.6	0.035 ~ 0.072mm (0.0014 ~ 0.0028in)
2.0	0.02 ~ 0.061mm (0.0008 ~ 0.0024in)

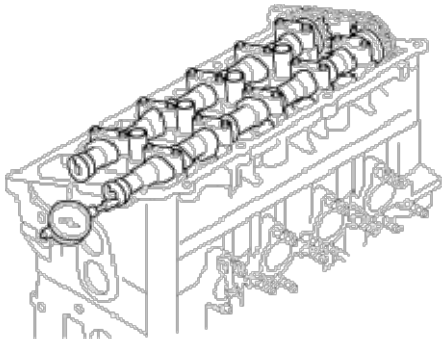
2. Mechanical system

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

- Completely remove the plastic gage.
- Remove the camshafts.

④ Inspect the camshaft end play.

- Install the camshafts.
- Using a dial indicator, measure the end play while moving the camshaft back and forth.
- Camshaft end play Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)
- Remove the camshafts.

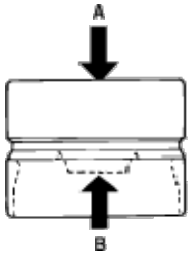


If the end play is greater than specified, replace the camshaft.
If necessary, replace the bearing caps and cylinder

2. Mechanical system

(4) HLA (HYDRAULIC LASH ADJUSTER):1.6 & 2.0

① With the HLA filled with engine oil,
hold A and press B by hand. If B moves, replace the HLA.



② For other specific trouble shooting regarding HLA, refer to the table below.

No.	Problem	Possible cause	Action
1	Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2	Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure Chamber on the HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2,000~3,000 rpm. If it doesn't disappear, refer to step 7 below.
3	Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4	Continuous noise when the engine is started after excessively cranking the engine by the starter motor.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA.	**CAUTION** **Do not run engine at a speed higher than 3,000 rpm, as this may damage the HLA.**
5	Continuous noise when the engine is running after changing the HLA.		

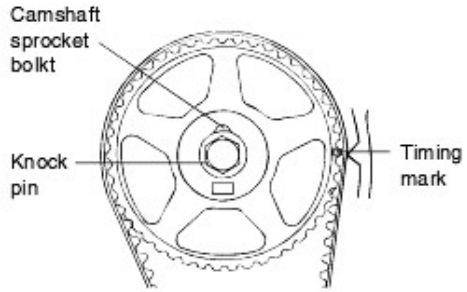
2. Mechanical system

No.	Problem	Possible cause	Action
6	Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
		Excessive amount of air in the oil at high engine speed.	Check oil supply system.
7	Noise continues for more than 15 minutes.	Deteriorated oil.	Check oil quality. If deteriorated, replace with specified type.
		Low oil pressure	Check oil pressure and oil supply system of each part of engine.
		Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA. **CAUTION** **Be careful with the hot HLAs.**

2. Mechanical system

VALVE CLEARANCE ADJUSTABLE PROCEDURE(1.0 eng)

1. Warm up engine.
2. Remove rocker cover.
3. Turn crankshaft to normal direction (right turn at engine front view) stop it at No.1 compression top dead center, shown in fig. Valve clearance adjustable at No.1 compression top dead center.



CYLINDER NO.	1	2	3	4
INTAKE	0	0		
EXHAUST	0		0	

4. Insert clearance gauge between rocker arm adjusting screw and valve stem end. Then fix screw with lock nut after adjusting valve clearance.

	INTAKE	EXHAUST
Standard Clearance (Warm,80 ~95℃)	0.22mm~0.28mm	0.27mm~0.33mm
Reference Clearance (Cold, 20℃)	0.15mm~0.21mm	0.19mm~0.25mm

5. Turn crankshaft just one revolution to normal direction (right turn at engine front view) stop it at No.4 compression top dead center.
   Insert clearance gauge between rocker arm adjusting screw and valve stem end.
   Then fix screw with lock nut after adjusting valve clearance.
   Valve clearance adjustable at No.4 compression top dead center.

CYLINDER NO.	1	2	3	4
INTAKE			0	0
EXHAUST		0		0

2. Mechanical system

6) REASSEMBLY

NOTE

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

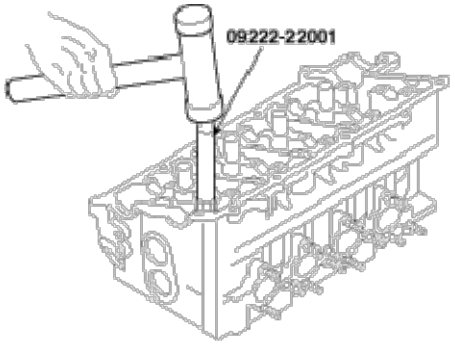
(1) Install the valves.

① Install the spring seats.

② Using the SST (09222 - 22001), push in a new oil seal.

NOTE

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



③ Install the valve, valve spring and spring retainer.

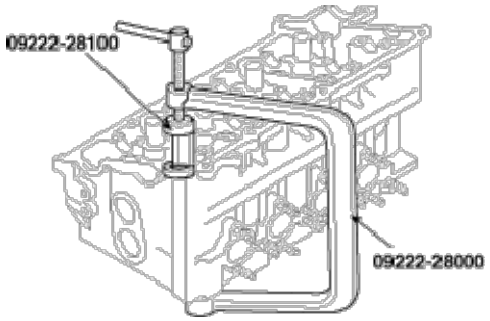
NOTE

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

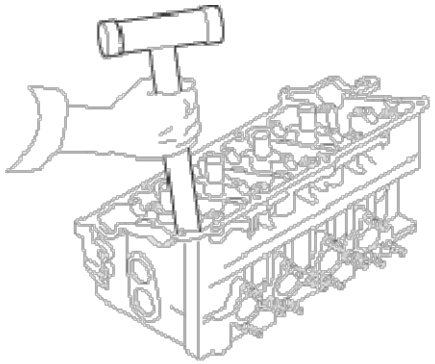
2. Mechanical system

④ Using the SST(09222 - 28000, 09222 - 28100), compress the spring and install the retainer locks.

⑤ After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



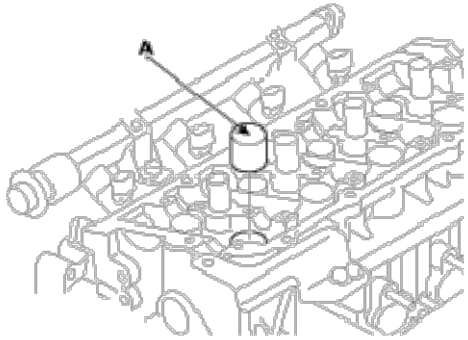
⑥ Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



2. Mechanical system

(2) Install the HLA (Hydraulic Lash Adjuster)s.

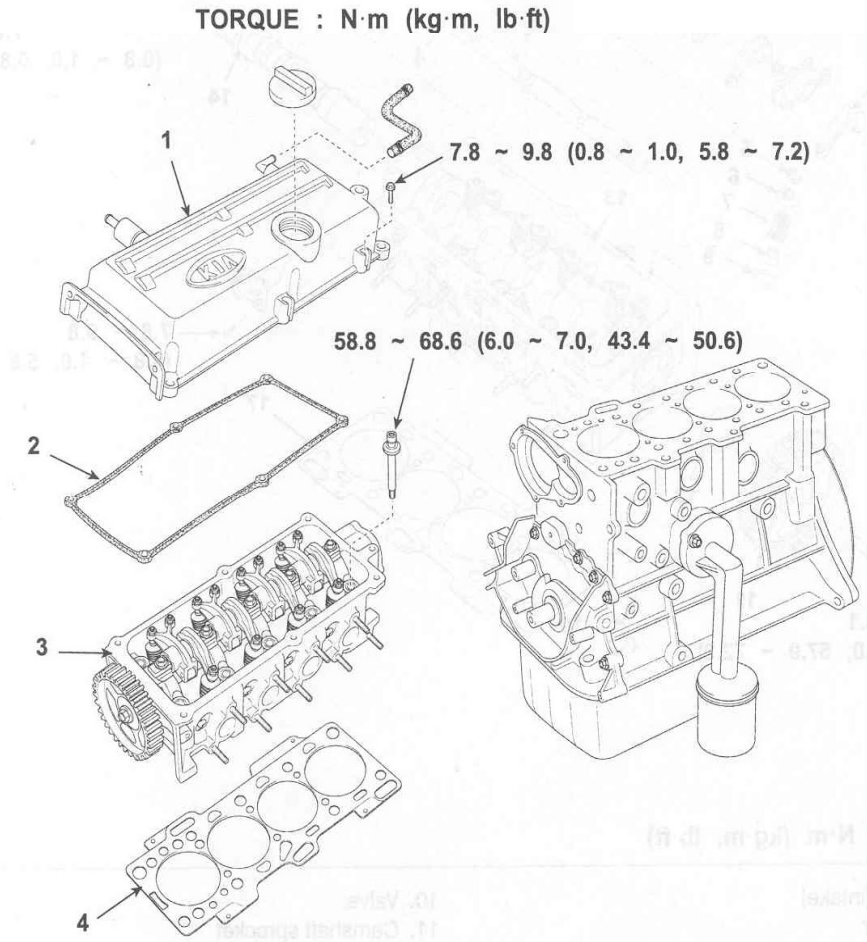
(3) Check that the HLA rotates smoothly by hand.



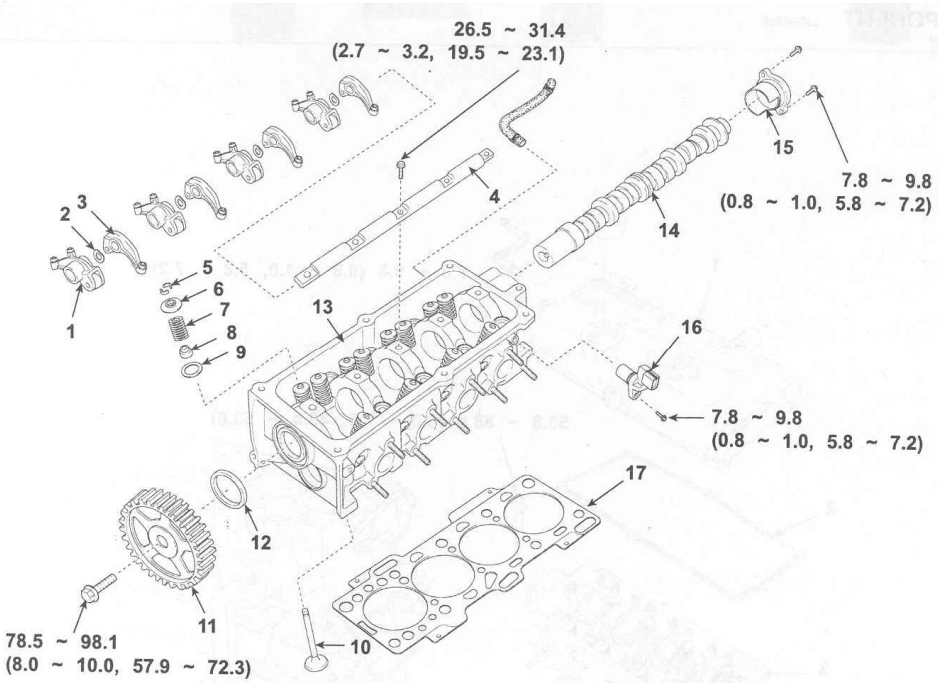
2. Mechanical system

4. Cylinder block

COMPONENTS (1.0 eng)



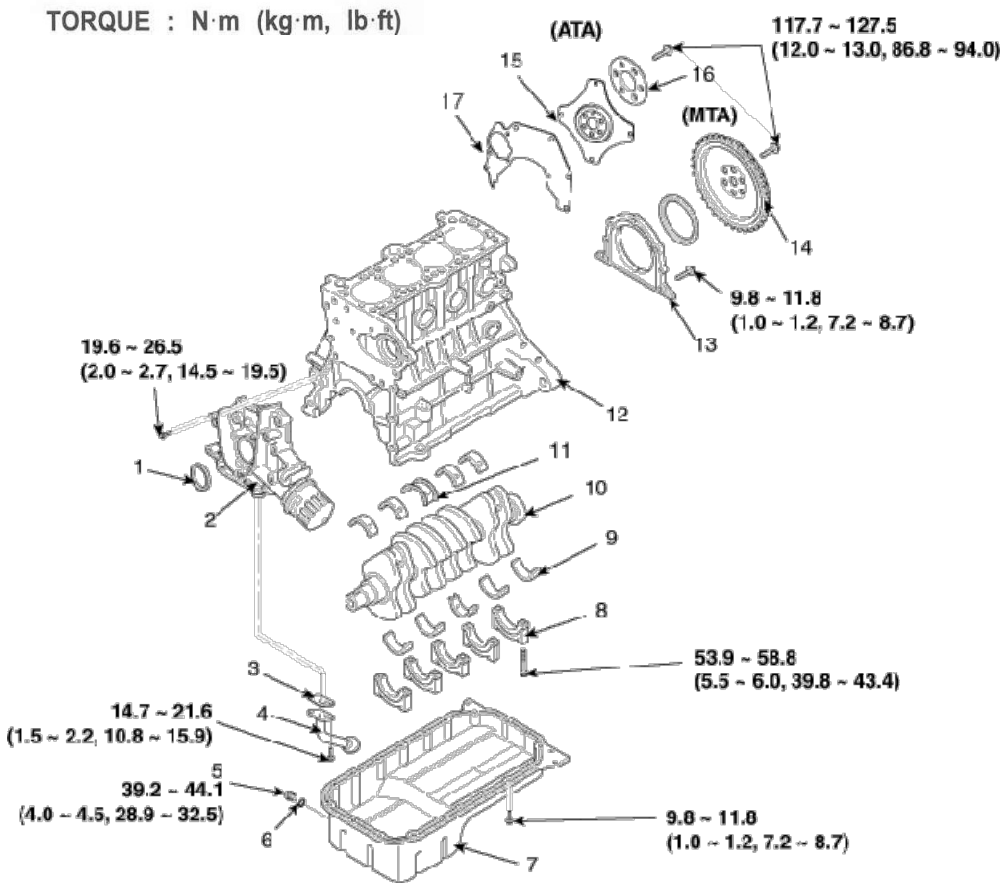
1. Cylinder head cover
2. Cylinder head cover gasket
3. Cylinder head assembly
4. Cylinder head gasket

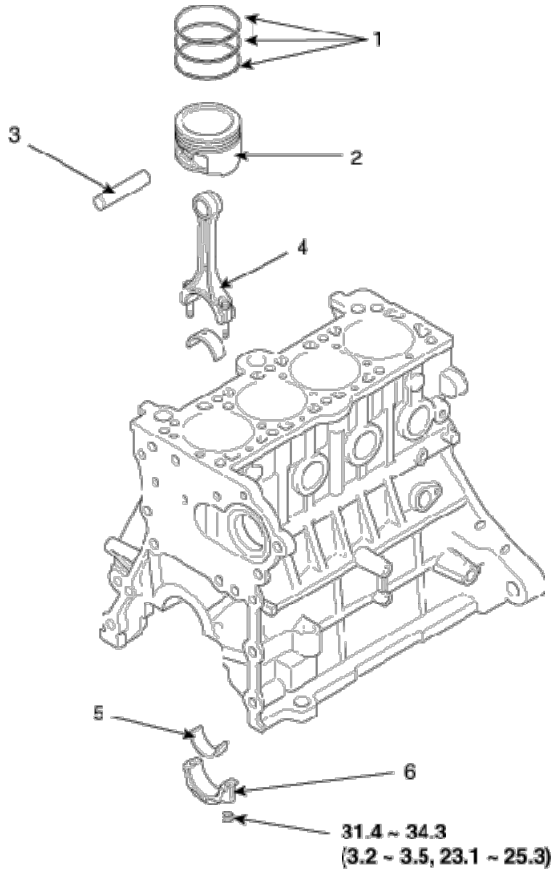


1. Rocker arm (intake)
2. Wave washer
3. Rocker arm (exhaust)
4. Rocker arm shaft
5. Retainer lock
6. Retainer
7. Valve spring
8. Stem seal
9. Spring seat
10. Valve
11. Camshaft sprocket
12. Camshaft oil seal
13. Cylinder head
14. Camshaft
15. Camshaft thrust cap
16. Camshaft position sensor
17. Cylinder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

2. Mechanical system

COMPONENTS (1.6 eng)



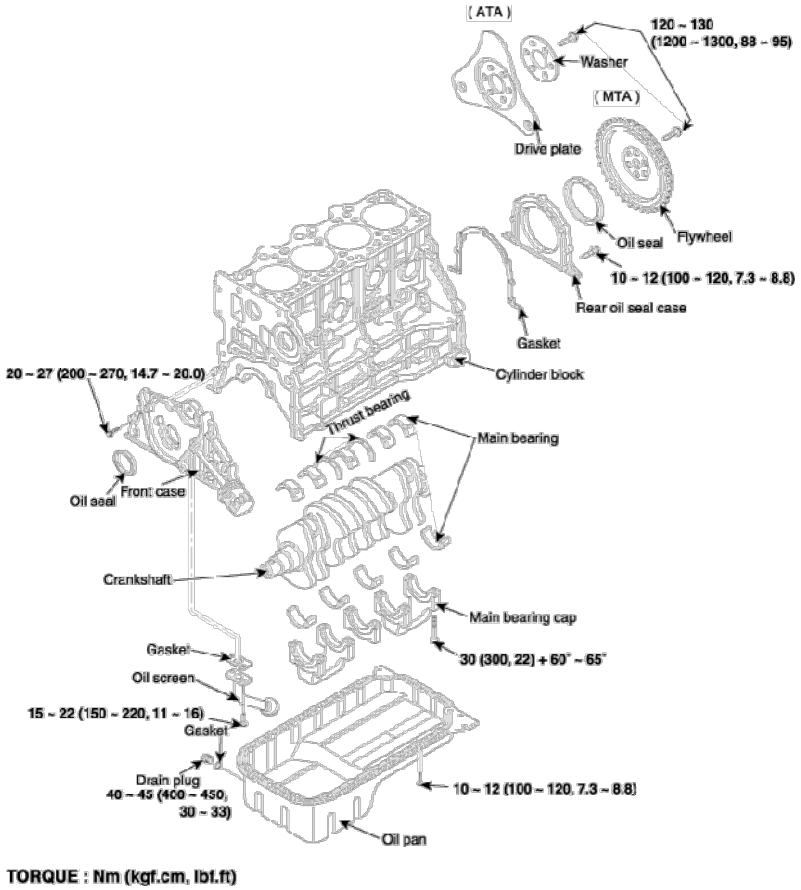


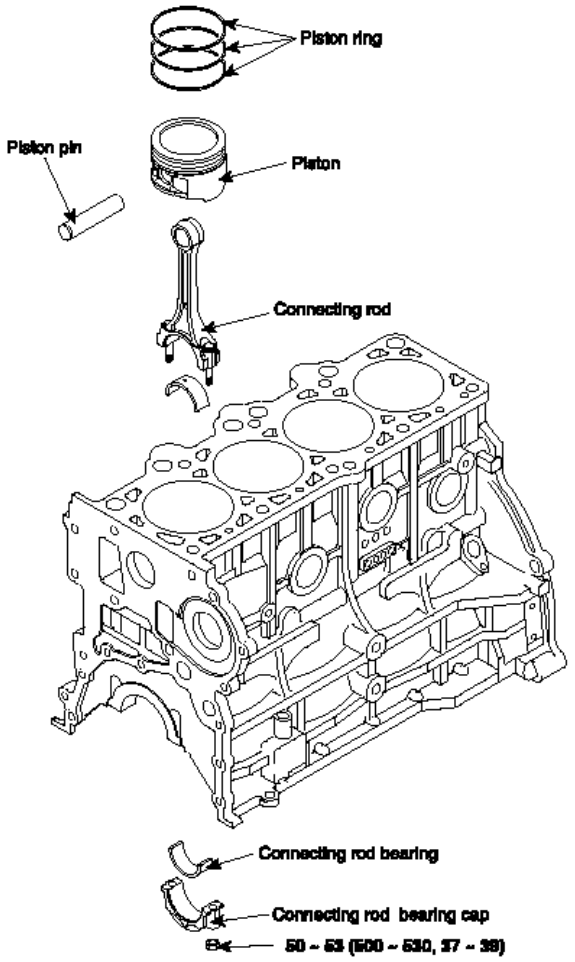
1. Oil seal
2. Front case
3. Gasket
4. Oil screen
5. Drain plug
6. Gasket
7. Oil pan
8. Main bearing cap
9. Main bearing
10. Crankshaft
11. Center bearing
12. Cylinder block
13. Rear oil seal case
14. Flywheel
15. Drive plate
16. Washer
17. Rear plate

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

2. Mechanical system

COMPONENTS (2.0 eng)

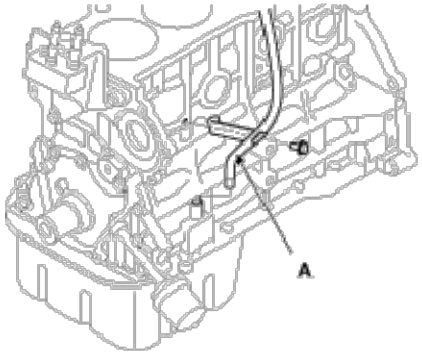




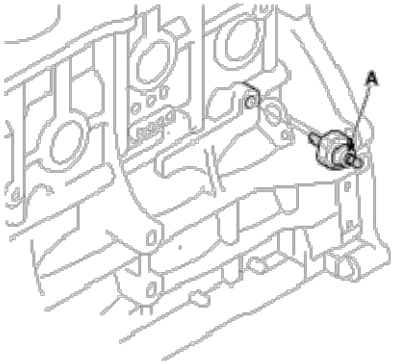
2. Mechanical system

1) DISASSEMBLY

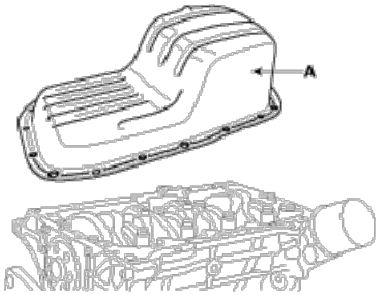
(1) Remove the timing belt.
(2) Remove the cylinder head.
(3) Remove the oil level gauge tube (A).



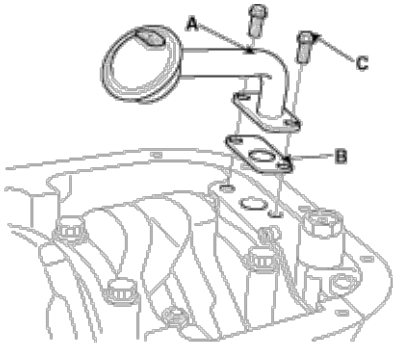
(4) Remove the oil pressure switch (A).



(5) Remove the water pump.
(6) Remove the oil pan (A).



(7) Remove the oil screen.

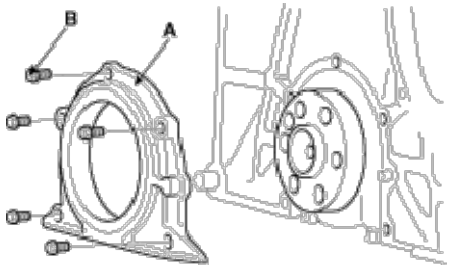


2. Mechanical system

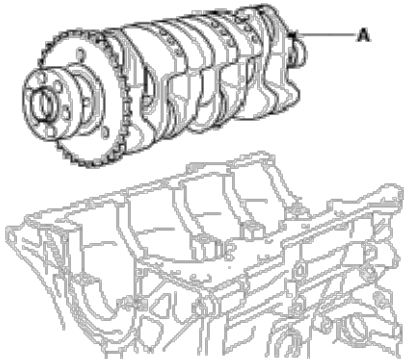
(8) Check the connecting rod end play.
(9) Remove the connecting rod caps and check oil clearance.
(10) Remove the piston and connecting rod assemblies.
① Using a ridge reamer, remove all the carbon from the top of the cylinder.
② Push the piston, connecting rod assembly and upper bearing through the top of the Cylinder block.

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

(11) Remove the front case.
(12) Remove the rear oil seal case.
(13) Remove the 5 bolts (B) and rear oil seal case (A).



(14) Remove the crankshaft bearing cap and check oil clearance.
(15) Check the crankshaft end play.
(16) Lift the crankshaft (A) out of the engine, being careful not to damage journals.



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

2. Mechanical system

(17) 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.

(18) Remove the piston rings.

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

NOTE

Arrange the piston rings in the correct order only.

(19) Remove the connecting rod from the piston.

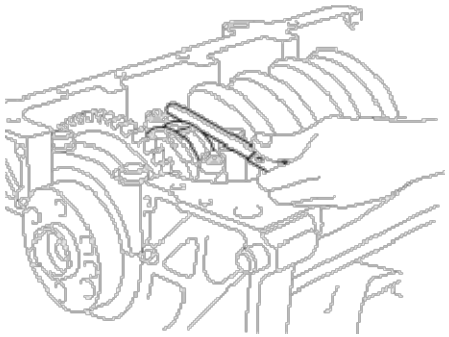
Using a press, remove the piston pin from piston.
(Press-in load : 500 ~ 1,500kg(1,102 ~ 3,306lb))

2) INSPECTION

(1) CONNECTING ROD AND CRANKSHAFT

① Check the connecting rod end play.
Using feeler gauge, measure the end play while moving the connecting rod back and forth.

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



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

② Check the connecting rod bearing oil clearance.
- Check the match marks on the connecting rod and cap are aligned to ensure correct reassembly.
- Remove the 2 connecting rod cap nuts.
- Remove the connecting rod cap and lower bearing.
- Clean the crankshaft pin journal and bearing.
- Place a plastic gauge across the crankshaft pin journal.
- Reinstall the lower bearing and cap, and tighten the nuts.

Engine	Tightening torque
1.0	20 ~ 23N.m (2.0 ~ 2.3kgf.m, 15 ~ 17lb-ft)
1.6	32 ~ 35N.m (3.2 ~ 3.5kgf.m, 24 ~ 26lb-ft)
2.0	50 ~ 53N.m (5.0 ~ 5.3kgf.m, 36 ~ 39lb-ft)

2. Mechanical system

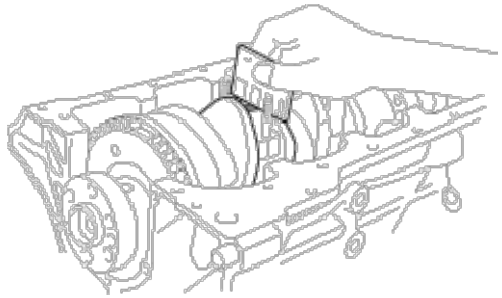
NOTE

Do not turn the crankshaft.

③ Remove the 2nuts, connecting rod cap and lower bearing .

④ Measure the plastic gauge at its widest point.

Engine	Standard oil clearance
1.0	0.012 ~ 0.041mm (0.0004 ~ 0.0016in)
1.6	0.018 ~ 0.036mm (0.0007 ~ 0.0014in)
2.0	0.024 ~ 0.044mm (0.0009 ~ 0.0017in)



⑤ If the plastic gauge measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. Recheck the oil clearance.

NOTE

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

⑤ If the plastic gauge shows the clearance is still incorrect, try the next larger or smaller bearing. Recheck the oil clearance.

NOTE

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.

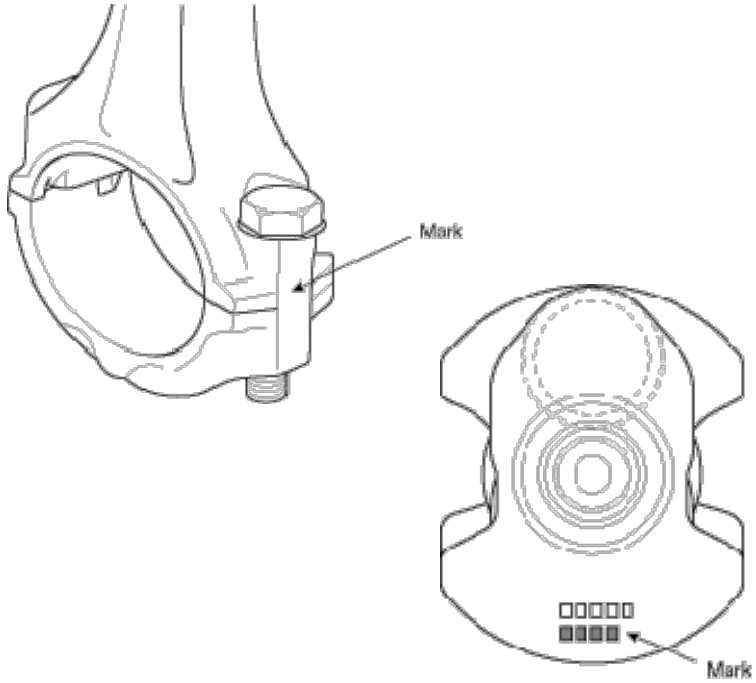
2. Mechanical system

Connecting rod mark location

- Discrimination of connecting rod

Connecting rod big-end inner diameter

Mark	1.0	1.6 & 2.0
	41.000 ~ 41.015 mm (1.6141 ~ 1.6147 in)	
A	-	48.000 ~ 48.006mm (1.8898 ~ 1.8900in)
B	-	48.006 ~ 48.012mm (1.8900 ~ 1.8902in)
C	-	48.012 ~ 48.018mm (1.8902 ~ 1.8905in)



Crankshaft pin journal mark location

- Discrimination of crankshaft pin journal

Crankshaft pin journal outer diameter

Mark	1.0
A	41.994 ~ 42.0mm (1.6533 ~ 1.6535in)
B	41.988 ~ 41.994mm (1.6530 ~ 1.6533in)
C	41.988 ~ 41.992mm (1.6530 ~ 1.6532in)

Mark	1.6
^	44.966 ~ 44.972mm (1.7703 ~ 1.7705in)
b	44.960 ~ 44.966mm (1.7701 ~ 1.7703in)
c	44.954 ~ 44.960mm (1.7698 ~ 1.7701in)

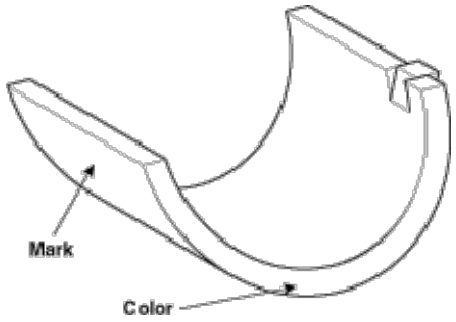
Mark	2.0
1	44.960 ~ 44.966mm (1.7700 ~ 1.7703in)
2	44.952 ~ 44.960mm (1.7697 ~ 1.7700in)
3	44.946 ~ 44.952mm (1.7695 ~ 1.7697in)

2. Mechanical system

Connecting rod bearing mark location

Discrimination of connecting rod bearing

Mark	Color	Connecting rod bearing thickness	
		1.0	1.6 & 2.0
AA	Blue	-	1.514 ~ 1.517mm (0.0596 ~ 0.0597in)
A	Black	1.498 ~ 1.501mm (0.0590 ~ 0.0591in)	1.511 ~ 1.514mm (0.0595 ~ 0.0596in)
B	None	1.494 ~ 1.497mm (0.0588 ~ 0.0589in)	1.508 ~ 1.511mm (0.0594 ~ 0.0595in)
C	Green	1.490 ~ 1.493mm (0.0587 ~ 0.0588in)	1.505 ~ 1.508mm (0.0593 ~ 0.0594in)
D	Yellow	-	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)



2. Mechanical system

⑥ Select the bearing by using selection table

Connecting rod bearing selection table

1.0 engine		
Crank shaft pin journal mark	Connecting rod bearing mark	Oil clearance
A	C (yellow)	0.014 ~ 0.041mm (0.0006 ~ 0.0016in)
B	B (none)	0.012 ~ 0.041mm (0.0005 ~ 0.0016in)
C	A (blue)	0.012 ~ 0.039mm (0.0005 ~ 0.0015in)

1.6 engine				
		Connecting rod mark		
		A	B	C
Crank shaft pin journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (Blue)
Oil clearance		0.018 ~ 0.036 mm(0.0007 ~ 0.0014in)		

2.0 engine					
		Connecting rod mark			Oil clearance
		A	B	C	
Crank shaft pin journal mark	1	D (Yellow)	C (Green)	B (None)	0.024 ~ 0.042 mm (0.0009 ~ 0.0016 in)
	2	C (Green)	B (None)	A (Black)	0.024 ~ 0.044 mm (0.0009 ~ 0.0017 in)
	3	B (None)	A (Black)	AA (Blue)	0.026 ~ 0.044 mm (0.0010 ~ 0.0017 in)

2. Mechanical system

(2) Check the crankshaft bearing oil clearance

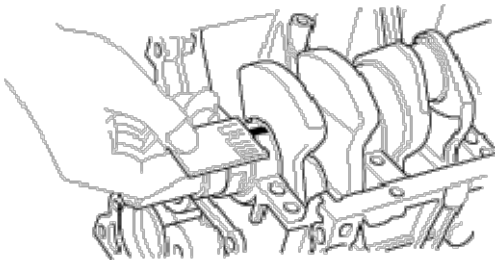
① To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
② Clean each main journal and lower bearing with a clean shop towel.
③ Place one strip of plastic gauge across each main journal.
④ Reinstall the lower bearings and caps, then tighten the bolts.

Engine	Tightening torque
1.0	50 ~ 55N.m (5.0 ~ 5.5kgf.m, 37 ~ 41.0lb-ft)
1.6	55 ~ 60N.m (5.5 ~ 6.0kgf.m, 41 ~ 44lb-ft)
2.0	27 ~ 33N.m + 60˚ ~ 65˚(2.7 ~ 3.3kgf.m + 60˚ ~ 65˚, 20 ~ 24lb-ft + 60˚ ~ 65˚)

NOTE
Do not turn the crankshaft.

⑤ Remove the cap and lower bearing again, and measure the widest part of the plastic gauge.

Engine	Standard oil clearance
1.0	0.020 ~ 0.038mm(0.0008 ~ 0.0015in)
1.6	0.022 ~ 0.040mm(0.0009 ~ 0.0016in)
2.0	0.028 ~ 0.046mm(0.0011 ~ 0.0018in)



2. Mechanical system

⑥ If the plastic gauge measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. Recheck the oil clearance.

CAUTION

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

⑦ If the plastic gauge shows the clearance is still incorrect, try the next larger or smaller bearing. Recheck the oil clearance.

NOTE

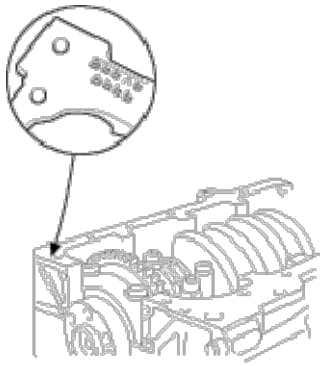
If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

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.

Cylinder block crankshaft journal bore mark location

Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores. Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.

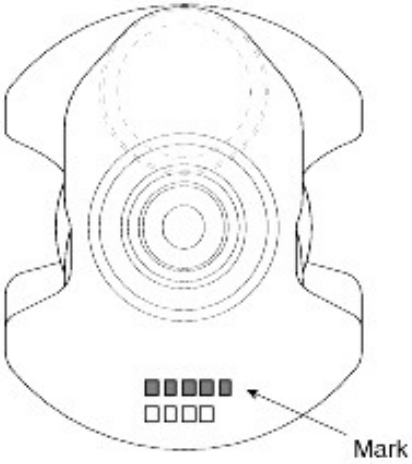


Discrimination of cylinder block crankshaft journal bore

Mark	Cylinder block crankshaft journal bore inner diameter		
	1.0	1.6	2.0
A	46.000 ~ 46.006mm (1.8110 ~ 1.8113in)	54.000 ~ 54.006mm (2.1260 ~ 2.1262in)	59.000 ~ 59.006mm (2.3228 ~ 2.3230in)
B	46.006 ~ 46.012mm (1.8113 ~ 1.8115in)	54.006 ~ 54.012mm (2.1262 ~ 2.1265in)	59.006 ~ 59.012mm (2.3230 ~ 2.3233in)
C	46.012 ~ 46.018mm (1.8115 ~ 1.8117in)	54.012 ~ 54.018mm (2.1265 ~ 2.1267in)	59.012 ~ 59.018mm (2.3233 ~ 2.3235in)

2. Mechanical system

Crankshaft main journal mark location
- Discrimination of crankshaft main journal



1.0 engine		
mark	color	Crankshaft main journal outer diameter
Ⅰ	yellow	41.994 ~ 42.000mm (1.6533 ~ 1.6535in)
Ⅱ	none	41.998 ~ 41.994mm (1.6531 ~ 1.6533in)
Ⅲ	white	41.982 ~ 41.998mm (1.6528 ~ 1.6531in)

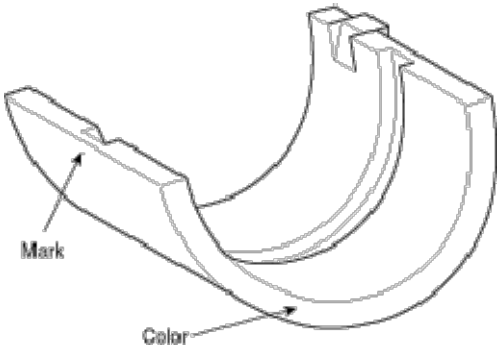
1.6 engine	
Mark	Crankshaft main journal outer diameter
^	49.962 ~ 49.968mm (1.9670 ~ 1.9672in)
b	49.956 ~ 49.962mm (1.9668 ~ 1.9670in)
c	49.950 ~ 49.956mm (1.9665 ~ 1.9668in)

2.0 engine		
class	mark	Crankshaft main journal outer diameter
Ⅰ	yellow	54.956 ~ 54.962mm (2.1636 ~ 2.1638in)
Ⅱ	none	54.950 ~ 54.956mm (2.1633 ~ 2.1636in)
Ⅲ	white	54.944 ~ 54.950mm (2.1631 ~ 2.1633in)

2. Mechanical system

Crankshaft main bearing mark location

- Discrimination of crankshaft main bearing



1.0 engine		
Mark	Color	Crankshaft main bearing thickness
A	Blue	1.999 ~ 2.002 mm (0.0793 ~ 0.0794 in)
B	Black	1.996 ~ 1.999 mm (0.0792 ~ 0.0793 in)
C	None	1.993 ~ 1.996 mm (0.0791 ~ 0.0792 in)
D	Green	1.990 ~ 1.993 mm (0.0789 ~ 0.0791 in)
E	Pink	1.987 ~ 1.990 mm (0.0788 ~ 0.0789 in)

1.6 engine			
Mark	Color	Crankshaft main bearing thickness	
		No.1, 2, 4, 5	No. 3
AA	Blue	2.014 ~ 2.017 mm (0.0793 ~ 0.0794 in)	2.011 ~ 2.014 mm (0.0792 ~ 0.0793 in)
A	Black	2.011 ~ 2.014 mm (0.0792 ~ 0.0793 in)	2.008 ~ 2.011 mm (0.0791 ~ 0.0792 in)
B	None	2.008 ~ 2.011 mm (0.0791 ~ 0.0792 in)	2.005 ~ 2.008 mm (0.0789 ~ 0.0791 in)
C	Green	2.005 ~ 2.008 mm (0.0789 ~ 0.0791 in)	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in)
D	Yellow	2.002 ~ 2.005 mm (0.0788 ~ 0.0789 in)	1.999 ~ 2.002 mm (0.0787 ~ 0.0788 in)

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

2. Mechanical system

⑧ Select the bearing by using selection table.

- Crankshaft main bearing selection table

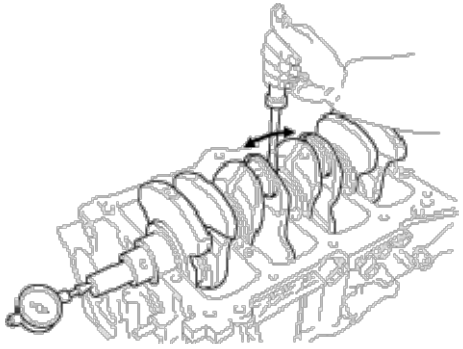
			Cylinder block crankshaft journal bore mark					
			1.0 Engine			2.0 Engine		
	mark	color	A	B	C	a(A)	b(B)	c(C)
Crank shaft main journal mark	Ⅰ	yellow	E (Pink)	D (Green)	C (yellow)	D (yellow)	C (Green)	B (None)
	Ⅱ	none	D (Green)	C (yellow)	B (None)	C (Green)	B (None)	A (BLACK)
	Ⅲ	white	C (yellow)	B (None)	A (Blue)	B (None)	A (BLACK)	AA (Blue)

		Cylinder block crankshaft journal bore mark		
		1.6 Engine		
	mark	^	b	c
Crank shaft Main journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (Blue)

2. Mechanical system

(3) Check the crankshaft end play.

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

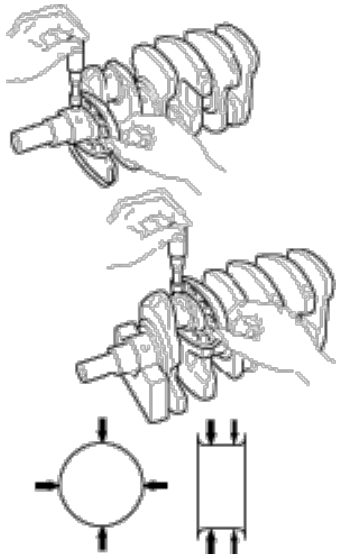


Engine	Standard end play
1.0	0.05 ~ 0.25mm(0.0023 ~ 0.010in)
1.6	0.05 ~ 0.175mm(0.0023 ~ 0.0068in)
2.0	0.06 ~ 0.26mm(0.0023 ~ 0.010in)

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

(4) Inspect the crankshaft main journals and pin journals.

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



Engine	Main journal diameter
1.0	41.982 ~ 42.000mm (1.6528 ~ 1.6535in)
1.6	49.950 ~ 49.968mm (1.9665 ~ 1.9672in)
2.0	54.944 ~ 54.962mm (2.1631 ~
Engine	**Pin journal diameter**
1.0	37.980 ~ 38.000mm (1.4953 ~ 1.4961in)
1.6	44.954 ~ 44.972mm (1.7698 ~ 1.7705in)
2.0	44.946 ~ 44.966mm (1.7695 ~ 1.7703in)

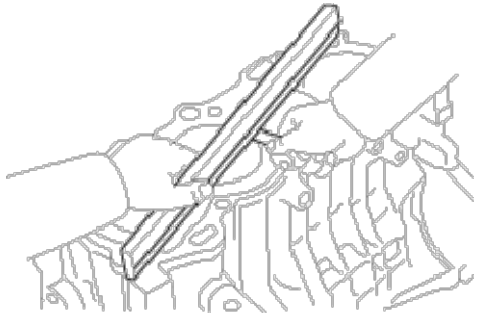
2. Mechanical system

(5) CYLINDER BLOCK

① Remove the gasket material.
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

② Clean the cylinder block
Using a soft brush and solvent, thoroughly clean the cylinder block.

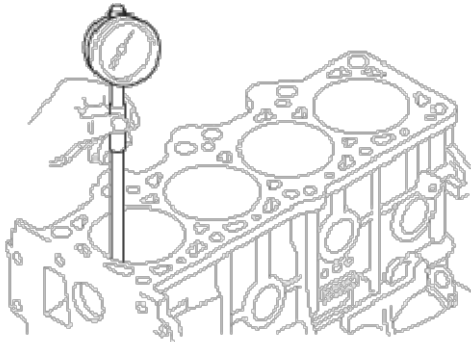
③ Inspect the top surface of cylinder block for flatness.
Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.



Flatness of cylinder block gasket surface Standard
: Less than 0.05mm (0.0020in)

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

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

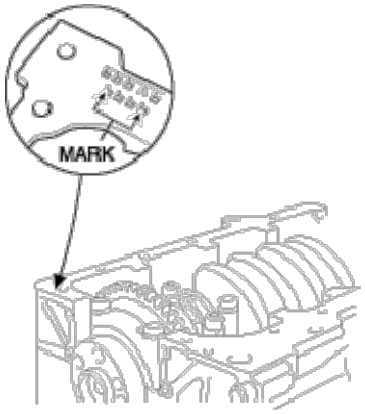


Engine	Standard diameter
1.0	66.00 ~ 66.03mm (2.599 ~ 2.600in)
1.6	76.50 ~ 76.53mm (3.0118 ~ 3.0130in)
2.0	82.0 ~ 82.03mm (3.2283 ~ 3.2295in)

2. Mechanical system

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

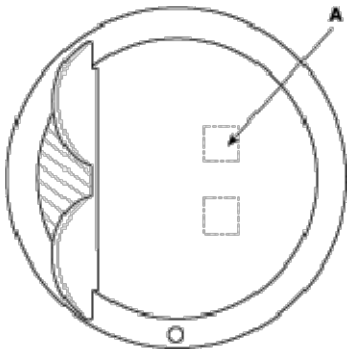
- Discrimination of cylinder bore size



Mark	Cylinder bore inner diameter		
	1.0	1.6	2.0
A	66.00 ~ 66.01mm (2.5984 ~ 2.5988in)	76.50 ~ 76.51mm (3.0118 ~ 3.0122in)	82.00 ~ 82.011mm (3.2283 ~ 3.2287in)
B	66.01 ~ 66.02mm (2.5988 ~ 2.5992in)	76.51 ~ 76.52mm (3.0122 ~ 3.0126in)	82.01 ~ 82.02mm (3.2287 ~ 3.2291in)
C	66.02 ~ 66.03mm (2.5992 ~ 2.5996in)	76.52 ~ 76.53mm (3.0126 ~ 3.0130in	82.02 ~ 82.03mm (3.2291 ~ 3.2295in)

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

- Discrimination of piston outer diameter



Mark	Piston outer diameter		
	1.0	1.6	2.0
A	65.97 ~ 65.98mm (2.5972 ~ 2.5976in)	76.47 ~ 76.48mm (3.0106 ~ 3.0110in)	81.97 ~ 81.98mm (3.2271 ~ 3.2275in)
none	65.98 ~ 65.99mm (2.5976 ~ 2.5980in)		
B		76.48 ~ 76.49mm (3.0110 ~ 3.0114in)	81.98 ~ 81.99mm (3.2275 ~ 3.2279in)
C	65.99 ~ 66.00mm (2.5980 ~ 2.5984in)	76.49 ~ 76.50mm (3.0114 ~ 3.0118in)	81.89 ~ 82.00mm (3.2279 ~ 3.2283in)

2. Mechanical system

⑧ Select the piston related to cylinder bore class.
Piston -to-cylinder clearance :0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

(6) Boring cylinder

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

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

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

③ According to the measured O.D (Outer Diameter), calculate the new bore size.
New bore size = piston O.D + 0.02 to 0.04mm (0.0008 to 0.0016in)
(clearance between piston and cylinder) - 0.01mm (0.0004in) (honing margin.)

④ Bore each of the cylinders to the calculated size.

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

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

⑥ Check the clearance between the piston and cylinder.
Standard : 0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

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

2. Mechanical system

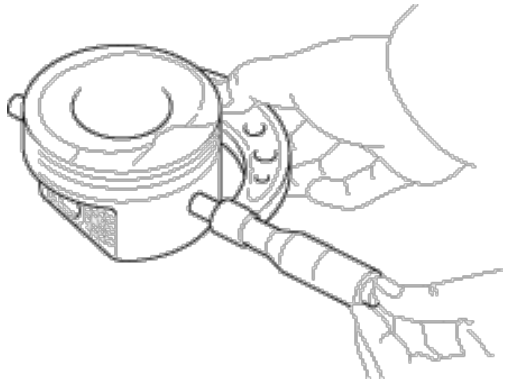
(7) PISTON AND PISTON RINGS

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

NOTE
Do not use a wire brush.

② The standard measurement of the piston outside diameter from top land of the piston.

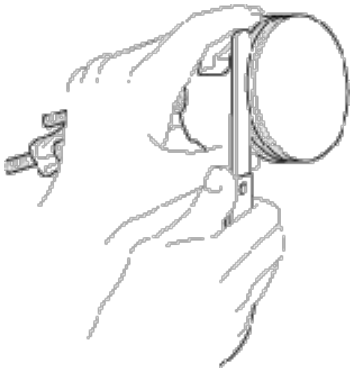
Engine	Standard diameter
1.0	65.97 ~ 66.00mm (2.5972 ~ 2.5984in)
1.6	76.47 ~ 76.50mm (3.0106 ~ 3.0118in)
2.0	81.97 ~ 82.00mm (3.2271 ~ 3.2283in)



③ Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.
Piston-to-cylinder clearance :0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

2. Mechanical system

④ Inspect the piston ring side clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of ring groove.



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

Engine	NO	Piston ring side clearance	Limit
1.0	NO.1	0.03 ~ 0.07mm (0.001 ~ 0.003in)	0.1mm (0.0039in)
	NO.2	0.02 ~ 0.06mm (0.0007 ~ 0.0024n)	
1.6	NO.1	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)	
	NO.2	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)	
2.0	NO.1	0.04 ~ 0.08mm (0.0015 ~ 0.0031in)	
	NO.2	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)	

Engine	oil ring side clearance	Limit
1.0	0.03 ~ 0.07mm (0.001 ~ 0.003in)	0.1mm (0.0039in)
1.6	0.08 ~ 0.175mm (0.0031 ~ 0.0069in)	
2.0	0.02 ~ 0.06mm (0.0078 ~ 0.0236in)	

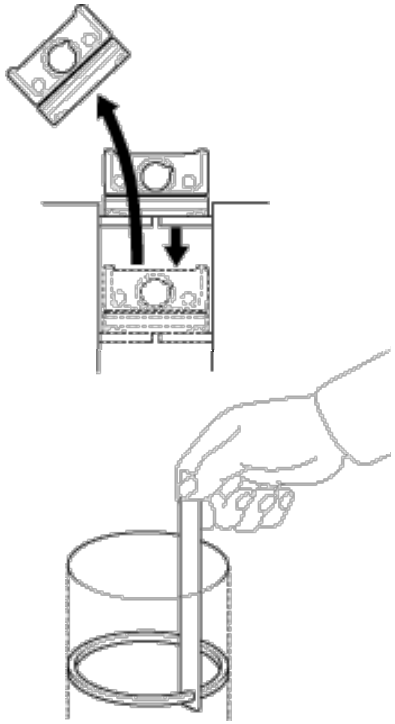
2. Mechanical system

⑤ Inspect the piston ring end gap.

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

Engine	NO	Piston ring End gap	Limit
1.0	NO. 1	0.03 ~ 0.07mm (0.001 ~ 0.003in)	0.1mm (0.0039in)
	NO. 2	0.02 ~ 0.06mm(0.0007 ~ 0.0024n)	
1.6	NO. 1	0.15 ~ 0.30mm(0.0059 ~ 0.0033in)	
	NO. 2	0.35 ~ 0.50mm(0.0138 ~ 0.0197in)	
2.0	NO. 1	0.23 ~ 0.38mm (0.0091 ~ 0.0150in)	
	NO.		

Engine	Oil ring End gap	Limit
1.0	0.03 ~ 0.07mm (0.001 ~ 0.003in)	0.1mm (0.0039in)
1.6	0.20 ~ 0.70mm (0.0079 ~ 0.0276in)	
2.0	0.02 ~ 0.06mm (0.0078 ~ 0.0236in)	

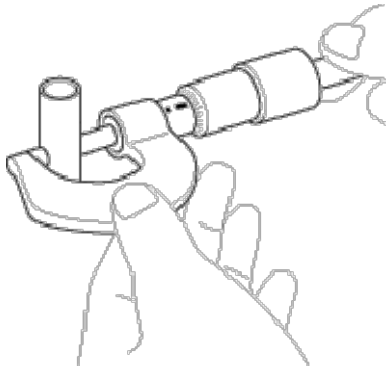


2. Mechanical system

(8) PISTON PINS

① Measure the outer diameter of piston pin

Engine	Piston pin diameter
1.0	17.000 ~ 17.003mm (0.6693 ~ 0.6694in)
1.6	18.001 ~ 18.007mm (0.7087 ~ 0.7089in)
2.0	20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



② Measure the piston pin-to-piston clearance.

Engine	Piston pin-to-piston clearance
1.0	0.008 ~ 0.014mm (0.0003 ~ 0.0006in)
1.6	0.011 ~ 0.018mm (0.0004 ~ 0.0007in)
2.0	0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

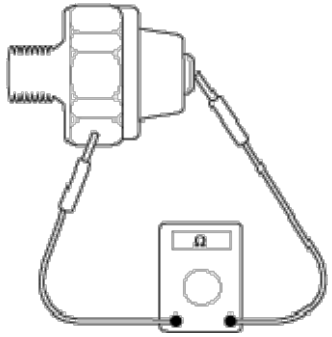
③ Check the difference between the piston pin outer diameter and the connecting rod small end inner diameter.

Engine	Piston pin-to-connecting rod interference
1.0	-0.029 ~ -0.015mm (-0.0011 ~ -0.0006in)
1.6	-0.033 ~ -0.016mm (-0.0013 ~ -0.0006in)
2.0	-0.032 ~ -0.016mm (-0.0012 ~ -0.0006in)

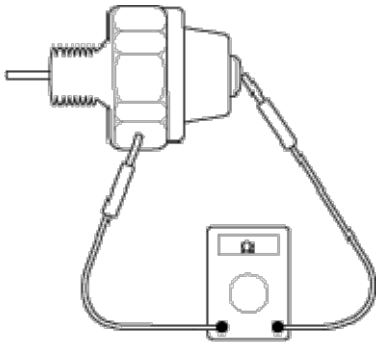
2. Mechanical system

(9) OIL PRESSURE SWITCH

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



② Check the continuity between the terminal and the body when the fine wire is pushed.
If there is continuity even when the fine wire is pushed, replace the switch.



③ If there is no continuity when a 49.0kpa (0.5kg/cm², 7.1psi) vacuum is applied through the oil hole, the switch is operating properly.
Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

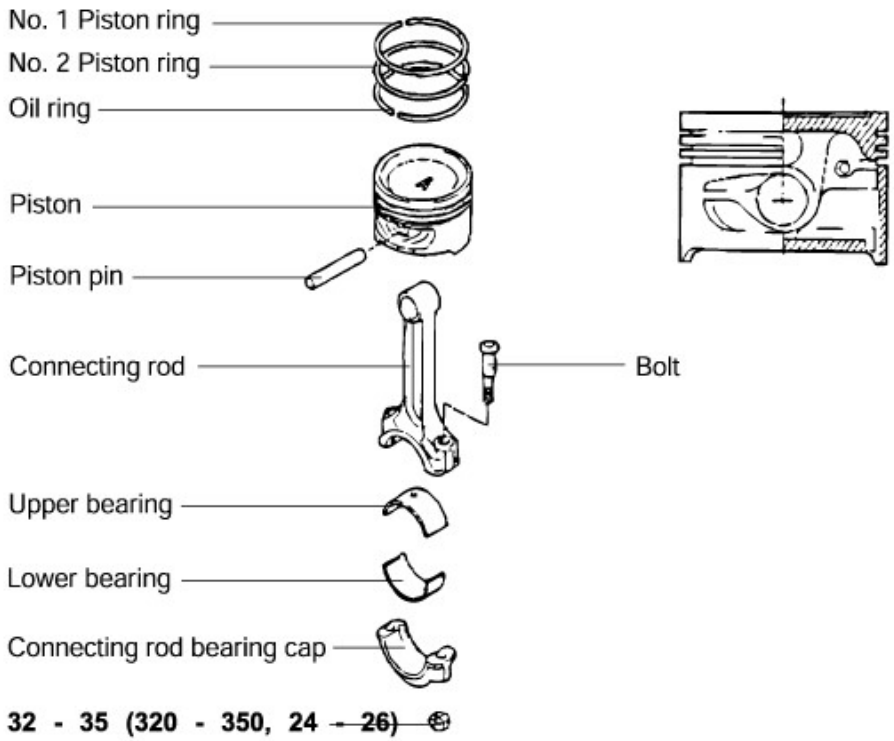
2. Mechanical system

3) REASSEMBLY

NOTE

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

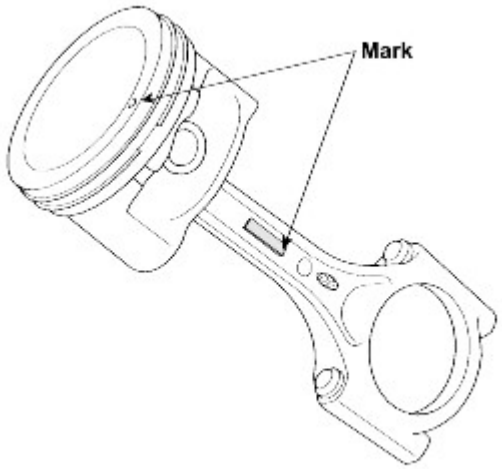
(1) Assemble the piston and connecting rod.



TORQUE : Nm (kg.cm, lb.ft)

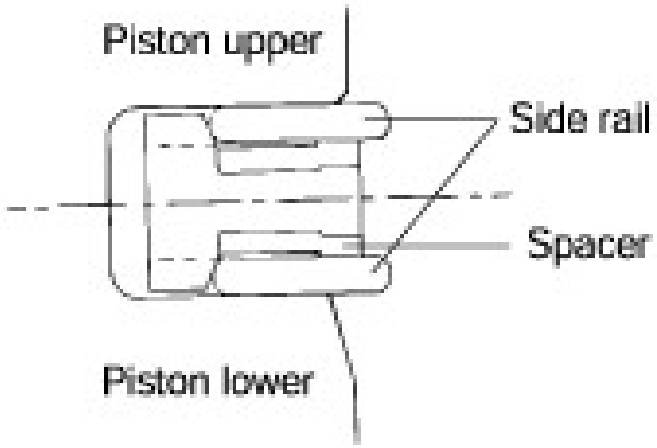
2. Mechanical system

① Use a hydraulic press for installation
② The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



(2) Install the piston rings.

① Install the spacer.

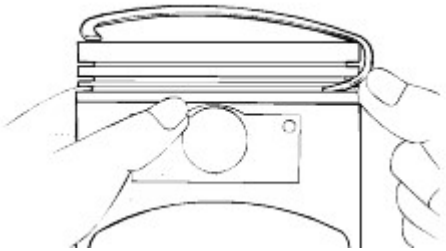


2. Mechanical system

② Install the upper side rail.
To install the side rail, first put one end of the side rail between the piston ring groove and spacer, hold it firmly, and press down with a finger on the portion to be inserted into the groove (as illustrated).

CAUTION
Do not use a piston ring expander when installing side rail.

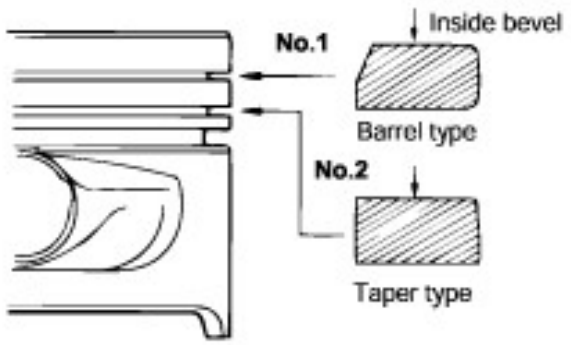
③ Install the lower side rail bv the same procedure described in Step 2.



④ Apply engine oil around the piston and piston grooves.

⑤ Using a piston ring expander, install the No.② piston ring.

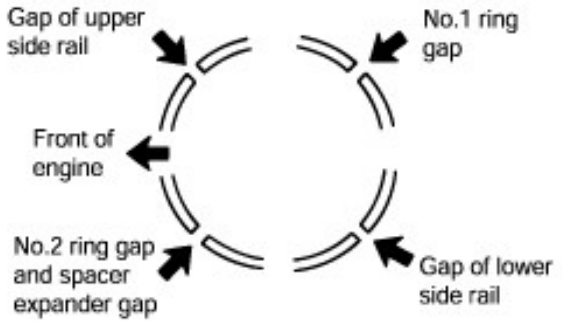
⑥ Install the No. 1 piston ring.



2. Mechanical system

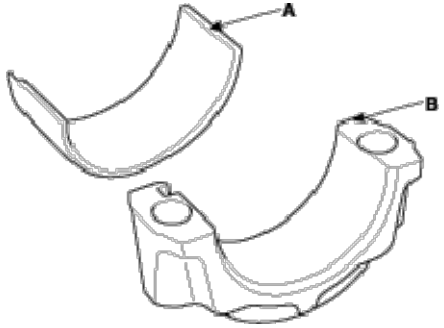
⑦ Position each piston ring end gap as far away from its neighboring gaps as possible.
Make sure that the gaps are not positioned in the thrust and pin directions.

⑧ Hold the piston rings firmly with a piston ring compressor as they are inserted into cylinder.



(3) Install the connecting rod bearings.

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



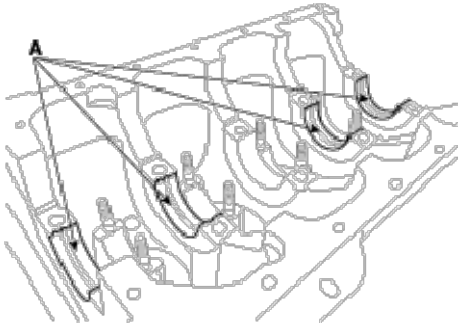
2. Mechanical system

(4) Install the crankshaft main bearings.

NOTE

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

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



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

(5) Install the center bearing.

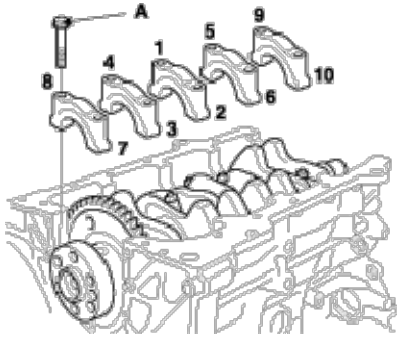
① Install the center bearing(A) under the No.3 journal
② position of the cylinder block with the oil grooves facing outward.

2. Mechanical system

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

NOTE
The main bearing cap bolts are tightened in 2 progressive steps.
If any of the bearing cap bolts in broken or deformed, replace it.

① Apply a light coat of engine oil on the threads and under the bearing cap bolts.
② Install and uniformly tighten the 10 bearing cap bolts (A), in several passes, in the sequence shown.



Engine	Tightening torque
1.0	50 ~ 55N.m (5.0 ~ 5.5kgf.m, 37 ~ 41.0lb-ft)
1.6	55 ~ 60N.m (5.5 ~ 6.0kgf.m, 41 ~ 44lb-ft)
2.0	27 ~ 33N.m + 60˚ ~ 65˚ (2.7 ~ 3.3kgf.m + 60˚ ~ 65˚, 20 ~ 24lb-ft + 60˚ ~ 65˚)

③ Check that the crankshaft turns smoothly.

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

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

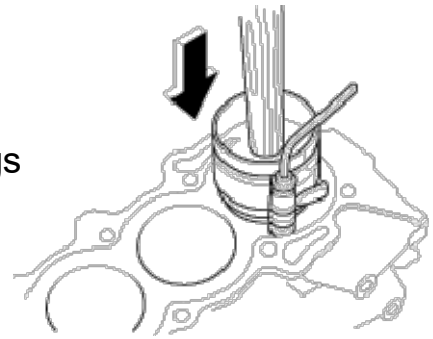
① Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
② Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.

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

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

Engine	Tightening torque
1.0	20 ~ 23N.m (2 ~ 2.3kgf.m, 15 ~ 17.0lb-ft)
1.6	32 ~ 35N.m (3.2 ~ 3.5kgf.m, 24 ~ 26lb-ft)
2.0	50 ~ 53N.m (5 ~ 5.3kgf.m, 36 ~ 39lb-ft)

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



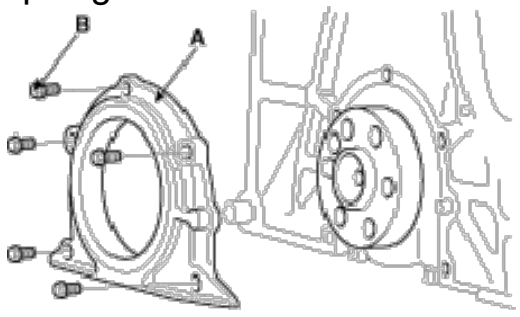
(11) Install the rear oil seal case.

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

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

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

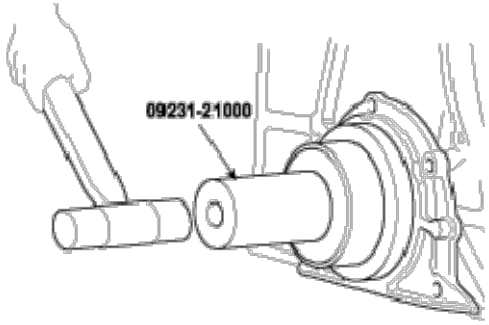
③ Install the rear oil seal case(A) with 5 bolts(B).
Tightening torque :9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



2. Mechanical system

(12) Install the rear oil seal.

① Apply engine oil to a new oil seal lip.
② Using the SST(09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

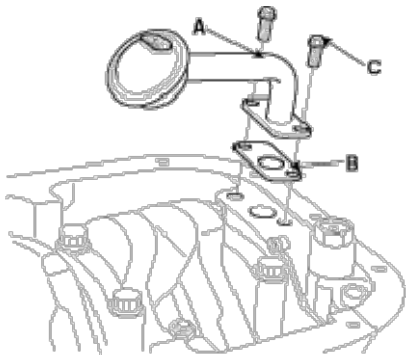


(13) Install the front case.

(14) Install the oil screen.

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

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



(15) Install the oil pan.

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

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

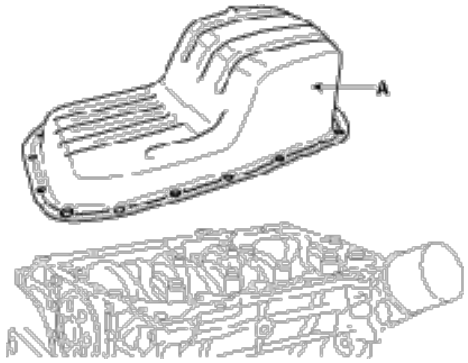
② Apply liquid gasket as an even bead, centered between the edges of the mating surface.

NOTE

1. To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
2. 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.
3. After assembly, wait at least 30 minutes before filling the engine with oil.

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

Engine	Tightening torque
1.0	6 ~ 8N.m (0.6 ~ 0.8kgf.m, 4 ~ 6lb-ft)
1.6 & 2.0	9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

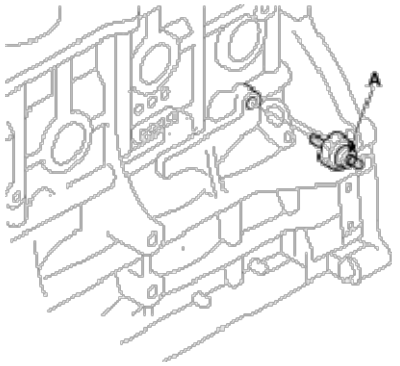


2. Mechanical system

(16) Install the water pump.

(17) Install the oil pressure switch.

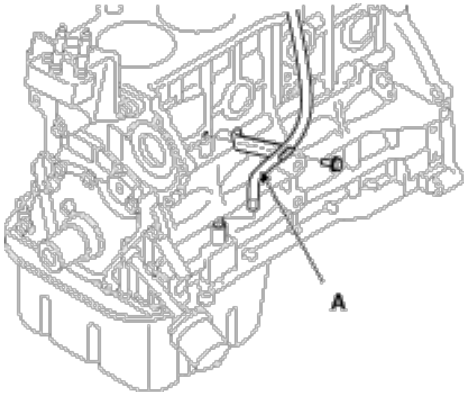
① Apply adhesive to 2 or 3 threads.
② Install the oil pressure switch(A).
Tightening torque : 14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



(18) Install the oil level gauge tube(A).

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

Tightening torque : 18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m 13.7 ~ 17.4.0lb-ft)



(19) Install the cylinder head.

(20) Install the timing belt.

(21) install the fly wheel.

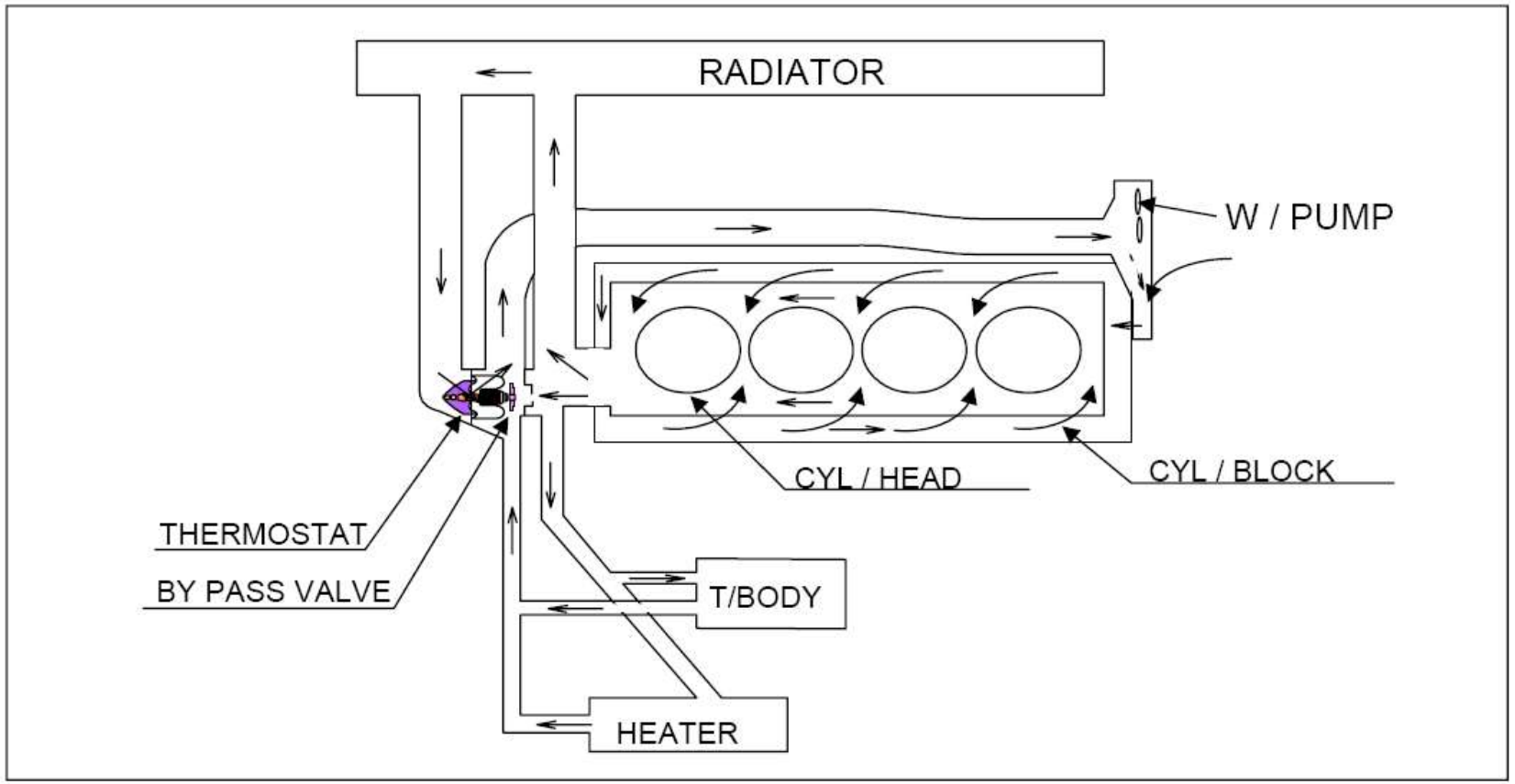
Engine	Tightening torque
1.0	70 ~ 80N.m (7 ~ 8kgf.m, 52 ~ 59.0lb-ft)
1.6	120 ~ 130N.m (12~ 13kgf.m, 89 ~ 96lb-ft)
2.0	120 ~ 130N.m (12 ~ 13kgf.m, 89 ~ 96lb-ft)

2. Mechanical system

5. Cooling system

INLET CONTROL TYPE

DIAGRAM



2. Mechanical system

1) ENGINE COOLANT REFILLING AND BLEEDING

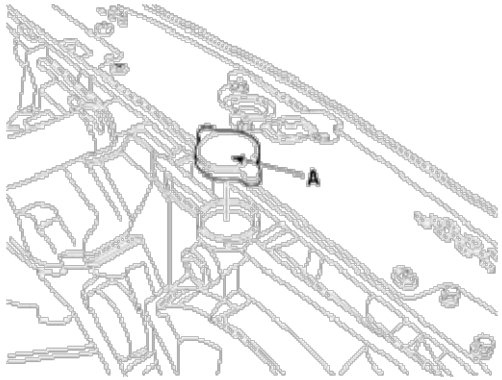
CAUTION

- 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

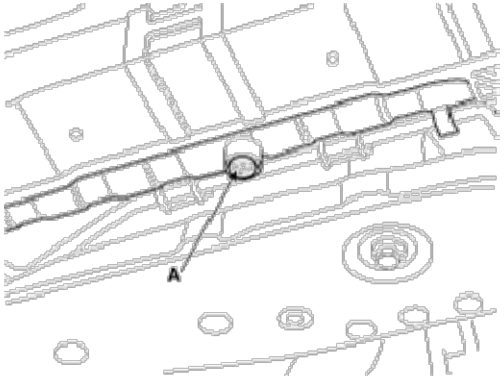
When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts of the paint. If any coolant spills, rinse it off immediately.

(1) Remove the radiator cap(A).



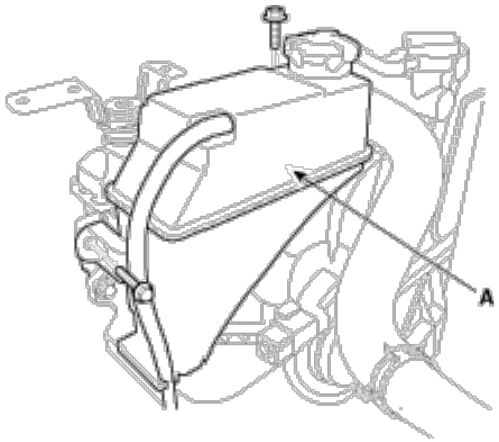
2. Mechanical system

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



(3) Tighten the radiator drain plug (A) securely.

(4) Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the MAX mark with the coolant.



2. Mechanical system

(5) Fill the coolant into the radiator to the base of filler neck.
Gently squeeze the upper/lower hoses of radiator so as to bleed air easily.

NOTE

1. Mix the recommended antifreeze with an equal amount of water in a clean container.
2. Use only genuine antifreeze/coolant.
3. For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum. Coolant concentrations less than 50% may not provide sufficient protection against corrosion of freezing.
4. Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

CAUTION

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

(6) Start the engine and allow coolant to circulates.
When the cooling fan operates and coolant circulates, refill coolant through the radiator filler neck.

(7) Repeat (6) until the cooling fan 3~5 times and bleed air sufficiently out of the cooling system.

(8) Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.

(9) Run the vehicle under idle until the cooling fan operates 2~3 times.

(10) Stop the engine and allow coolant to cool.

(11) Repeat steps (5) to (10) until the coolant level stays constant and all air is bleed out of the cooling system.

NOTE

Recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.
Coolant capacity :5.5~5.8 liters(5.8~6.1 US qt, 4.8~5.1 lmp qt)

2. Mechanical system

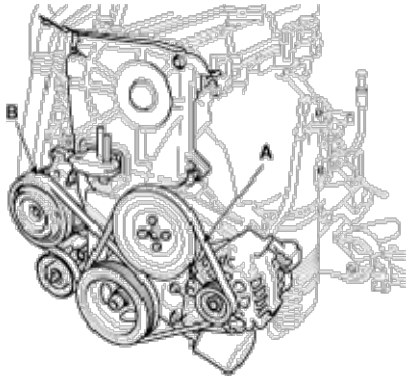
2) REMOVAL

(1) WATER PUMP

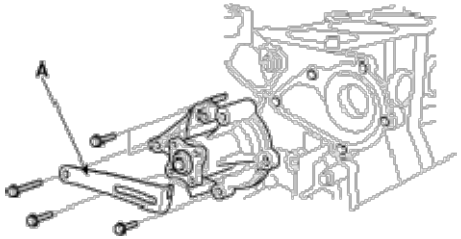
① Drain the engine coolant.

CAUTION

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 Loosen the water pump pulley bolts.
③ Remove the drive belts.
④ Remove the water pump pulley.
⑤ Remove the timing belt.
⑥ Remove the timing belt idler.
⑦ Remove the water pump.
Remove the 2 bolts and alternator brace (A).
Remove the 3 bolts and remove the water pump (B) and gasket.

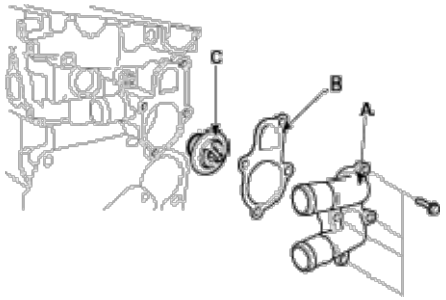


(2) THRMOSTAT

NOTE

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

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



2. Mechanical system

3) INSTALLATION

(1) WATER PUMP

① Install the water pump.

Install the water pump (C) and a new gasket with the 3 bolts (B).
Tightening torque :11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)

Install the alternator brace (D) with the 2 bolts (A).
Tightening torque :19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

② Install the timing belt idler.

③ Install the timing belt.

④ Install the water pump pulley.

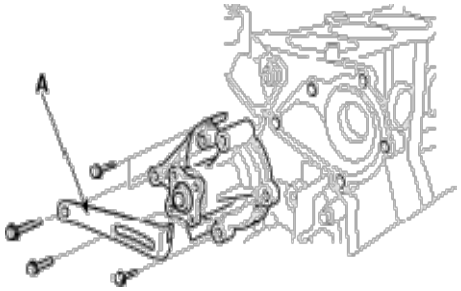
⑤ Install the drive belts.

⑥ Tighten the water pump pulley bolts.
Tightening torque :7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

⑦ Fill with engine coolant.

⑧ Start engine and check for leaks.

⑨ Recheck engine coolant level.



(2) THRMOSTAT

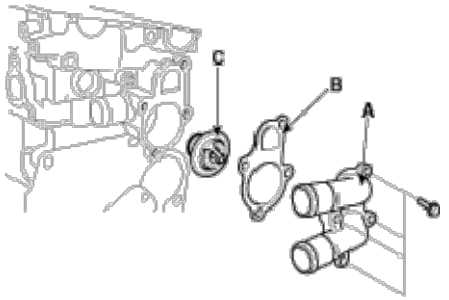
① Place the thermostat in thermostat housing.

Install the thermostat (B) with the jiggle valve upward.
Install a new gasket (A) to the thermostat (B).

② Install the water inlet fitting (A).
Tightening torque :14.7 ~ 19.6N.m (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lb-ft)

③ Fill with engine coolant.

④ Start engine and check for leaks.



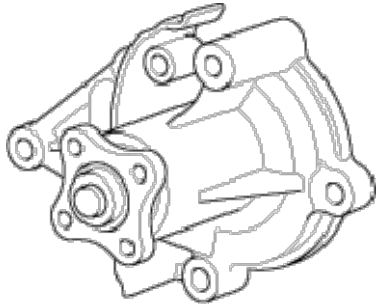
4) INSPECTION

(1) WATER PUMP

① Check each part for cracks, damage or wear, and replace the coolant pump assembly if necessary.

② Check the bearing for damage, abnormal noise and sluggish rotation, and replace the coolant pump assembly if necessary.

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



NOTE

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

(2) THRMOSTAT

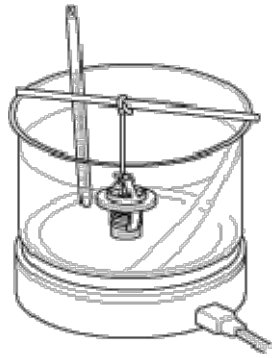
① Immerse the thermostat in water and gradually heat the water.

② Check the valve opening temperature.

Valve opening temperature : 82±1.5°C (179.6±2.7°F)

Full opening temperature : 95°C (203°F)

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



③ Check the valve lift.

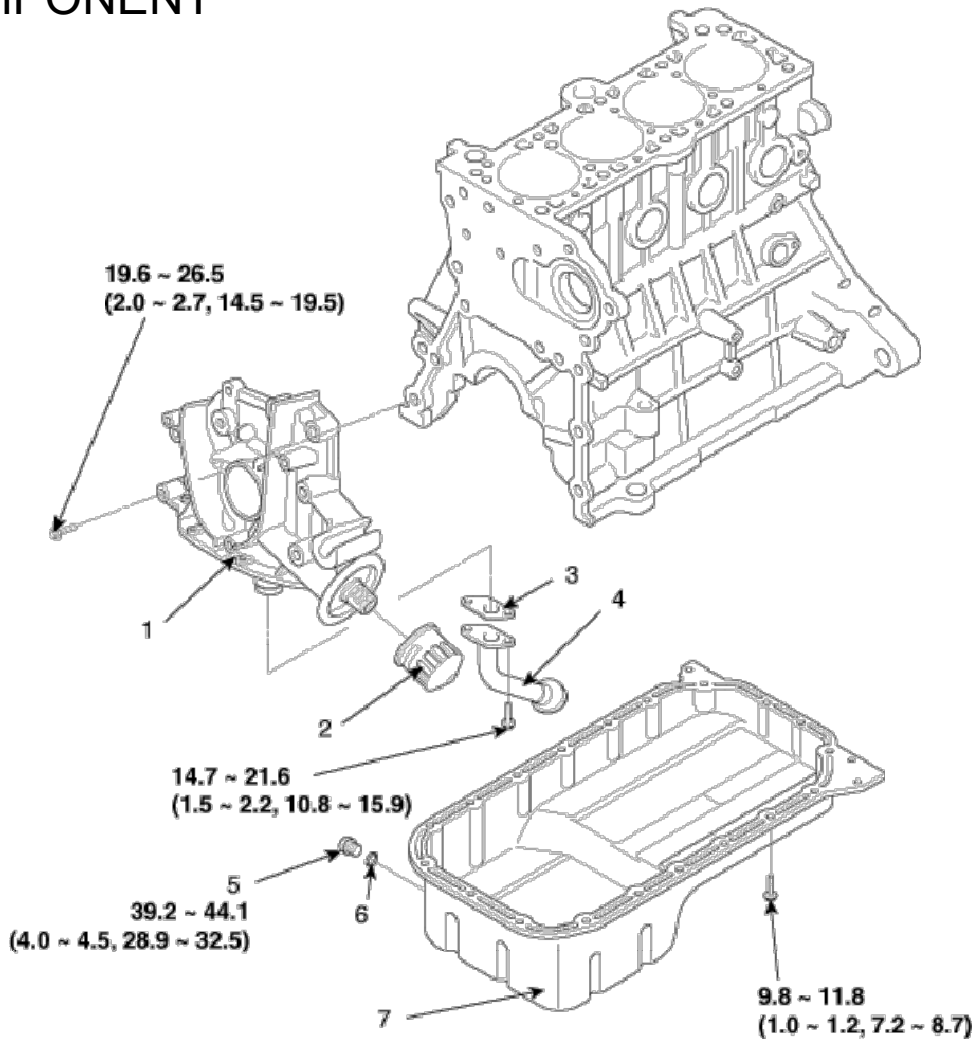
Valve lift : 8mm(0.3in) or more at 95°C (203°F)

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

2. Mechanical system

6. Lubrication System

COMPONENT

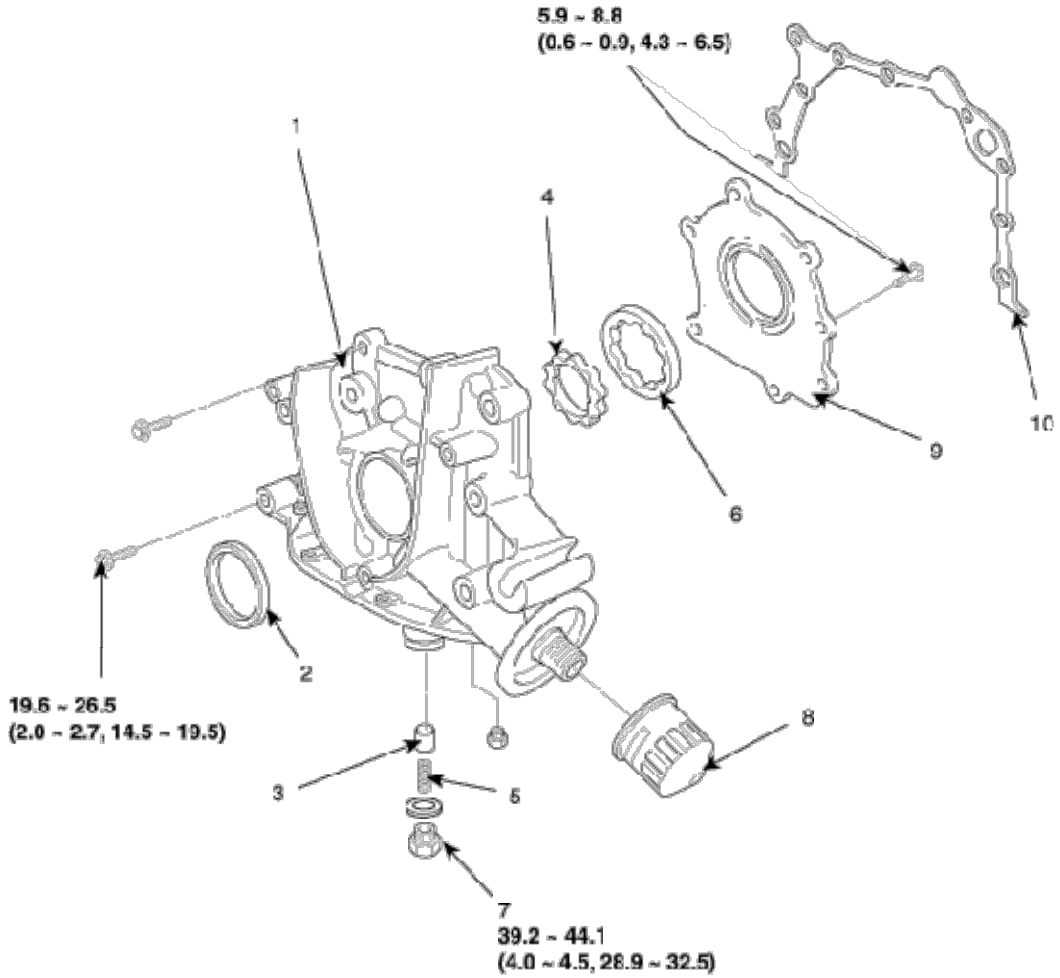


1. Front case
2. Filter
3. Gasket
4. Oil screen
5. Drain plug
6. Gasket
7. Oil pan

TORQUE : N.m (kgf.m, lb-ft)

2. Mechanical system

COMPONENT



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

TORQUE : N.m (kgf.m, lb-ft)

2. Mechanical system

1) OIL AND FILTER REPLACEMENT

CAUTION

1. 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.
2. 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.
3. In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.

① Drain the engine oil.

- Remove the oil filler cap.
- Remove the oil drain plug, and drain the oil into a container.

② Replace the oil filter.

- 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.
- 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.

③ **Refill with engine oil.**

- Clean and install the oil drain plug with a new gasket.
  Tightening torque :39.2 ~ 44.1N.m (4.0 ~ 4.5kgf.m, 28.9 ~ 32.5lb-ft)
- Fill with fresh engine oil.
  Oil Capacity Total : 3.3 L (3.49 US qt, 2.90 lmp qt)Oil pan : 3.0 L (3.17 US qt, 2.64 lmp qt)
  Oil filter : 0.3 L (0.32 US qt, 0.26 lmp qt)
- Install the oil filler cap.

④ Start engine and check for oil leaks.

⑤ Recheck the engine oil level.

(1) INSPECTION

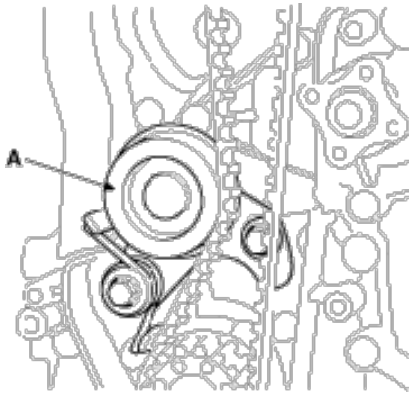
① Check the engine oil quality.
Check the oil deterioration, entry of water, discoloring of thinning.
If the quality is visibly poor, replace the oil.

② Check the engine oil level.
After warning up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks in the dipstick.
If low, check for leakage and add oil up to the "F" mark.

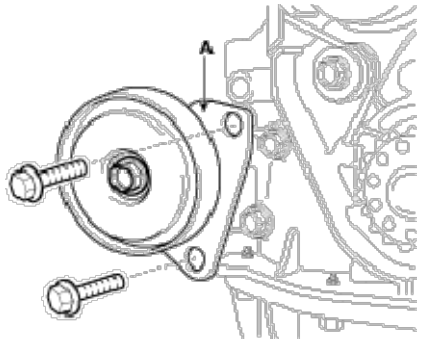
NOTE
Do not fill with engine oil above the "F" mark.

2) REMOVAL

(1) OIL PUMP

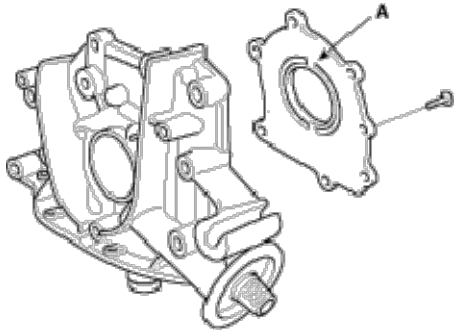


① Drain the engine oil.
② Remove the drive belts.
③ Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.
④ Remove the timing belt.
⑤ Remove the timing belt tensioner(A).
⑥ Remove the oil pan and oil screen.
⑦ Remove the front case.
⑧ Remove the air conditioner compressor tensioner bracket(A).

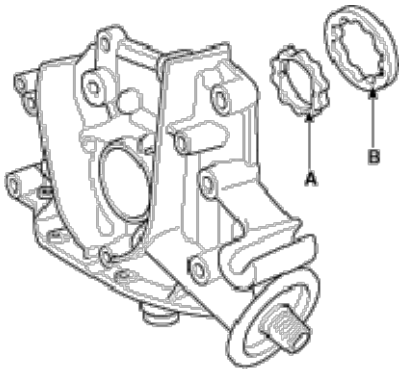


⑨ Remove the front case.

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

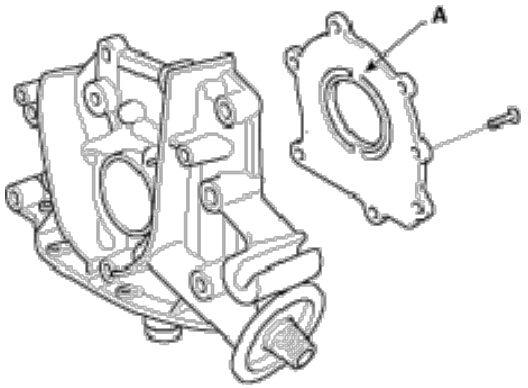


- Remove the inner rotor(A) and outer rotor(B).



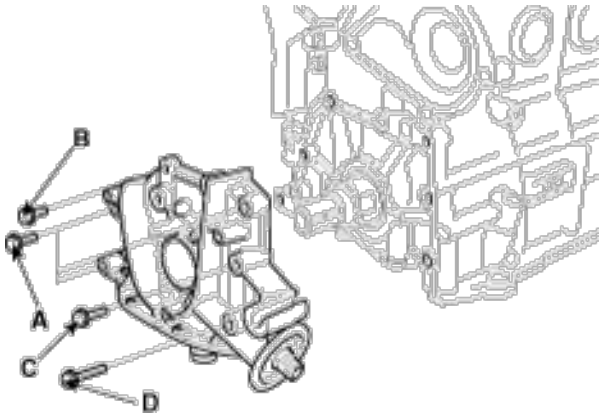
3) INSTALLATION

(1) OIL PUMP



① Install the oil pump.
-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.
Tightening torque :5.9 ~ 6.9N.m (0.6 ~ 0.7kgf.m, 4.3 ~ 5.1lb-ft)

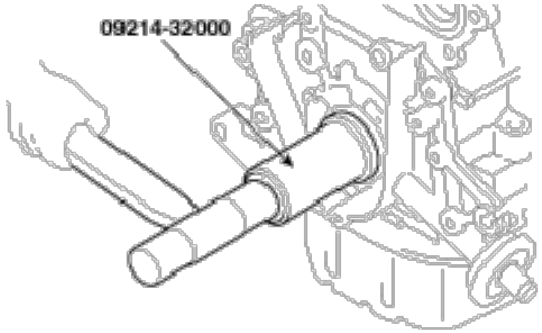
② Check that the oil pump turns freely.
③ Install the oil pump on the cylinder block.
- Place a new front case gasket on the cylinder block.
- Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft.
- When the pump is in place, clean any excess grease off the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



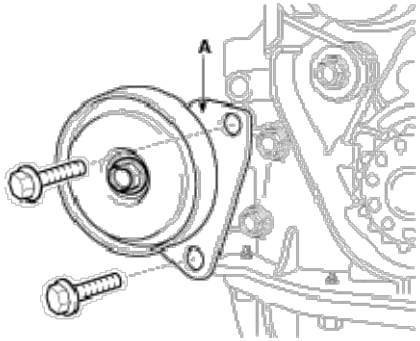
Bolt length(A) : 30mm (1.181in), (B) : 22mm (0.866in),(C) : 45mm (1.772in),
(D) : 60mm (2.362in)Tightening torque :19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

2. Mechanical system

④ Apply a light coat of oil to the front case oil seal lip.
⑤ Using the SST(09214-32000),install the front case oil seal.



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



⑦ Install the alternator.
⑧ Install the oil screen.
Tightening torque :14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)

2. Mechanical system

⑨ Install the oil pan
Tightening torque :9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

NOTE
Clean the oil pan gasket mating surfaces.

⑩ Install the timing belt
⑪ Install the drive belts.
⑫ Fill with engine oil.

2. Mechanical system

(2) OIL PAN

① Install the oil pan.

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

NOTE

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

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

Liquid gasket : MS 721-40A or equivalent

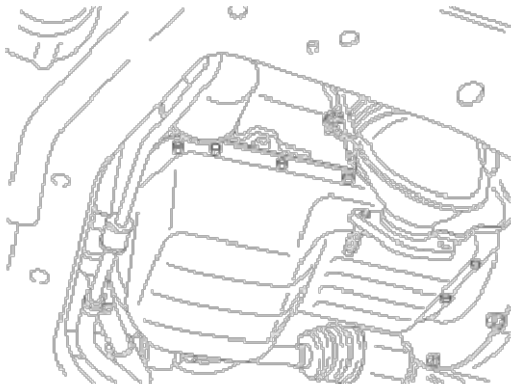
NOTE

1. To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
2. 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.
3. After assembly, wait at least 30 minutes before filling the engine with oil.

- Install the oil pan(A) with the bolts.

Uniformly tighten the bolts in several passes.

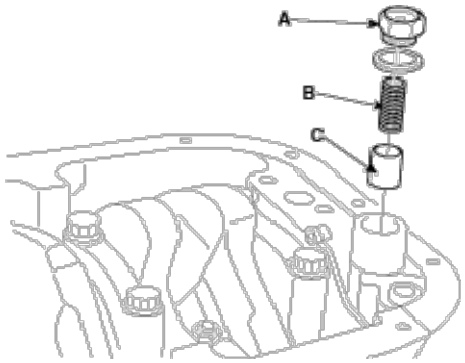
Tightening torque :9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



4) DISASSEMBLY

(1) RELIEF PLUNGER

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



5) INSPECTION

(1) Inspect the relief plunger.

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

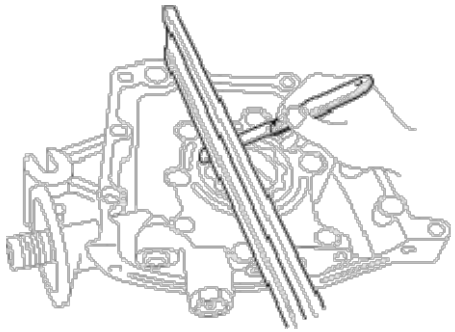
(2) Inspect the relief valve spring.

Inspect for distorted or broken relief valve spring.
Standard value Free height : 46.6mm (1.8346in)Load : 6.1±0.4kg/40.1mm (13.4±0.9 lb/1.5787in)

(3) Inspect the rotor side clearance.

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

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



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

2. Mechanical system

(4) Inspect the rotor tip clearance.

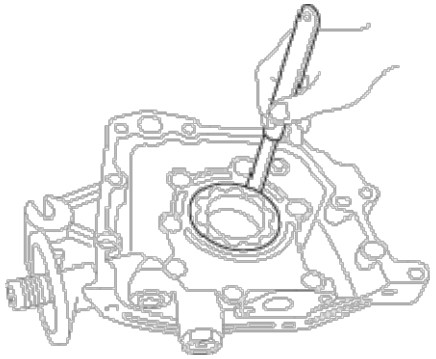
Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

Tip clearance0.025 ~ 0.069mm (0.0010 ~ 0.0027in)

(5) Inspect the rotor body clearance.

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

Body clearance0.060 ~ 0.090mm (0.0024 ~ 0.0035in)



If the body clearance is greater than specified, replace the rotors as a set.

If necessary, replace the front case.

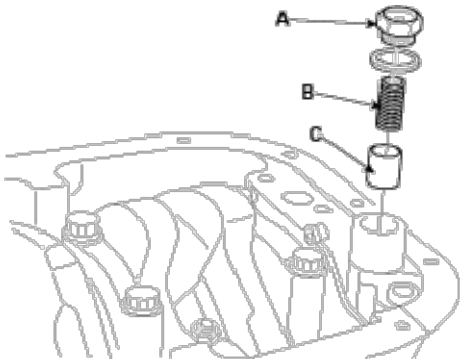
6) REASSEMBLY

(1) RELIEF PLUNGER

① Install the relief plunger.

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

Tightening torque :39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



3. Electrical system

1. IGNITION SYSTEM

1) IGNITION COIL

Items		Specification		
		1.0	1.6	2.0
Ignition coil	Primary resistance	0.87 ± 10 % (Ω)	0.87 ± 10 % (Ω)	0.71 ± 10 % (Ω)
	Secondary resistance	13.0 ± 15 % (kΩ)	13.0 ± 15 % (kΩ)	18~19.5 ± 15 % (kΩ)
Spark plugs	NGK	BKR5ES-11	BKR5ES-11	RPFR6N
	CHAMPION	RC10YC4	RC10YC4	RC8PYPB
	gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.)	1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.)	0.7 ~ 0.8 mm (0.028 ~ 0.032in.)

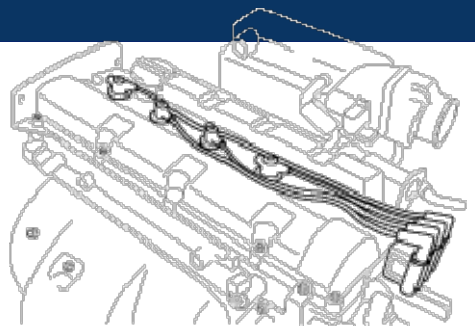
2) SPARK TEST

(1) Remove the spark plug cable.
(2) Using a spark plug socket, remove the spark plug.
(3) Install the spark plug to the spark plug cable.
(4) Ground the spark plug to the engine.
(5) Check is spark occurs while engine is being cranked.

NOTE

To prevent fuel being injected from injectors while the engine is being cranked, off the power of fuel pump (remove the fuel pump relay from the fuse box.) Crank the engine for no more than 5 ~ 10 seconds.

3. Electrical system



(6) Inspect all the spark plugs.
(7) Using a spark plug socket, install the spark plug.
(8) Install the spark plug cable.

3) INSPECT SPARK PLUG

(1) Remove the spark plug cable.

NOTE

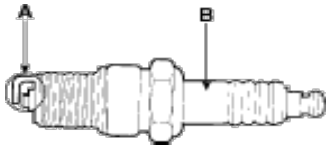
When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.

(2) Using a spark plug socket, remove the spark plug.

CAUTION

Be careful that no contaminates enter through the spark plug holes.

(3) Inspect the electrodes (A) and ceramic insulator (B).



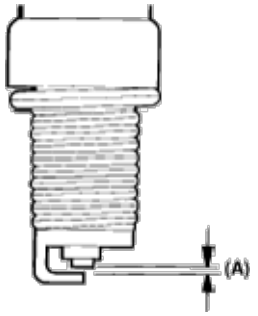
- INSPECTION OF ELECTRODES

Condition	Dark deposits	White deposits
Description	1) Fuel mixture too rich 2) Low air intake	1) Insufficient plug tightening torque 2) Advanced ignition timing 3) Fuel mixture too lean

3. Electrical system

- **Check the electrode gap (A).**

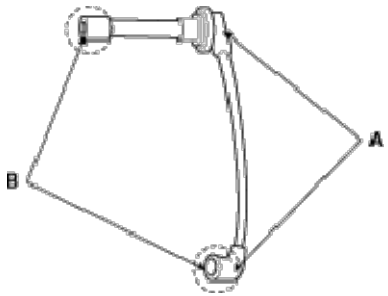
	1.0 & 1.6 eng	2.0 eng
(A)	1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.)	0.7 ~ 0.8 mm (0.028 ~ 0.032in.)



3) INSPECT SPARK PLUG CABLE (1.0 & 1.6 only)

(1) Carefully remove the spark plug cable by pulling on the rubber boots (A).

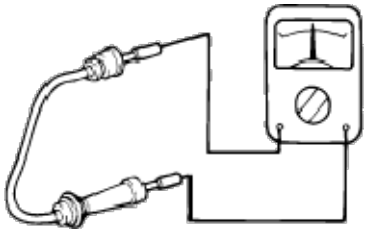
Check the condition of the spark plug cable terminals (B), if any terminal is corroded, cleans it, and if it broken or distorted, replace the spark plug cable.



3. Electrical system

(2) Connect the ohmmeter probes and measure resistance.
RESISTANCE : 5.6kΩ/m ± 20%

(3) Resistance should not be higher than 10 kΩ/m.
If resistance is higher, replace the cable.

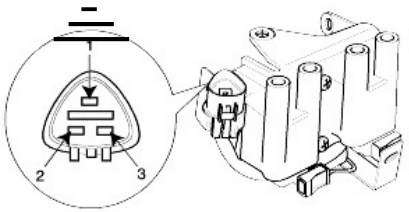


4) INSPECT IGNITION COIL

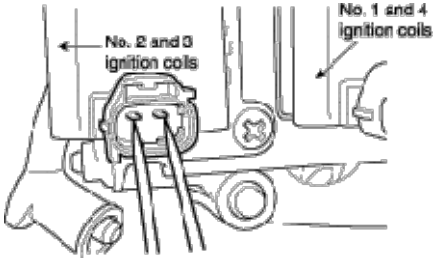
(1) Measure the primary coil resistance between terminals (+) and (-).

Standard value

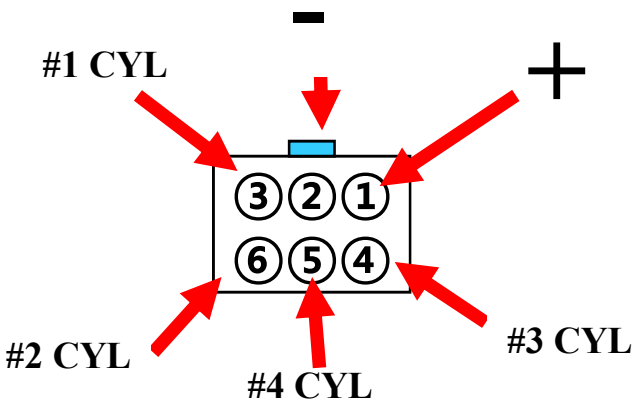
1.0 eng	1.6 eng	2.0 eng
0.87Ω ± 10%	0.87Ω ± 10%	0.71Ω ± 15%



1.0 eng



1.6 eng



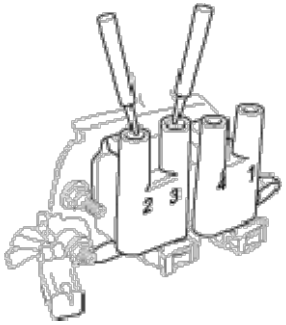
2.0 eng

3. Electrical system

(2) Measure the secondary coil resistance between the high-voltage terminals for the No.1 and No. 4 cylinders, and between the high voltage terminals for the No. 2 and No. 3 cylinders.

CAUTION

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.



1.0 & 1.6 eng

Standard value

1.0 eng	1.6 eng	2.0 eng
8.8 ± 15 % (kΩ)	13.0 ± 15 % (kΩ)	-

3. Electrical system

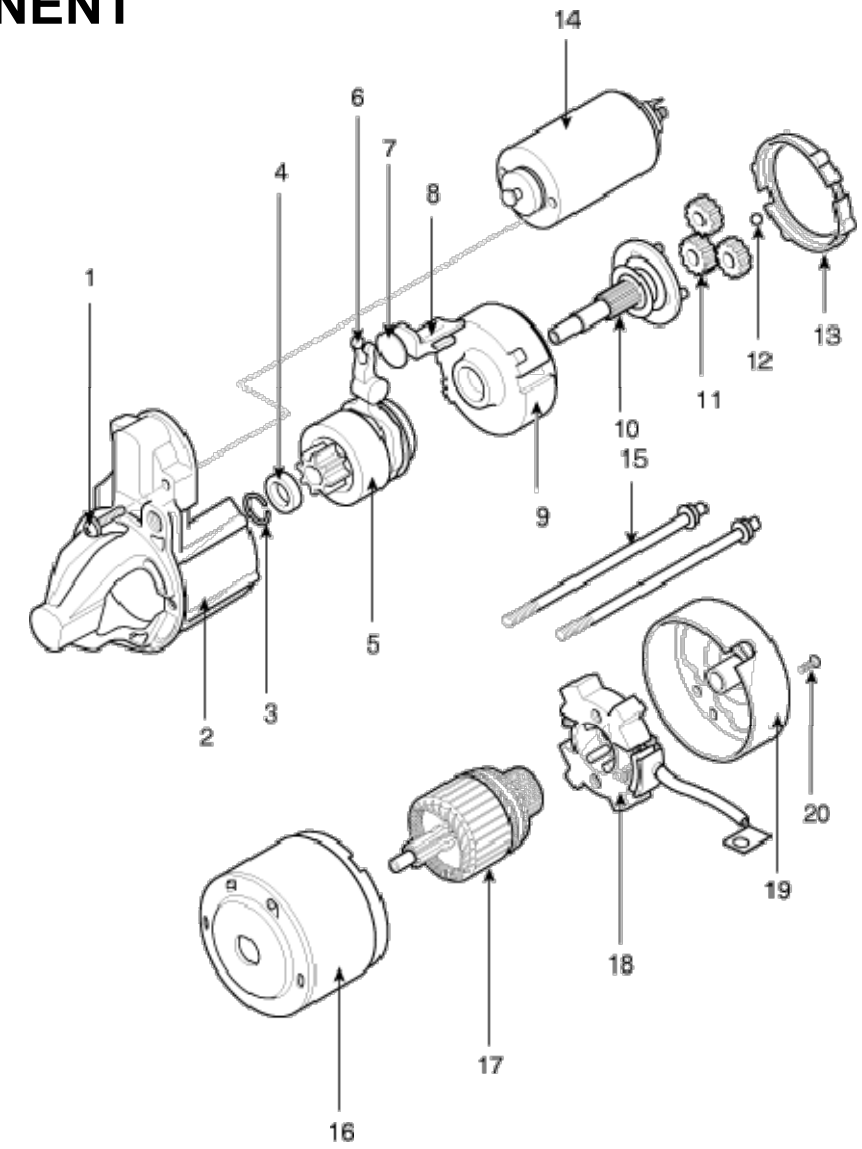
2. STARTER SYSTEM

1) STARTER MOTOR SPECIFICATION

Items			Specification		
			1.0	1.6	2.0
Starter	Rated voltage		12 V, 0.9 kW	12 V, 0.9 kW	12 V, 1.7 kW
	No. of pinion teeth		8	8	8
	No-load characteristics	Voltage	11.5v	11.5v	11V
		Ampere	60A, MAX	60A, MAX	90A, MAX
		Speed	5.500 rpm, MIN	5.500 rpm, MIN	2,600 rpm, MIN
	Commutator diameter	Standard	33 mm (1.2992in.)	33 mm (1.2992in.)	33 mm (1.2992in.)
	Under cut depth	Standard	0.5 mm (0.0197in.)	0.5 mm (0.0197in.)	0.5 mm (0.0197in.)
		Limit	0.2 mm (0.0079in.)	0.2 mm (0.0079in.)	0.2 mm (0.0079in.)

3. Electrical system

COMPONENT



1. Screw
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overrun clutch assembly
6. Lever
7. Plate
8. Lever packing
9. Internal gear assembly
10. Planet shaft assembly
11. Planetary gear assembly
12. Steel ball
13. Packing
14. Magnet switch assembly
15. Through bolt
16. Yoke assembly
17. Armature assembly
18. Brush holder assembly
19. Rear bracket
20. Screw

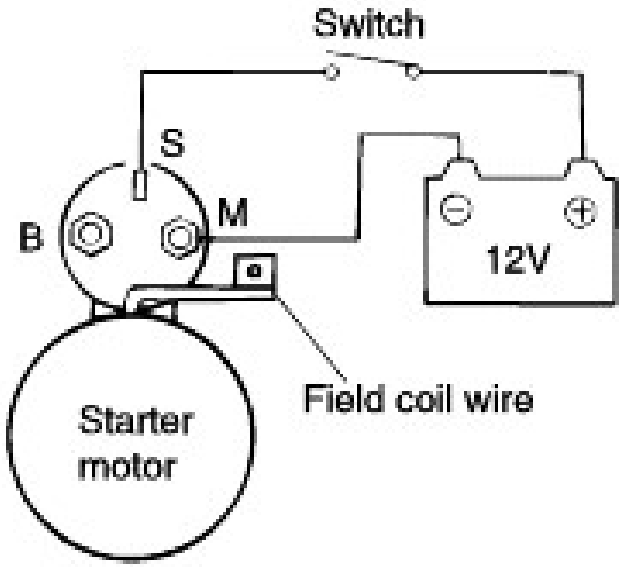
3. Electrical system

2) CHECKING FOR OPERATION

(1) SERVICE ADJUSTMENT PROCEDURES FOR PINION GAP ADJUSTMENT

① Disconnect the field coil wire from the M-terminal of the solenoid
② Connect a 12V battery the S-terminal and the M-terminal.
③ The pinion will move out.

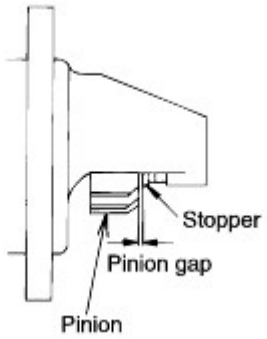
CAUTION
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



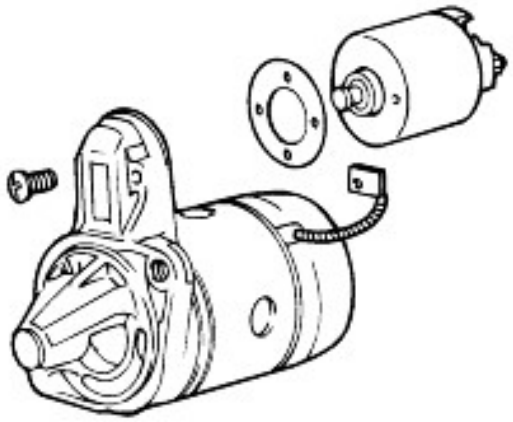
3. Electrical system

④ Check the pinion to stopper clearance (pinion gap) with a feeler gauge.

Pinion gap : 0.5 ~ 2.0 mm (0.02 ~ 0.079 in.)



⑤ If the pinion gap is out of specification, adjust by adding or removing gaskets between the solenoid and the front bracket.



3. Electrical system

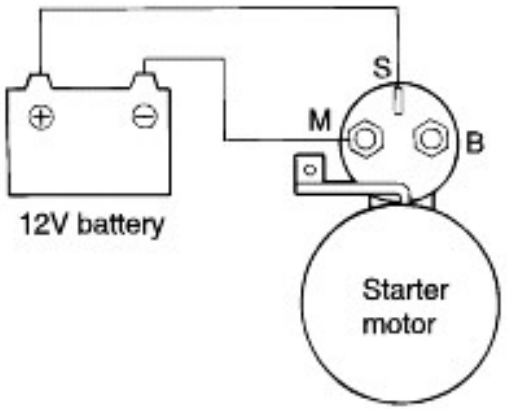
(2) MAGNETIC SWITCH PULL-IN TEST

① Disconnect the field coil wire from the M-terminal of the magnetic switch.
② Connect a 12V battery between the S-terminal and the M- terminal.

CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

③ If the pinion moves out, then the pull-in coil is good. If it doesn't move out, replace the magnetic switch.



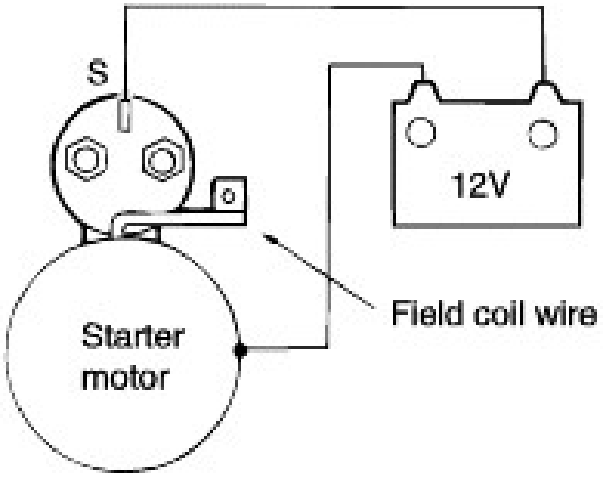
3. Electrical system

(3) MAGNETIC SWITCH HOLD-IN TEST

① Disconnect the field coil wire from the M-terminal of the magnetic switch.
② Connect a 12V battery between the S-terminal and the body.

CAUTION
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

③ If the pinion moves out, everything is in order.
If the pinion moves back and forth repeatedly the hold-in circuit is open.
Then replace the magnetic switch.



3. Electrical system

(4) FREE RUNNING TEST

①Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:

② Connect a test ammeter (100-ampere scale) and carbon pile rheostat as shown is the illustration.

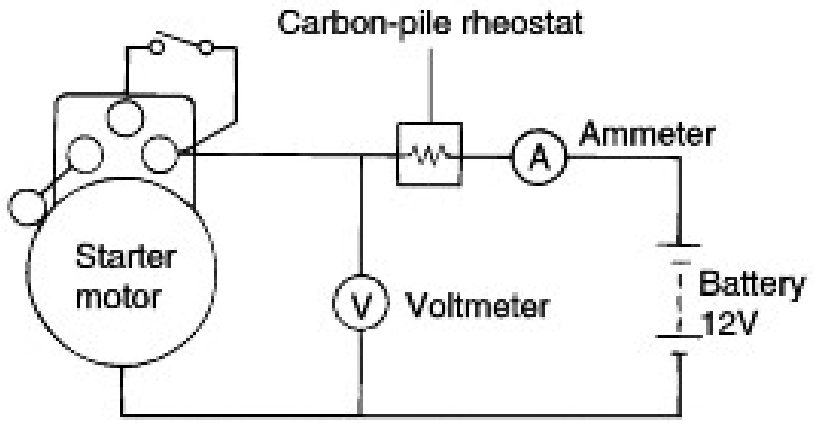
③ Connect a voltmeter (15-volt scale) across starter motor.

④ Rotate carbon pile to the off position.

⑤ Connect battery cable from battery negative post to starter motor body.

⑥ Adjust until battery voltage shown on the voltmeter reads 11 volts.

⑦ Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely



Speed : Min. 3,000 rpm
Current : Max. 90 Amps

(5) MAGNETIC SWITCH RETURN TEST

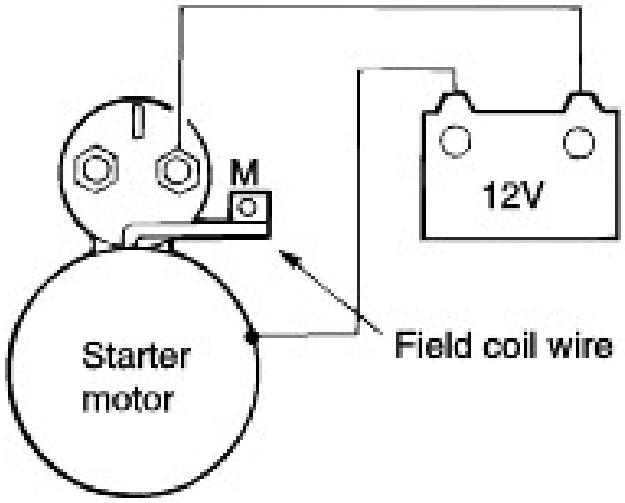
① Disconnect field coil wire from the M-terminal of the magnetic switch.

② Connect a 12V battery between M-terminal and the body.

CAUTION

This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

③ Pull pinion out and release. If pinion returns quickly to its original position, everything is in order. If it doesn't, replace the magnetic switch.



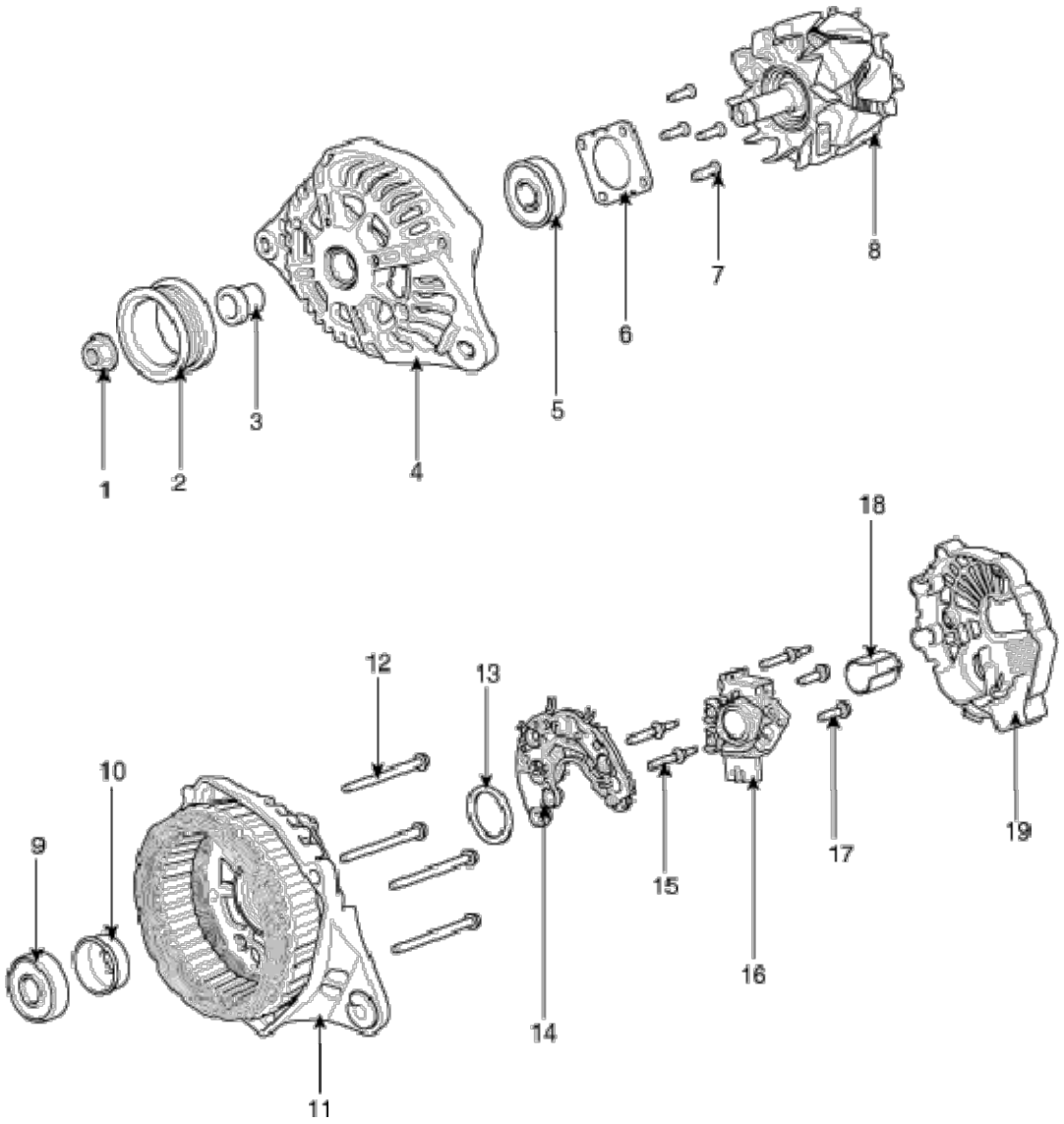
3. Electrical system

3. GENERATOR

Items		Specification		
		1.0	1.6	2.0
Alternator	type	Battery voltage sensing		
	Rate voltage	13.5 V, 70A	13.5 V, 90A	13.5 V, 95A
	Speed in use	1,000 ~ 18,000 rpm		
	Voltage regulator	Electronic built-in type		
	Regulator setting voltage	14.7 ± 0.3 V	14.55 ± 0.2 V	14.4 ± 0.3 V
	Temperature compensation	-7 ± 3 mV / °C		-10 ± 3 mV / °C

3. Electrical system

COMPONENT



1. Nut
2. Pulley
3. Spacer
4. Front cover assembly
5. Front bearing
6. Bearing cover
7. Bearing cover bolts
8. Rotor coil
9. Rear bearing
10. Bearing cover
11. Rear cover
12. Bolts
13. Seal
14. Rectifier assembly
15. Stud bolts
16. Brush holder assembly
17. Brush holder bolts
18. Slip ring guide
19. Cover

3. Electrical system

1) ALTERNATOR BELT INSPECTION AND ADJUSTMENT

NOTE

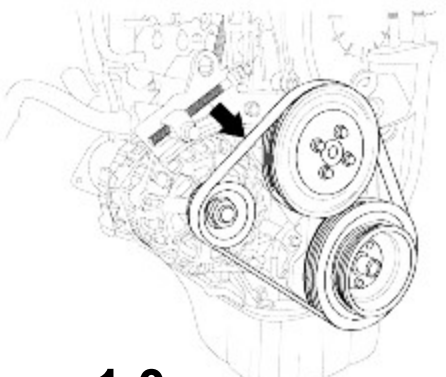
When using a new belt, first adjust the deflection or tension to the values for the new belt, then readjust the deflection or tension to the value for the used belt after running engine for five minutes.

Deflection method:

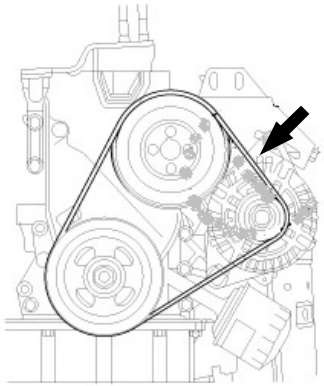
Apply a force of 98N (10kg, 22lb), and measure the deflection between the alternator and the water pump pulley.

Deflection

	1.0	1.6	2.0
Used belt	9.5 ~ 11 mm (0.3740 ~ 0.4331 in)	4.2 ~ 4.7 mm (0.1654 ~ 0.1850 in)	8.5 ~ 11.5 mm (0.33 ~ 0345 in)
New belt	8.5 ~ 9.5 mm (0.3346 ~ 0.3740 in)	3.3 ~ 3.7 mm (0.1299 ~ 0.1457 in)	5.5 ~ 8.0 mm (0.22 ~ 0361 in)



1.0 eng



1.6 & 2.0 eng

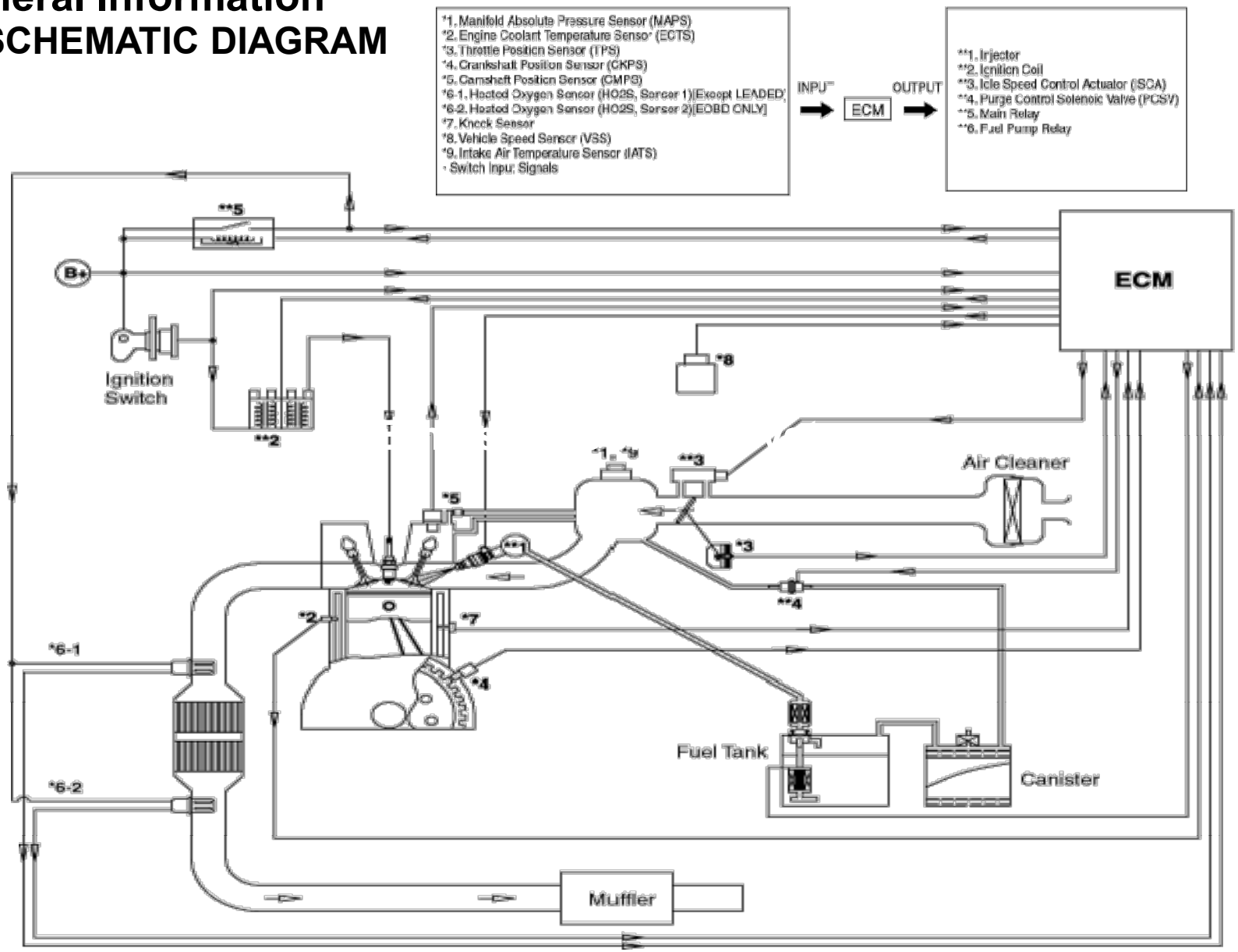
NOTE

If the belt is worn or damaged, replace it.

4. Emission Control System

1.General Information

1) SCHEMATIC DIAGRAM



4. Emission Control System

2) DESCRIPTION

Components	Function	Remarks
Crankcase Emission System 1) Positive Crankcase Ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System 1) Evaporative emission canister 2) Purge Control Solenoid Valve (PCSV)	HC reduction	Duty control solenoid valve
Exhaust Emission System 1) MFI system (air-fuel mixtrue control device) 2) Three-way catalytic converter	CO, HC, Nox reduction	Heated oxygen sensor (feedback type) Monolithic type

4. Emission Control System

3) TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the EVAP. Canister Purge Solenoid Valve	Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged	Repair or replace
	Malfunction of the PCV valve	Replace
	Malfunction of the evaporative emission canister purge system	Check the system; if there is a problem, check related components parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system

4) SPECIFICATIONS

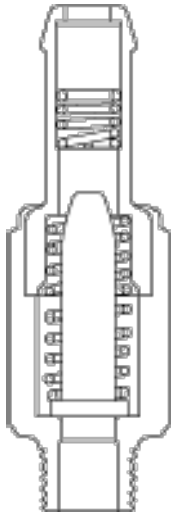
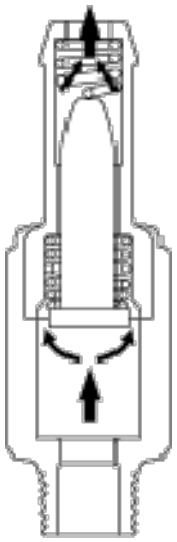
Item	Specification	
Purge Control Solenoid Valve (PCSV)	Type	Duty Control type
	Resistance (Ω)	26.0Ω at 20 °C (68 °F)

4. Emission Control System

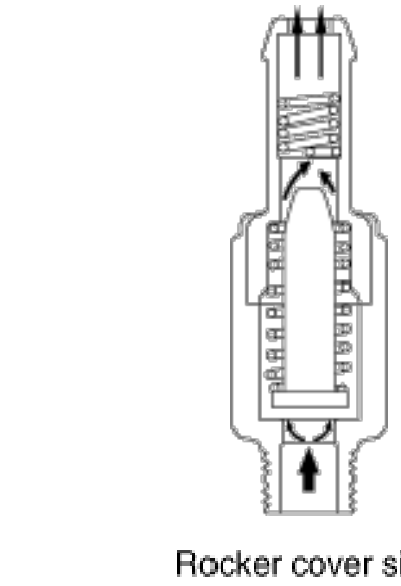
2. Crankcase Emission Control System

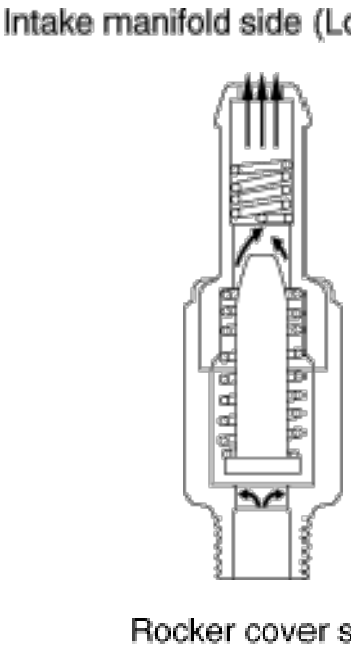
1) Positive Crankcase Ventilation (PCV) Valve

(1) OPERATION

<table>
<tr>
<td colspan="2">Intake manifold side (No vacuum)
 
Rocker cover side</td>
<td colspan="2">Intake manifold side (High vacuum)
 
Rocker cover side</td>
</tr>
<tr><td>Engine condition</td><td>Not running</td><td>Engine condition</td><td>Idling or decelerating</td></tr>
<tr><td>PCV valve</td><td>Not operating</td><td>PCV valve</td><td>Fully operating</td></tr>
<tr><td>Vacuum passage</td><td>Restricted</td><td>Vacuum passage</td><td>Small</td></tr>
</table>

4. Emission Control System



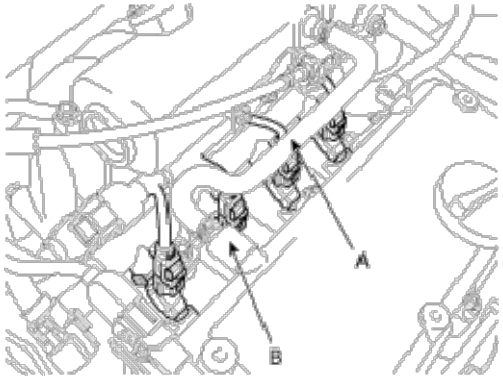


Engine condition	**Normal operation**	**Engine condition**	**Accelerating and high load**
PCV valve	**Properly operating**	**PCV valve**	**Slightly operating**
Vacuum passage	**Large**	**Vacuum passage**	**Very large**

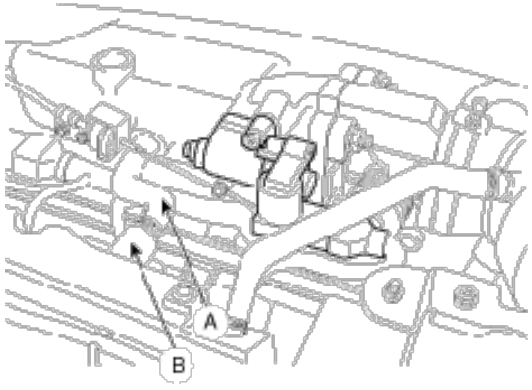
4. Emission Control System

(2) REMOVAL

① Remove the valve pad and disconnect the vacuum hose (A).
② Remove the PCV Valve(B).



[1.1 SOHC]



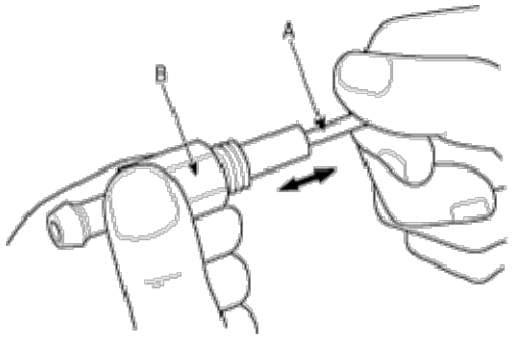
[1.4/1.6 DOHC]

(3) INSTALLATION

Install the PCV valve according to the reverse order of the "REMOVAL" procedure.
PCV Valve Installation : 7.8 ~ 11.8 N·m (0.8 ~ 1.2 kgf·m, 5.8 ~ 8.7 lbf·ft)

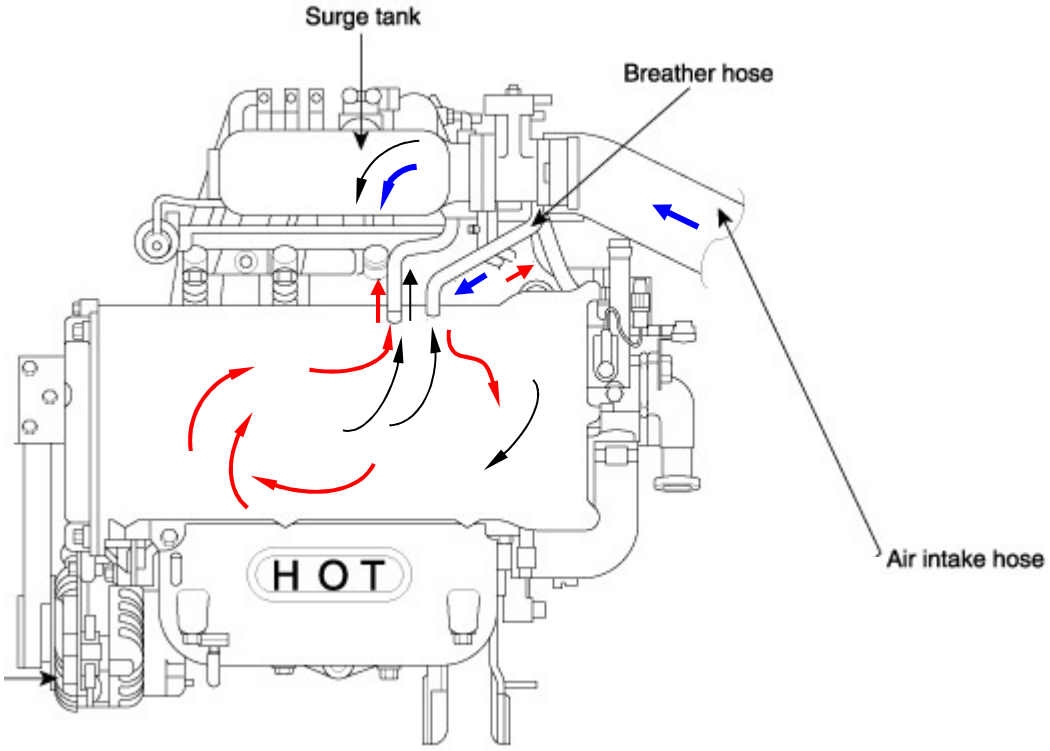
(4) INSPECTION

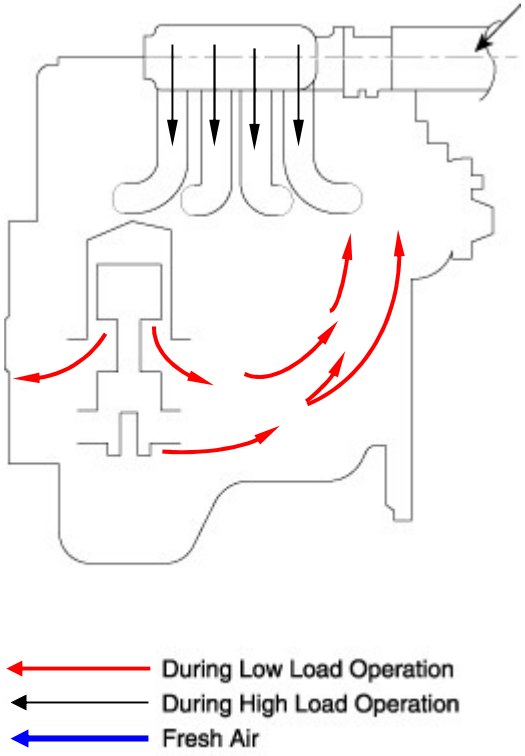
① Remove the PCV valve.
② Insert a thin stick(A) into the PCV valve(B) from the threaded side to check that the plunger moves.
③ If the plunger does not move, the PCV valve is clogged. Clean it or replace.



4. Emission Control System

2) COMPONENT LOCATION





4. Emission Control System

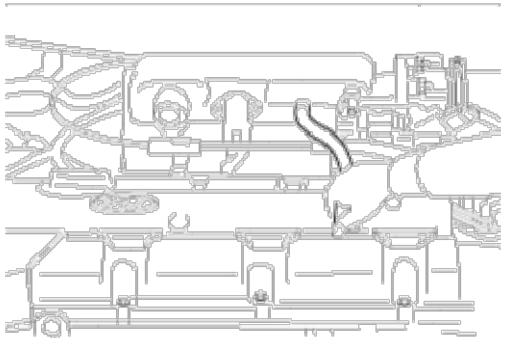
3) INSPECTION

(1) Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve.
Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.

(2) Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum can be felt.

NOTE

The plunger inside the PCV valve will move back and forth.



5. Fuel System

1. FUEL SYSTEM

1) FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Filter (built in Fuel Pump Assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump Assembly)	Regulated Fuel Pressure	343 kpa (3.5 kgf/cm2, 49.8 psi)

2) REMOVAL

(1) Release residual pressure from the fuel line to prevent fuel from spilling.

CAUTION

Cover the hose connection with rags to prevent splashing of fuel that couldbe caused by residual pressure in the fuel line.

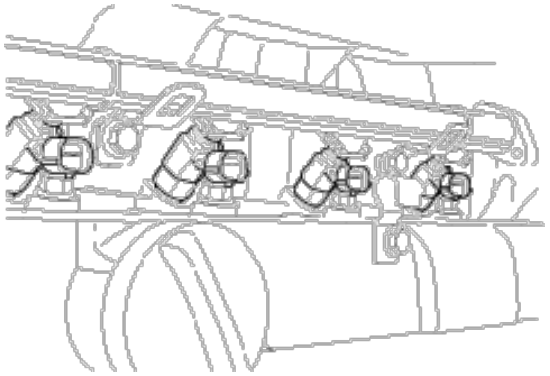
(2) Remove the delivery pipe with the fuel injectors.

CAUTION

1.Be careful not to drop any injectors when removing the delivery pipe.

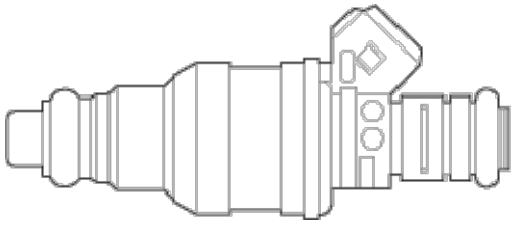
2. Be aware that fuel may flow out when removing the Injector.

2
.



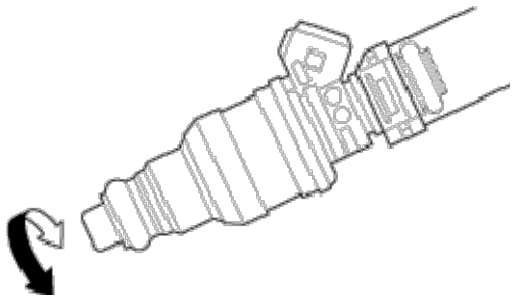
3) INSTALLATION

(1) Install a new grommet and O-ring to the injector.
(2) Apply a coating of solvent, spindle oil or gasoline to the O-ring of the injector.



(3) While turning the injector to the left and right, fit it on to the delivery pipe.
Be sure the injector turns smoothly.

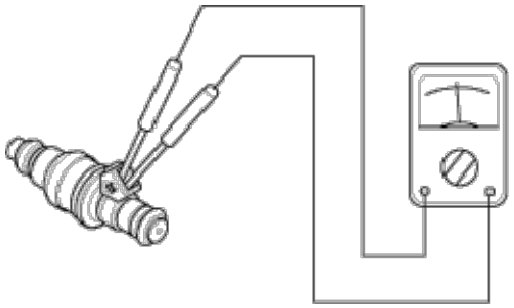
NOTE
If it does turn smoothly, the O-ring may be jammed: Remove the injector and re-insert it into the delivery pipe and recheck.



4) INSPECTION

(1) Measure the resistance of the injectors between the terminals using an ohmmeter.
Resistance : 14.5 ± 0.7Ω at 20°C (68°F)

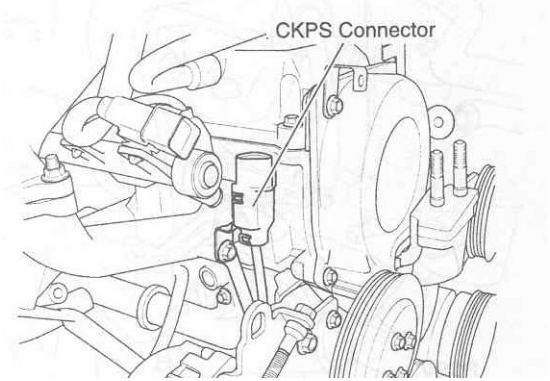
(2) If the resistance is not within specifications, replace the injector.



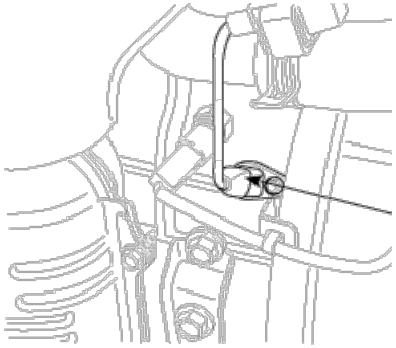
5. Fuel System

5) SENSOR

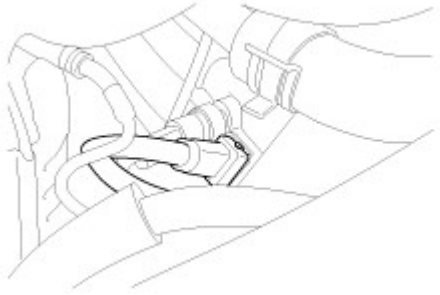
(1) CRANKSHAFT POSITION SENSOR



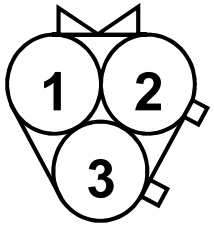
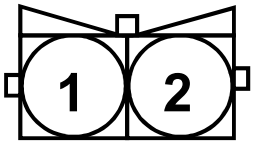
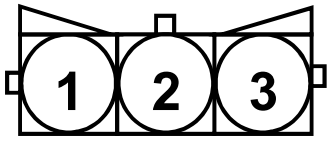
1.0 engine



1.6 engine

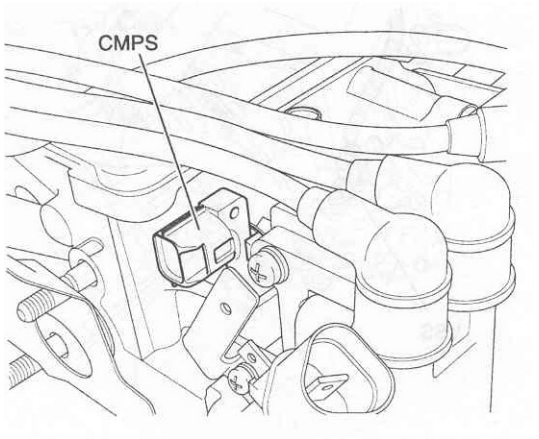


2.0 engine

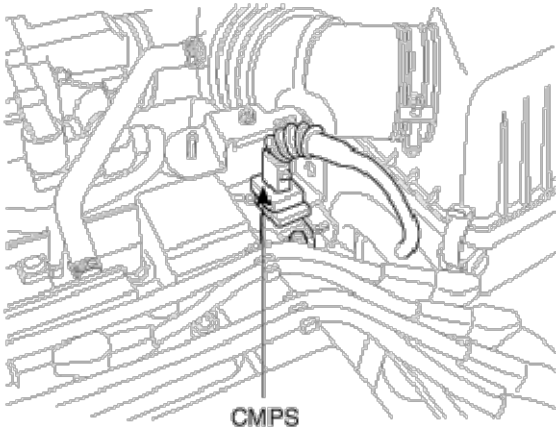
1.0	1.6	2.0
		
①:ground(-) ②:signal ③:battery(+)	①: ground(-) ②: battery(+)	①: battery(+) ②: signal ③: ground(-)

5. Fuel System

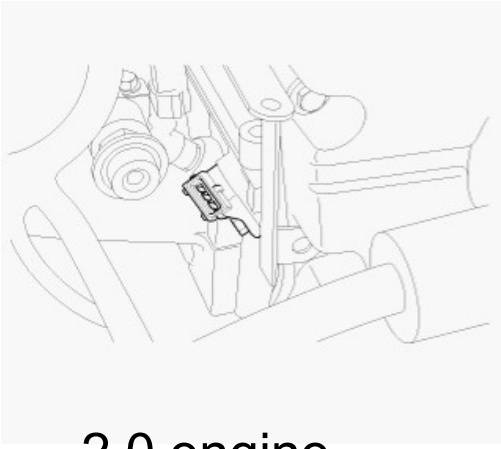
(2) TDC SENSOR



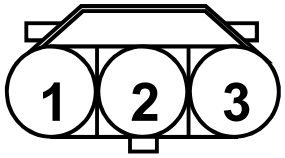
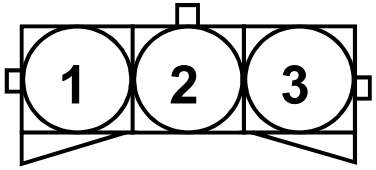
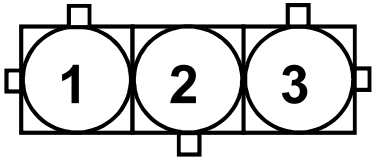
1.0 engine



1.6 engine

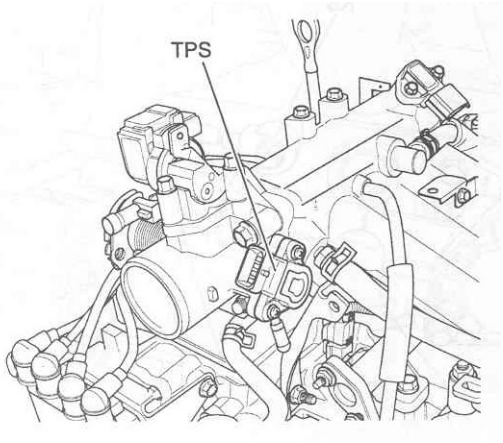


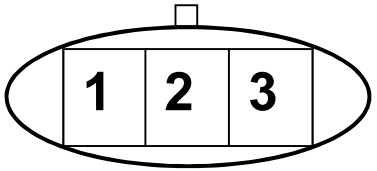
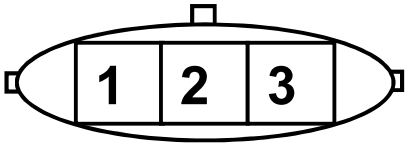
2.0 engine

1.0	1.6	2.0
		
①:ground(-) ②:signal ③:battery(+)	①: battery(+) ②: signal ③: ground(-)	①: ground(-) ②: signal ③: battery(+)

5. Fuel System

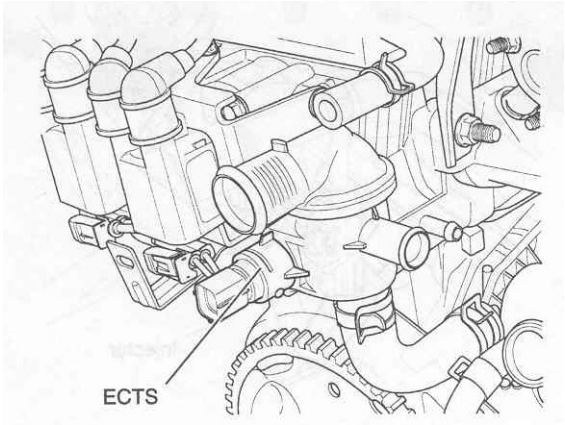
3) THROTTLE POSITION SENSOR(1.0 & 1.6)

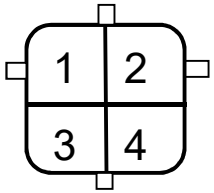
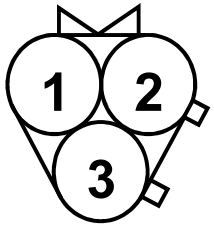
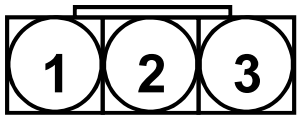


1.0	1.6
	
①: signal ②: ground(-) ③: battery(+)	①: signal ②: ground(-) ③: battery(+)

5. Fuel System

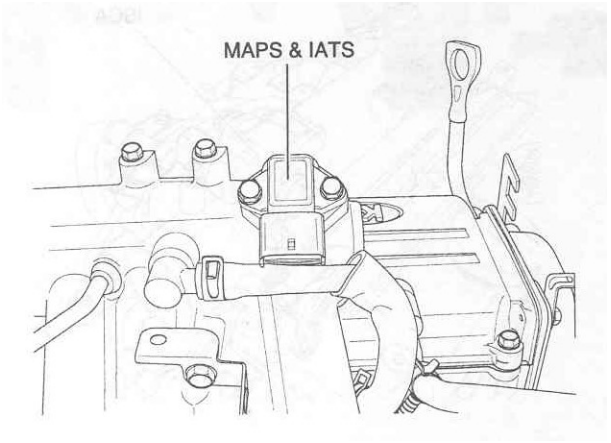
4) WATER TEMP SENSOR

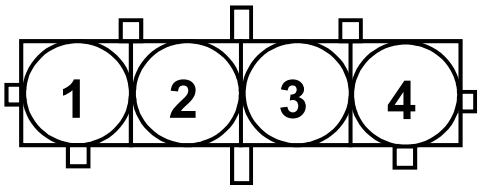


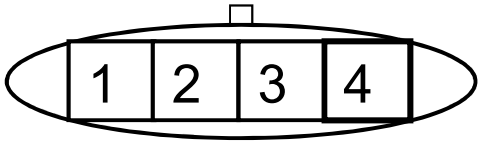
1.0	1.6	2.0
 ①: ground ②:cluster ③:ground ④: signal	 ①:signal ②:ground ③: +	 ①:signal ②:ground ③: +

5. Fuel System

5) MAP & IATA SENSOR(1.0 & 1.6)







①: maps signal

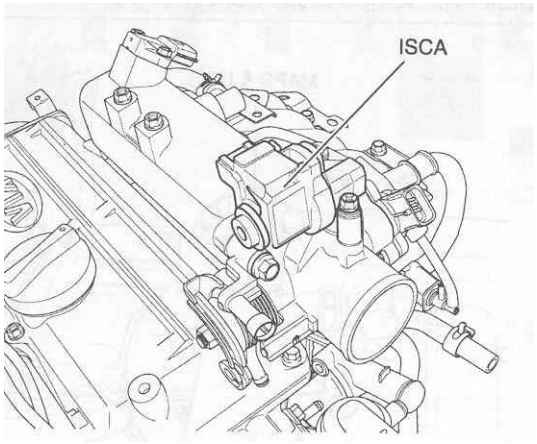
②: maps power

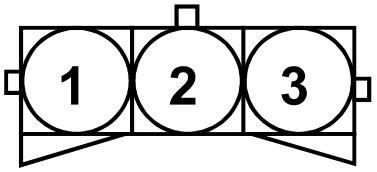
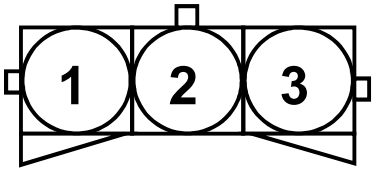
③: iats signal

④: ground

5. Fuel System

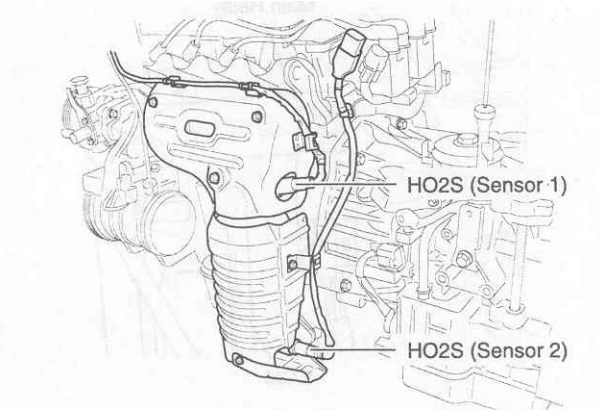
6) IDLE SPEED CONTROL ACTUATOR(1.0 & 1.6)

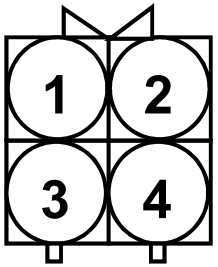
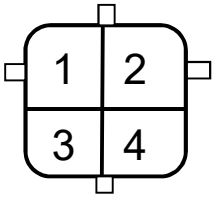


1.0	1.6
 ①: isca(close) ②: + ③: isca(open)	 ①: isca(open) ②: + ③: isca(close)

5. Fuel System

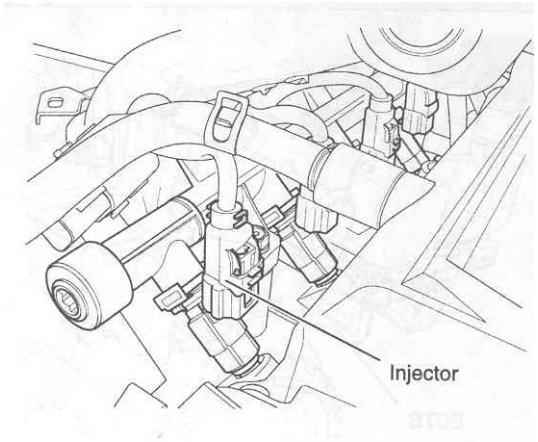
7) OXYGEN SENSOR(1.0)



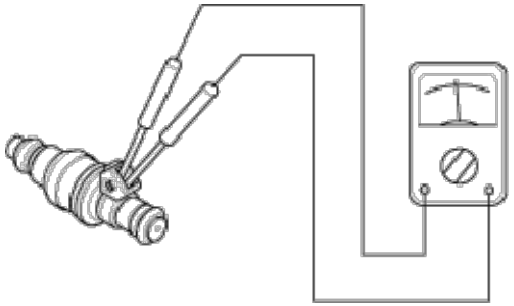
1.0	1.6/2.0
 ①: signal ②: ground ③: after main relay ④: heater control	 ①: signal ②: ground ③: heater + ④: heater -

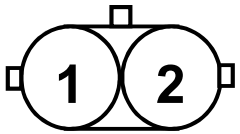
5. Fuel System

8) INJECTOR



Resistance : 14.5 ± 0.7Ω at 20°C (68°F)





①: after main relay+

②: ecu -