

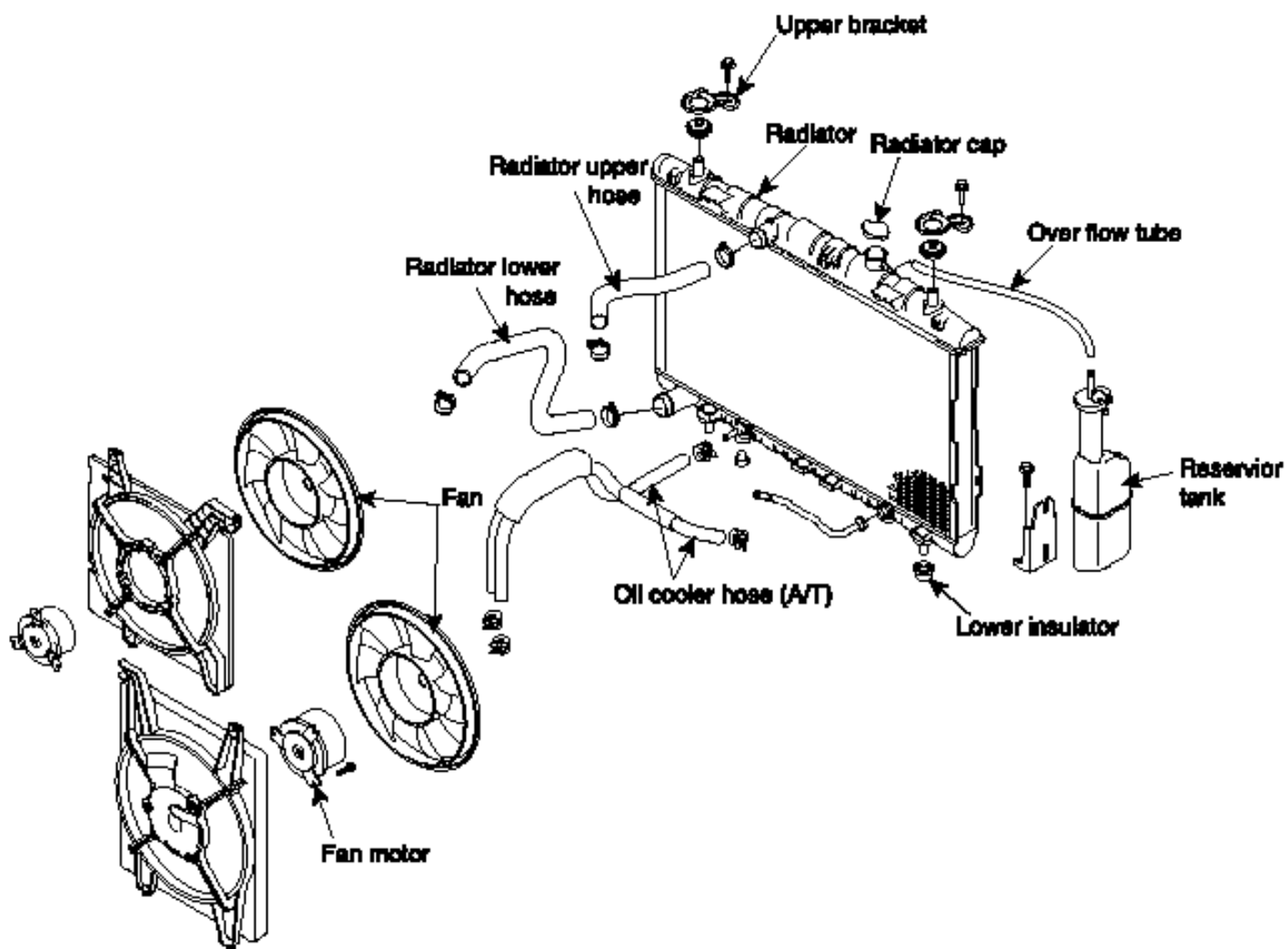


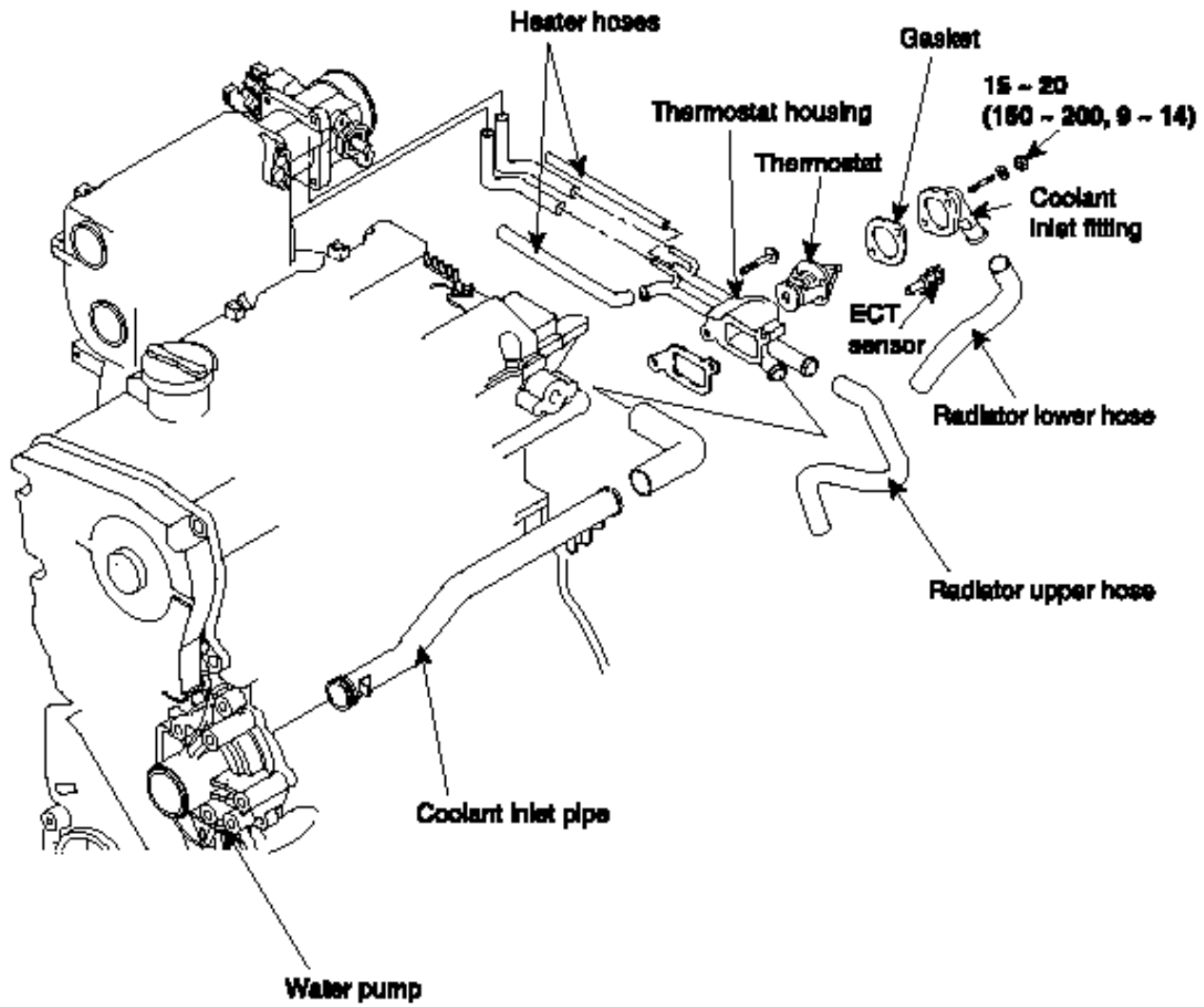
HYUNDAI

Elantra



Workshop Manual
2001 - 2006

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



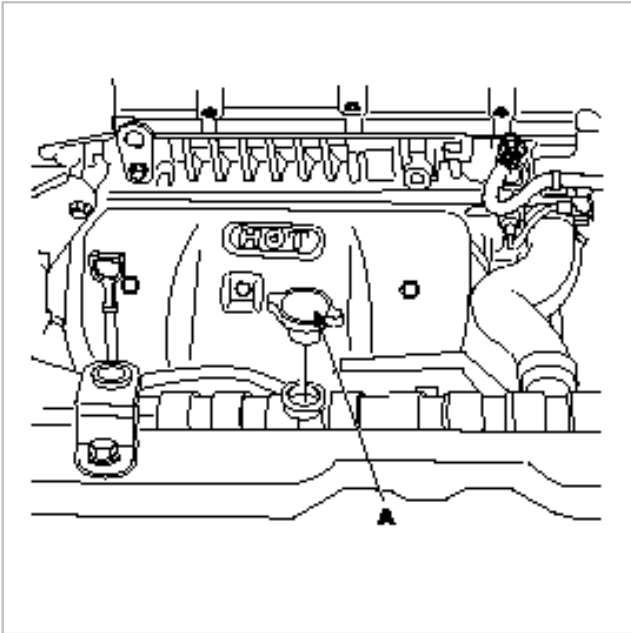
TORQUE : Nm (kgf.cm, lbf.ft)

Engine Coolant Refilling and Bleeding

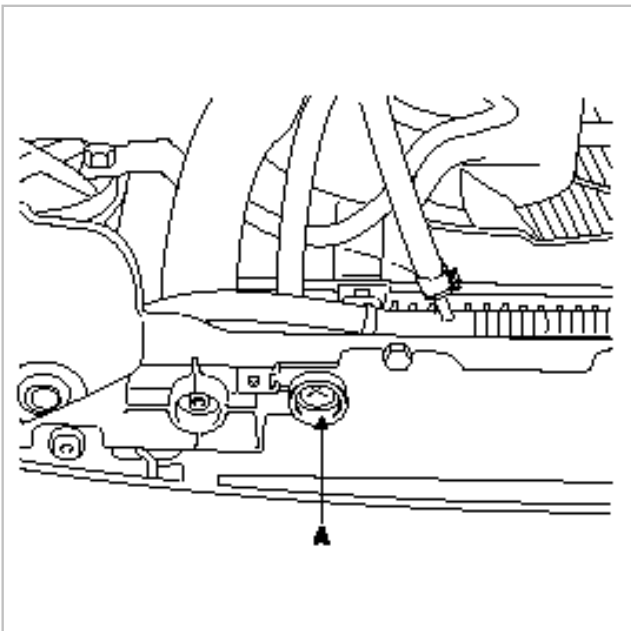
CAUTION

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

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



3. Loosen the drain plug, and drain the coolant.



4. Tighten the radiator drain plug (A) securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.

6. Mix the recommended antifreeze with an equal amount of water in a clean container.

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NOTE

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

CAUTION

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

7. Pour coolant into the radiator up to base of the filler neck, and install the radiator cap loosely.

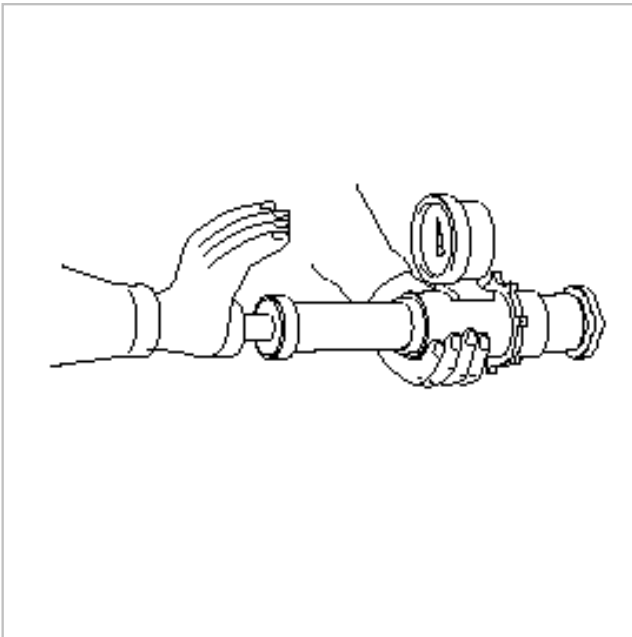
8. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).

9. Turn off the engine. Check the level in the radiator, add coolant if needed.

10. Put the radiator cap on tightly, then run the engine again and check for leaks.

Cap Testing

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



2. Apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm², 14 ~ 19psi)

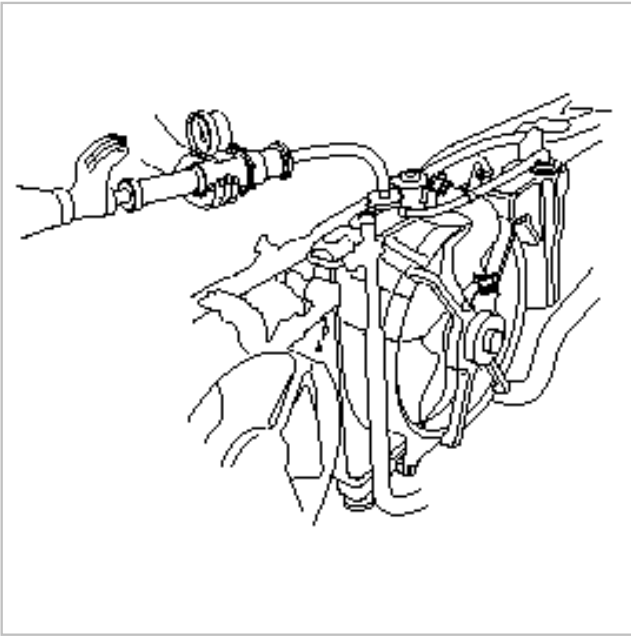
3. Check for a drop in pressure.

4. If the pressure drops, replace the cap.

Testing

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.

2. Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123kPa (0.95 ~ 1.25kgf/cm² 14 ~ 19psi).
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3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTE

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



REMOVAL

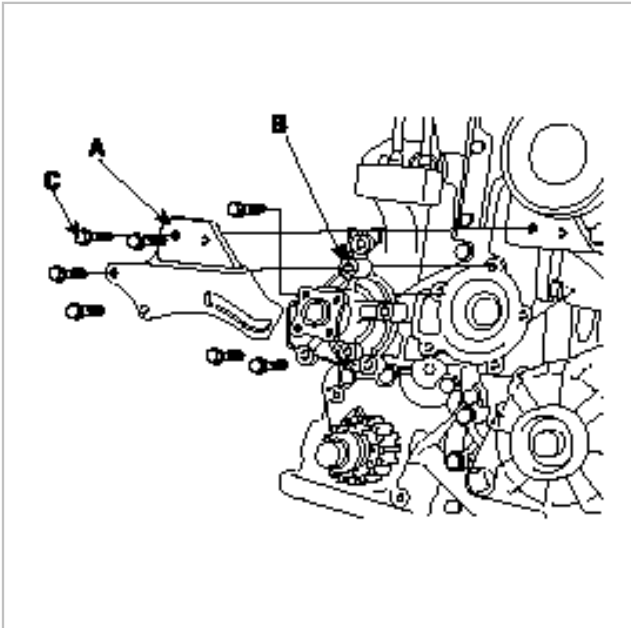
WATER PUMP

1. Drain the engine coolant.

WARNING

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

2. Remove drive belts.
3. Remove the timing belt. (see page EM-25)
4. Remove the timing belt idler. (see page EM-28)
5. Remove the water pump.
 - (1) Remove the 4 bolts and pump pulley.
 - (2) Remove the 2 bolts, then remove the alternator brace (A).
 - (3) Remove the water pump (B) and gasket.



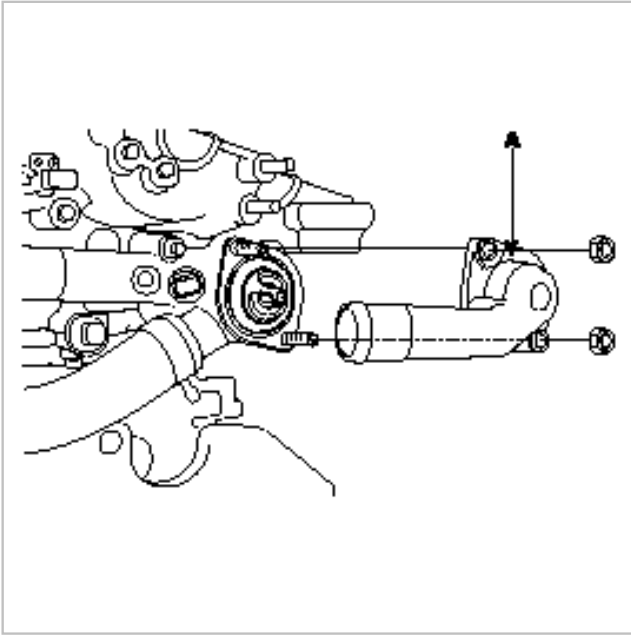
THERMOSTAT

NOTE

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

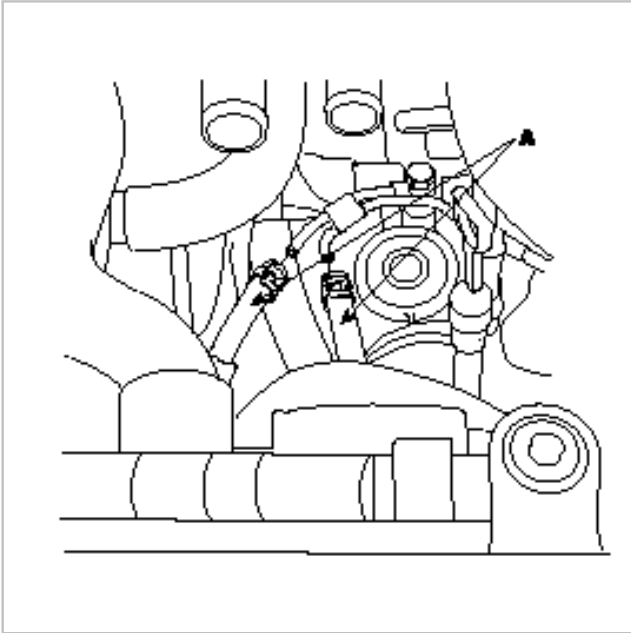
1. Drain engine coolant so its level is below thermostat.

2. Remove water inlet (A), gasket and thermostat. Ebay User ID: reveleus1



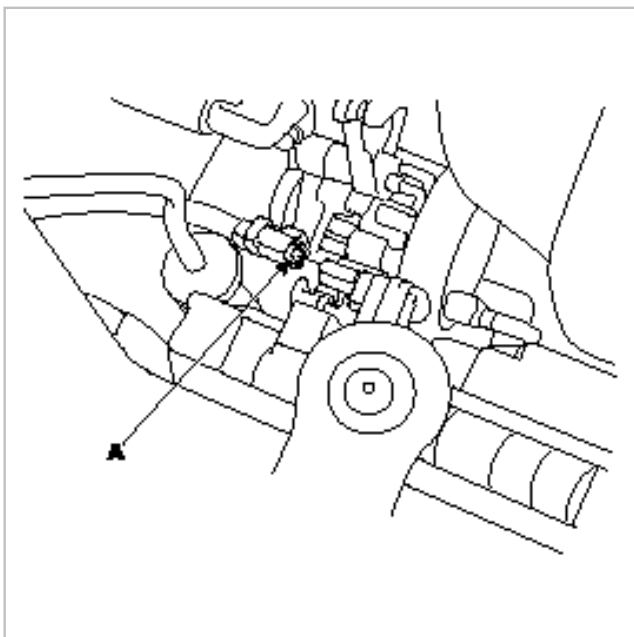
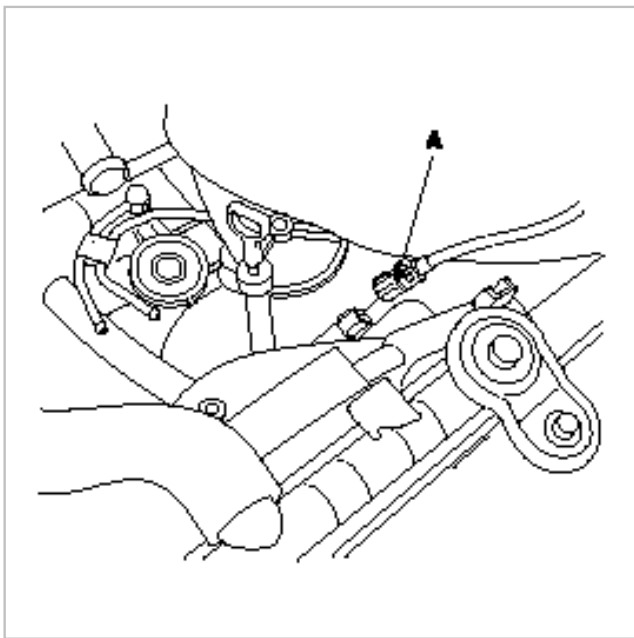
RADIATOR

1. Drain the engine coolant.
2. Remove the upper and lower radiator hoses(A), and ATF cooler hoses.



3. Disconnect the fan motor connector.

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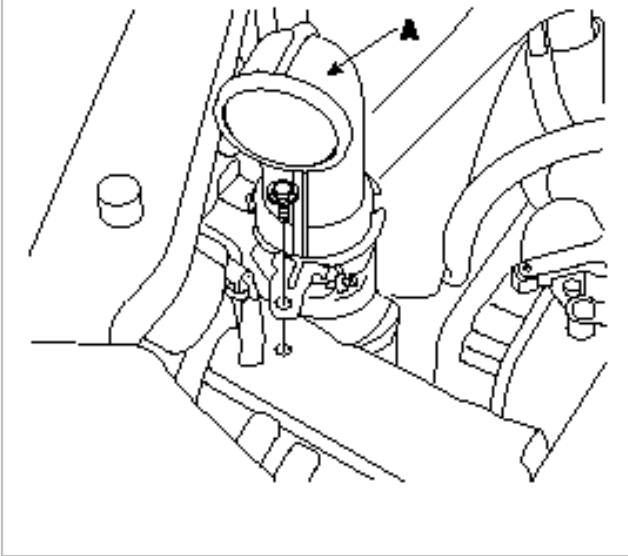


4. Separate the air conditioner condenser with radiator.

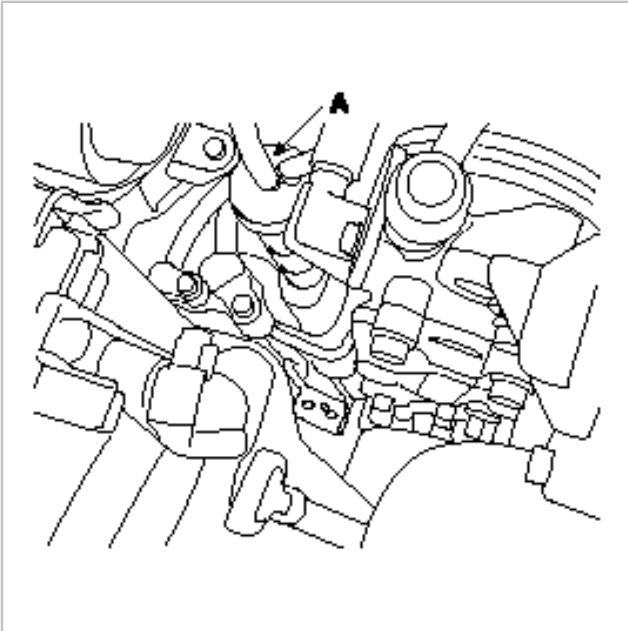
(1) Remove the heat shield.

(2) Remove the battery and battery tray.

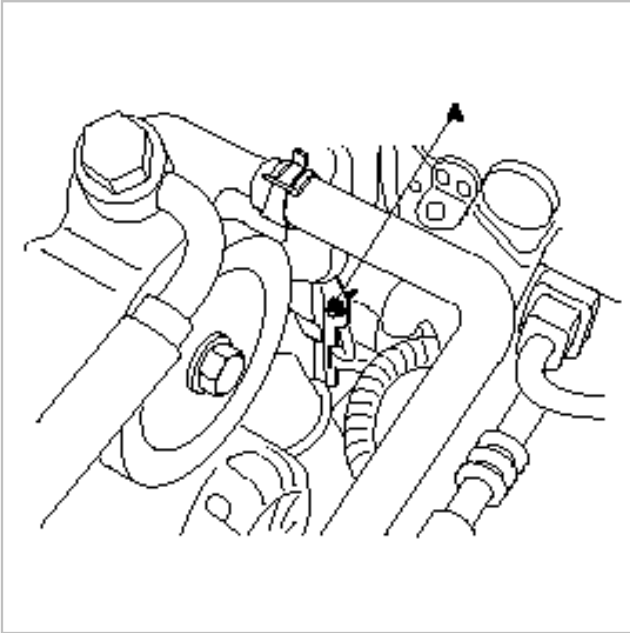
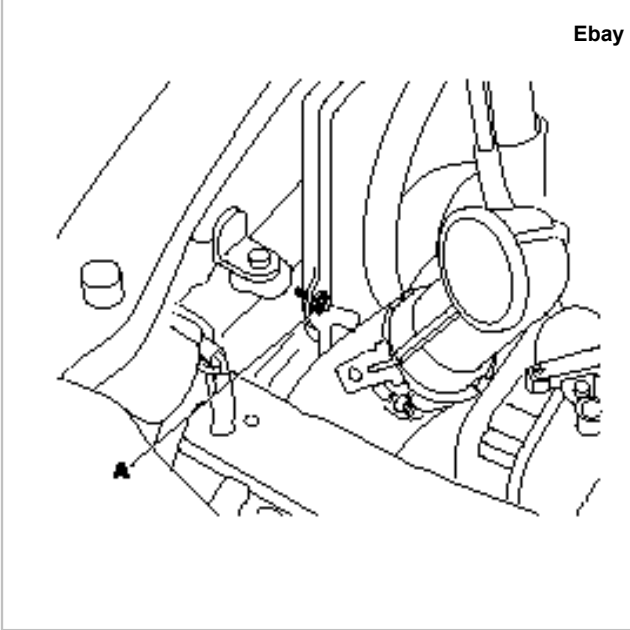
(3) Remove the air duct (A) and make the task space.



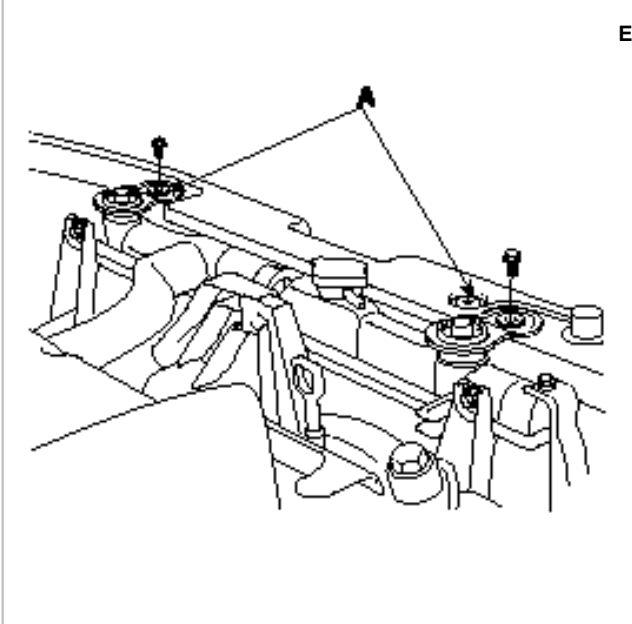
(4) Remove the reservoir tank (A) and make the task space.



(5) Remove the 10mm bolt.



5. Remove the radiator upper bracket(A), then pull up the radiator.

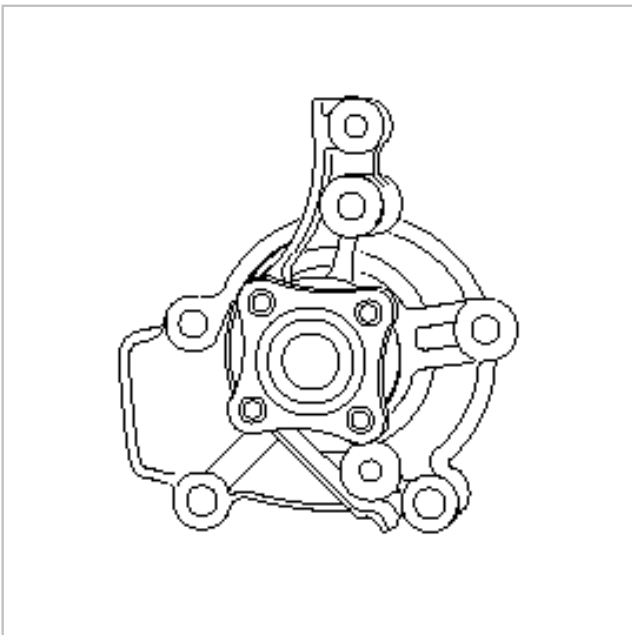


6. Remove the cooling fan from the radiator.

INSPECTION

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.



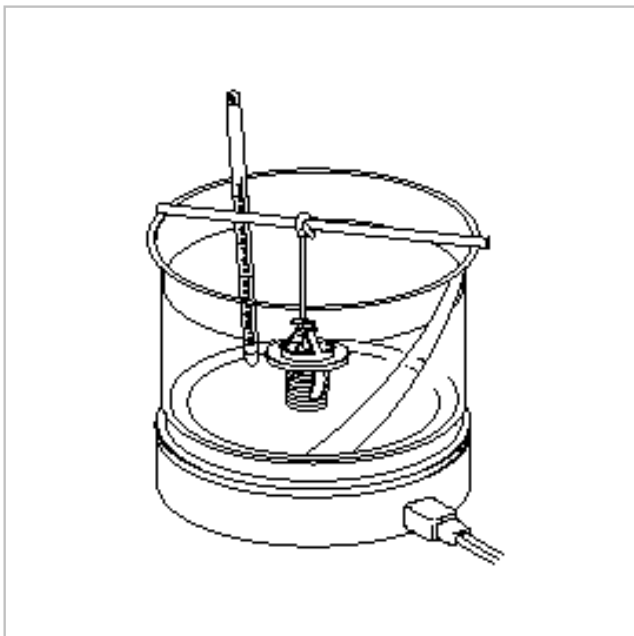
3. Check for coolant leakage. If coolant leaks form hole, the seal is defective. Replace the coolant pump assembly

NOTE

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

THERMOSTAT

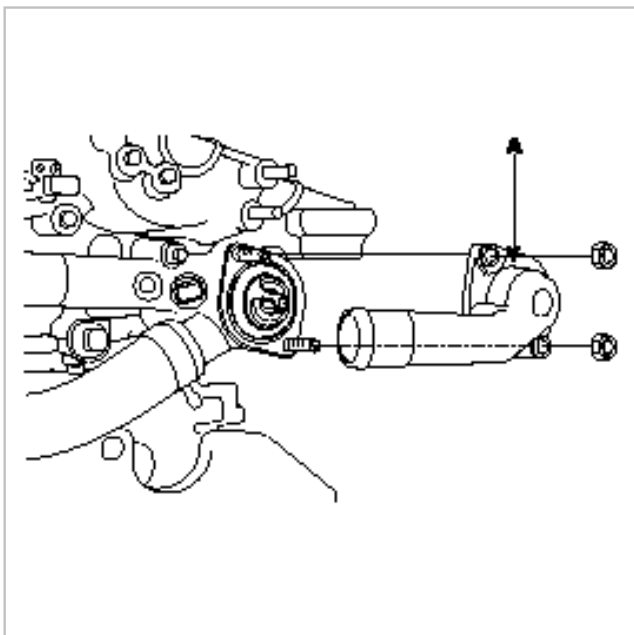
1. Immerse the thermostat in water and gradually heat the water. Ebay User ID: reveleus1



2. Check the valve opening temperature.

Valve opening temperature : 82 °C(177 °F)

Full opening temperature : 95 °C(205 °F)



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

3. Check the valve lift.

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

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

INSTALLATION

WATER PUMP

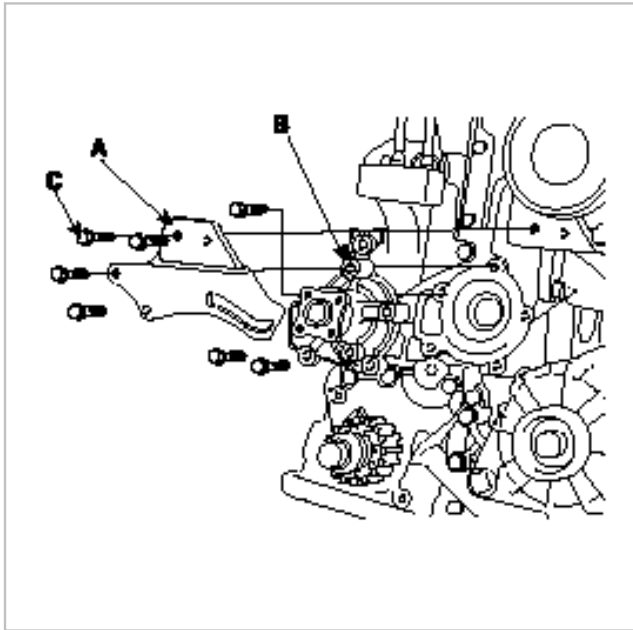
1. Install the water pump.

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

Tightening torque

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



- (2) Install the alternator brace (A) with the 2 bolts.

- (3) Install the 4 bolts and pump pulley.

2. Install the timing belt idler.(see page-)

3. Install the timing belt.(see page-)

4. Install drive belts.

5. Fill with engine coolant.

6. Start engine and check for leaks.

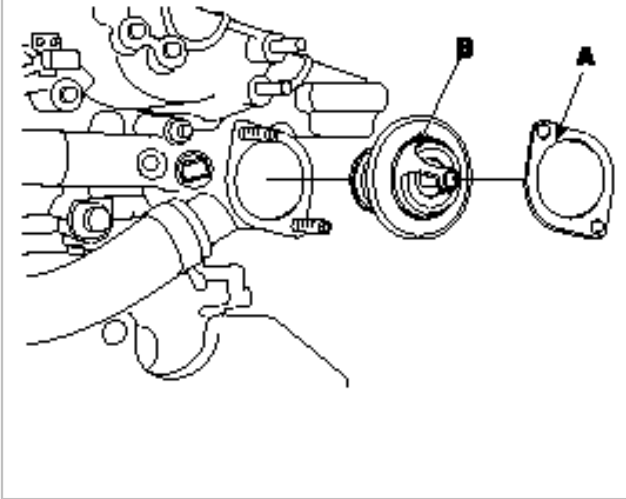
7. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat in thermostat housing.

- (1) Install the thermostat with the jiggle valve upward.

- (2) Install a new gasket (A) to the thermostat (B).



2. Install water inlet (A).

Tightening torque

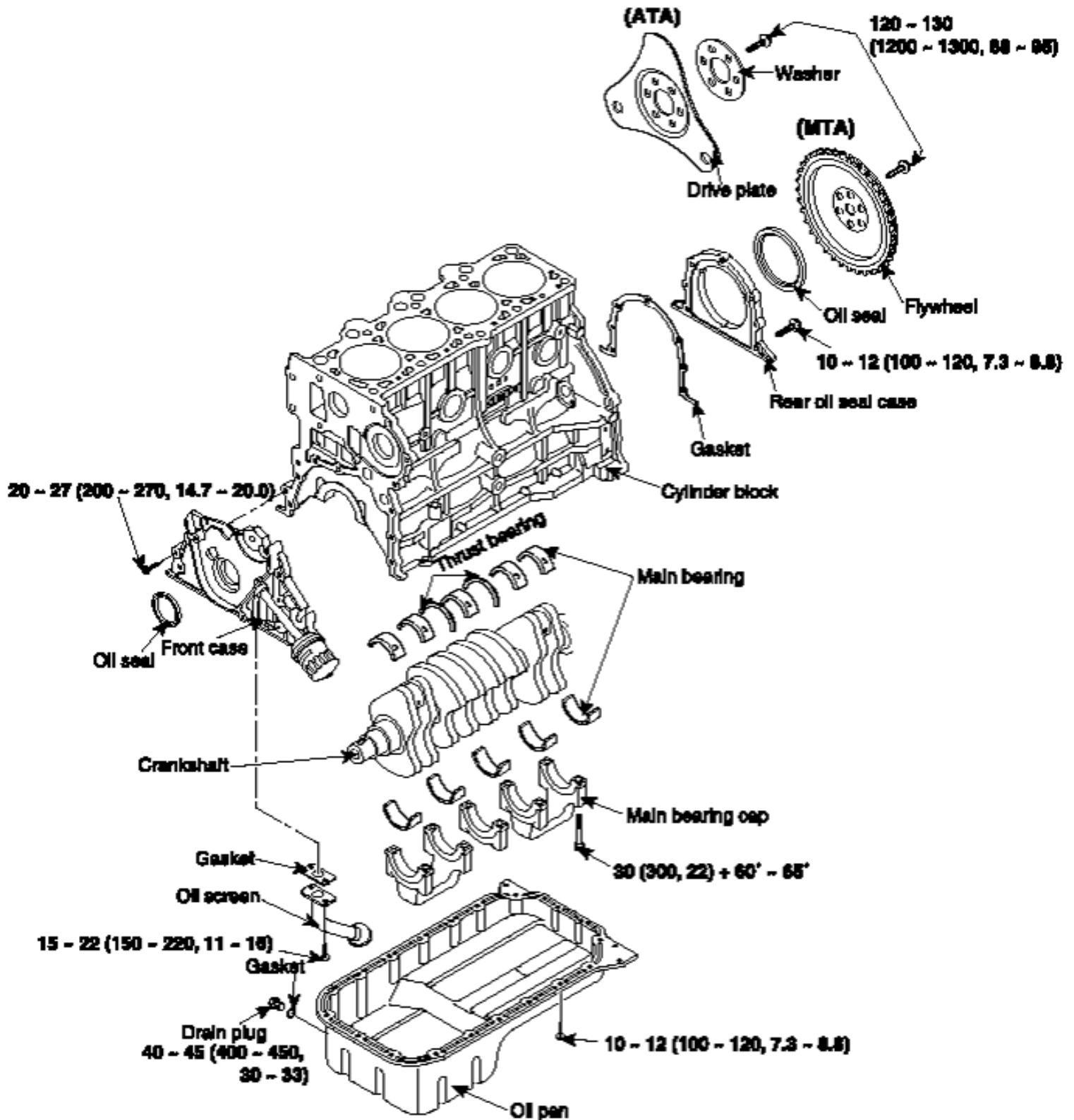
15 ~ 20Nm (150 ~ 200kf.cm, 9 ~ 14lb.ft)

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

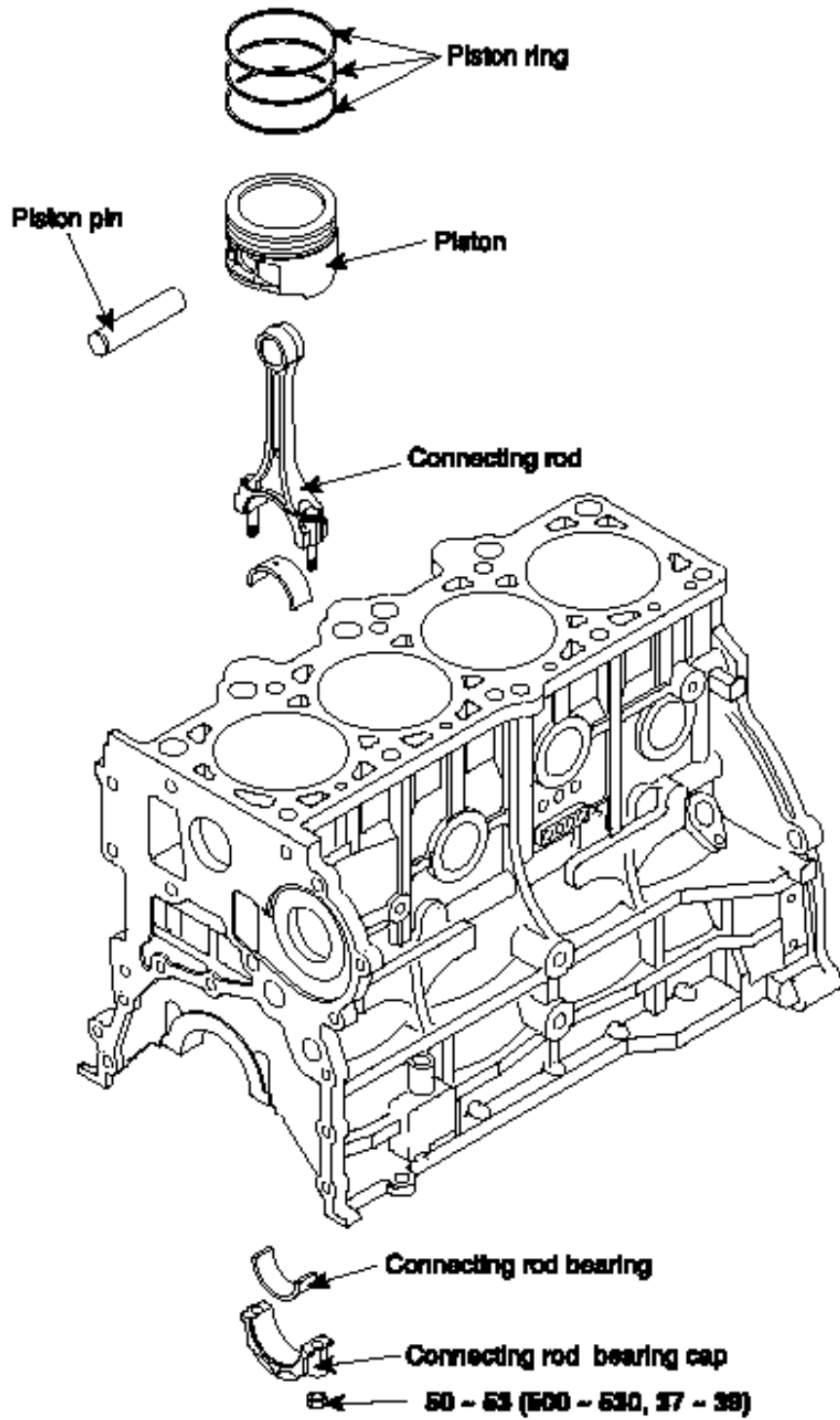
RADIATOR

1. Install the cooling fan to the radiator.
2. Install the radiator at the air conditioner condenser.
Installation is in the reverse order of removal.
3. Connect the fan motor connector.
4. Install the upper and lower radiator hoses, and ATF cooler hoses.
5. Fill with engine coolant.
6. Start engine and check for leaks.

COMPONENT



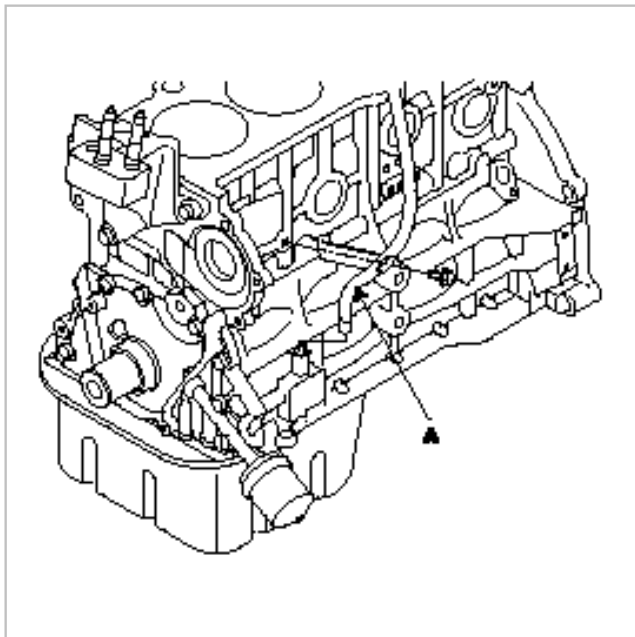
TORQUE : Nm (kgf.cm, lbf.ft)



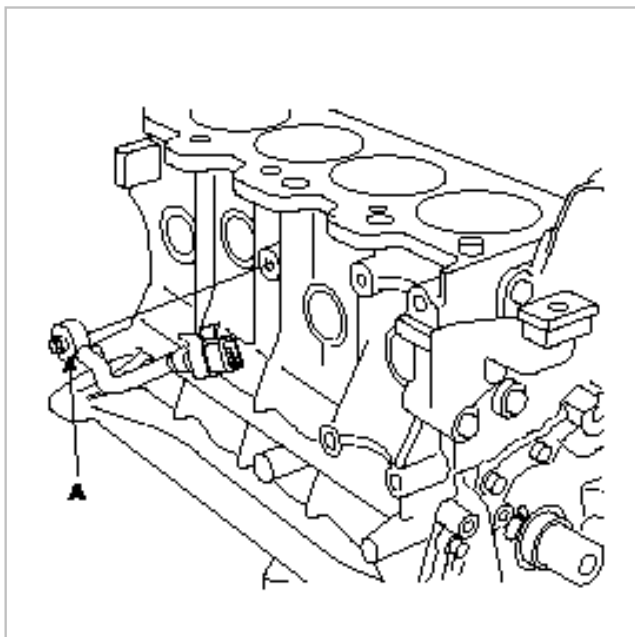
TORQUE : Nm (kgf.cm, lbf.ft)

DISASSEMBLY

1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly (A).
4. Remove timing belt(see page EM-25).
5. Remove cylinder head(see page EM-39)
6. Remove oil level gauge assembly (A).

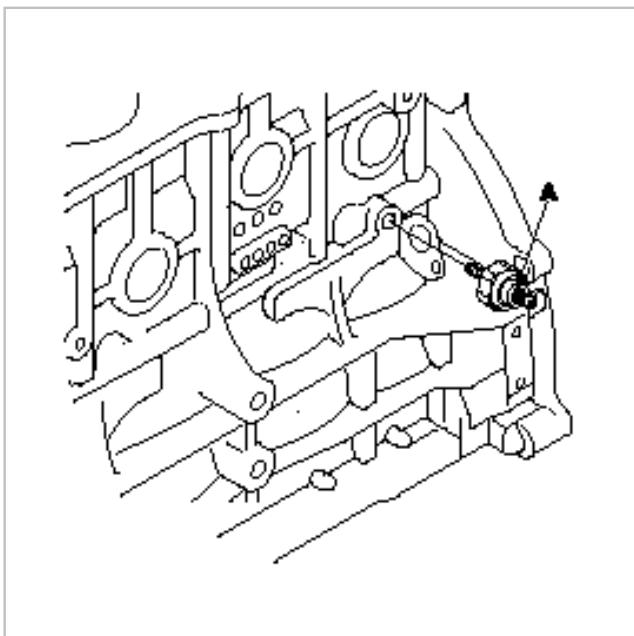


7. Remove knock sensor (A).



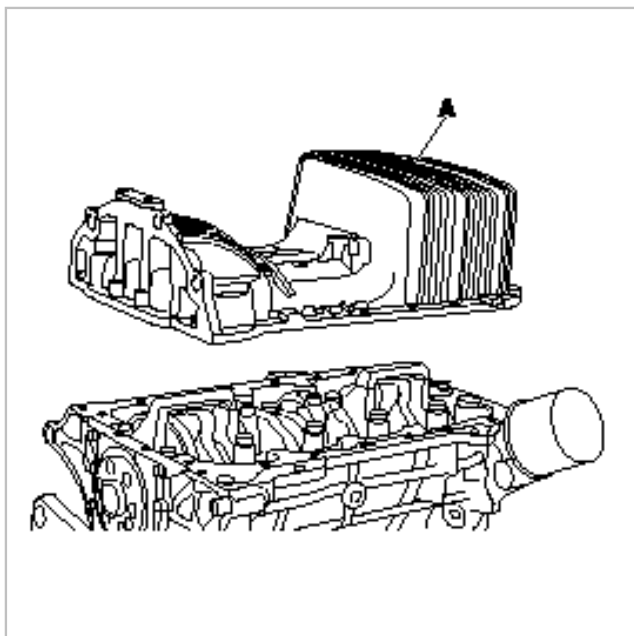
8. Remove oil pressure sensor (A).

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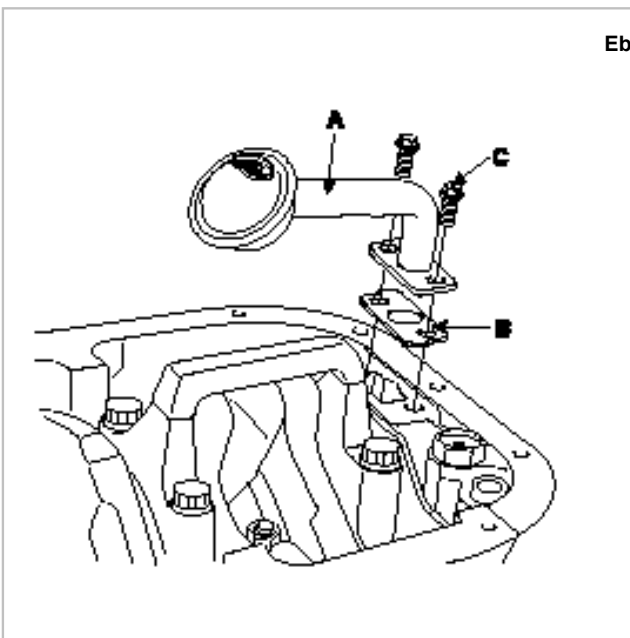
9. Remove water pump.(see page EM-99)

10. Remove oil pan (A).



11. Remove oil screen.

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

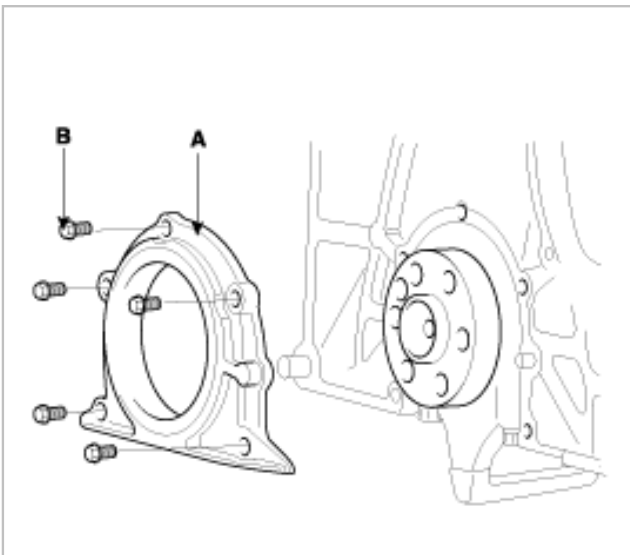


12. Check the connecting rod end play. (see page EM-77)
13. Remove the connecting rod caps and check oil clearance.(see page EM-77)
14. Remove piston and connecting rod assemblies.
 - (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
 - (2) Push the piston, connecting rod 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.

15. Remove front case. (see page EM-114)
16. Remove rear oil seal case.
Remove the 5 bolts (B) and rear oil seal case (A).



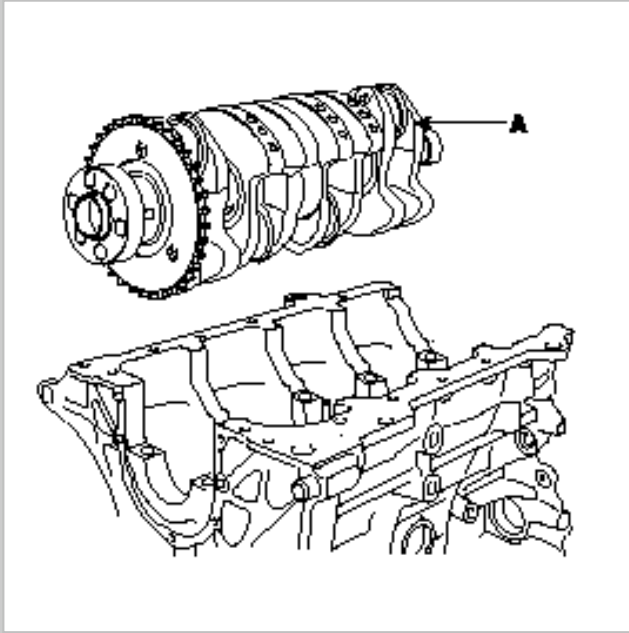
17. Remove crankshaft bearing cap and check oil clearance.(see page EM-80)
18. Check the crankshaft end play.(see page EM-82)

19. Lift the crankshaft out of the engine, being careful not to damage journals.

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NOTE

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



20. Check fit between piston and piston pin.

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

21. Remove piston rings.

- (1) Using a piston ring expander, 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.

22. Disconnect connecting rod from piston.

INSPECTION

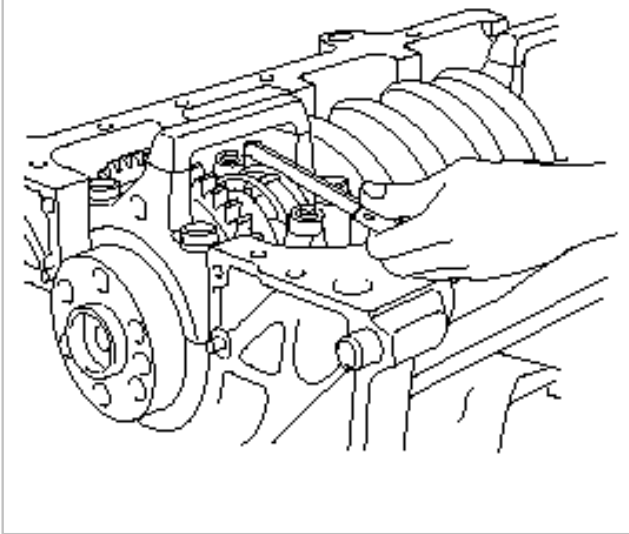
CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

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

Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in.)

Maximum end play : 0.4mm(0.016in.)



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.

(1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.

(2) Remove the 2 connecting rod cap nuts.

(3) Remove the connecting rod cap and bearing half.

(4) Clean the crank pin and bearing.

(5) Place plastigage across the crank pin.

(6) Reinstall the bearing half and cap, and torque the nuts.

Tightening torque

50 ~ 53 N.m (500 ~ 530kgf.cm, 36.9 ~ 39lb.ft)

NOTE

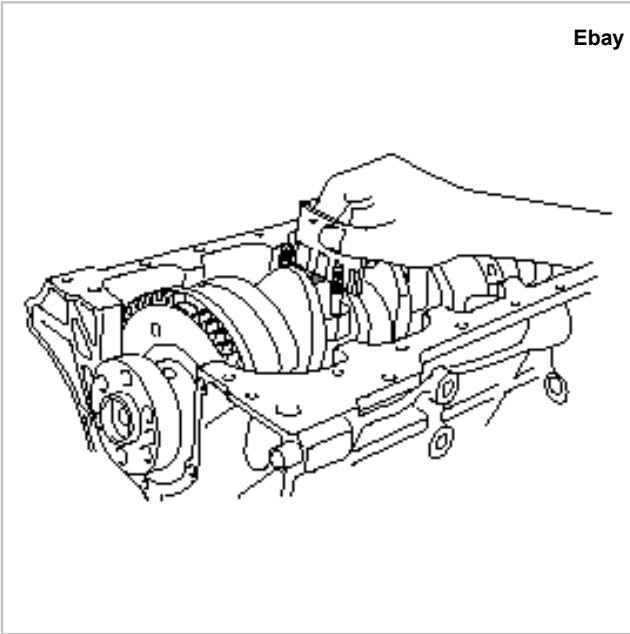
Do not turn the crankshaft.

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

(8) Measure the plastigage at its widest point.

Standard oil clearance :

0.024 ~ 0.042mm(0.0009 ~ 0.0017in.)



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

CAUTION

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

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

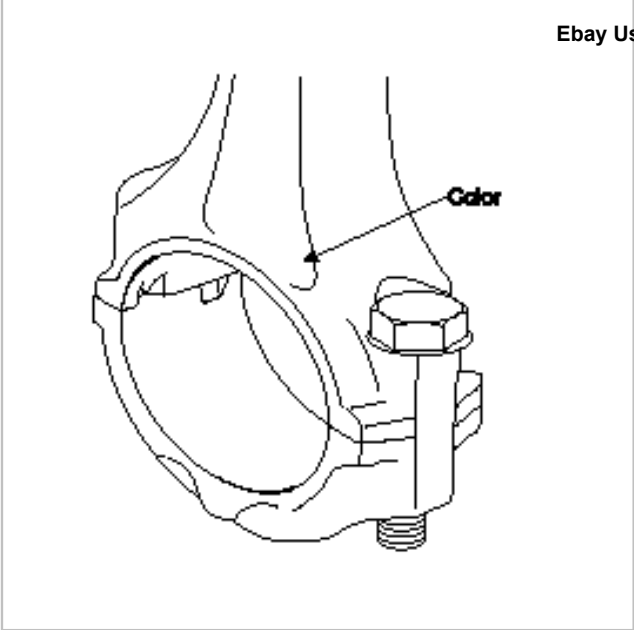
NOTE

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.

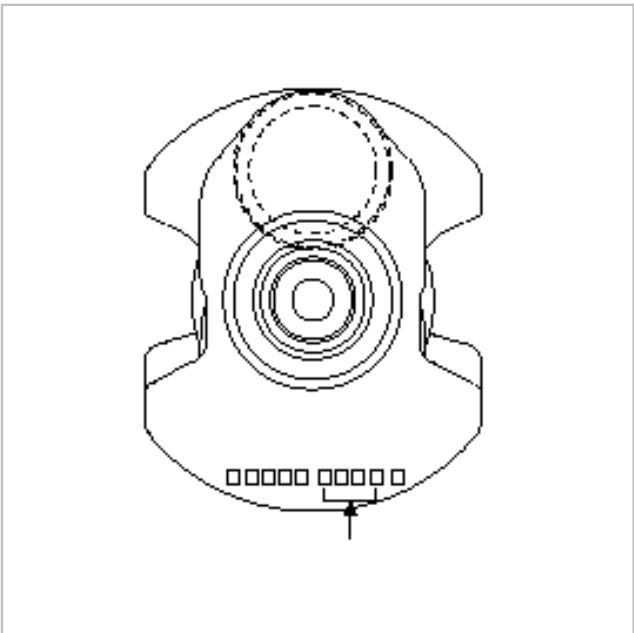
Connecting rod mark location

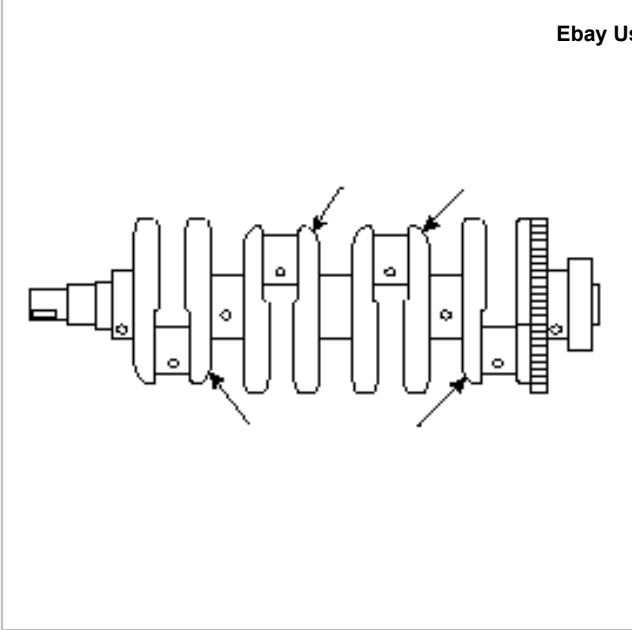


Discrimination of connecting rod

CLASS	MARK	INSIDE DIAMETER
a	WHITE	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
b	NONE	48.006 ~ 48.12mm (1.8899 ~ 1.8902in.)
c	YELLOW	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

Crankshaft pin mark location

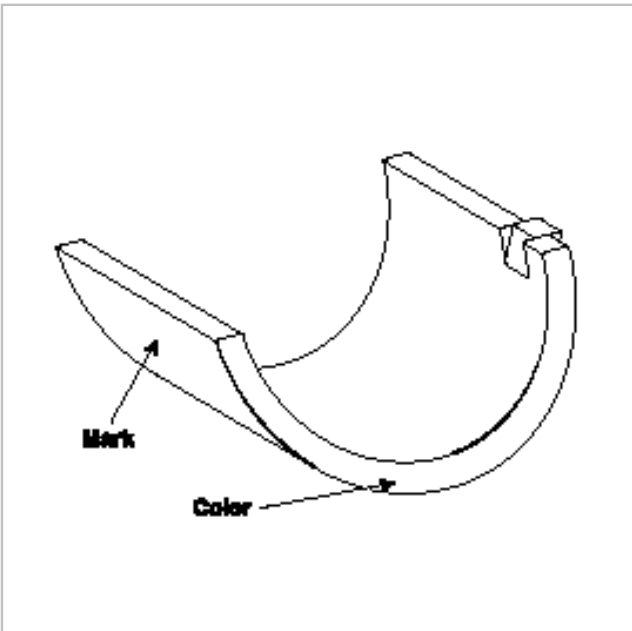




Discrimination of crankshaft

CLSASS	MARK	OUTSIDE DIAMETER OF PAN
I	YELLOW	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	NONE	44.955 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	WHITE	44.948 ~ 44.955mm (1.7696 ~ 1.7698in.)

Place of identification mark (Connecting rod bearing)



Discrimination of connecting rod bearing

CLASS	MARK	THICKNESS OF BEARING
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AA	Ebay User ID: reveleus1 BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
A	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	GREEN	0.505 ~ 0.508mm (0.593 ~ 0.594in.)
D	YELLOW	0.502 ~ 0.505mm (0.0591 ~ 0.0593in.)

(11) Selection

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (WHITE)	D (YELLOW)
	b (NONE)	C (GREEN)
	c (YELLOW)	B (NONE)
II (NONE)	a (WHITE)	C (GREEN)
	b (NONE)	B (NONE)
	c (YELLOW)	A (BLACK)
III (WHITE)	a (WHITE)	B (NONE)
	b (NONE)	A (BLACK)
	c (YELLOW)	AA (BLUE)

3. Check the crankshaft bearing oil clearance.

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

Tightening torque

30Nm (300kgf.cm, 22lb.ft) + 60° ~ 65°

NOTE

Do not turn the crankshaft.

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

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Standard oil clearance

0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)

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

CAUTION

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

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

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.

Connecting rods

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

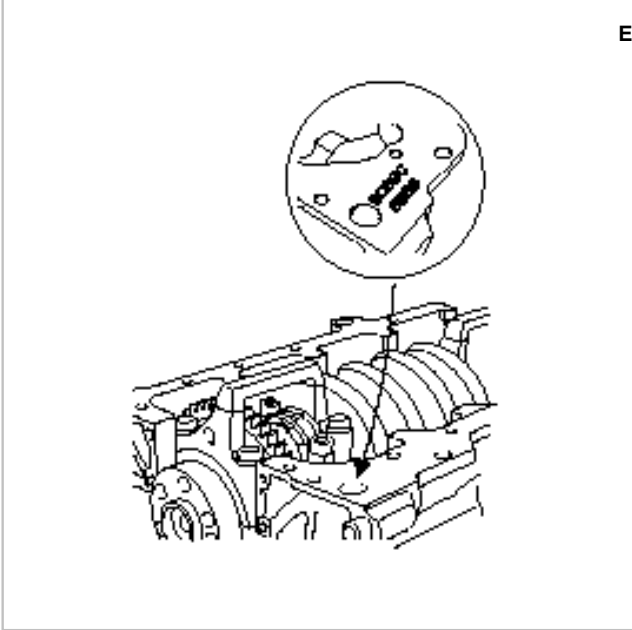
Allowable bend of connecting rod :

0.05mm / 100mm (0.0020 in./3.94 in.) or less

Allowable twist of connecting rod :

0.1mm / 100mm (0.0039 in./3.94 in.) or less

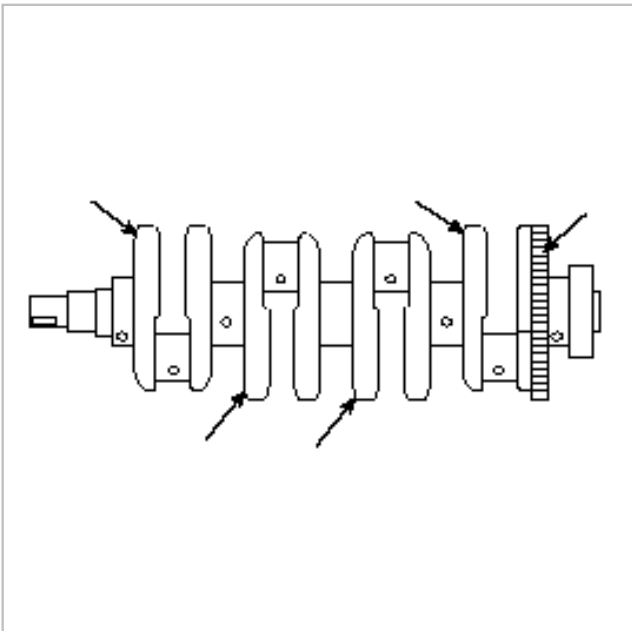
Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores.



Discrimination of cylinder block

CALSS	MARK	INSIDE DIAMETER
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

Crankshaft journal mark location



Discrimination of crankshaft

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
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54.956 ~ 54.962mm
(2.1636 ~ 2.1638in.)

I

NONE

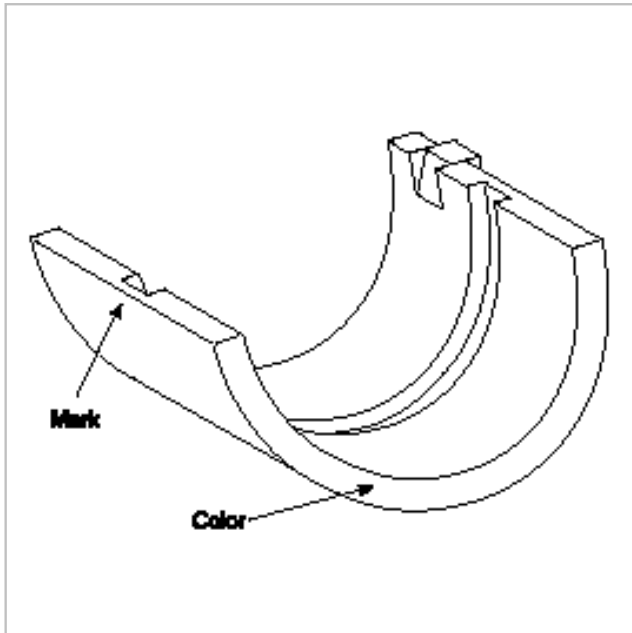
54.950 ~ 54.956mm
(2.1633 ~ 2.1636in.)

II

WHITE

54.944 ~ 54.950mm
(2.1631 ~ 2.1633in.)

III

Place of identification mark (Crankshaft bearing)**Discrimination of crankshaft bearing**

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
A	BLACK	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	NONE	2.008 ~ 2.011mm (0.0789 ~ 0.0790in.)
C	GREEN	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	YELLOW	2.002 ~ 5.005mm (0.0788 ~ 0.0789in.)

Selection

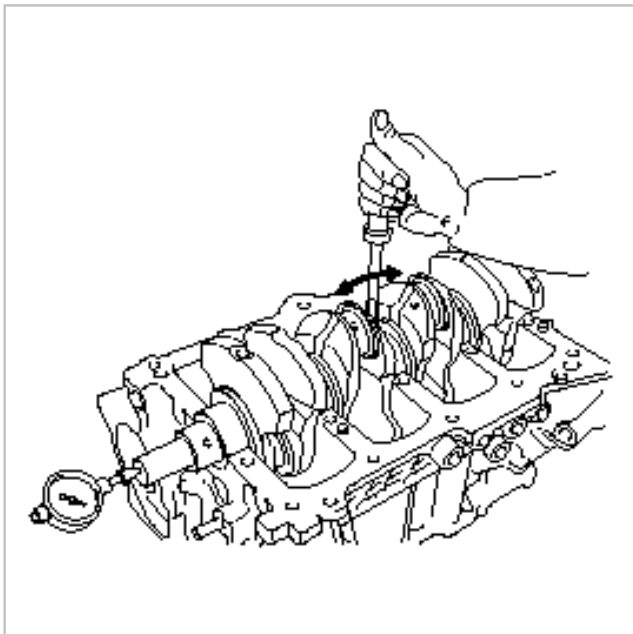
CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (NONE)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (WHITE)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

4. Check crankshaft end play.

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

: 0.06 ~ 0.26mm (0.0023 ~ 0.010in.)

Limit : 0.30mm (0.0118in.)



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

Thrust bearing thickness

2.44 ~ 2.47mm(0.096 ~ 0.097in.)

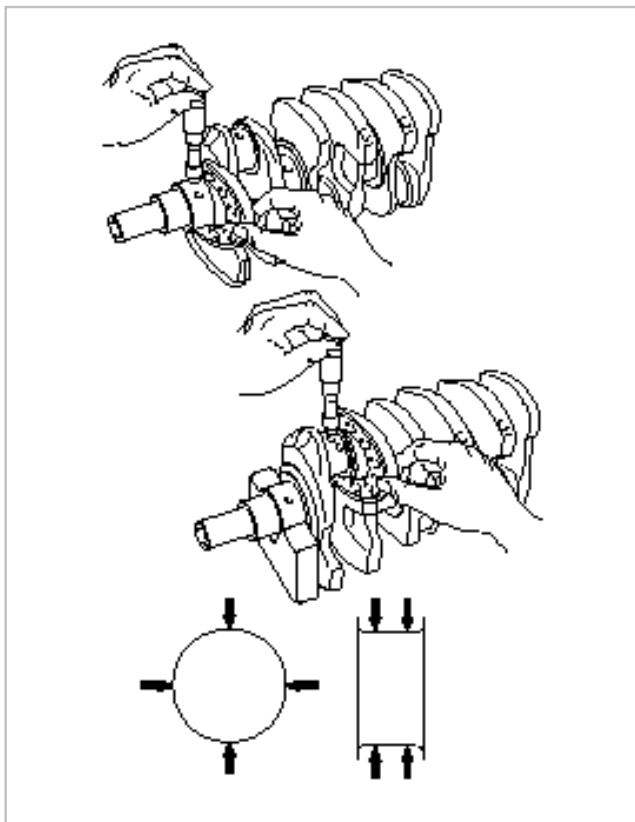
5. Inspect main journals and crank pins

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

Main journal diameter : 57mm (2.244in.)

Crank pin diameter : 45mm (1.77in.)



CYLINDER BLOCK

1. Remove gasket material.

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

2. Clean cylinder block

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

3. Inspect top surface of cylinder block for flatness.

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

Flatness of cylinder block gasket surface

Standard : Less than 0.03mm(0.0012 in.)

Limit : 0.05 mm (0.0020 in.)

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

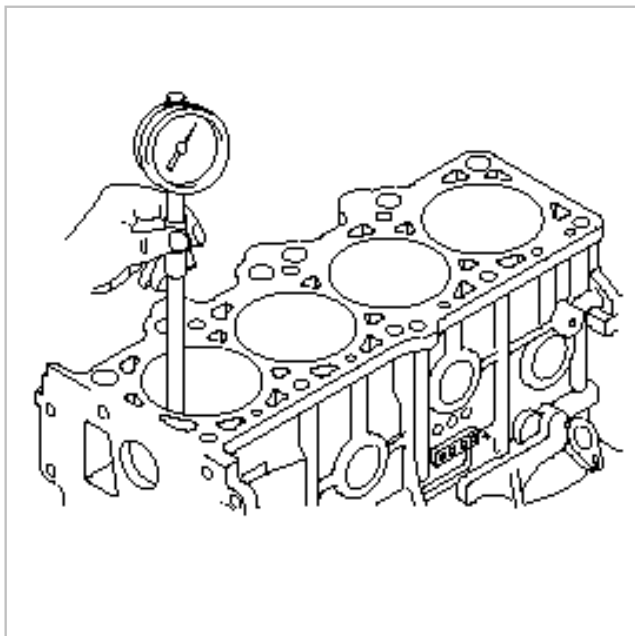
5. Inspect cylinder bore diameter

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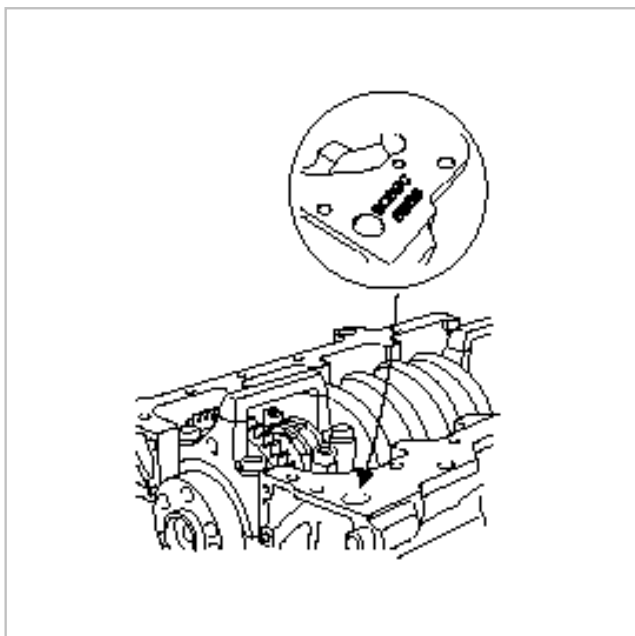
Using a cylinder bore gauge, measure the cylinder bore diameter at position A, B and C in the thrust and axial directions.

Standard diameter

82.00 ~ 82.03mm (3.2283 ~ 3.2295in.)

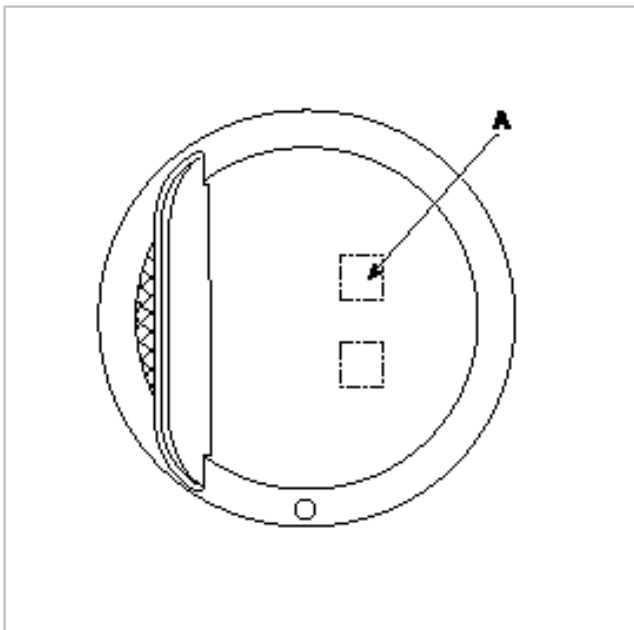


6. Check the cylinder bore size code (A) on the cylinder block bottom face.



Class	Cylinder bore inner diameter	Size code
A	82.00 ~ 82.01mm (3.2283~ 3.2287in.)	A
B	82.01 ~ 82.02mm (3.2287~ 3.2291in.)	None
C	82.02 ~ 82.03mm (3.2291~ 3.2295in.)	C

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



NOTE		
Stamp the grade mark of basic diameter with rubber stamp.		
Class	Piston outer diameter	Size code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in.)	A
B	81.98 ~ 81.99mm (3.2275 ~ 3.2279in.)	None
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in.)	C

8. Select the piston related to cylinder bore class.

Clearance

0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

Boring Cylinder

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

Identification Mark	Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.0250in.)

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., calculate the new bore size.
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New bore size = Piston O.D + 0.02 to 0.04 mm
(0.0008 to 0.0016 in.) (clearance between piston and
cylinder) - 0.01 mm (0.0004 in.) (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 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

NOTE

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

PISTON AND RINGS

1. Clean piston

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

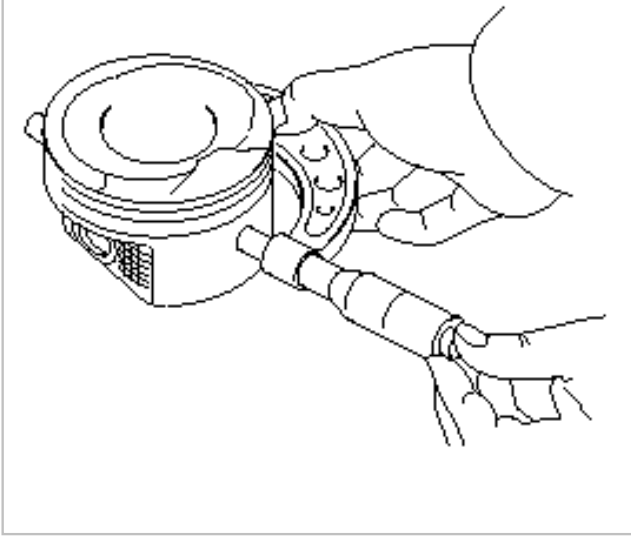
NOTE

Do not use a wire brush.

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

Standard diameter

81.97 ~ 82.00mm(3.2272 ~ 3.2283in.)



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

Piston-to-cylinder clearance

0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

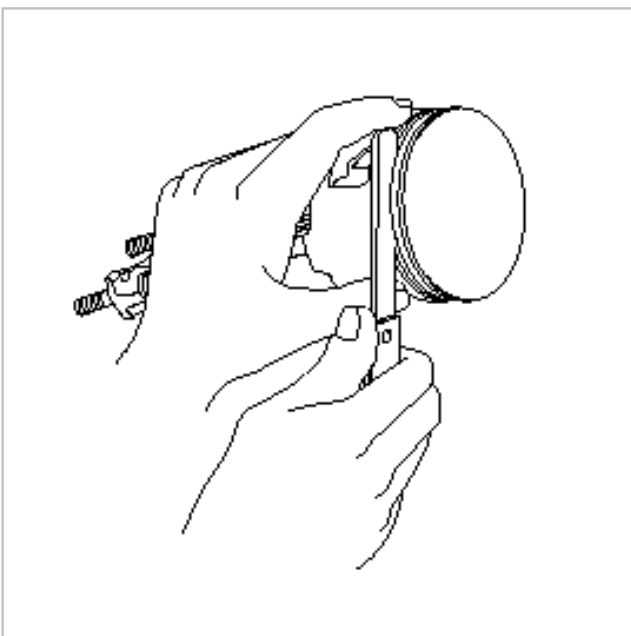
No. 1 : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in.)

No. 2 : 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)



If the clearance is greater than maximum, replace the piston.
Email: suzlever@gmail.com

5. Inspect piston ring end gap.

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

Piston ring end gap

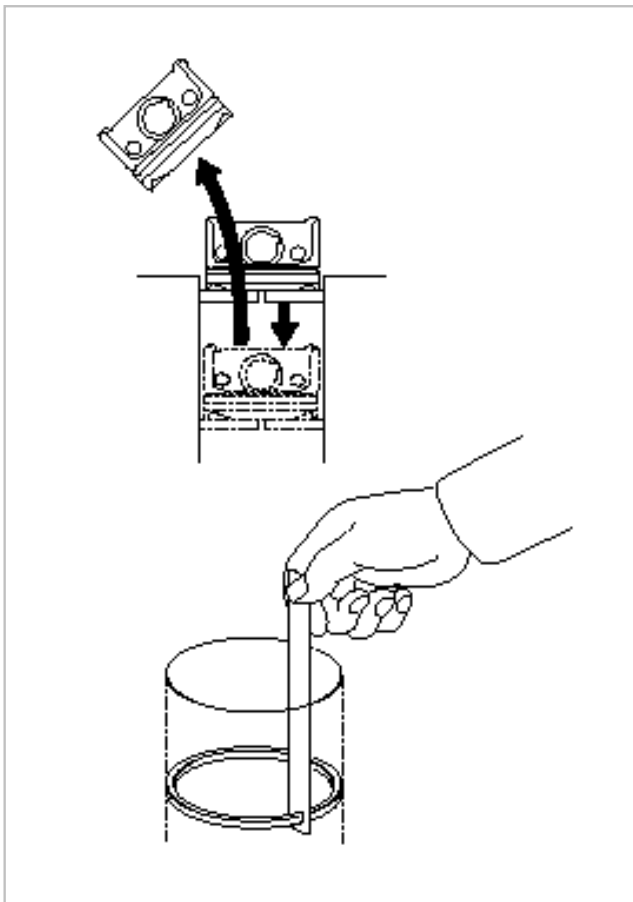
Standard

No. 1 : 0.23 ~ 0.38mm (0.0091 ~ 0.0150in.)

No. 2 : 0.33 ~ 0.48mm (0.0130 ~ 0.0189in.)

Limit

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



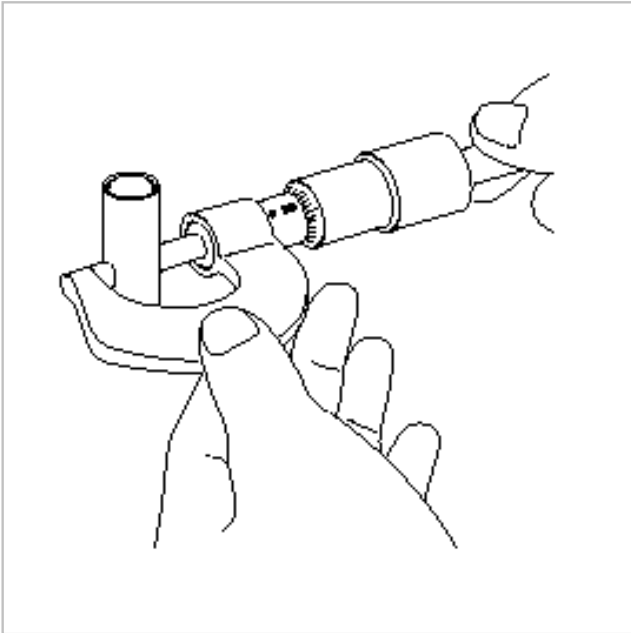
PISTON PINS

1. Measure the diameter of the piston pin.

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Piston pin diameter

20.001 ~ 20.006mm (0.7874 ~ 0.7876in.)



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

Piston pin-to-piston clearance

0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

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

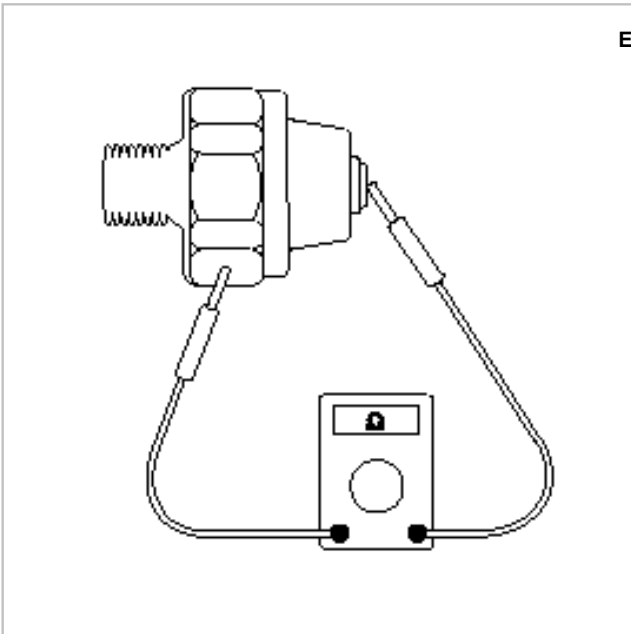
Piston pin-to-connecting rod interference

0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

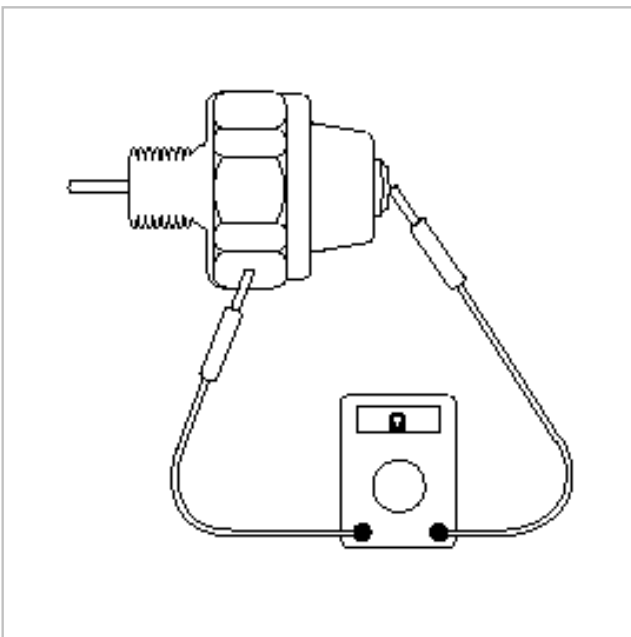
OIP PRESSURE SWITCH

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 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.
Check for air leakage. If air leaks, the diahragm is broken. Replace it.



REASSEMBLY

NOTE

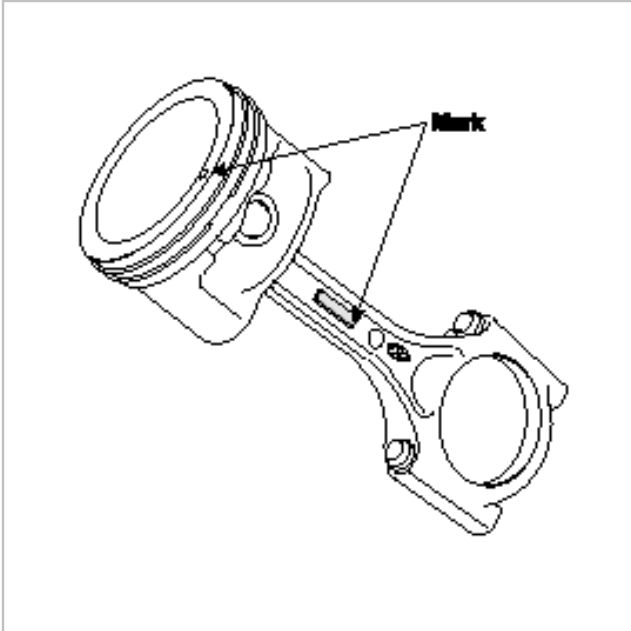
- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. Assemble piston and connecting rod.

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(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.

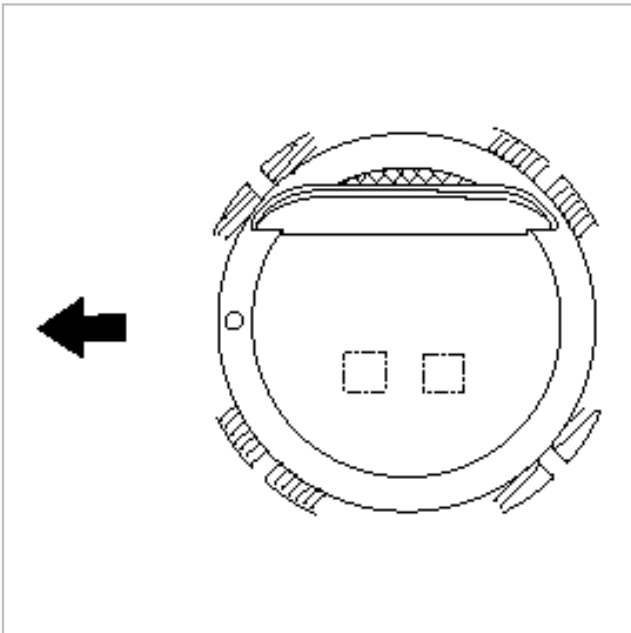


2. Install piston rings.

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

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

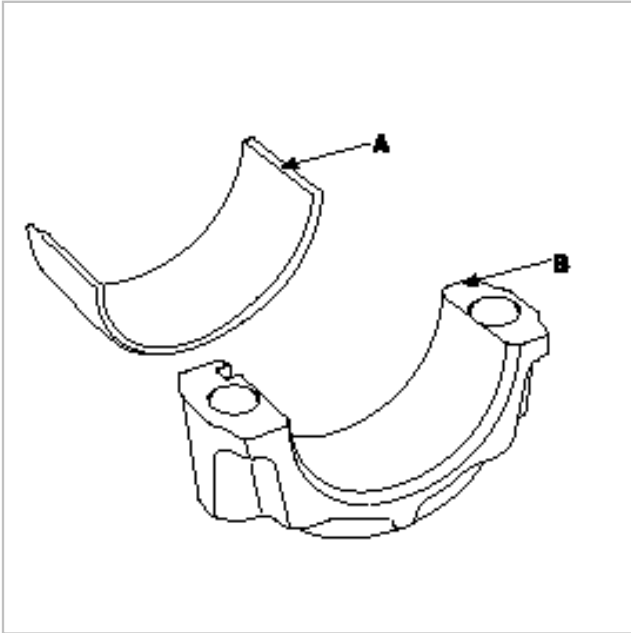
(3) Position the piston rings so that the ring ends are as shown.



3. Install connecting rod bearings.

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



4. Install main bearings.

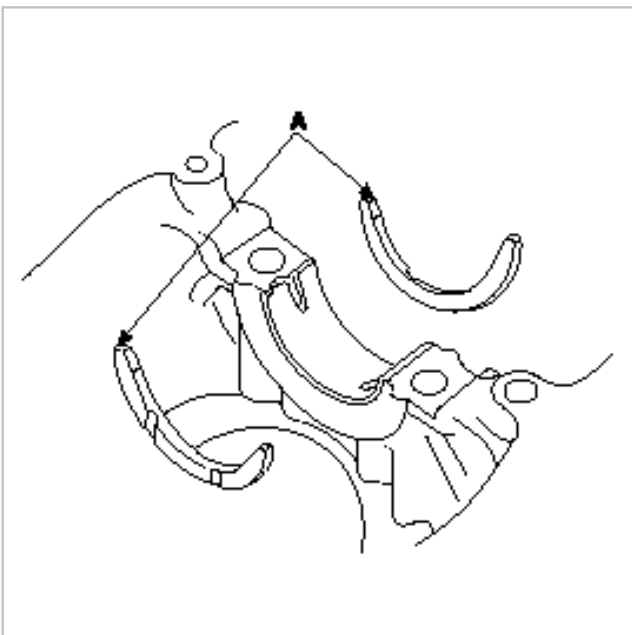
NOTE

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

- (1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings.
- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install thrust bearings.

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



6. Place crankshaft on the cylinder block.

7. Place main bearing caps on cylinder block.

8. Install main bearing cap bolts.

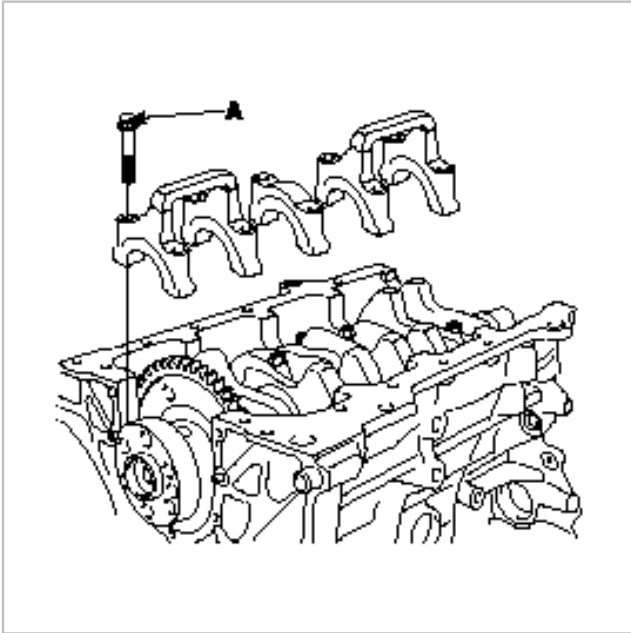
Ebay User ID: reveleus1

NOTE

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

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

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



- (3) Retighten the bearing cap bolts by 60°~65° in the numerical order shown.

Tightening torque

Main bearing cap bolt :

30Nm (300kgf.cm, 22lbf.ft) + 60° ~ 65°

- (4) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.(see page-)

10. Install piston and connecting rod assemblies.

NOTE

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

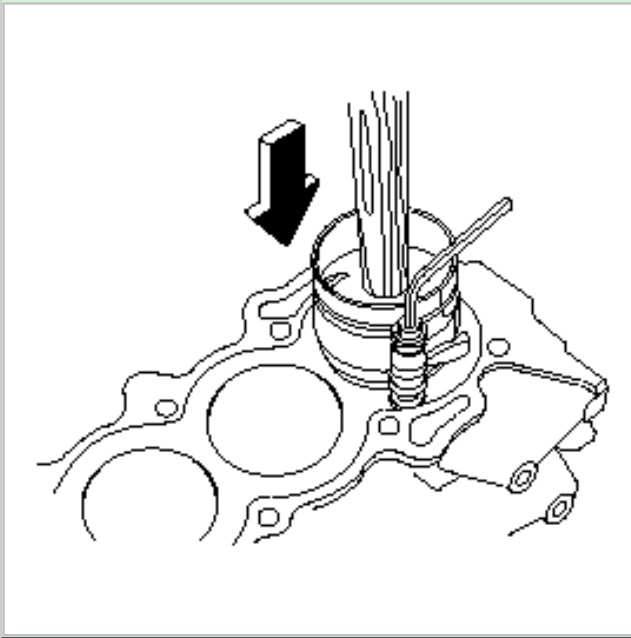
- (1) Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
- (2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.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

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

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NOTE

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



11. Install a new gasket and rear oil seal case with 5 bolts.

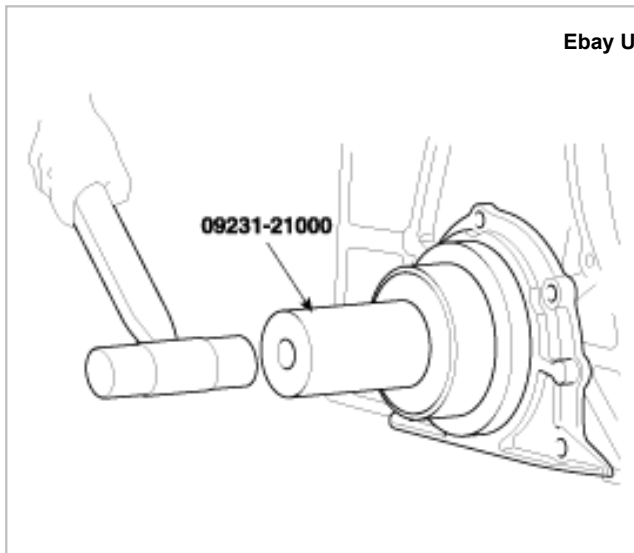
Tightening torque

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

NOTE

Check that the mating surfaces are clean and dry.

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



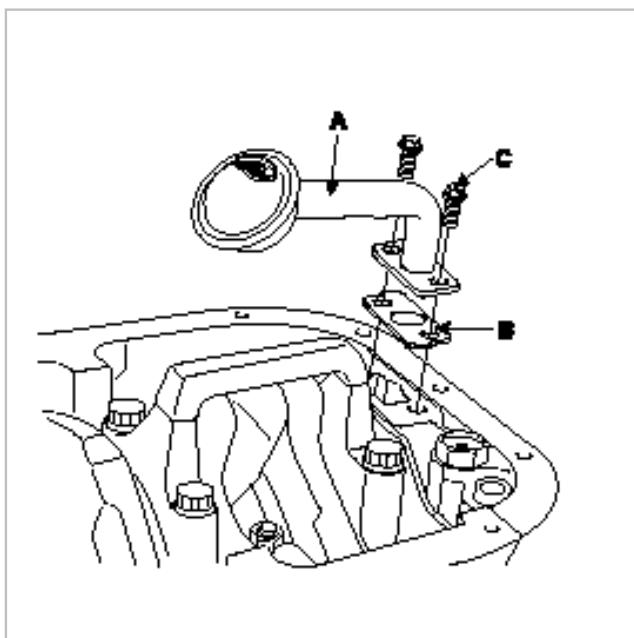
13. Install front case.(see page-)

14. Install oil screen.

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

Tightening torque

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



15. Install oil pan.

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(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.
Use liquid gasket MS 721-40A or equivalent.

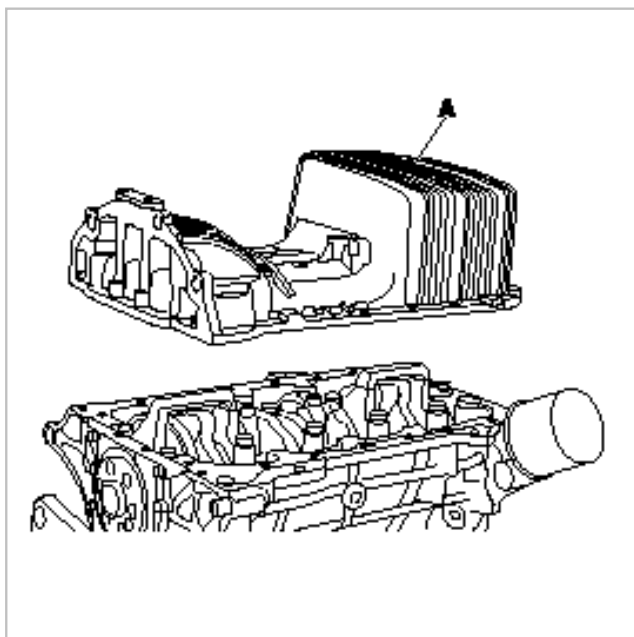
NOTE

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

(3) with the 19 bolts.
Uniformly tighten the bolts in several passes.

Tightening torque

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



16. Install water pump. (see page EM-104)

17. Install oil pressure sensor (A).

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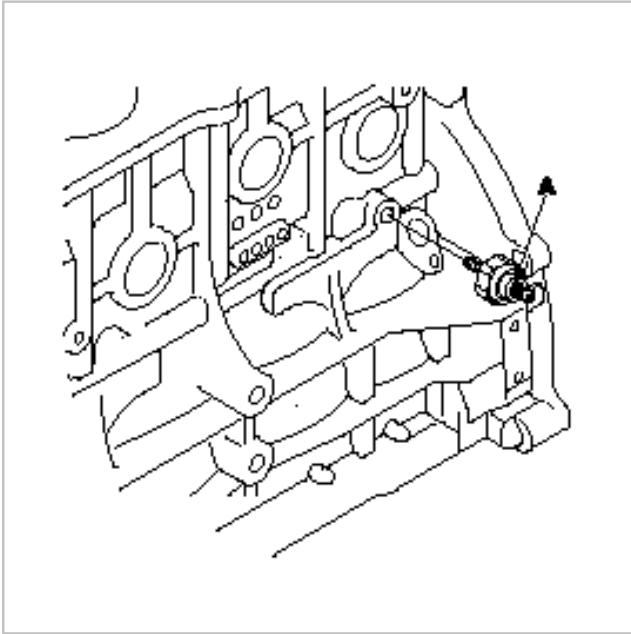
(1) Apply adhesive to 2 or 3 threads.

Adhesive : MS 721-39(B) or equivalent.

(2) Install the oil pressure sensor.

Tightening torque

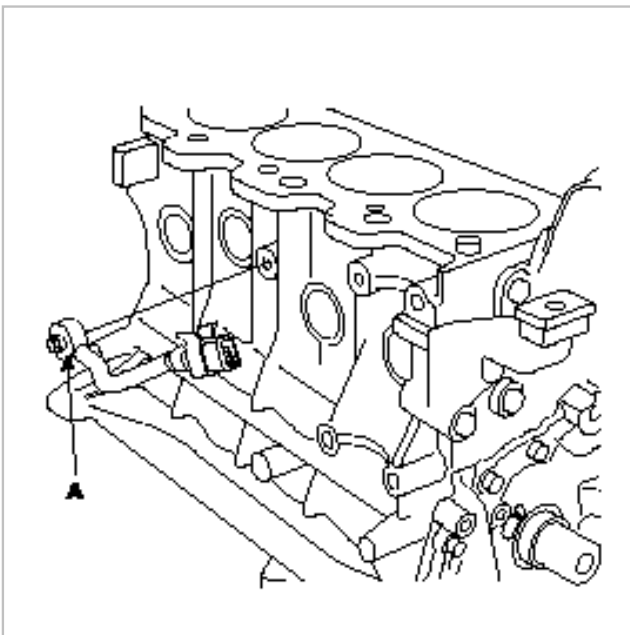
15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lb.ft)



18. Install knock sensor (A).

Tightening torque

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



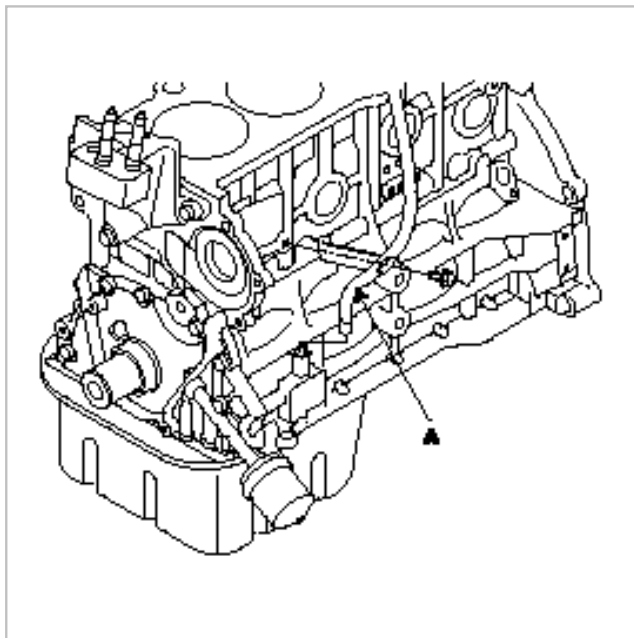
19. Install oil level gauge assembly.

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

Tightening torque

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



20. Install cylinder head. (see page EM-54)

21. Install timing belt. (see page EM-31)

22. Remove engine stand.

23. A/T : Install drive plate.

Tightening torque

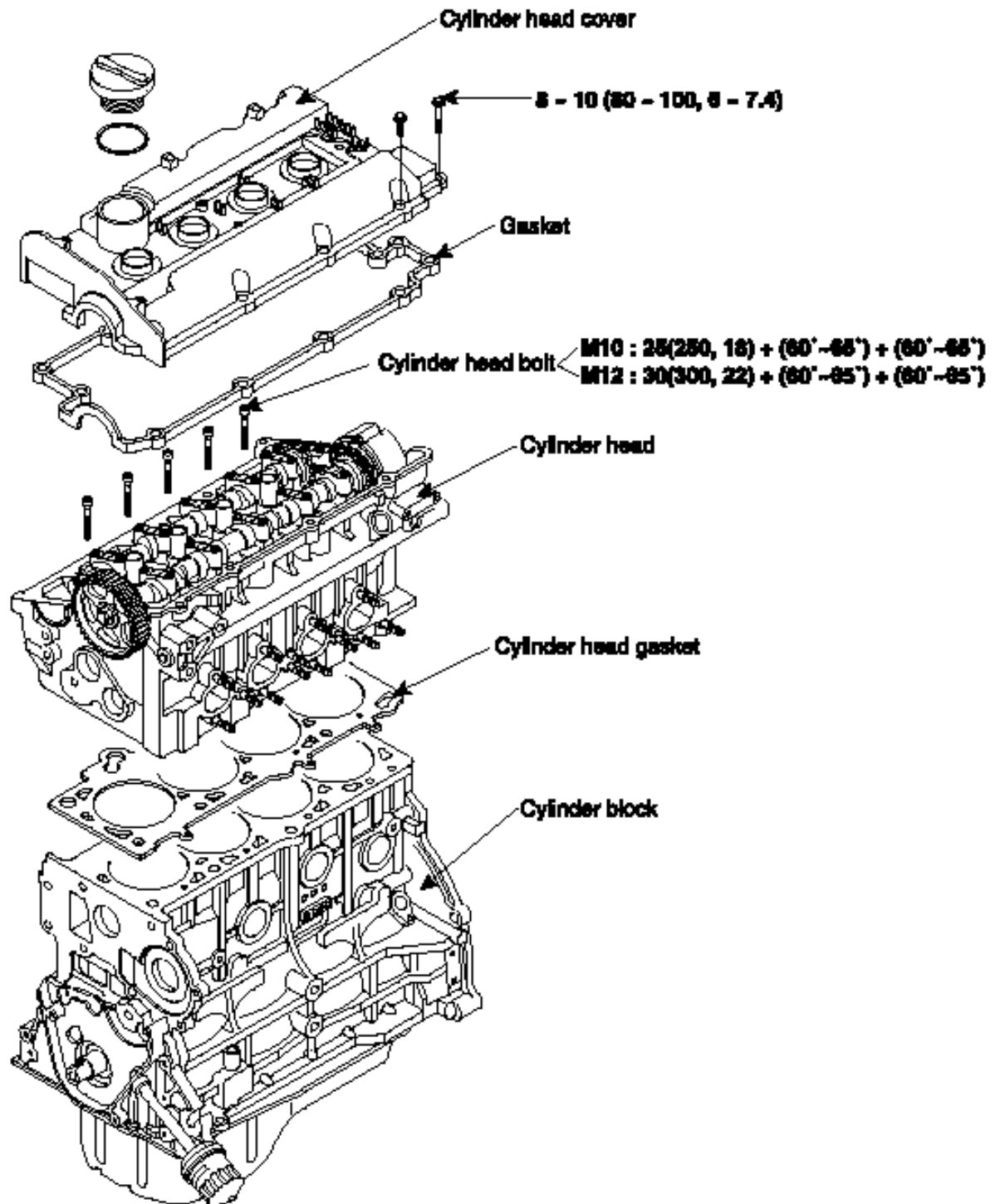
120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96bf.ft)

24. M/T : Install flywheel.

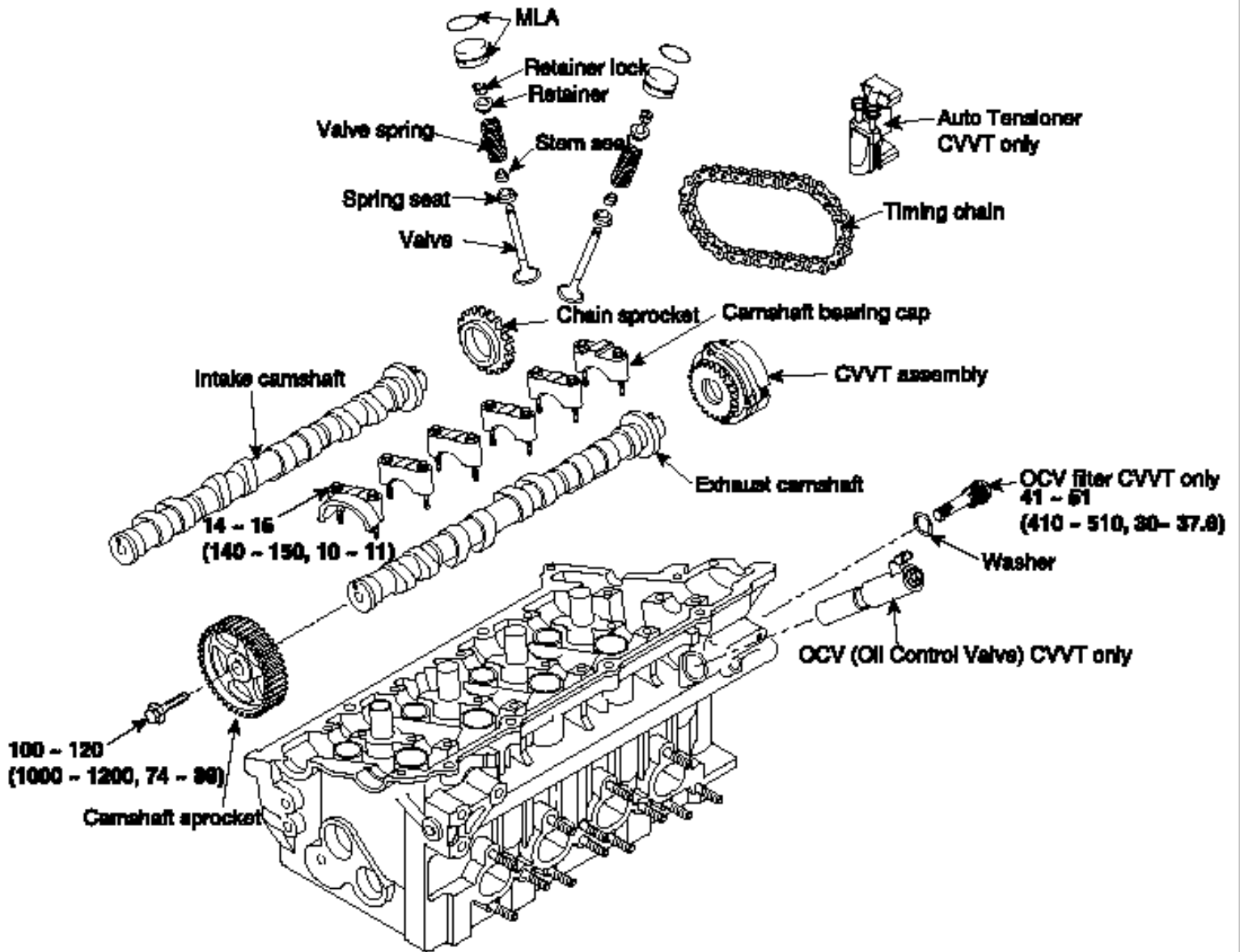
Tightening torque

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

COMPONENTS



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



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



REMOVAL

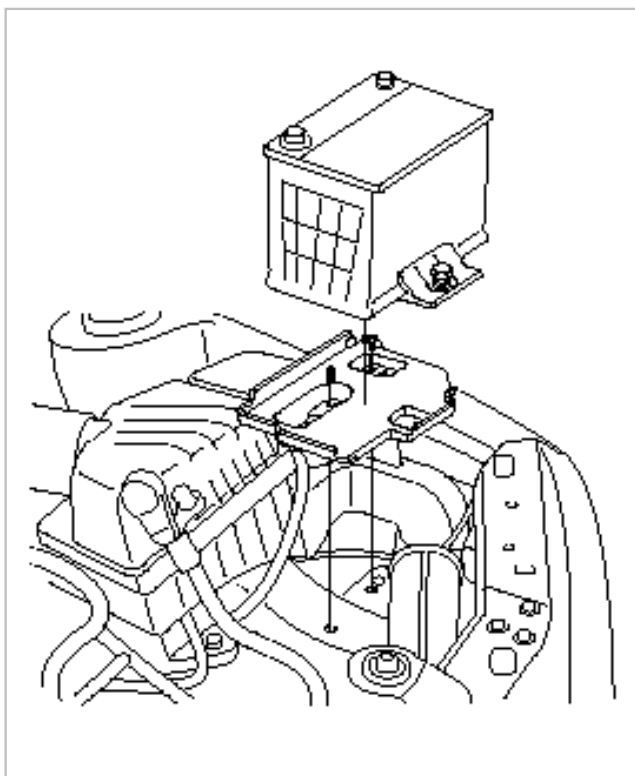
CAUTION

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

NOTE

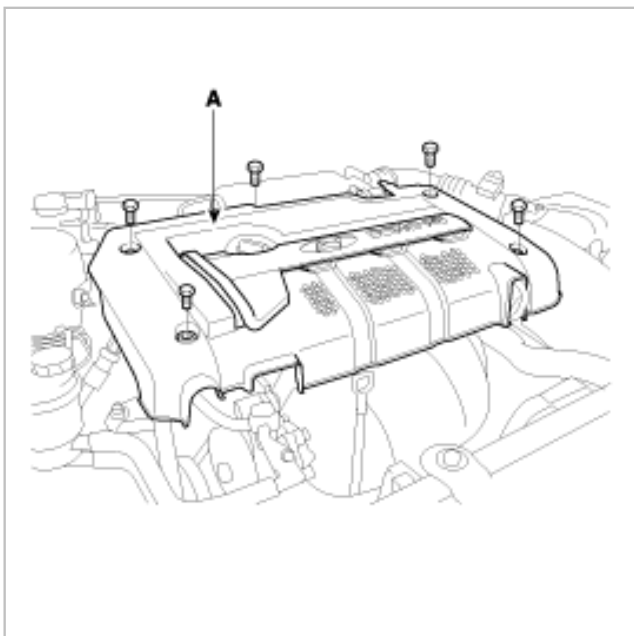
- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.(see page-).

1. Disconnect the negative terminal from the battery.



2. Remove the engine cover (A).

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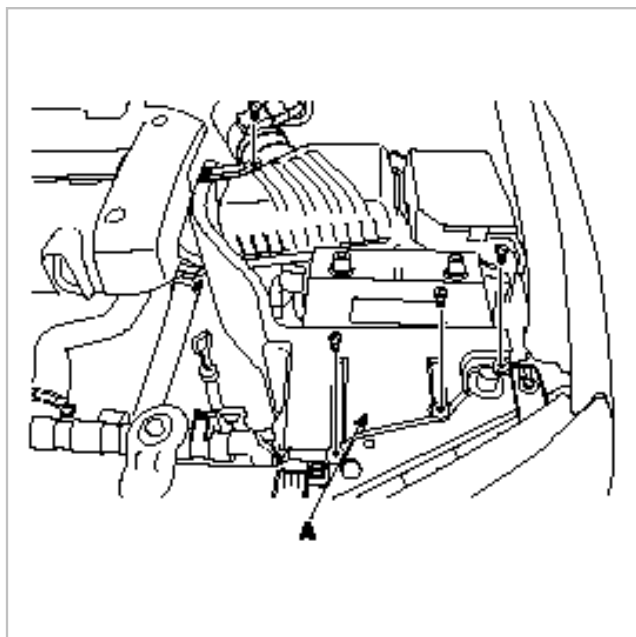


3. Drain the engine coolant(see page EM-97).

Remove the radiator cap to speed draining.

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

(1) Remove the heat shield (A).



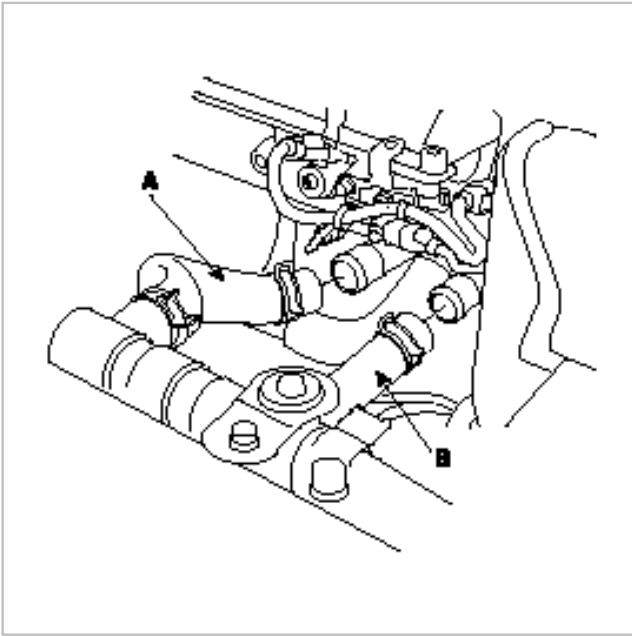
(2) Disconnect the AFS connector.

(3) Disconnect the breather hose from air cleaner hose.

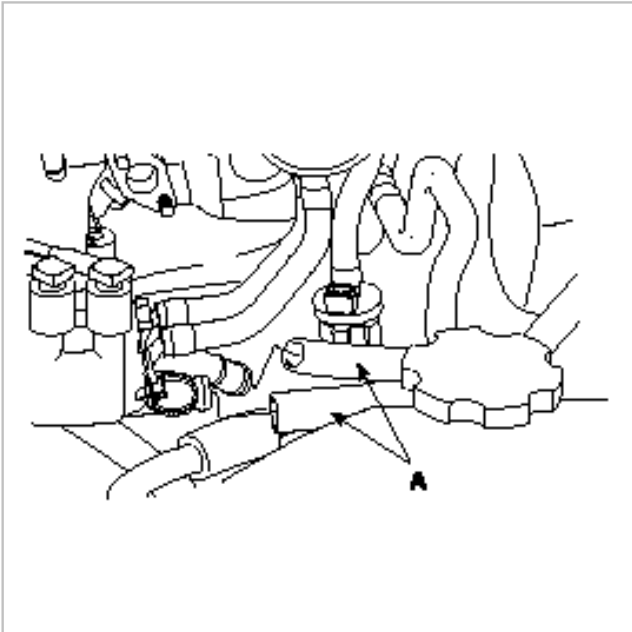
(4) Remove the intake air hose and air cleaner assembly.

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

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6. Remove the heater hoses (A).

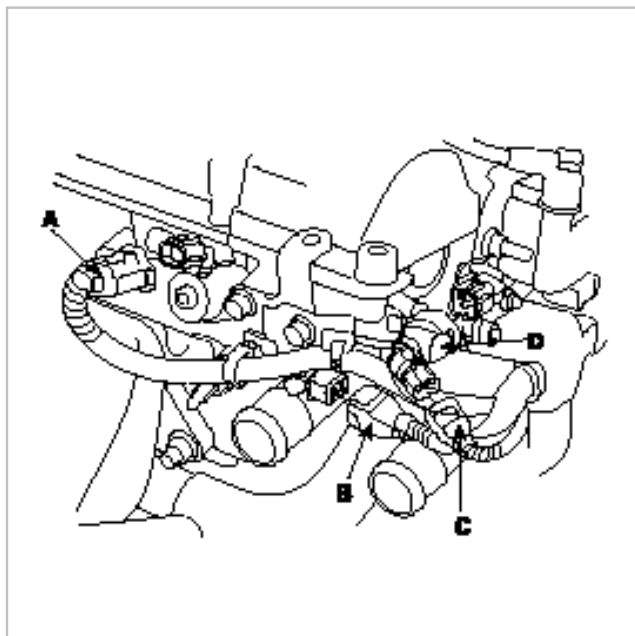


7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.

- (1) OCV(Oil control Valve) connector(A).
- (2) Oil temperature sensor connector(B).
- (3) ECT(Engine Coolant Temperature) sensor connector(C).

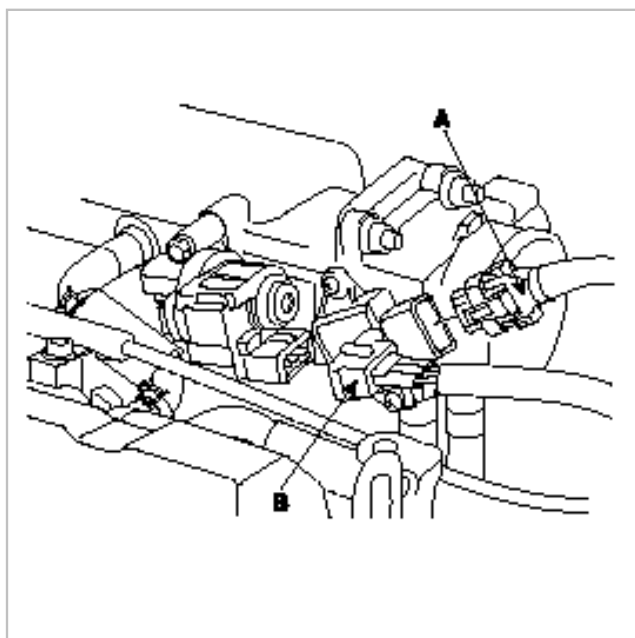
(4) Ignition coil connector(D).

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(5) TPS(Throttle Position Sensor) connector(A).

(6) ISA(Idle Speed Actuator) connector(B).

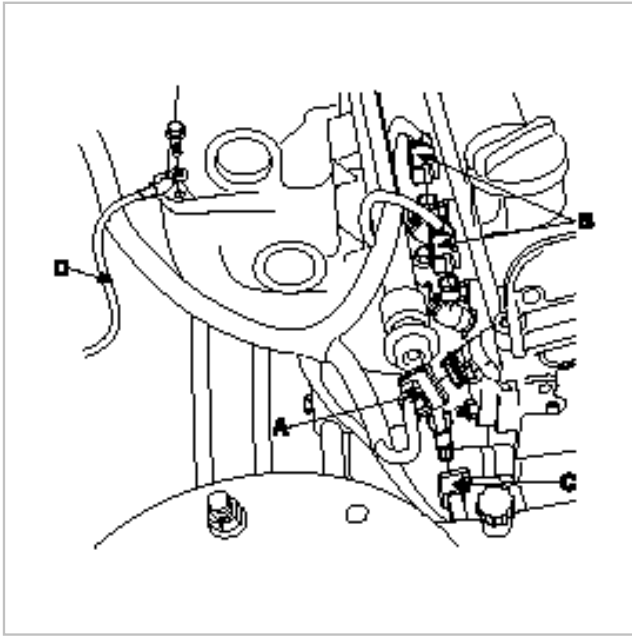


(7) CMP(Camshaft Position Sensor) connector(A).

(8) Four fuel injector connectors(B).

(9) Knock sensor connector(C).

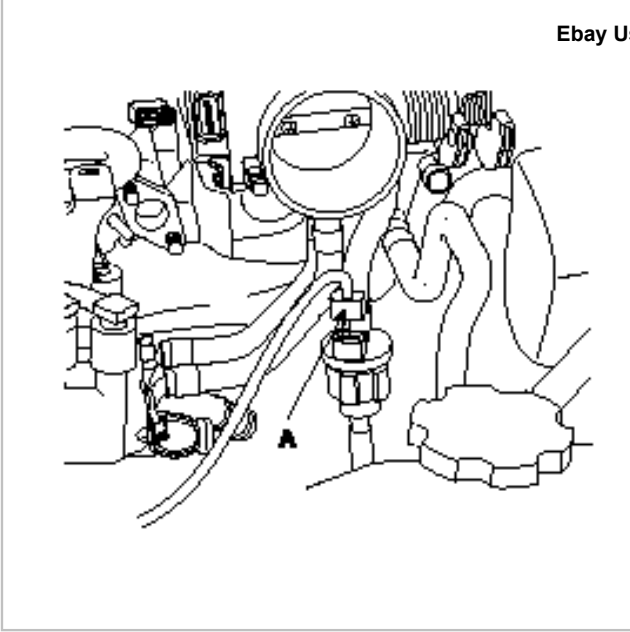
(10) Disconnect ground cable(D) from the intake manifold.
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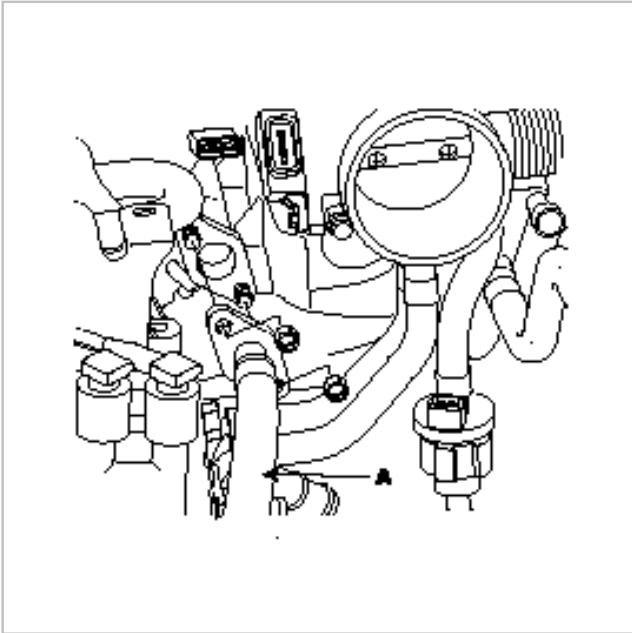
(11) Front heated oxygen sensor connector(A).



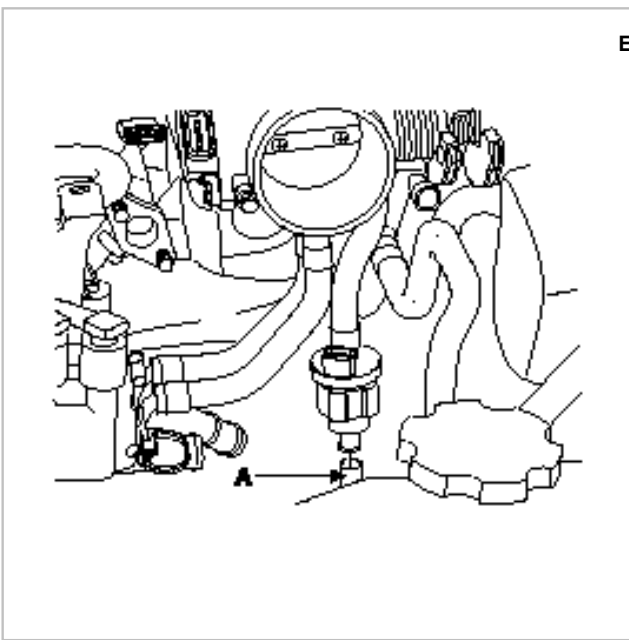
(12) PCSV(Purge Control Solenoid Valve) connector(A).



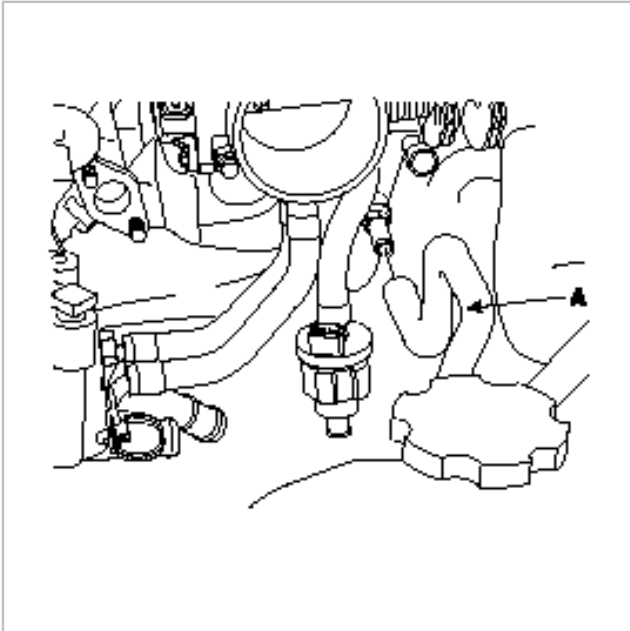
8. Remove the fuel inlet hose(A) from delivery pipe.



9. Remove the PCSV hose(A).



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



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

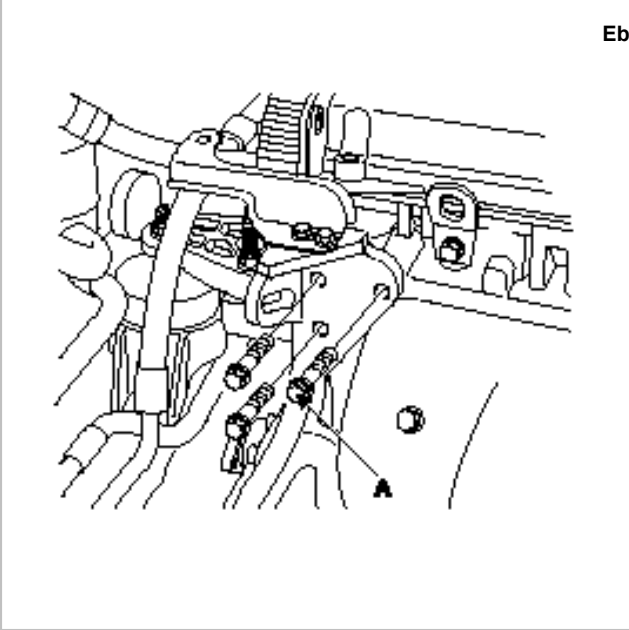
12. Remove the power steering pump.(see ST group - power steering pump)

13. Remove the power steering pump bracket bolts.

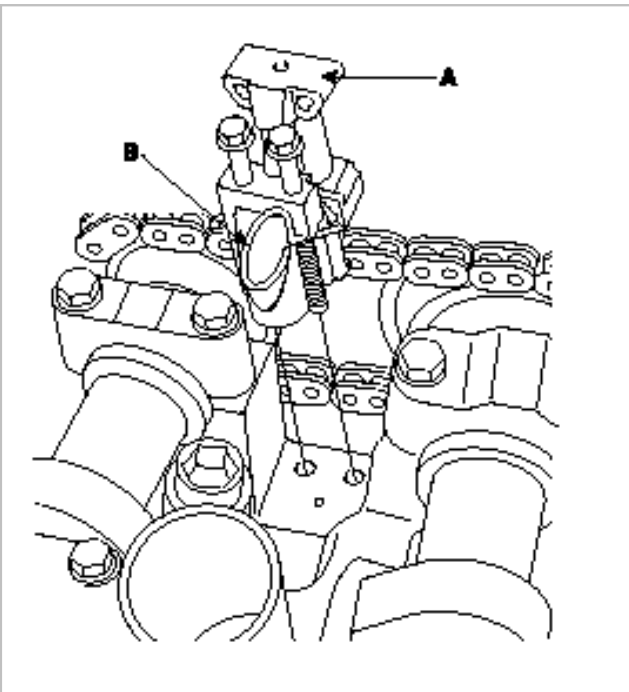
Purchased
from Ebay seller
Reveleus1

Thank-you for purchasing from me, it
is much appreciated.

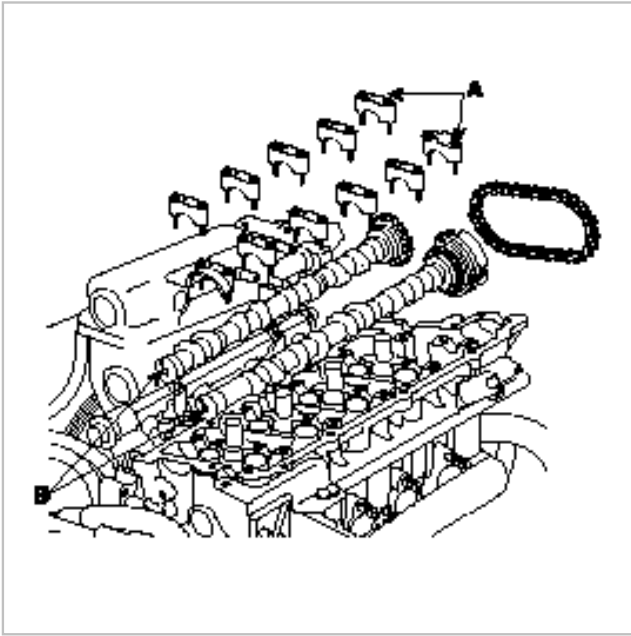
To contact me please email
suzlever@gmail.com



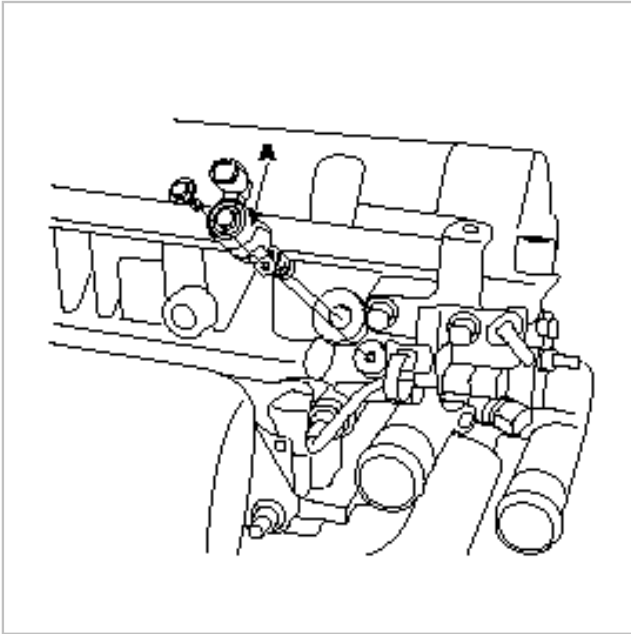
14. Remove the spark plug cable. (see EE group - ignition)
15. Remove the PCV hose. (see page EM-12)
16. Remove the cylinder head cover(see page EM-13).
17. Remove the timing belt(see page EM-25).
18. Remove the exhaust manifold(see page EM-117).
19. Remove the intake manifold.(see page EM-116).
20. Remove the camshaft sprocket.(see page EM-29).
21. Remove the timing chain auto tensioner.



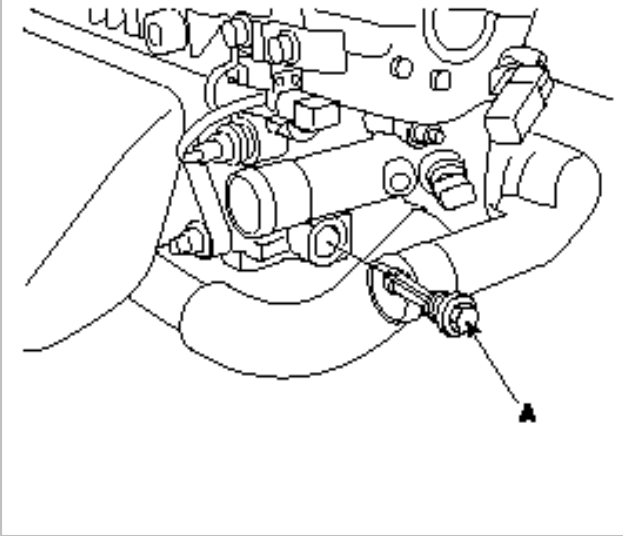
22. Remove the camshaft bearing caps(A) and camshafts(B).
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23. Remove the OCV(oil control valve) (A).

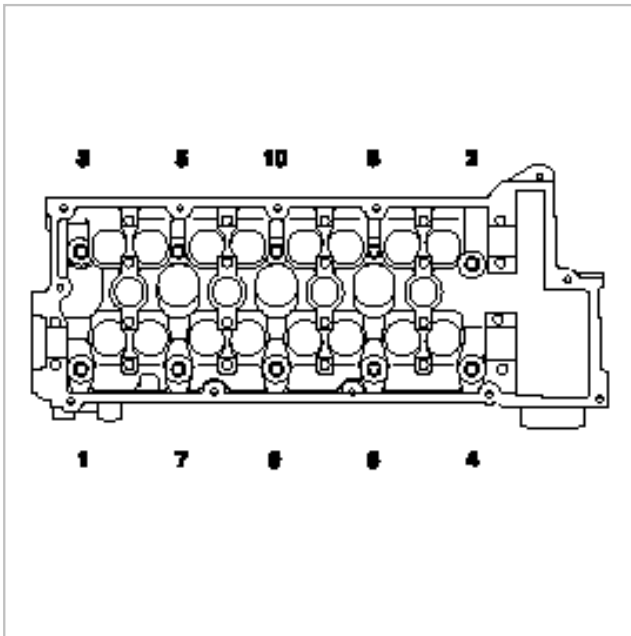


24. Remove the OCV(oil control valve) filter (A).



25. Remove the cylinder head bolts, then remove the cylinder head.

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



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

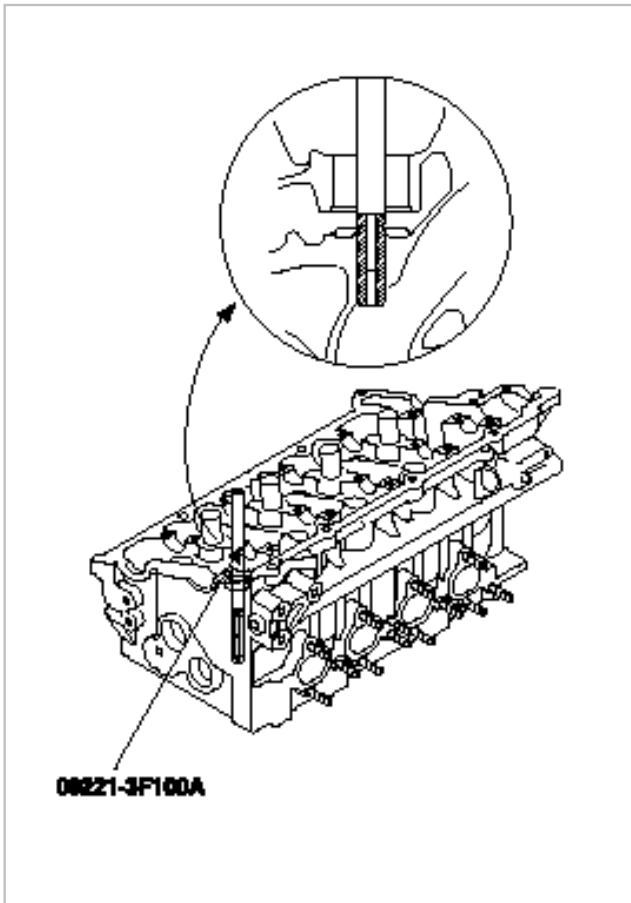
Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

REPLACEMENT

VALVE GUIDE

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

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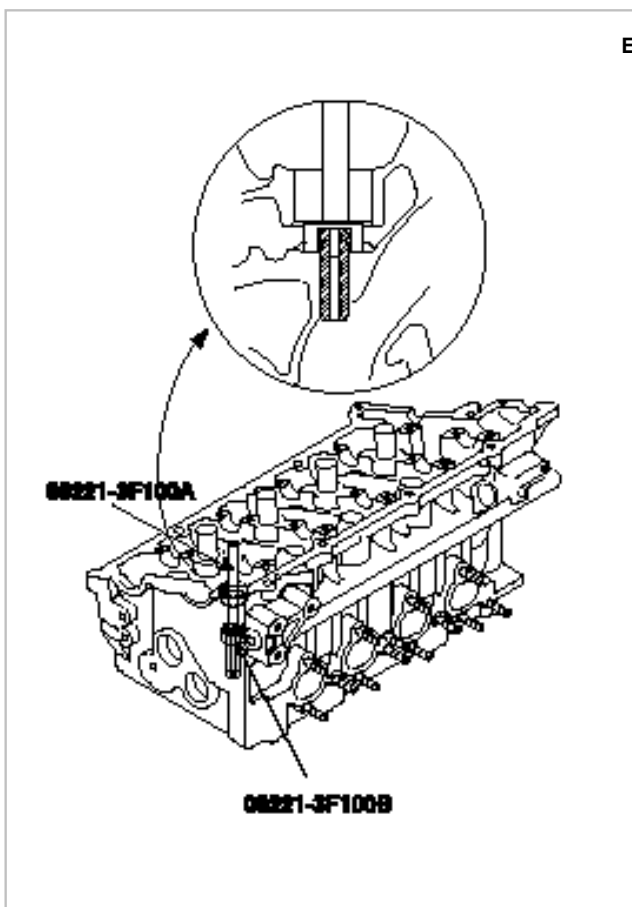
2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.
3. Using the SST(service special tool: 09221-3F100A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust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

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

Valve guide length

Intake : 46mm (1.8in.)

Exhaust : 54.5mm (2.15in.)



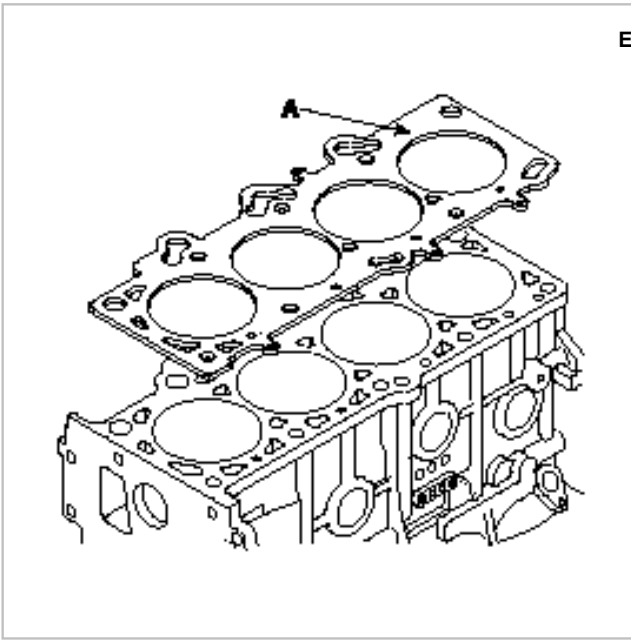
4. After the valve guide is press-fitted, insert a new valve and check for proper stem -to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

INSTALLATION

NOTE

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

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.
3. Install cylinder head bolts.
 - (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

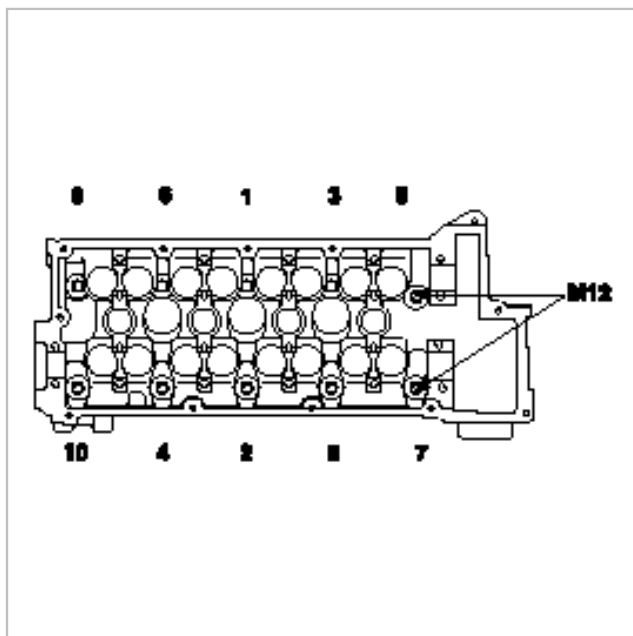
Tightening torque

M10 :

25Nm (250kgf.cm, 18lb.ft) + (60° ~ 65°) + (60° ~ 65°)

M12 :

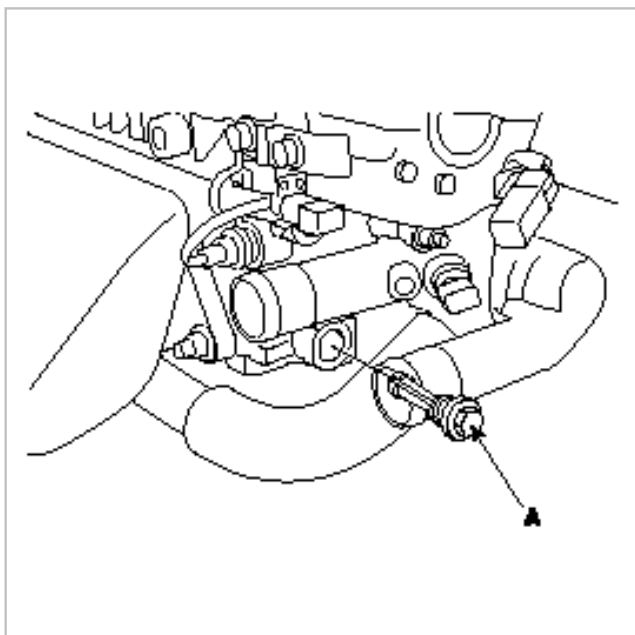
30Nm (300kgf.cm, 22lb.ft) + (60° ~ 65°) + (60° ~ 65°)



4. Install OCV filter (A).

Tightening torque

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



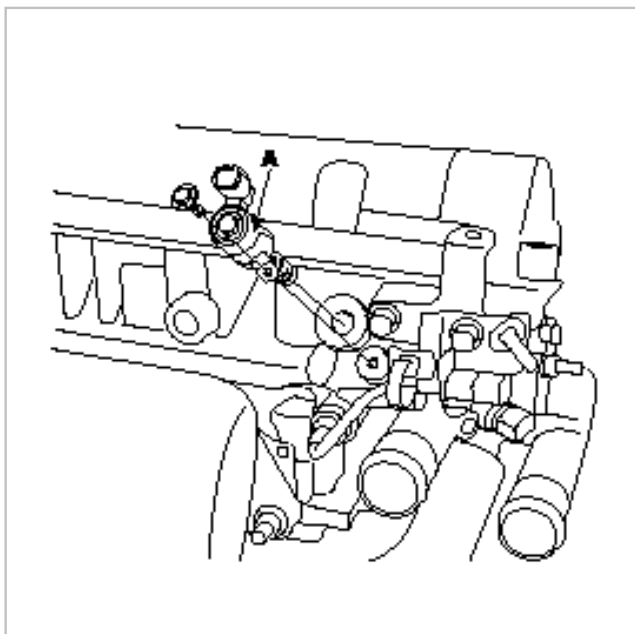
NOTE

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

5. Install OCV.

Tightening torque

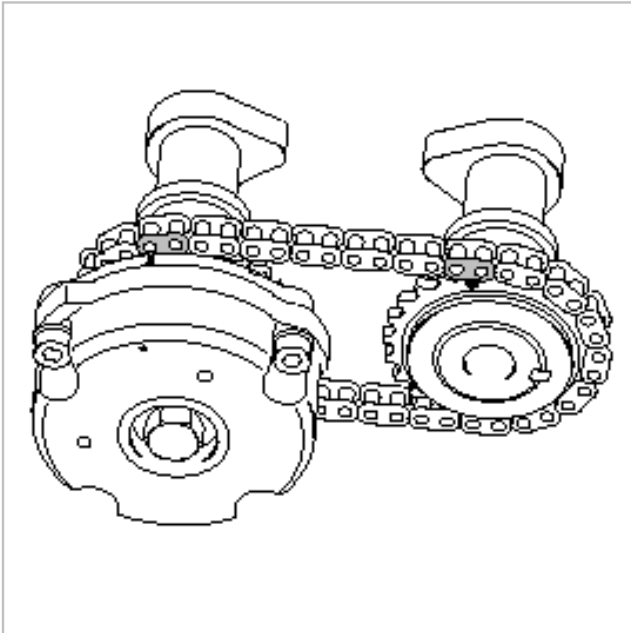
10 ~ 12Nm(100 ~ 120kgf.cm, 7.3 ~ 8.8lb.ft)



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

6. Install the camshafts.

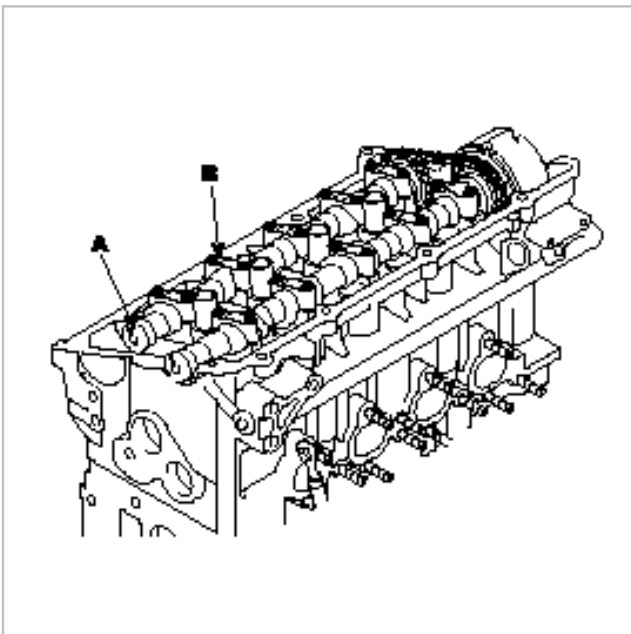
- (1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



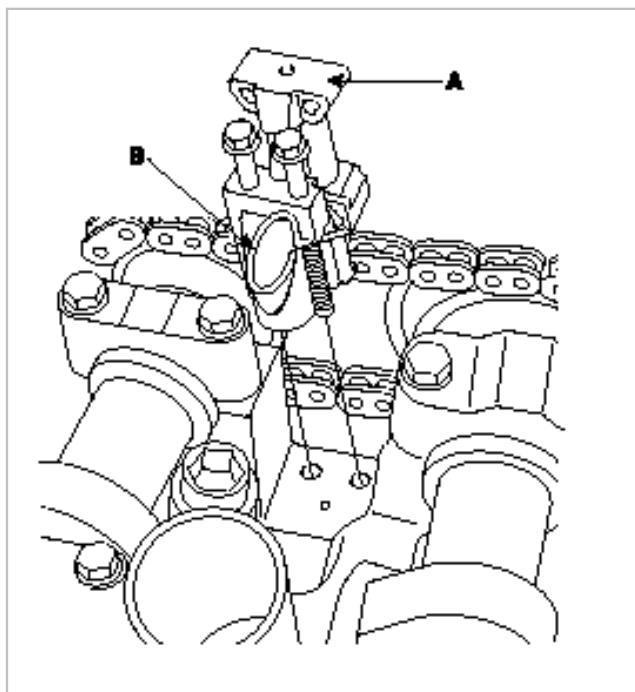
- (2) Install the camshafts and bearing caps.

Tightening torque

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



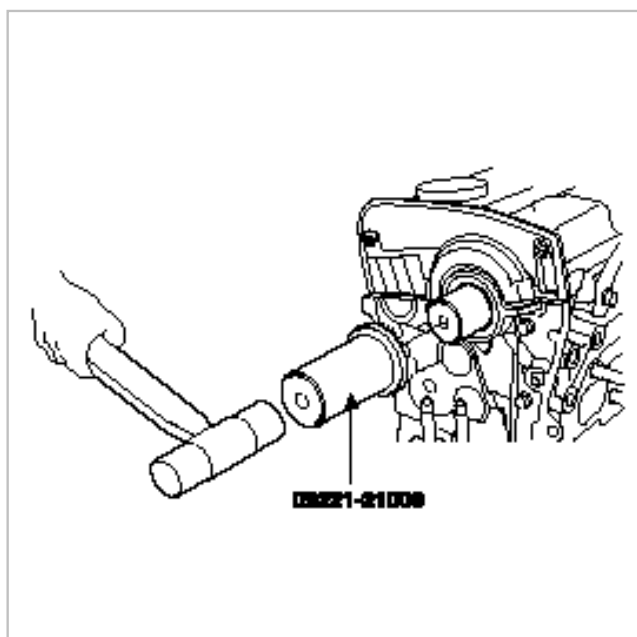
(3) Install the timing chain auto tensioner (A). Ebay User ID: reveleus1



(4) Remove the auto tensioner stopper pin (B).

7. Check and adjust valve clearance.(see page EM-12).

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



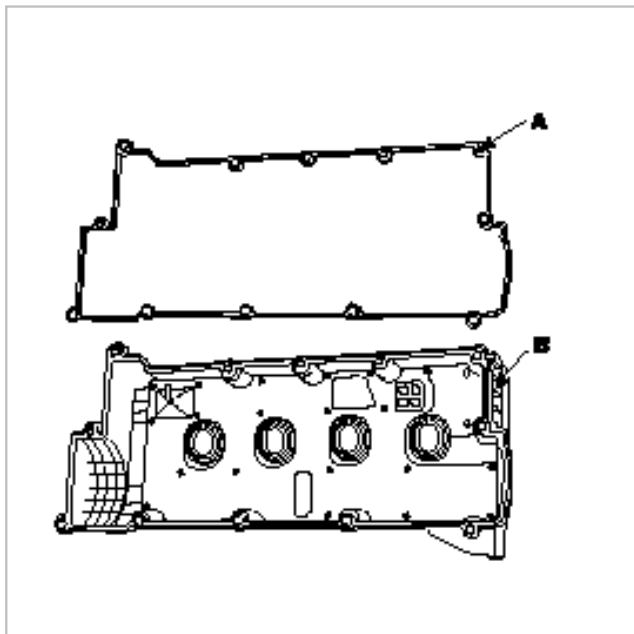
9. Install the camshaft sprocket.(see page EM-31).

10. Install the timing belt(see page EM-31).

11. Install the cylinder head cover.

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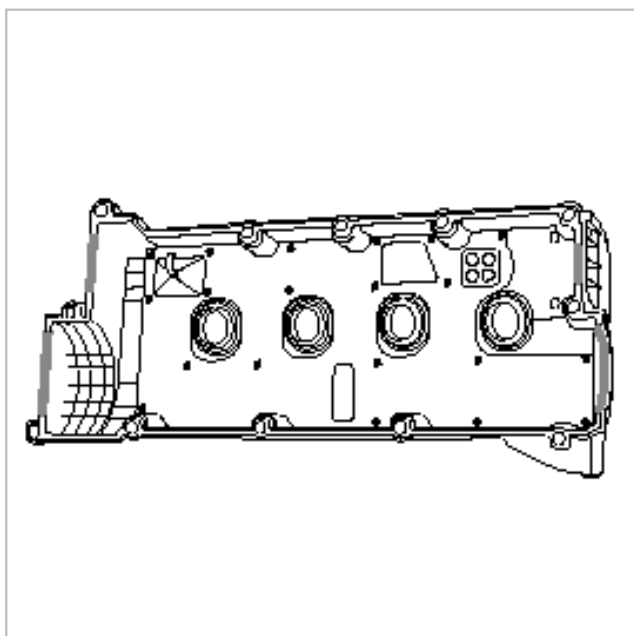
(1) Install the cylinder head cover gasket in the groove of the cylinder head cover.



NOTE

- Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.
- When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.

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



NOTE

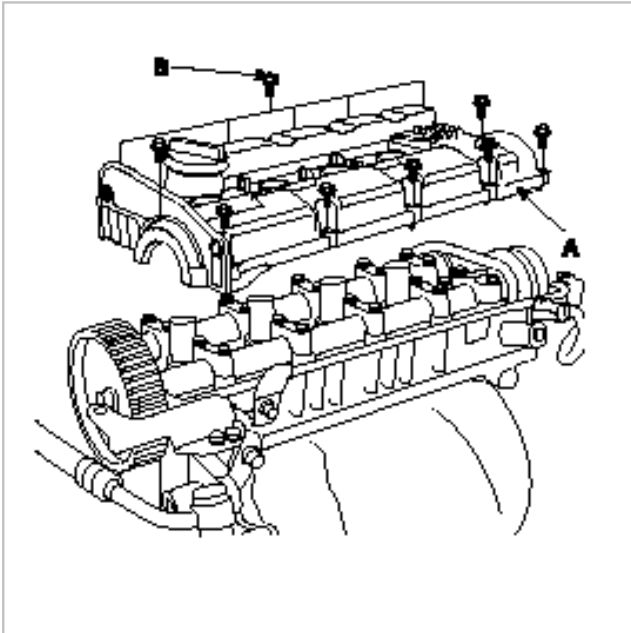
- Use liquid gasket, loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket
- After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the cylinder head cover (A) with the 12 bolts. Uniformly tighten the bolts in several passes.

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Tightening torque

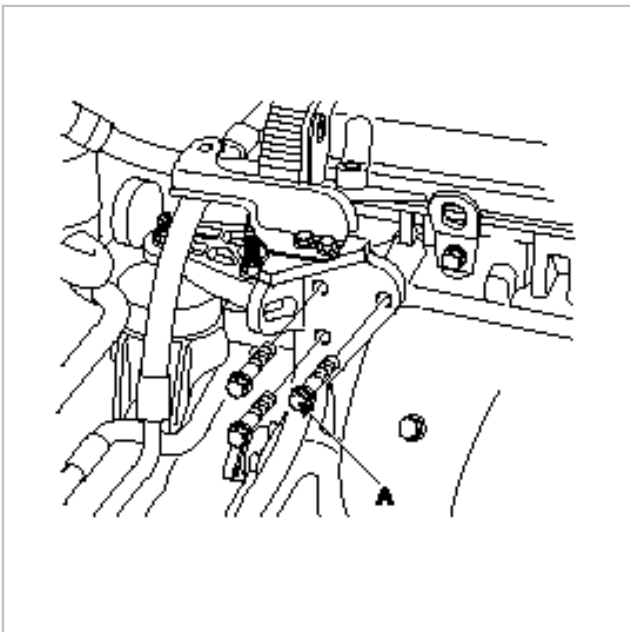
8 ~ 10N.m (80 ~ 100kgf.cm, 6 ~ 7.4 lb.ft)



12. Install the intake manifold. (see page EM-116)
13. Install the exhaust manifold. (see page EM-117)
14. Install the PCV. (see page EM-31)
15. Install the spark plug cable. (see EE group - ignition)
16. Install the power steering pump bracket bolts (A).

Tightening torque

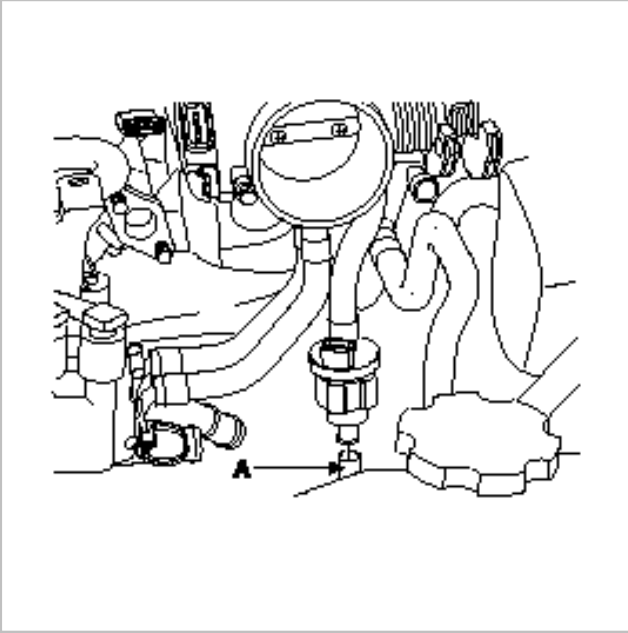
35 ~ 50Nm (350 ~ 500kgf.cm, 26 ~ 37lb.ft)



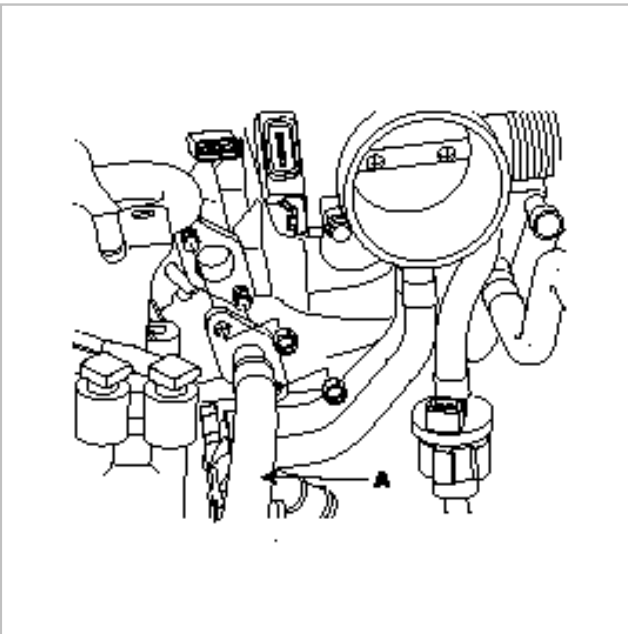
17. Install the power steering pump. (see ST group - power steering pump)

18. Install the accelerator cable.
19. Install the bake booster hose.
20. Install the PCSV hose (A).

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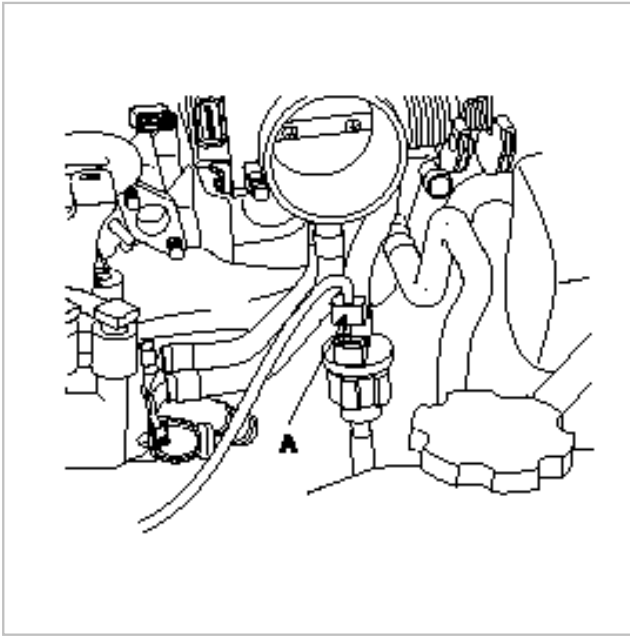
21. Install the fuel inlet hose (A).



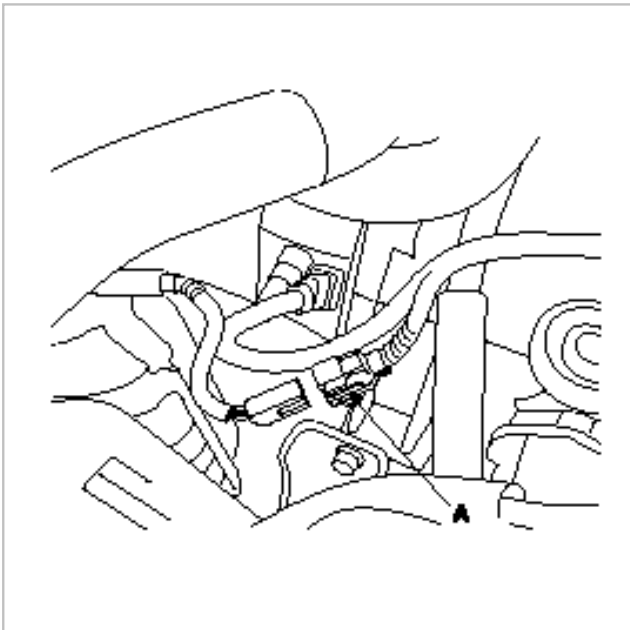
22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.

(1) PCSV connector (A).

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(2) Front heated oxygen sensor connector (A).



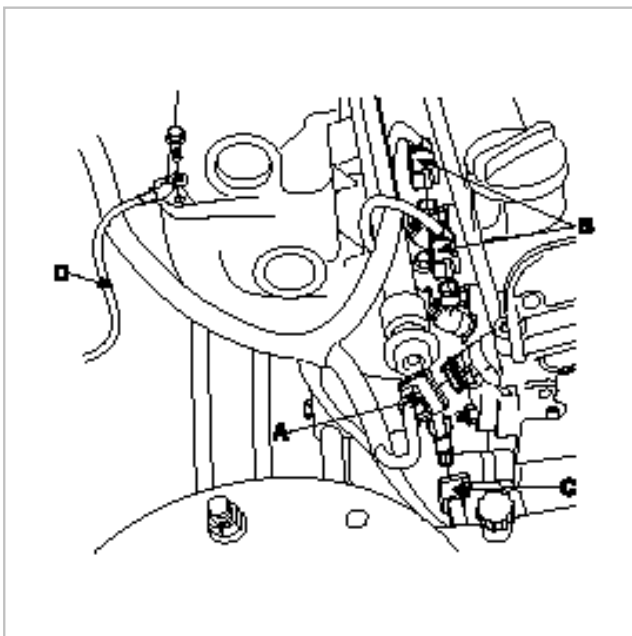
(3) Connect the ground cable to the intake manifold (D).

(4) Knock sensor connector (C).

(5) Four fuel injector connectors (B).

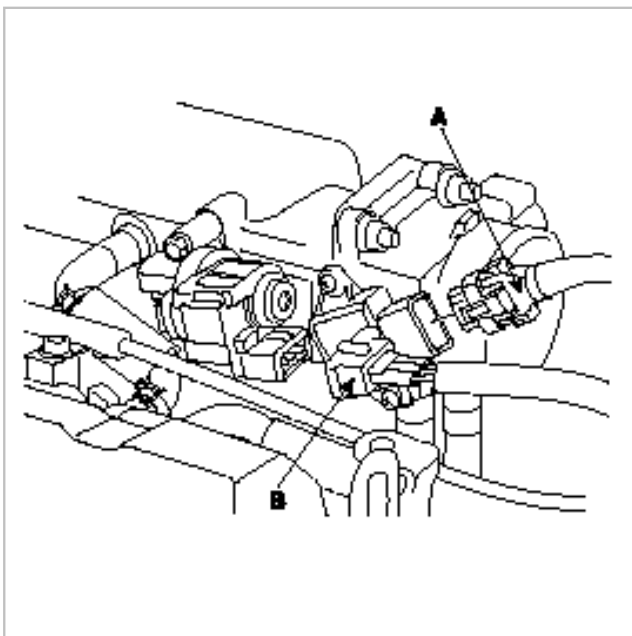
(6) CMP connector (A).

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(7) ISA connector (B).

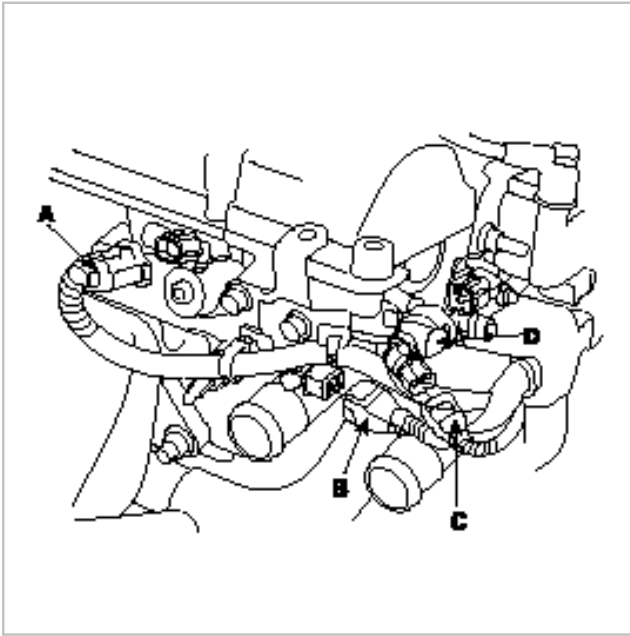
(8) TPS connector (A).



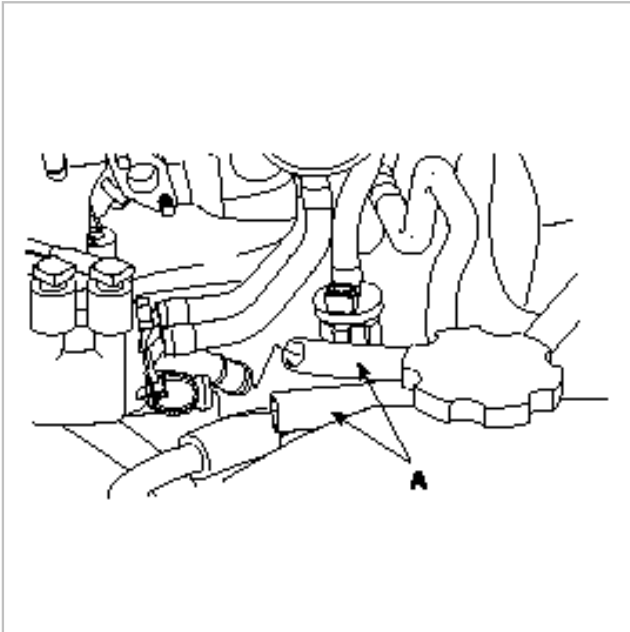
(9) Ignition coil connector (D).

(10) ECT sensor connector (C).

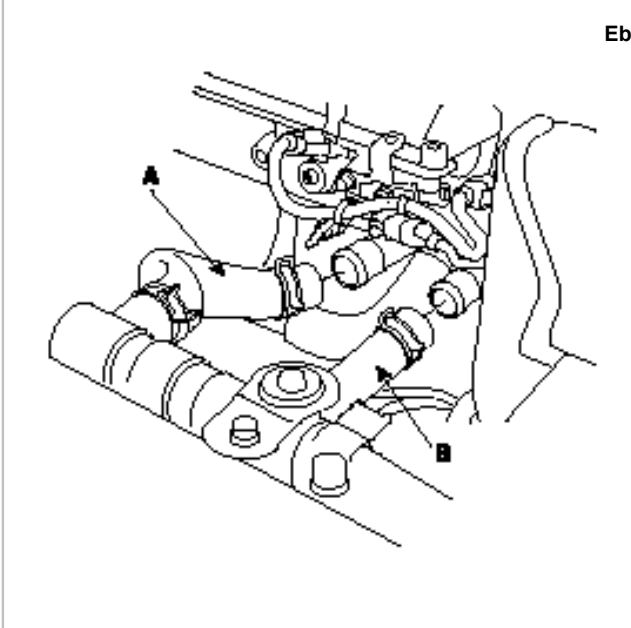
(11) Oil temperature sensor connector (B).



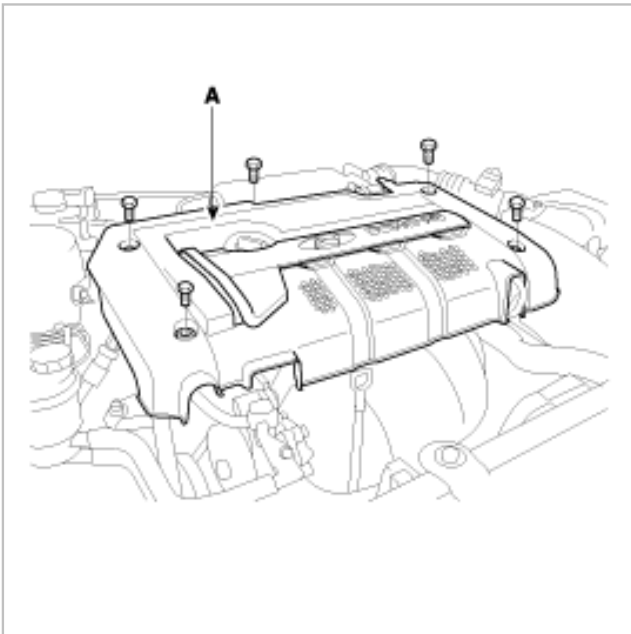
23. Install the heater hoses (A).



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



- 25. Install the intake air hose and air cleaner assembly.
- 26. Install the engine cover (A).



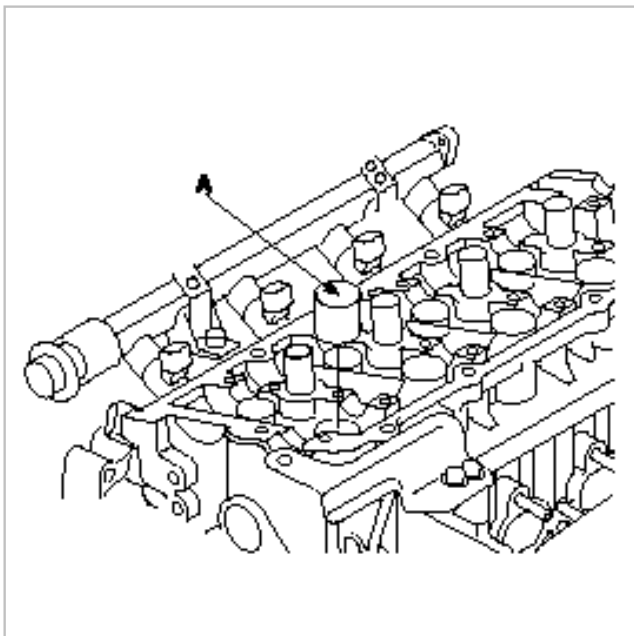
- 27. Connect the negative terminal to the battery.
- 28. Fill with engine coolant.
- 29. Start the engine and check for leaks.
- 30. Recheck engine coolant level and oil level.

DISASSEMBLY

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

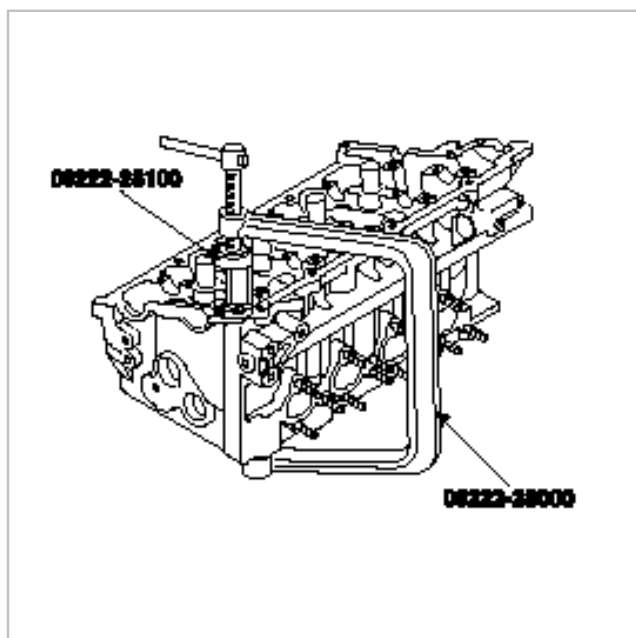
1. Remove MLAs (A).

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2. Remove valves.

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



(2) Remove the spring retainer.

(3) Remove the valve spring.

(4) Remove the valve.

(5) Remove the using needle-nose pliers, remove the oil seal.

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

INSPECTION

1. Inspect for flatness.

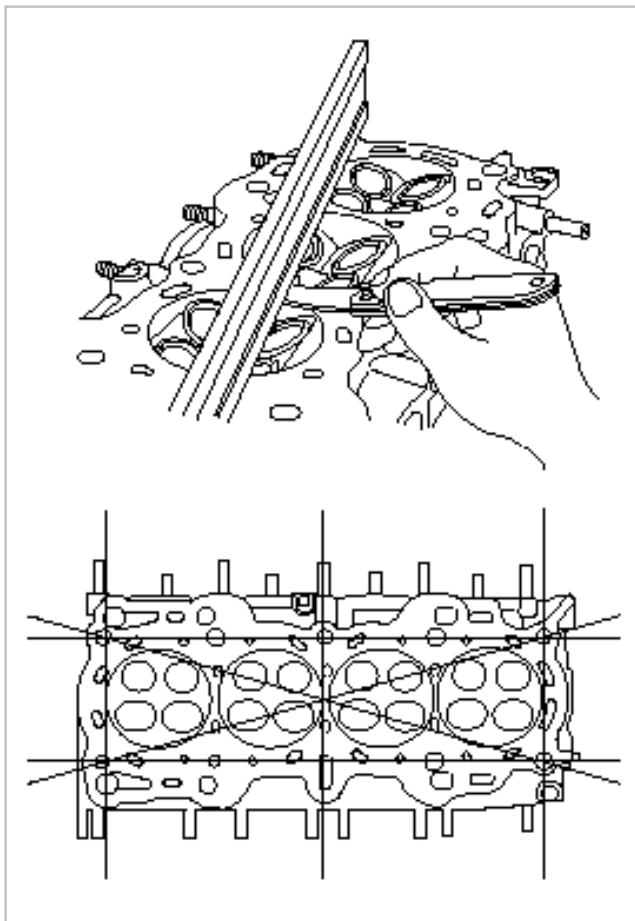
Ebay User ID: reveleus1

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

Flatness of cylinder head gasket surface

Standard : Less than 0.03mm(0.0012 in.)

Limit : 0.06 mm (0.0024 in.)



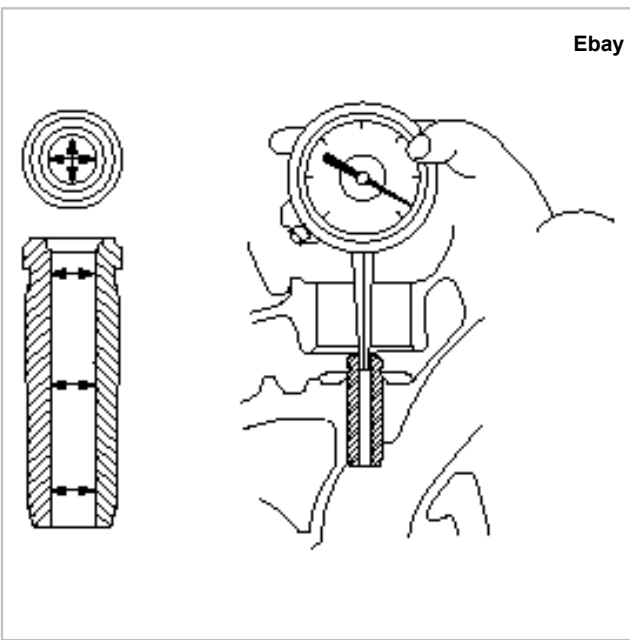
2. Inspect for cracks.

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

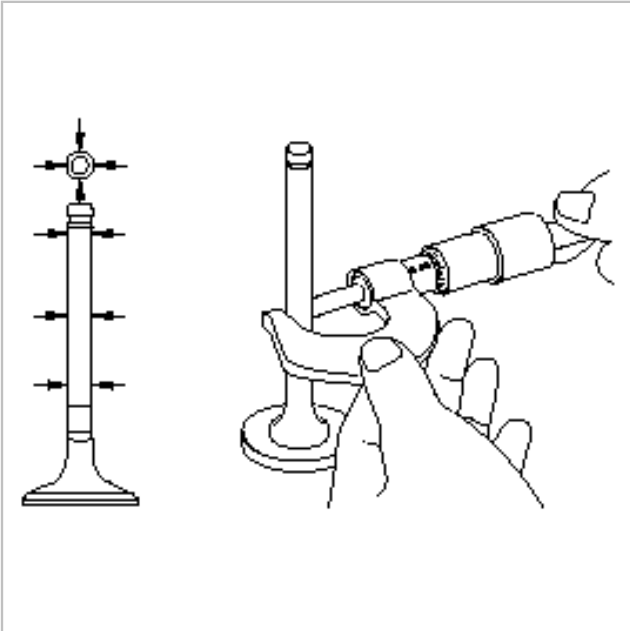
3. Inspect valve stems and valve guides.

(1) Using a caliper gauge, measure the inside diameter of the valve guide.

Valve guide inside.



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



(3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance

[Standard]

Intake : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in.)

Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)

[Limit]

Intake : 0.1mm (0.0040in.)

Exhaust : 0.13mm (0.0051in.)

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

4. Inspect valves.

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(1) Check the valve is ground to the correct valve face angle.

(2) Check that the surface of the valve for wear.

If the valve face is worn, replace the valve.

(3) Check the valve head margin thickness.

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

Margin

[Standard]

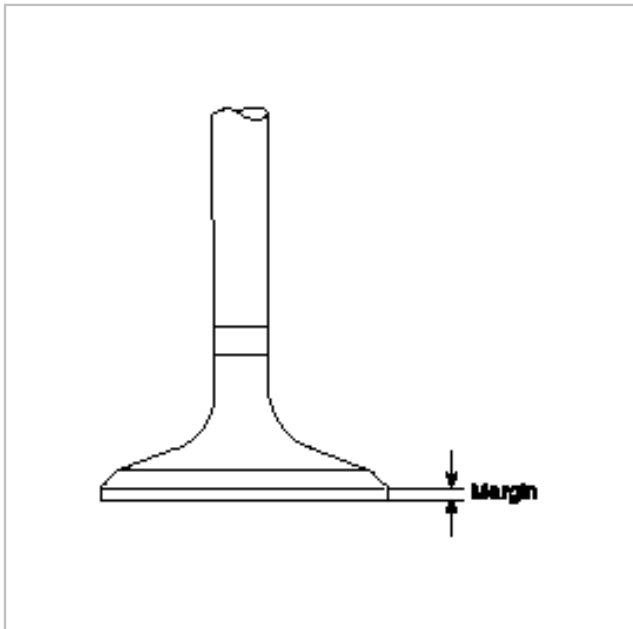
Intake : 1.15 mm(0.0453 in.)

Exhaust : 1.35 mm(0.0531 in.)

[Limit]

Intake : 0.8 mm(0.0315 in.)

Exhaust : 1.0mm(0.040 in.)



(4) Check the surface of the valve stem tip for wear.

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

5. Inspect valve seats

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

Replace the seat if necessary.

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

6. Inspect valve springs.

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

Valve spring

[Standard]

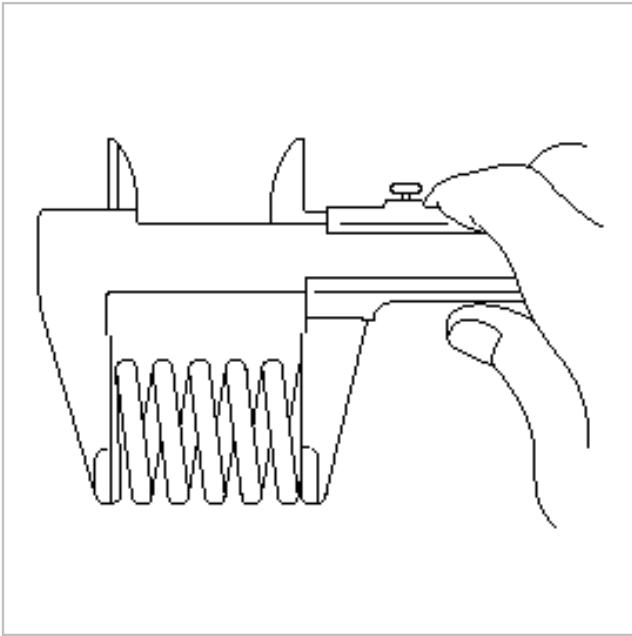
Free height : 48.86mm (1.9236 in.)

Load : 18.3kg / 39 mm (40.0 kg / 30.5mm)

[Limit]

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

Out-of-square : 3°



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

7. Inspect camshaft for runout.

- (1) Place the camshaft on V-blocks.

If the circle runout is greater than maximum, replace the camshaft.

8. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

W/O CVVT

[Standard value]

Intake : 44.820 mm (1.7646 in.)

Exhaust : 44.720 mm (1.7606 in.)

[Limit]

Intake : 44.720 mm (1.7606 in.)

Exhaust : 44.620 mm (1.7567 in.)

W/CVVT

[Standard value]

Intake : 44.618 mm (1.7566 in.)

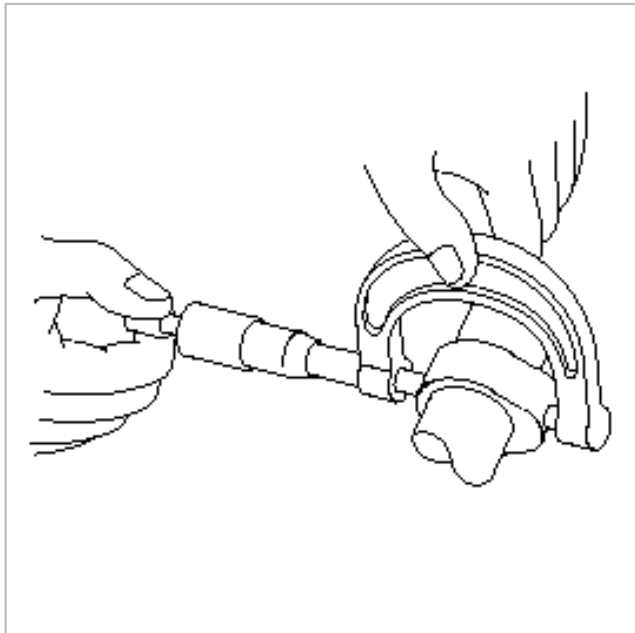
Exhaust : 44.518 mm (1.7527 in.)

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[Limit]

Intake : 44.518 mm (1.7527 in.)

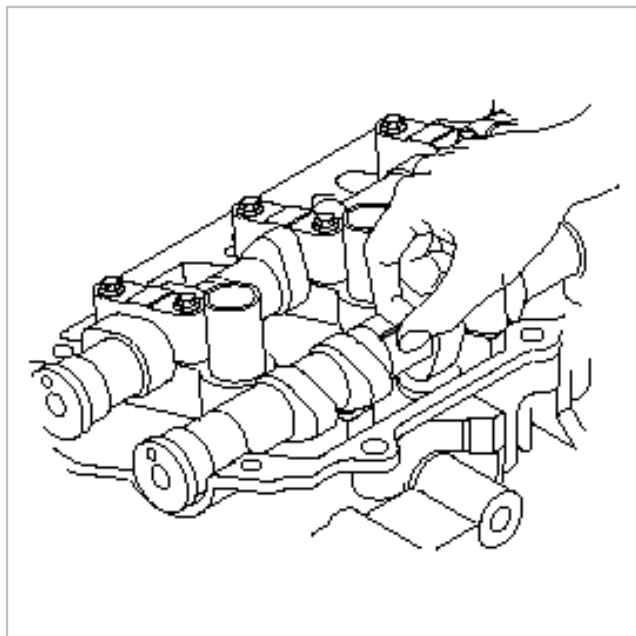
Exhaust : 44.418 mm (1.7487 in.)



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

9. Inspect camshaft journal clearance.

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



- (4) Install the bearing caps.(see page-)

CAUTION

Do not turn the camshaft.

(5) Remove the bearing caps.

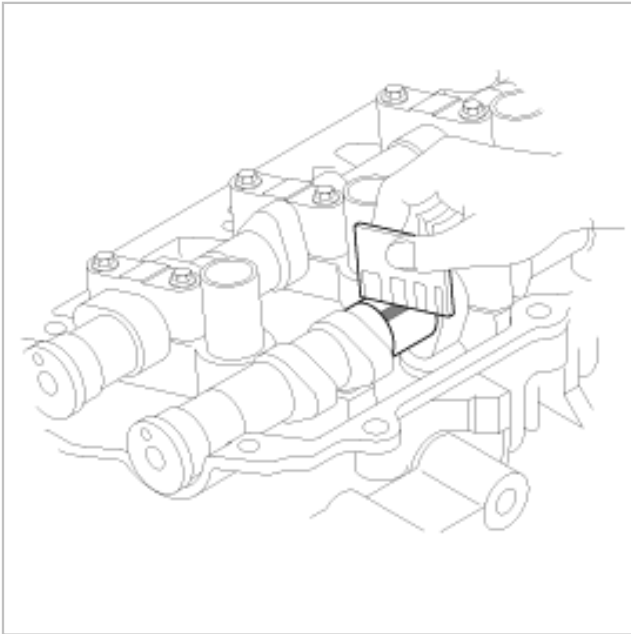
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(6) Measure the plastigage at its widest point.

Bearing oil clearance :

[Standard value] : 0.02 ~ 0.061mm(0.0008 ~ 0.0024in.)

[Limit] : 0.1mm(0.0039in.)



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

(7) Completely remove the plastigage.

(8) Remove the camshafts.

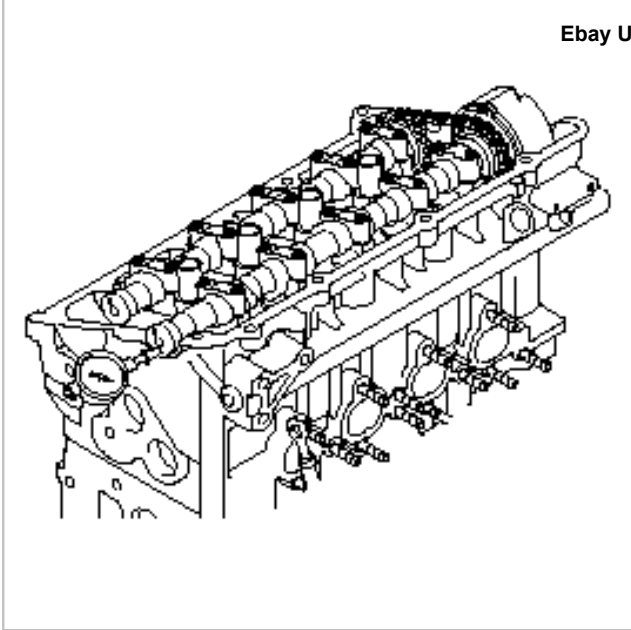
10. Inspect camshaft end play.

(1) Install the camshafts.(see page-).

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

Camshaft end play

[Standard value] : 0.1 ~ 0.2mm(0.004 ~ 0.008in.)



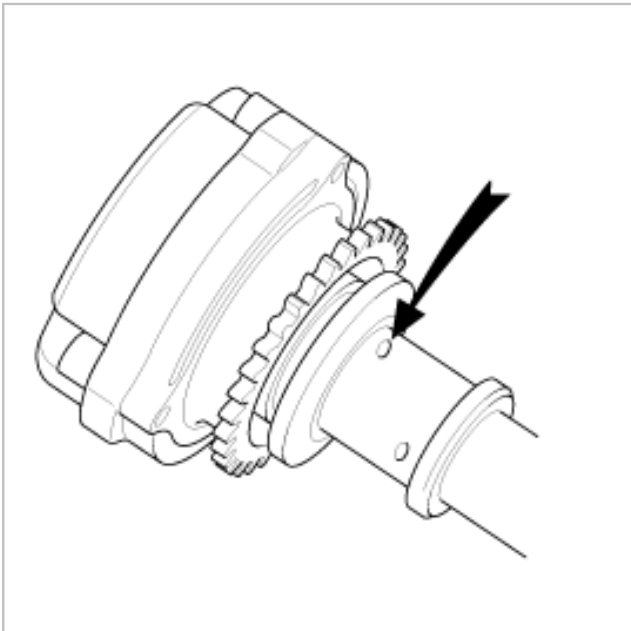
If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(3) Remove the camshafts.

11. Inspect CVVT assembly.

(1) Check that the CVVT assembly will not turn.

(2) Apply vinyl tape to all the parts except the one indicated by the arrow in the illustration.



(3) Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm², 14psi) to the port of the camshaft.

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

NOTE

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

- (4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

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Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

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

Standard: Movable smoothly in the range about 20°

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

REASSEMBLY

NOTE

Thoroughly clean all parts to be assembled.

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

Replace oil seals with new ones.

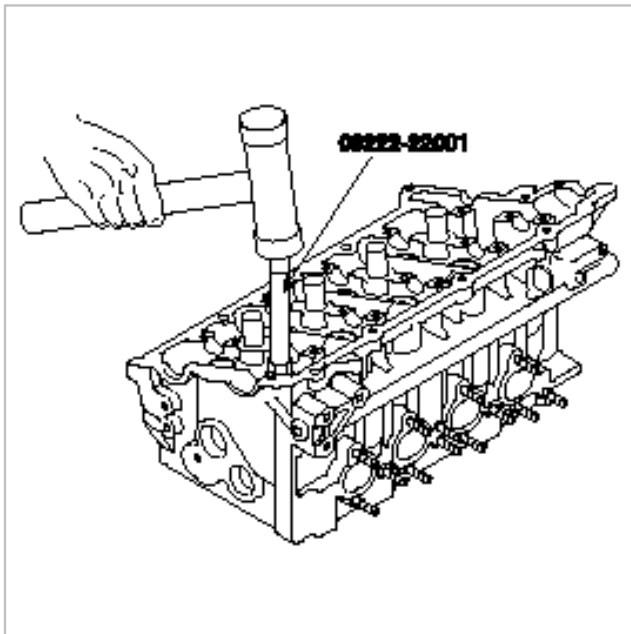
1. Install valves.

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

NOTE

Do not reuse old valve stem seals.

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

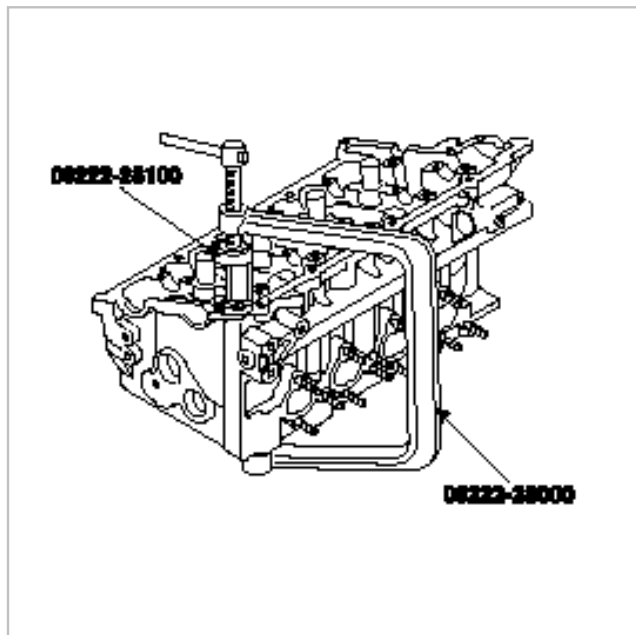


(3) Install the valve, valve spring and spring retainer.
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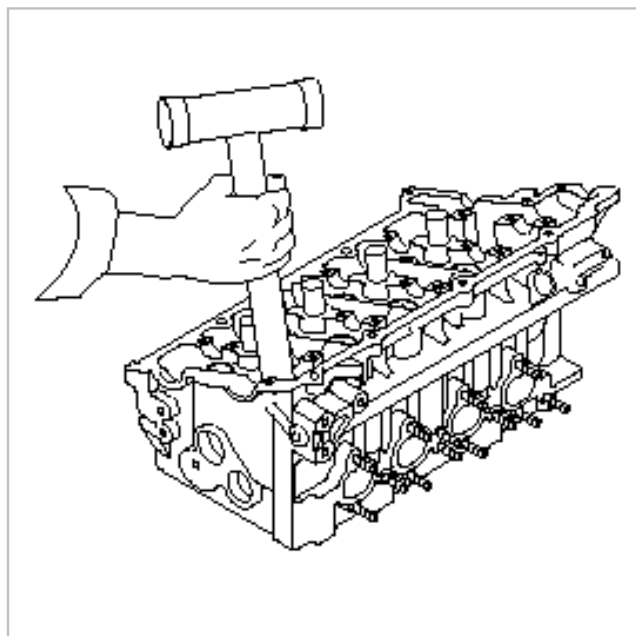
NOTE

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

(4) Using the SST(09222-28000,09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.



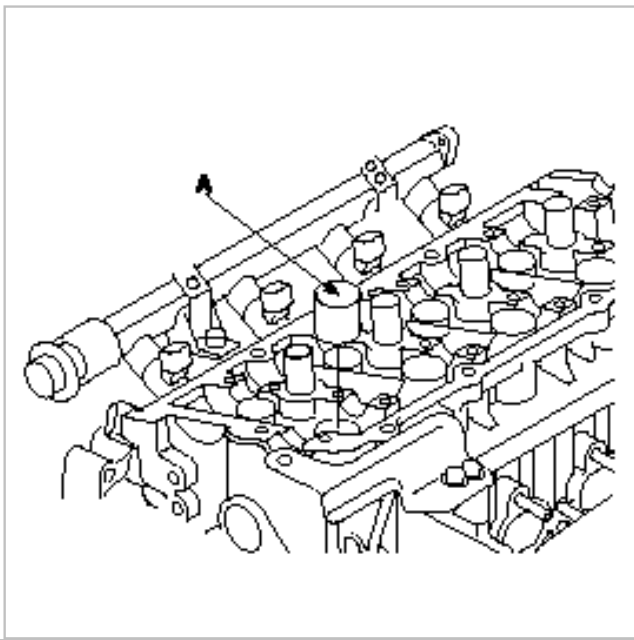
(5) Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



2. Install MLAs.

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Check that the MLA rotates smoothly by hand.



REMOVAL

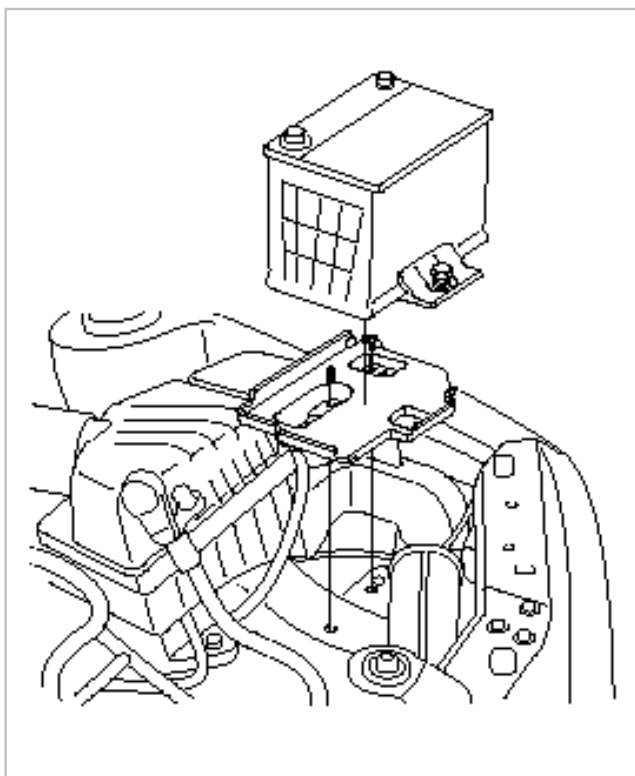
CAUTION

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

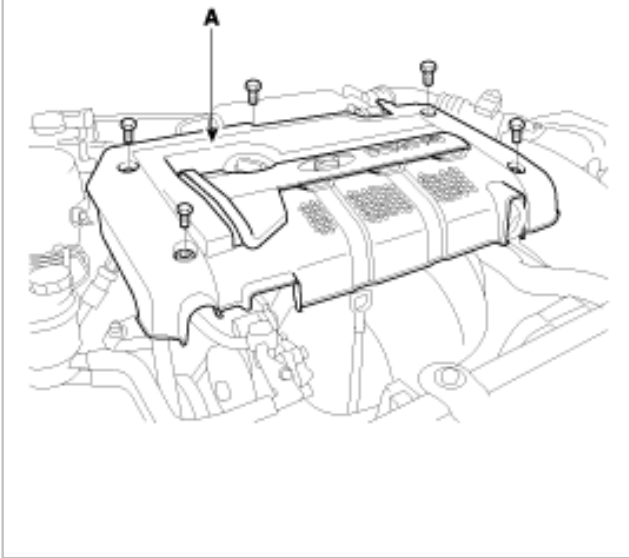
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (See page EM-13)

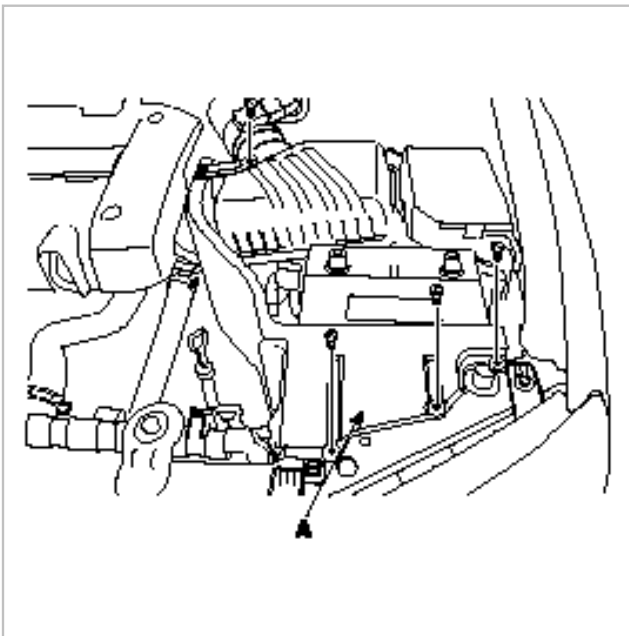
1. Disconnect the neagative terminal from the battery.



2. Remove the engine cover.



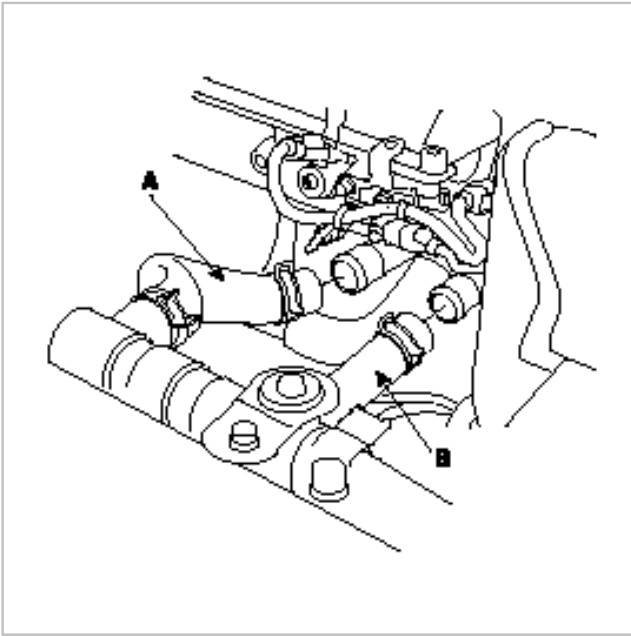
3. Drain the engine coolant (see page EM-97)
Remove the radiator cap to speed draining.
4. Remove the intake air hose and air cleaner assembly.
 - (1) Remove the heat shield (A).



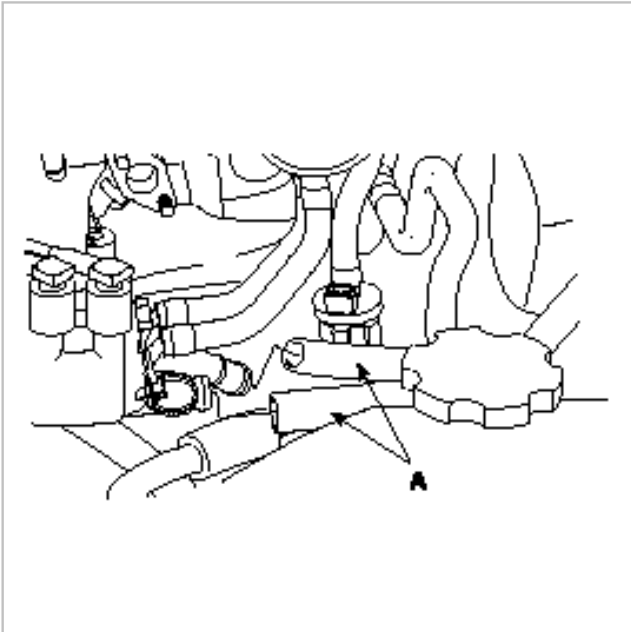
- (2) Disconnect the AFS connector.
- (3) Disconnect the breather hose from air cleaner hose.
- (4) Remove the intake air hose and air cleaner.

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

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6. Remove the heater hoses (A).

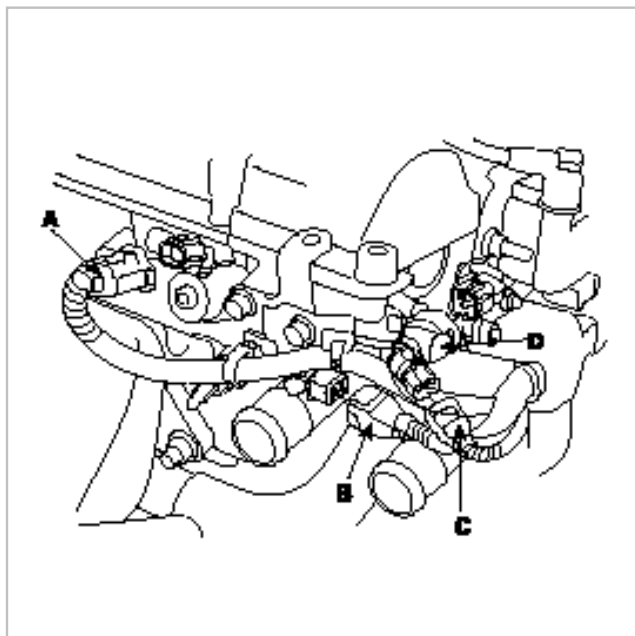


7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.

- (1) OCV(Oil Control Valve) connector (A).
- (2) Oil temperature sensor connector (B).
- (3) ECT (Engine Coolant Temperature) sensor (C) connector.

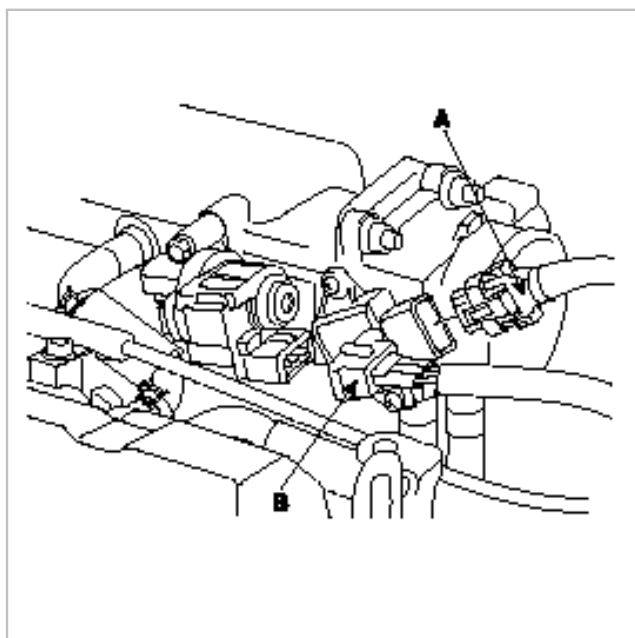
(4) Ignition coil connector (D).

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(5) TPS (Throttle Position Sensor) connector (A).

(6) ISA (Idle Speed Actuator) connector (B).

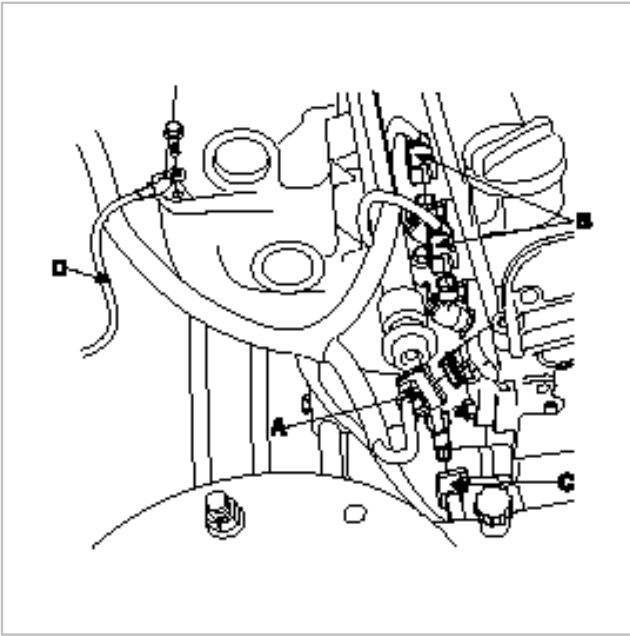


(7) CMP (Camshaft Position Sensor) connector (A).

(8) Four fuel injector connectors (B).

(9) Knock sensor connector (C).

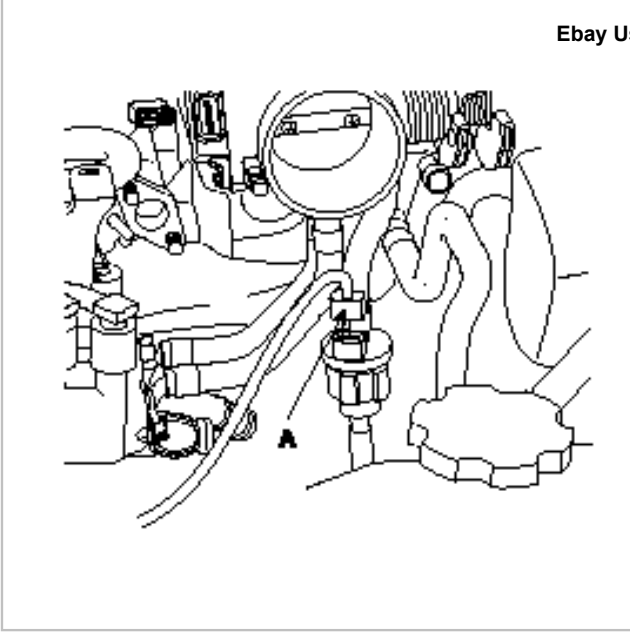
(10) Disconnect ground cable (D) from the intake manifold.
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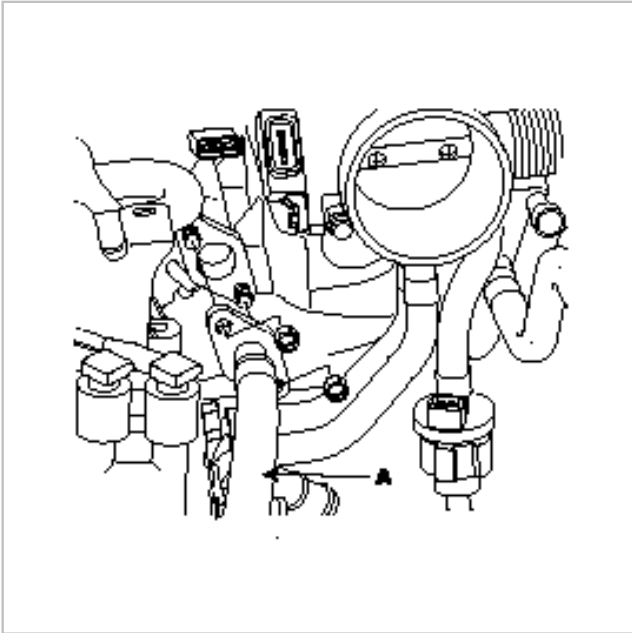
(11) Front heated oxygen sensor (A) connector.



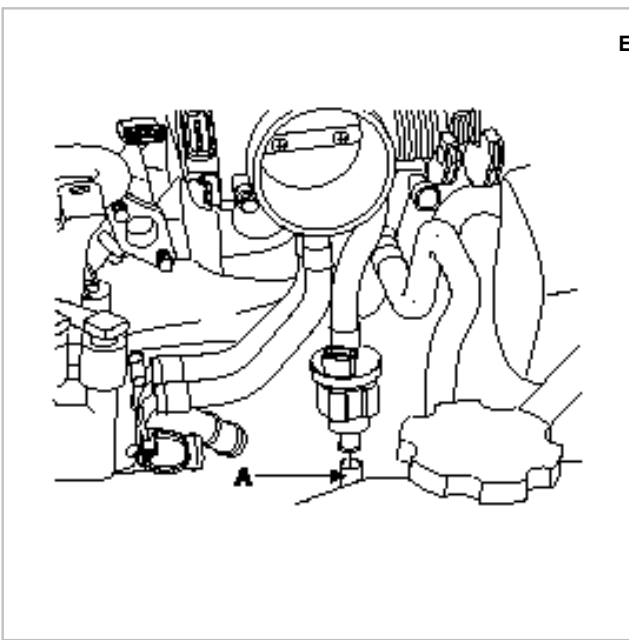
(12) PCSV (Purge Control Solenoid Valve) (A) connector.



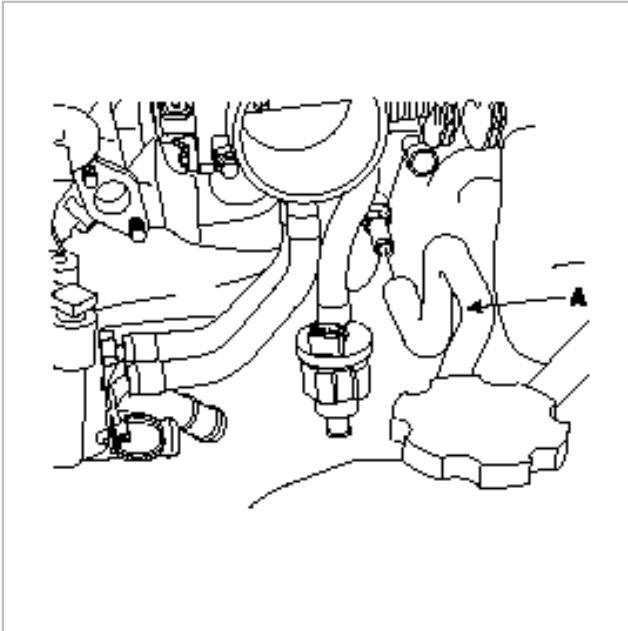
8. Remove the fuel inlet from delivery pipe (A).



9. Remove the PCSV hose (A).



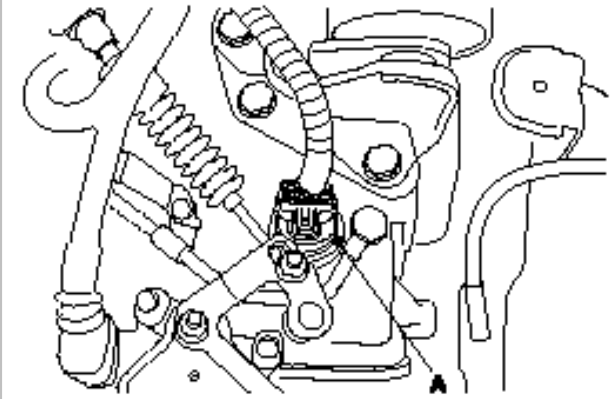
10. Remove the brake booster vacuum hose (A).



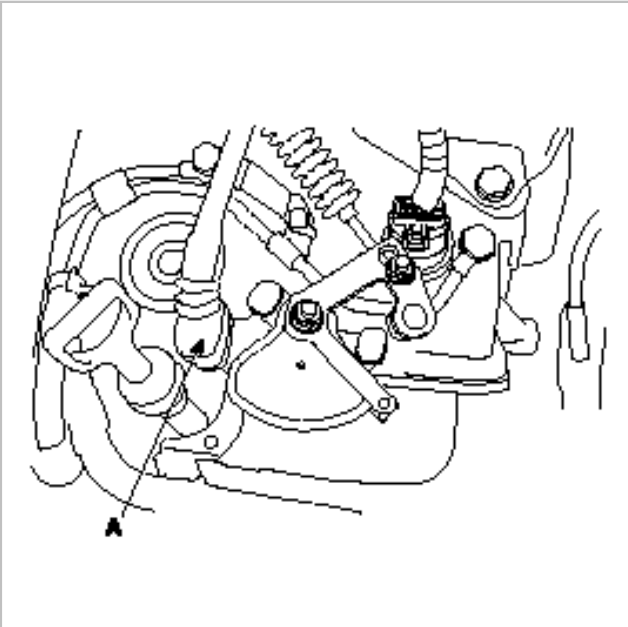
11. Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.

12. Remove the power steering pump. (see ST group - power steering pump)

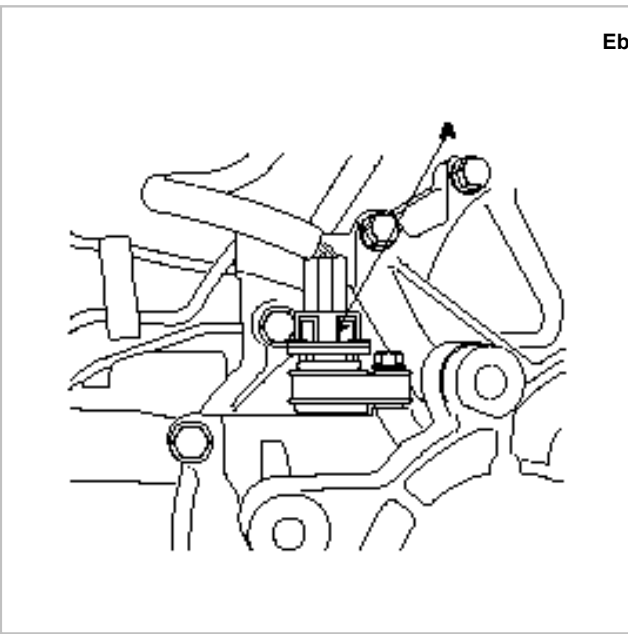
13. Disconnect the inhibitor switch and solenoid valve connector (A).



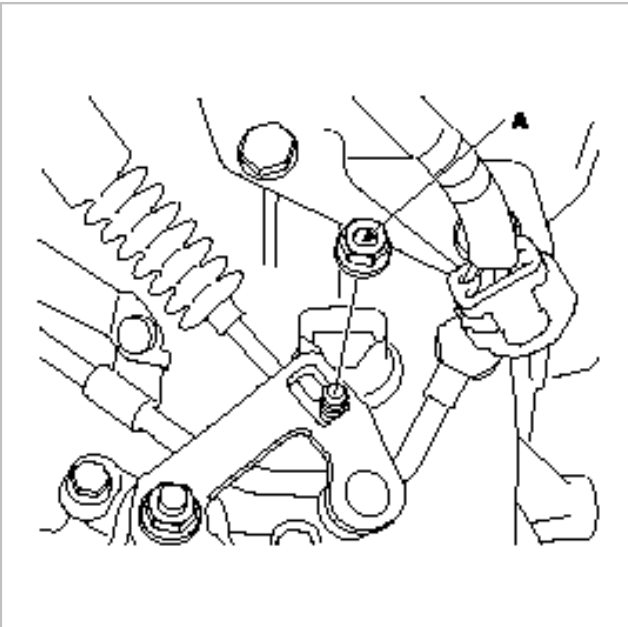
14. Remove the transaxle range switch connector (A).



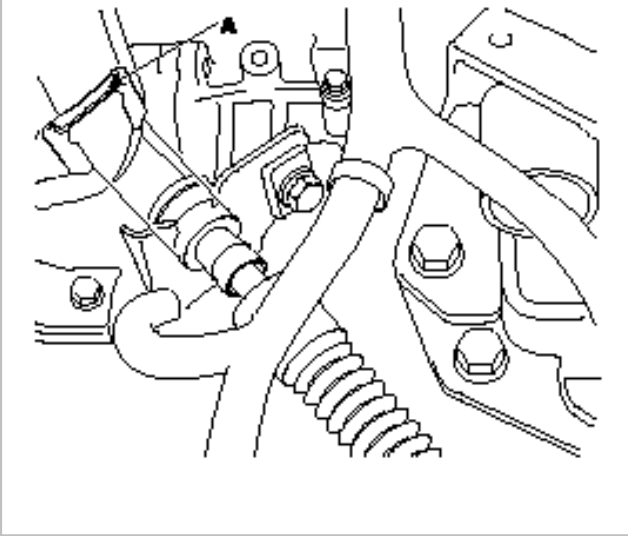
15. Remove the vehicle speed sensor connector (A).



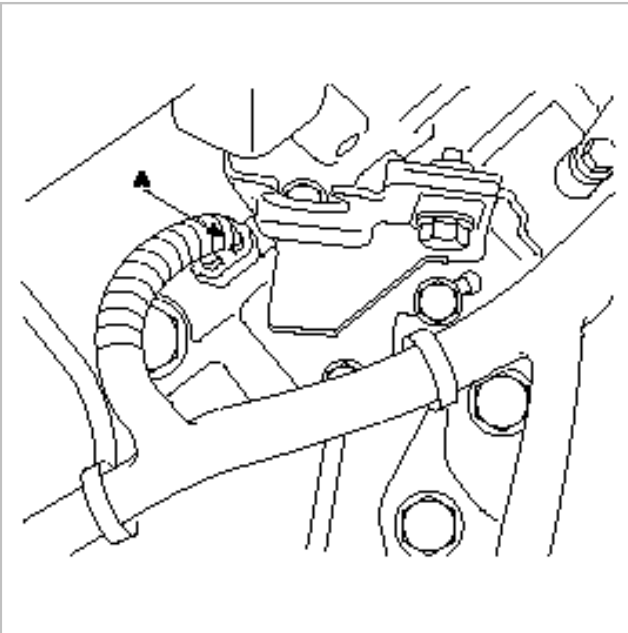
16. Remove the control cable transaxle range switch nut (A).



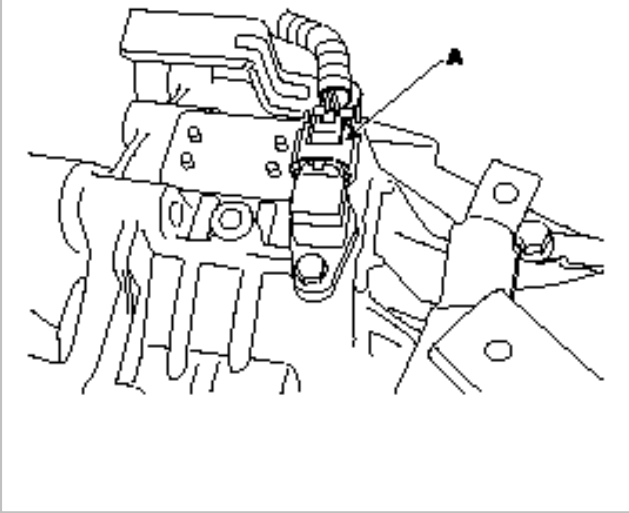
17. Remove the clip (A) of the control cable.



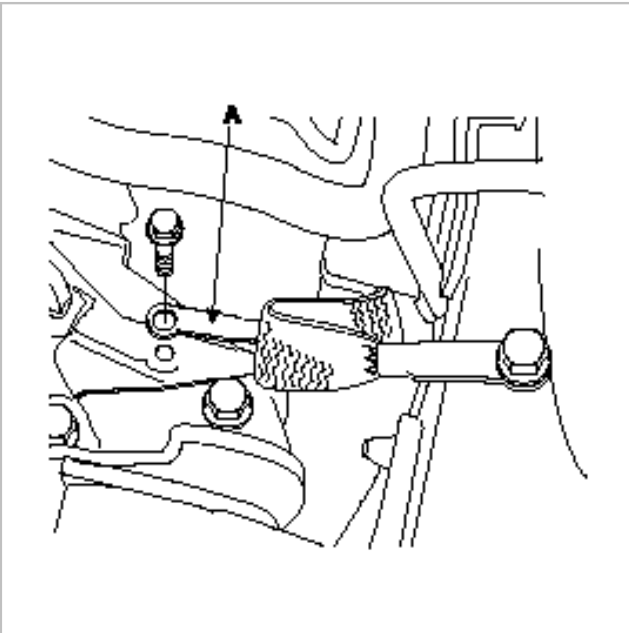
18. Remove the input shaft speed sensor connector (A).



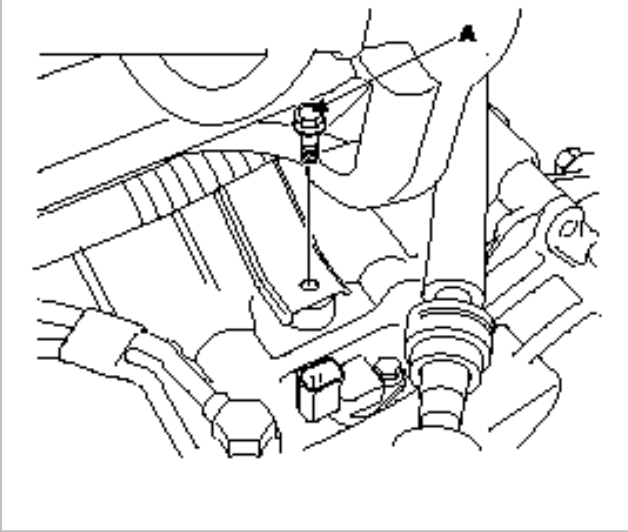
19. Remove the output shaft speed sensor connector (A).



20. Remove the transaxle earth cable (A).



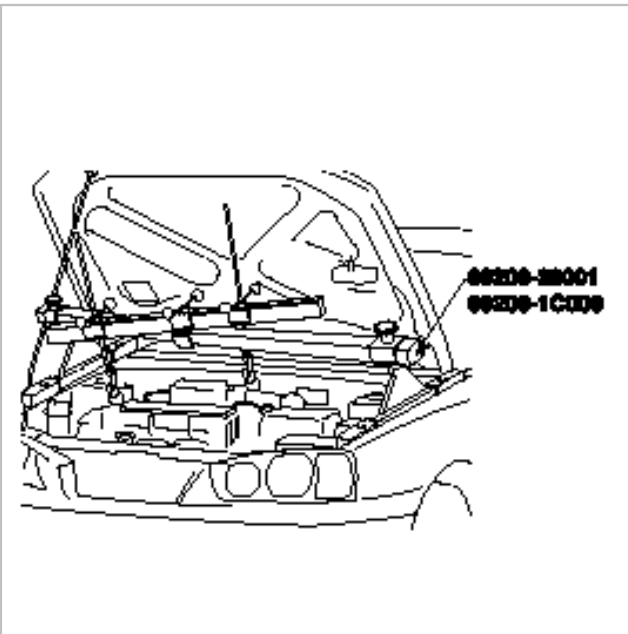
21. Remove the start motor cable mounting bolts (A).



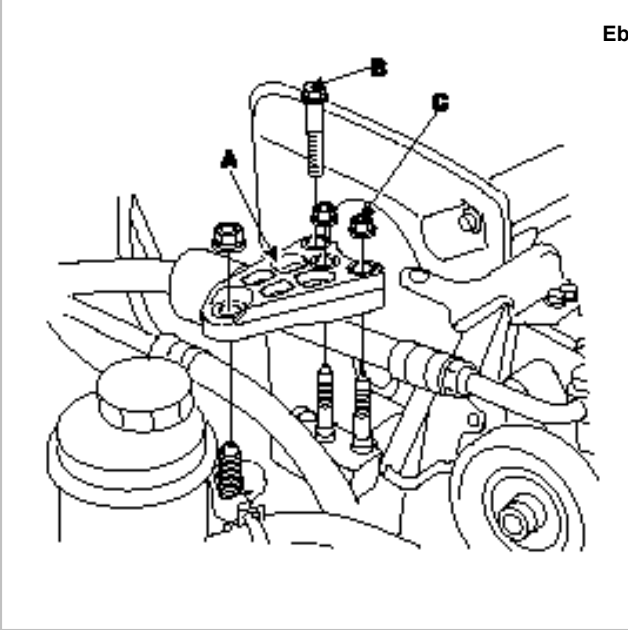
22. Remove the starting motor connector.

23. Remove the alternator connector.

24. Install the special tool (09200-38001, 09200-1C000), the engine support fixture and the adapter, on the engine and transaxle assembly.



25. Remove the engine mounting bracket.

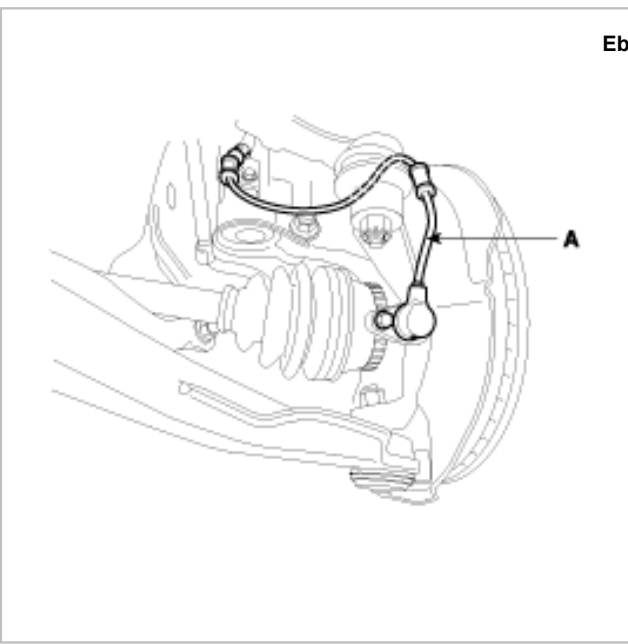


26. Remove the transaxle mounting bracket (A).

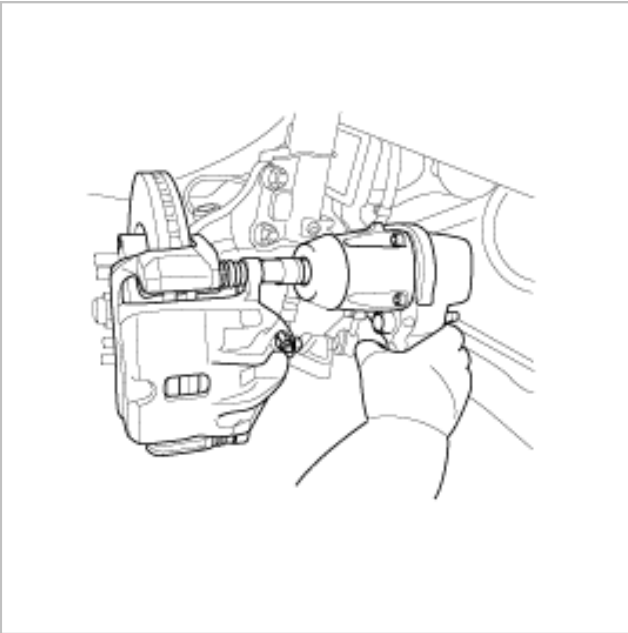


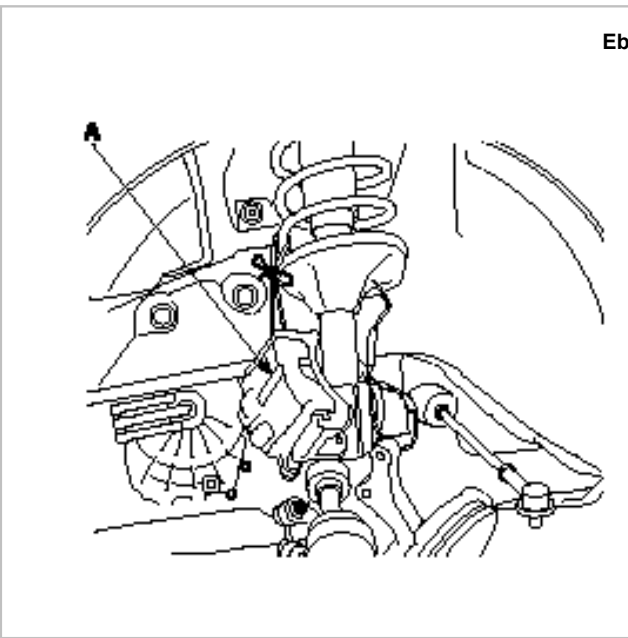
27. Remove the front tires.

28. Remove the ABS wheel speed sensor (A).

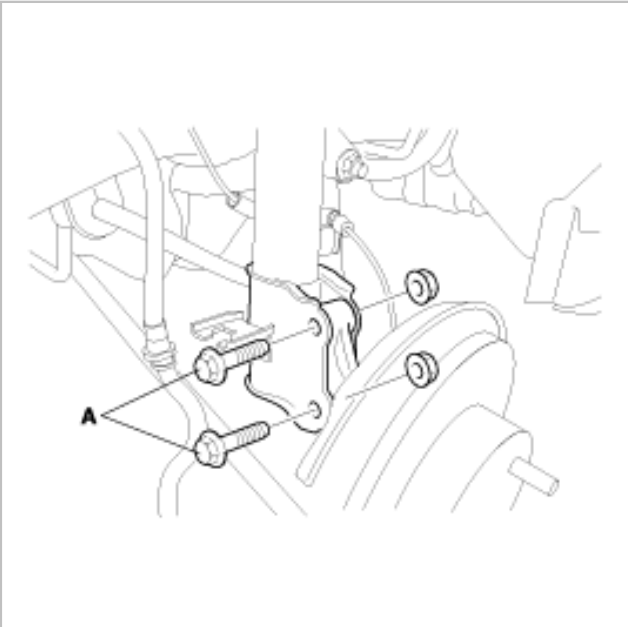


29. Remove the caliper and hang the caliper assembly (A).

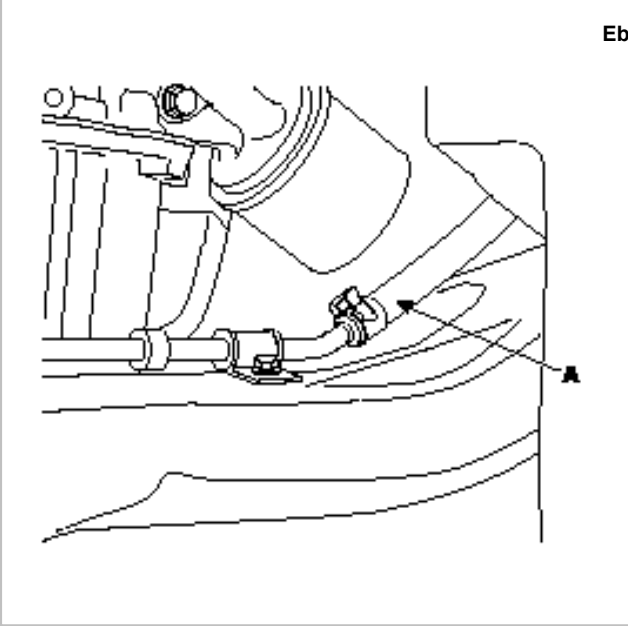




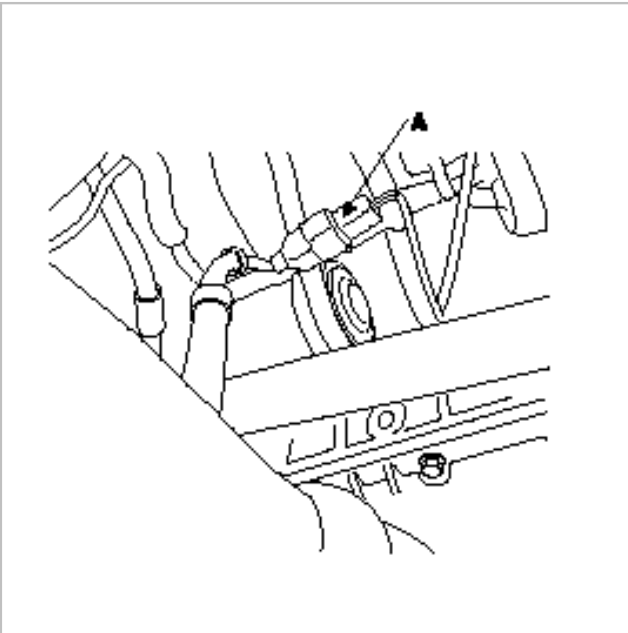
30. Remove the knuckle mounting bolts (A).



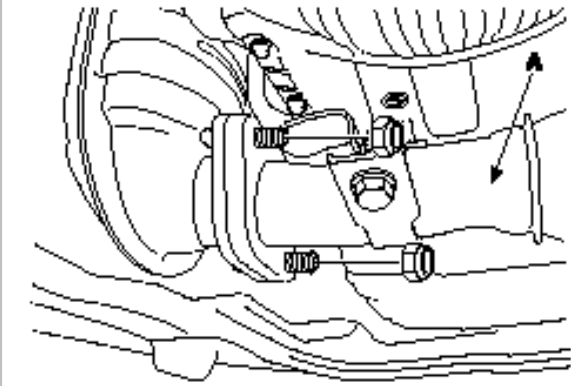
31. Remove the power steering return hose (A) and drain the power steering oil.



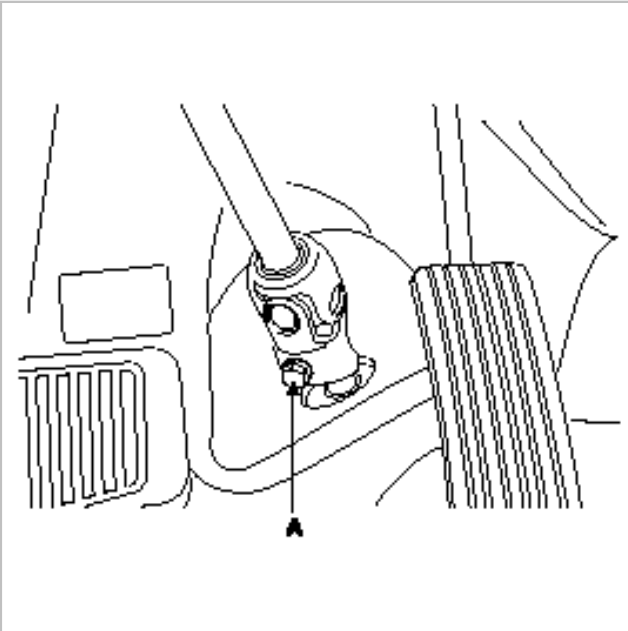
32. Disconnect the rear oxygen sensor connector (A).



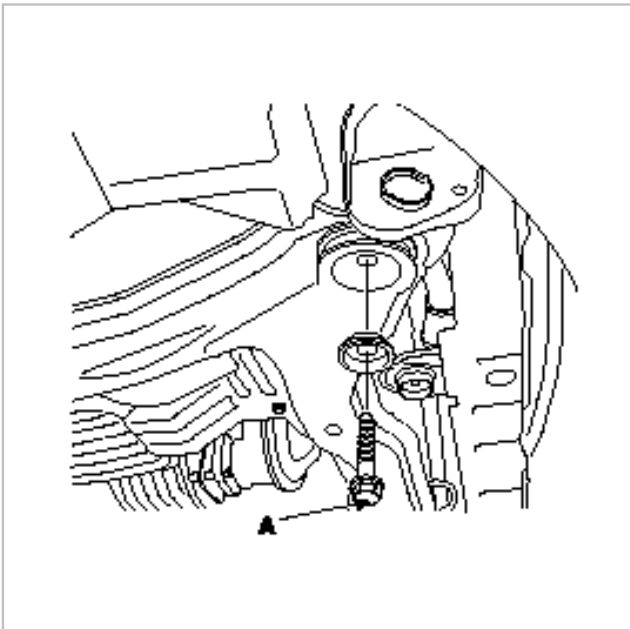
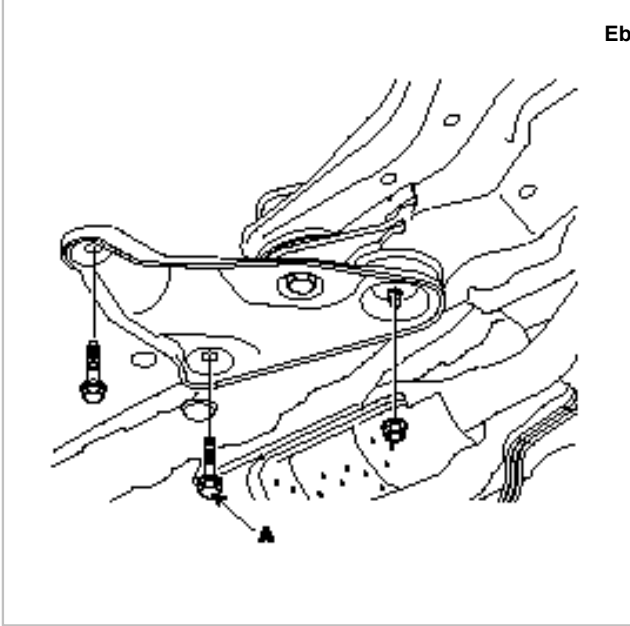
33. Remove the front muffler (A).



34. Remove the steering u-joint mounting bolt.



35. Remove the sub frame bolts (A).



36. Remove the engine support fixture and the adapter.

37. Jack up the vehicle.

INSTALLATION

Perform the following :

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

- Inspect for fuel leakage.

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

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



SPECIFICATIONS

Description	Specifications	Limit
General		
Type		
Number of cylinder		
Bore	In-line, Double Overhead Camshaft	
2.0L	4	
Stroke	82mm	
2.0L	93.5mm	
Total displacement	1975cc (120.52cu.in.)	
2.0L	10.1	
Compression ratio	1 - 3 - 4 - 2	
2.0L		
Firing order		
2.0L		
Valve timing (W/O - CVVT)		
Intake valve		
Opens (BTDC)		
Closes (ABDC)	9°	
Exhaust valve	43°	
Opens (BBDC)	50°	
Closes (ATDC)	6°	
Valve timing (W/CVVT)	11°	
Intake valve	59°	
Opens (ATDC)	42°	
Closes (ABDC)	6°	
Exhaust		
Opens (BTDC)		
Closes (ABDC)		
Valve		
Valve length		
Intake	114.34mm (4.5016in.)	
Exhaust	116.8mm (4.598in.)	
Stem O.D.	5.965 ~ 5.98mm (0.2348 ~ 0.2354in.)	
Intake	5.950 ~ 5.965mm (0.2343 ~ 0.2348in.)	
Exhaust		
Face angle thickness of valve head (Margin)		
Intake	1.15mm (0.0452in.)	0.8mm (0.031in.)
Exhaust	1.35mm (0.0531in.)	1.0mm (0.039in.)

Valve stem to valve guide clearance Intake Exhaust	0.02 ~ 0.05mm (0.0008 ~ 0.0019in.) 0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)	0.10mm (0.0039in.) 0.13mm (0.0051in.)
Valve guide Installed dimension O.D Intake Exhaust Service oversize	46mm (1.811in.) 54.5mm (2.146in.) 0.05, 0.25, 0.50mm (0.002, 0.010, 0.020in.) oversize	
Valve seat Width of seat contact Intake Exhaust Seat angle Oversize	1.1 ~ 1.5mm (0.043 ~ 0.059in.) 1.3 ~ 1.7mm (0.051 ~ 0.066in.) 45° 0.3, 0.6mm (0.012, 0.024in.) oversize	
Valve spring Free length Load Installed height Squarances	48.86mm (1.9236in.) 18.3kg/39mm (40.0kg/30.5mm) 39mm (1.5354in.) 1.5° or less	
Valve clearance Cold (20°C [68°F]) Intake Exhaust Hot (80°F [176°F]) : only for reterence Intake Exhaust	0.20mm (0.0079in.) 0.28mm (0.0110 in.) 0.29mm (0.0114in.) 0.34mm (0.0134in.)	0.12 ~ 0.28mm (0.0047 ~ 0.0110in.) 0.20 ~ 0.38mm (0.0079 ~ 0.0150in.)
Cylinder head Flatness of gasket surface Flatness of manifold mounting surface Oversize rework dimensions of valve seat hole Intake 0.3mm (0.012in.) O.S. 0.6mm (0.024in.) O.S. Exhaust 0.3mm (0.012in.) O.S. 0.6mm (0.024in.) O.S. Oversize rework dimensions of valve guide hole (both intake and exhaust) 0.05mm (0.002in.) O.S 0.25mm (0.010in.) O.S 0.50mm (0.020in.) O.S	Max. 0.03mm (0.0012in.) Max. 0.15mm (0.0059in.) 33.300 ~ 33.325mm (1.3110 ~ 1.3120in.) 33.600 ~ 33.625mm (1.3228 ~ 1.3238in.) 28.800 ~ 28.821mm (1.1338 ~ 1.1346in.) 29.100 ~ 29.121mm (1.1456 ~ 1.1465in.) 11.05 ~ 11.068mm (0.435 ~ 0.4357in.) 11.25 ~ 11.268mm (0.443 ~ 0.4436in.) 11.50 ~ 11.518mm (0.453 ~ 0.4535in.)	0.06mm (0.0024in.) 0.03mm (0.0012in.)

Cylinder block Cylinder bore Out-of-round and taper of cylinder bore Clearance with piston (To set limits to new parts)	Ebay User ID: reveleus1 82.00 ~ 82.03mm (3.2283 ~ 3.2295in.) Less than 0.01mm (0.0004in.) 0.02 ~ 0.04mm (0.0008 ~ 0.0016in.)	
Piston O.D (To set limits to new parts) Service oversize	81.97 ~ 82.00mm (3.2271 ~ 3.2283in.) 0.25, 0.50mm (0.010, 0.020in.) oversize	
Piston ring Side clearance No. 1 No. 2 End gap No. 1 No.2 Oil ring side rail Service oversize	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.) 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.) 0.23 ~ 0.38mm (0.0090 ~ 0.0149in.) 0.33 ~ 0.48mm (0.0130 ~ 0.0189in.)0.20 ~ 0.60mm (0.0078 ~ 0.0236in.) 0.25, 0.50mm (0.010, 0.020in.) oversize	0.1mm (0.004in.) 1mm (0.039in.) 1mm (0.039in.) 1mm (0.039in.)
Connecting rod Bend Twist Connecting rod big end to crankshaft side clearance	0.05mm (0.0020in.) or less 0.1mm (0.004in.) or less 0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	0.4mm (0.0157in.)
Connecting rod bearing Oil clearance (To seat limits to new parts) Undersize	0.024 ~ 0.044mm (0.0009 ~ 0.0017in.) 0.25, 0.50, 0.75mm (0.01, 0.02, 0.03in.)	
Camshaft (Non - CVVT) Cam lobe height Intake Exhaust Camshaft (CVVT) Cam height Intake Exhaust Journal O.D. Bearing oil clearance End play	44.820mm (1.7646in.) 44.720mm (1.7606in.) 44.618mm (1.7566in.) 44.518mm (1.7527in.) 28mm (1.1023in.) 0.02 ~ 0.061mm (0.0008 ~ 0.0024in.) 0.1 ~ 0.2mm (0.004 ~ 0.008in.)	44.720mm (1.7606in.) 44.620mm (1.7567in.) 44.518mm (1.7527in.) 44.418mm (1.7487in.) 0.1mm (0.0039in.)

Crankshaft Pin O.D. Journal O.D. Bend Out-of-round, taper of journal and pin End play Undersize rework dimension of pin 0.25mm (0.010in.) 0.50mm (0.020in.) 0.75mm (0.030in.) Undersize rework dimension of journal 0.25mm (0.010in.) 0.50mm (0.020in.) 0.75mm (0.030in.)	Ebay User ID: reveleus1 45mm (1.77in.) 57mm (2.244in.) 0.03mm (0.0012in.) or less 0.01mm (0.0004in.) or less 0.06 ~ 0.260mm (0.0023 ~ 0.010in.) 44.725 ~ 44.740mm (1.7608 ~ 1.7614in.) 44.475 ~ 44.490mm (1.7509 ~ 1.7516in.) 44.225 ~ 44.240mm (1.7411 ~ 1.7417in.) 56.727 ~ 56.742mm (2.2333 ~ 2.2339in.) 56.477 ~ 56.492mm (2.2235 ~ 2.2240in.) 56.227 ~ 56.242mm (2.2136 ~ 2.2142in.)	0.030mm (0.0012in.)
Crankshaft bearing Oil clearance	0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)	
Flywheel Runout	0.1mm (0.0039in.)	0.13mm (0.0051in.)
Cooling method	Water-cooled, pressurized. Forced circulation with electrical fan	
Coolant Quantity	6 liter (6.3U.S qts, 5.2Imp. qts)	
Radiator Type	Pressurized corrugated fin type	
Radiator cap Main valve opening pressure Vacuum valve opening pressure	83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1kg/cm ²) -7kpa (-100psi, -0.07kg/cm ²) or less	
Thermostat Type Valve opening temperature Full-opening temperature	Wax pellet type with jiggle valve 82°C (177°F) 95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt Type	V-ribbed belt	
Engine coolant temperature sensor Type Resistance	Heat-sensitive thermistor type 2.31 ~ 2.59K at 20°C (68°F)	

Oil pump Clearance between outer circumference and front case. Front case tip clearance Side clearance Inner gear Outer gear Engine oil pressure at 1,500RPM [Oil temperature is 90 to 110°C 194 to 230°F]	0.120 ~ 0.185mm (0.0049 ~ 0.0073in.) 0.025 ~ 0.069mm (0.0009 ~ 0.0027in.) 0.04 ~ 0.085mm (0.0016 ~ 0.0033in.) 0.04 ~ 0.09mm (0.0016 ~ 0.0035in.) 245kPa (2.5kg/cm ² , 35.5psi)
Relief spring Free height Load	43.8mm (1.725in.) 3.7kg at 40.1mm (3.15lb/1.578in.)
Air cleaner Type Element	Dry type Unwoven cloth type
Exhaust pipe Muffler Suspension system	Expansion resonance type Rubber hangers

SERVICE STANDRDS

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

TIGHTENING TORQUE

Item	Nm	kgf.cm	lb.ft
Cylinder Block			
Front engine support bracket bolt and nut	35 ~ 50	350 ~ 500	25 ~ 37
Front roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear roll stopper bracket bolt	70 ~ 90	700 ~ 900	51 ~ 65
Rear engine stopper bracket bolt	35 ~ 50	350 ~ 500	25 ~ 37
Engine Mounting	90 ~ 110	900 ~ 1100	65 ~ 80
Right mounting insulator (large) nut	45 ~ 60	450 ~ 600	33 ~ 44
Right mounting insulator (small) nut	50 ~ 65	500 ~ 650	36 ~ 48
Right mounting bracket to engine nuts and bolts	90 ~ 110	900 ~ 1100	65 ~ 80
Transmission mount insulator nut	40 ~ 50	400 ~ 500	30 ~ 36
Transmission insulator bracket to side member bolt	50 ~ 65	500 ~ 650	36 ~ 48
	40 ~ 50	400 ~ 500	30 ~ 36
Rear roll stopper insulator nut	50 ~ 65	500 ~ 650	36 ~ 48
Rear roll stopper bracket to center member bolts	40 ~ 50	400 ~ 500	30 ~ 36
Front roll stopper insulator nut			

Front roll stopper bracket to center member bolts.	Ebay User ID: reveleus1		
Main Moving			
Connecting rod cap nut	50 ~ 53	500 ~ 530	36 ~ 39
Crankshaft bearing cap bolt	27~33 + (60°~65°)	270~330 + (60°~65°)	20~24 + (60°~65°)
Fly wheel M/T bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Drive plate A/T bolt	120 ~ 130	1200 ~ 1300	88 ~ 95
Engine cover	4 ~ 6	40 ~ 60	3 ~ 4
Heat protector	15 ~ 20	150 ~ 200	11 ~15
Water pipe bracket bolts	12 ~ 15	120 ~ 150	9 ~ 11
Cooling system			
Alternator support bolt and nut	20 ~ 25	200 ~ 250	14 ~ 18
Alternator lock bolt	12 ~ 15	120 ~ 150	9 ~ 11
Alternator brance mounting bolt	20 ~ 27	200 ~ 270	15 ~ 20
Coolant pump pulley bolts	8 ~ 10	80 ~ 100	6 ~ 7
Coolant pump bolts	20 ~ 27	200 ~ 270	14 ~ 19
Coolant temperature sensor	20 ~ 40	200 ~ 400	15 ~ 30
Coolant inlet fitting nuts	15 ~ 20	150 ~ 200	11 ~ 14
Thermostat housing bolts and nuts	15 ~ 20	150 ~ 200	11 ~ 14
Lubrication system			
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Oil pan bolts	10 ~ 12	100 ~ 120	7 ~ 9
Oil pan drain plug	40 ~ 45	400 ~ 450	30 ~33
Oil screen bolts	15 ~ 22	150 ~ 220	11 ~16
Oil pressure switch	13 ~ 15	130 ~ 150	9.7 ~11
Intake and Exhaust system			
Air cleaner body mounting bolts	8~ 10	80 ~ 100	6 ~ 7
Resonator mounting bolts	4 ~ 6	40 ~ 60	3 ~ 4
Intake manifold to cylinder head nuts and bolts	16 ~ 23	160 ~ 230	12 ~ 17
Intake manifold stay to cylinder block bolts	18 ~ 25	180 ~ 250	13 ~ 18
Throttle body to surge tank nuts	15 ~ 20	150 ~ 200	11 ~ 14
Exhaust manifold to cylinder head nuts	43 ~ 55	430 ~ 550	32 ~ 40
Exhaust manifold cover to exhaust manifold bolts	15 ~ 20	150 ~ 200	11 ~ 14
Oxygen sensor to front muffler	50 ~ 60	500 ~ 600	36 ~ 43
Oxygen sensor to exhaust manifold	30 ~ 40	300 ~ 400	22 ~ 29
Front exhaust pipe to exhaust manifold nuts	30 ~ 40	300 ~ 400	22 ~ 29
Front exhaust pipe bracket bolts	40 ~ 60	400 ~ 600	29 ~ 43
Front exhaust pipe to catalytic converter bolts	10 ~ 15	100 ~ 150	7 ~ 11
Main muffler hanger support bracket bolts			

Cylinder head	$25 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$	$250 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$	$18 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$
Cylinder head bolts - M10			
Cylinder head bolts - M12	$30 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$	$300 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$	$22 + (60^\circ \sim 65^\circ) + (60^\circ \sim 65^\circ)$
Intake manifold nuts	18 ~ 25	180 ~ 250	13 ~ 18
Exhaust manifold nuts	43 ~ 55	430 ~ 550	32 ~ 41
Cylinder head cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Camshaft bearing cap bolts	14 ~ 15	140 ~ 150	10 ~ 11
Oil control valve bolt	10 ~ 12	100 ~ 120	7.3 ~ 8.8
OCV Filter	41 ~ 51	410 ~ 510	30 ~ 37.6
CVVT unit to exhaust camshaft bolt	66 ~ 78	660 ~ 780	48.7 ~ 57.5
Rear plate bolts	8 ~ 10	80 ~ 100	6 ~ 7
Timing Belt			
Crankshaft pulley bolt	170 ~ 180	1700 ~ 1800	125 ~ 133
Camshaft sprocket bolt	100 ~ 120	1000 ~ 1200	74 ~ 89
Timing belt tensioner bolts	43 ~ 550	430 ~ 550	31 ~ 40
Timing belt cover bolts	8 ~ 10	80 ~ 100	6 ~ 7
Front case bolts	20 ~ 27	200 ~ 270	14 ~ 20
Timing belt idler bolt	43 ~ 55	430 ~ 550	31 ~ 40

M/T : Manual Transmission

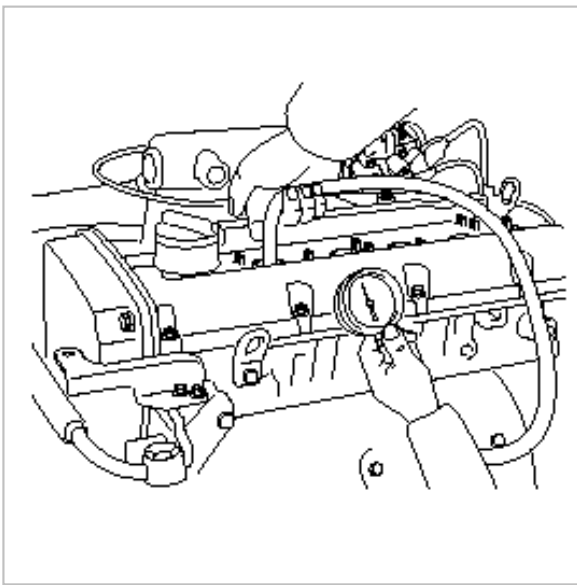
A/T : Automatic Transmission

COMPRESSION

NOTE

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

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



B. Fully open the throttle.

C. while cranking the engine, measure the compression pressure.

NOTE

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

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

NOTE

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

E. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

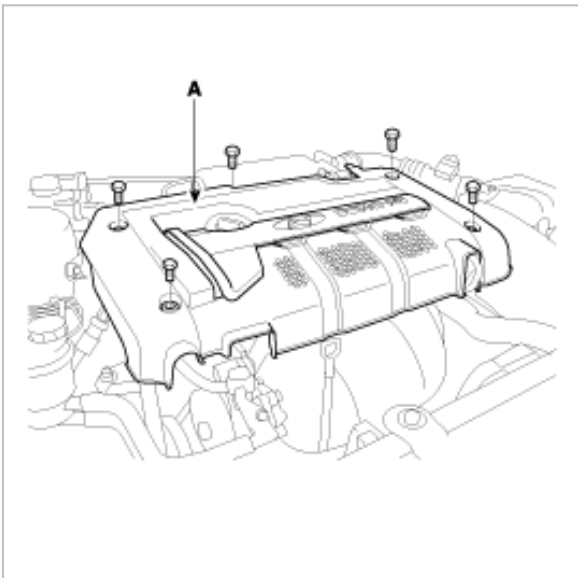
- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

Reinstall spark plugs.

Install ignition coils. (see EE group - ignition)

Timing belt tension adjustment

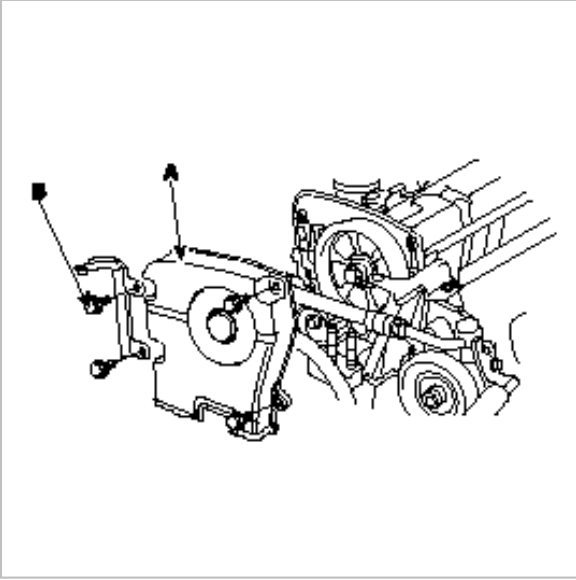
1. Remove the engine cover (A).



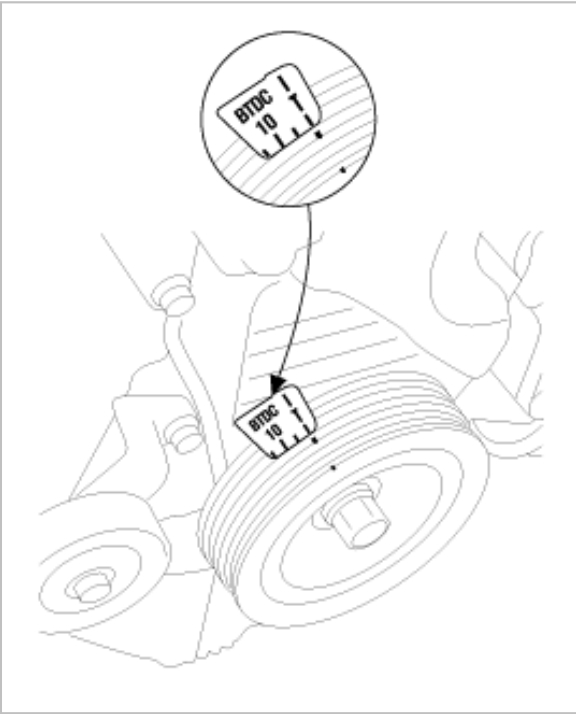
2. Remove RH front wheel.

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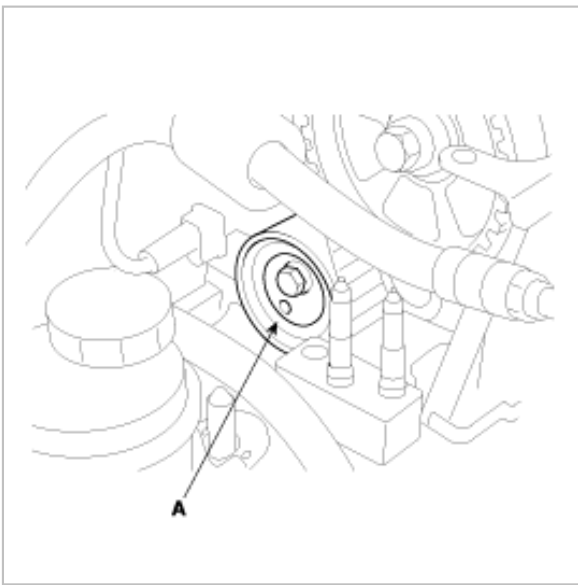
3. Remove the 4bolts and timing belt upper cover (A).



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

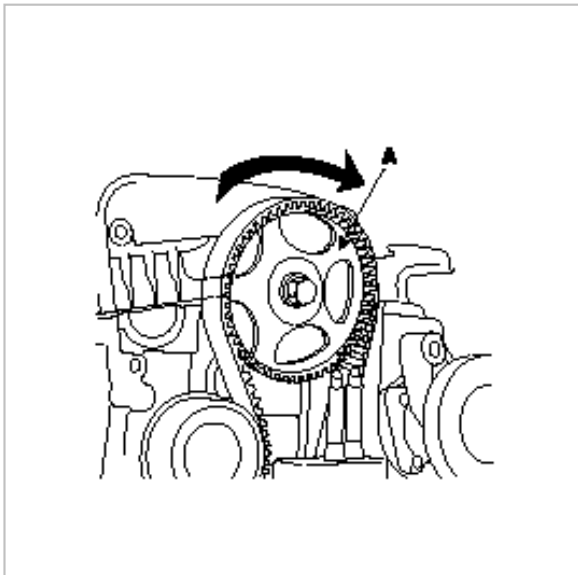


5. Temporarily loosen tensioner pulley by center bolt.

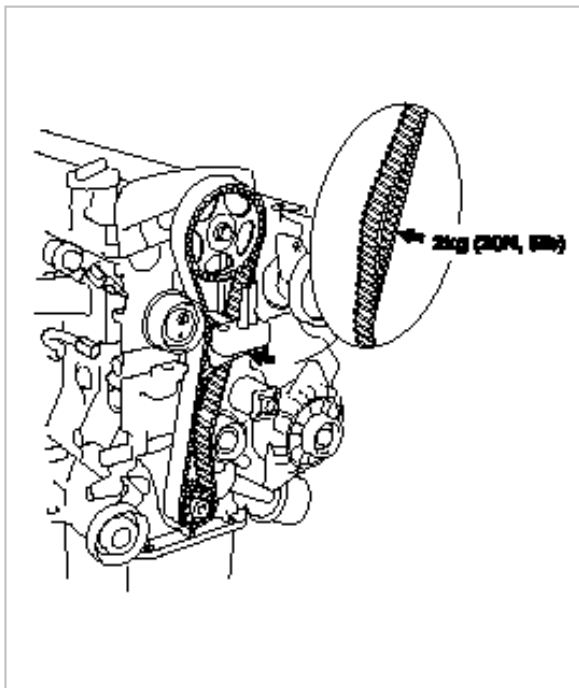


6. Timing belt tension adjusting

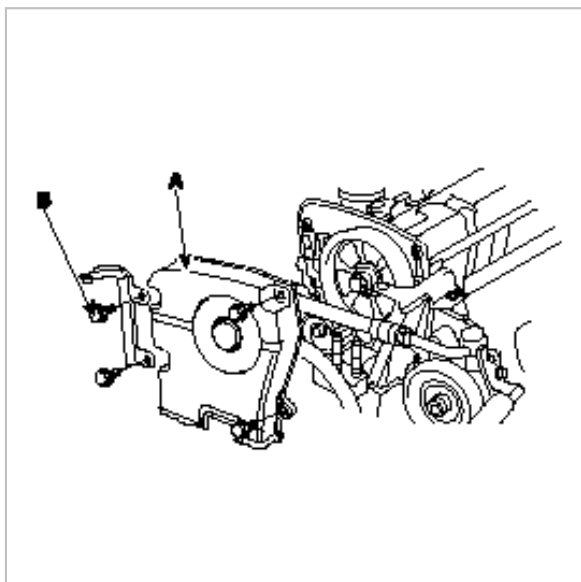
- (1) Rotate crankshaft in regular direction (clock wise view from front) through angle equivalent to two teeth (18°) of camshaft sprocket.



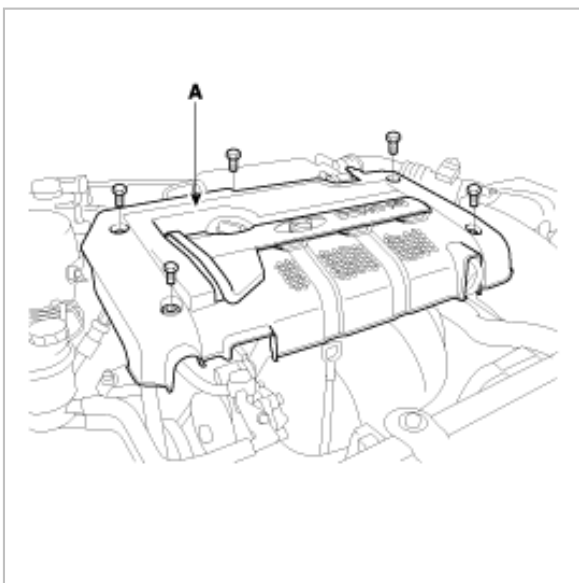
- (2) Give tension to timing belt rotating tensioner in arrow direction tool and set timing belt not to give slack to tension side.
- (3) Tightening tensioner bolt.
- (4) Recheck the belt tension, When the tension side of timing belt is pushed horizontally with a moderate force [approx. 2kg (20N, 51b)], the timing belt cog end segs in approx. 4 ~ 6mm (0.16 ~ 0.24in.)



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



9. Install RH front wheel.
10. Install engine cover with 5bolts.



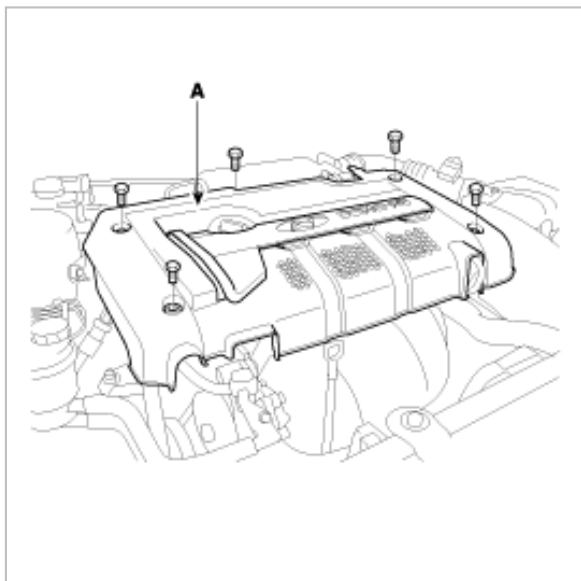
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

MLA (MECHANICAL LASH ADJUSTER)

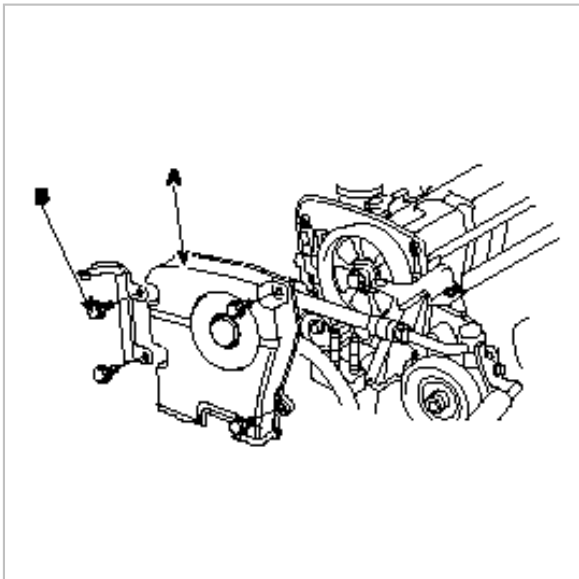
NOTE

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

1. Remove the engine cover (A).



2. Remove the upper timing belt cover (A).



A. Loosen the upper timing cover bolts and then remove the cover.

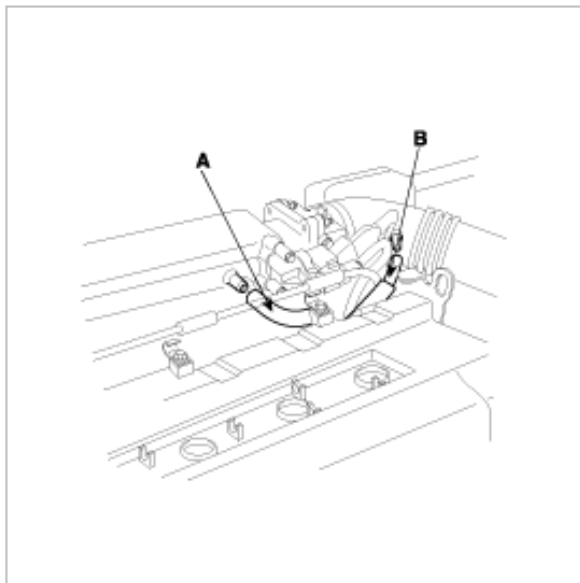
3. Remove the cylinder head cover.

A. Disconnect the spark plug cables and do not pull on the spark plug by force.

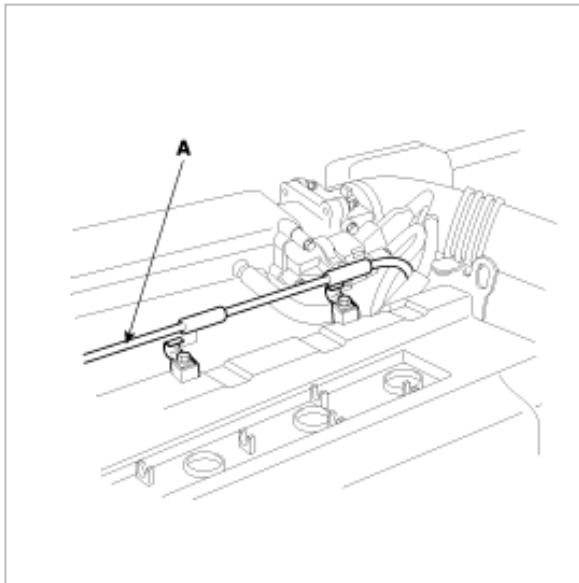
NOTE

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

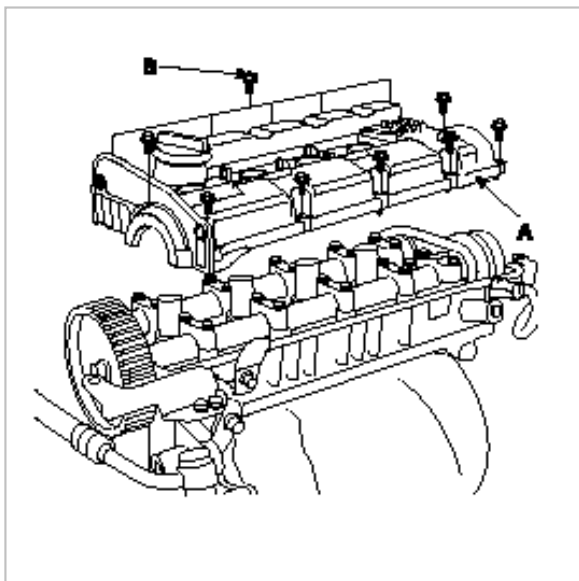
B. Disconnect the P.C.V hose (A) and the breather hose (A) from the cylinder head cover.



C. Disconnect the accelerator cable (A) from the cylinder head cover.

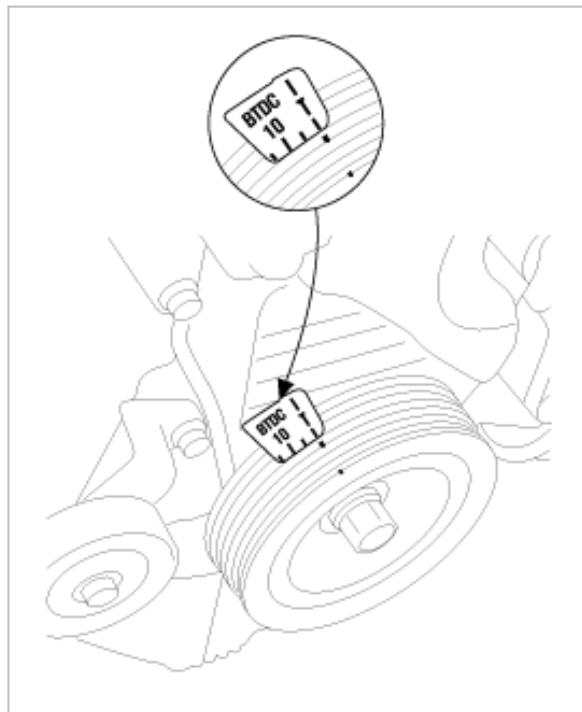


D. Loosen the cylinder head cover bolts and then remove the cover and gasket.

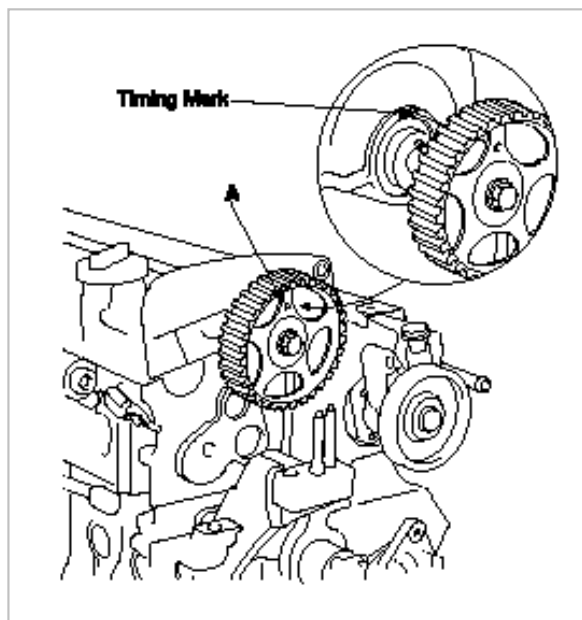


4. Set No. 1 cylinder to TDC/compression.

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

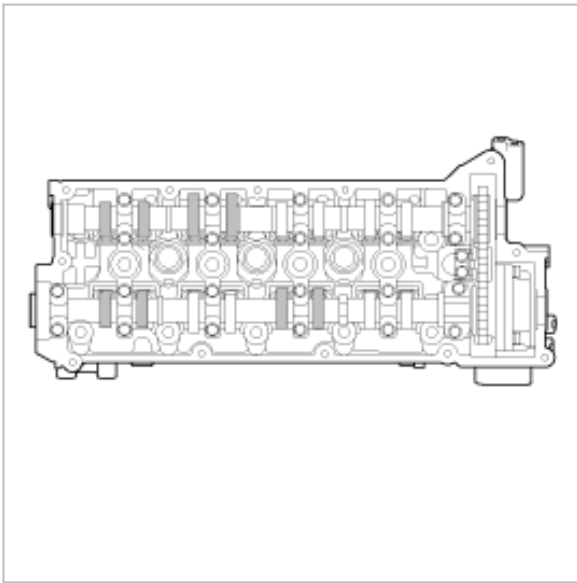


B. Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.
If not, turn the crankshaft one revolution (360°)



5. Inspect the valve clearance.

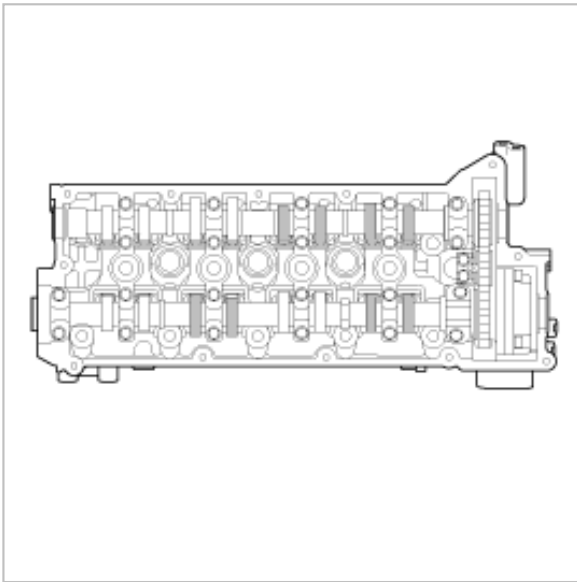
A. Check only the valve indicated as shown. [No. 1 cylinder : TDC/Compression] measure the valve clearance.



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

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

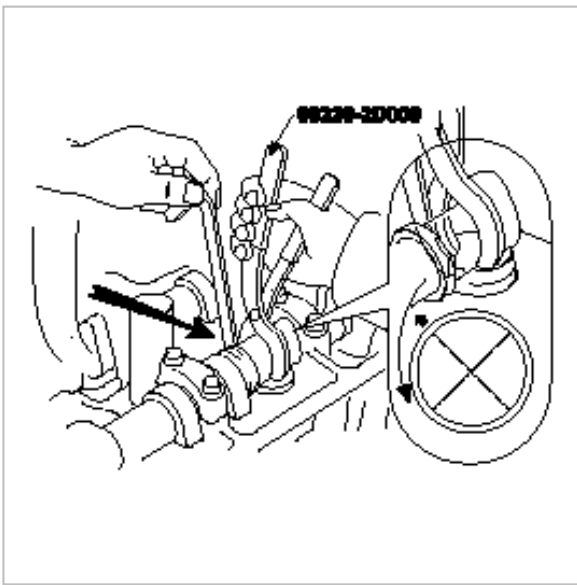
C. Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance. (See procedure in step 6)



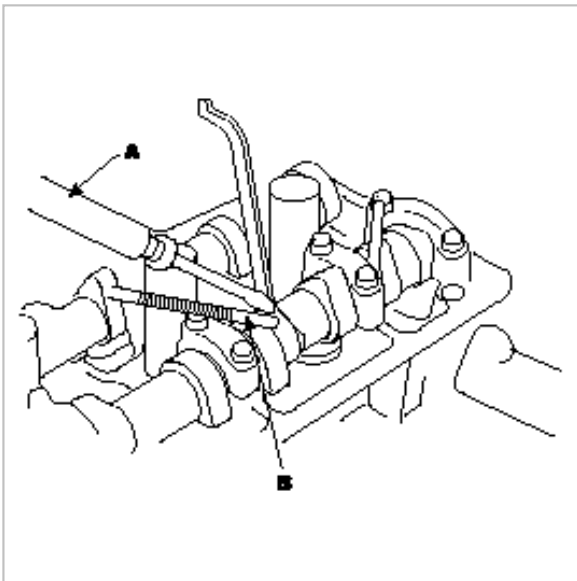
6. Adjust the intake and exhaust valve clearance.

A. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.

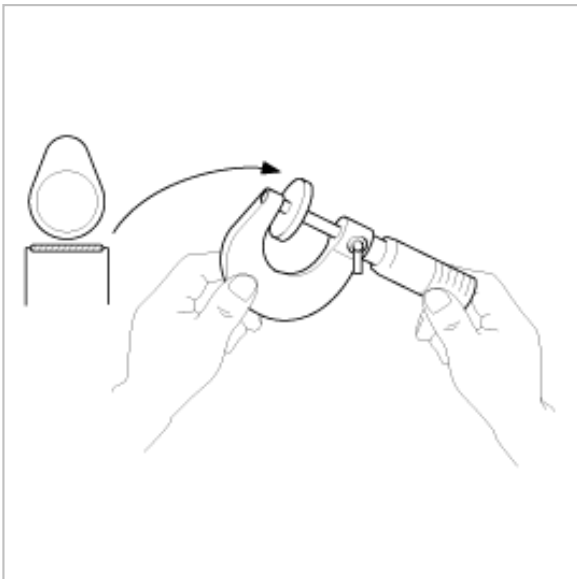
B. Using the special tool (09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



C. Remove the adjusting shim with a small screw driver and magnet.



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



E. Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

F. Select a new shim with a thickness as close as possible to the calculated value. [Refer to the Adjusting shim selection chart]
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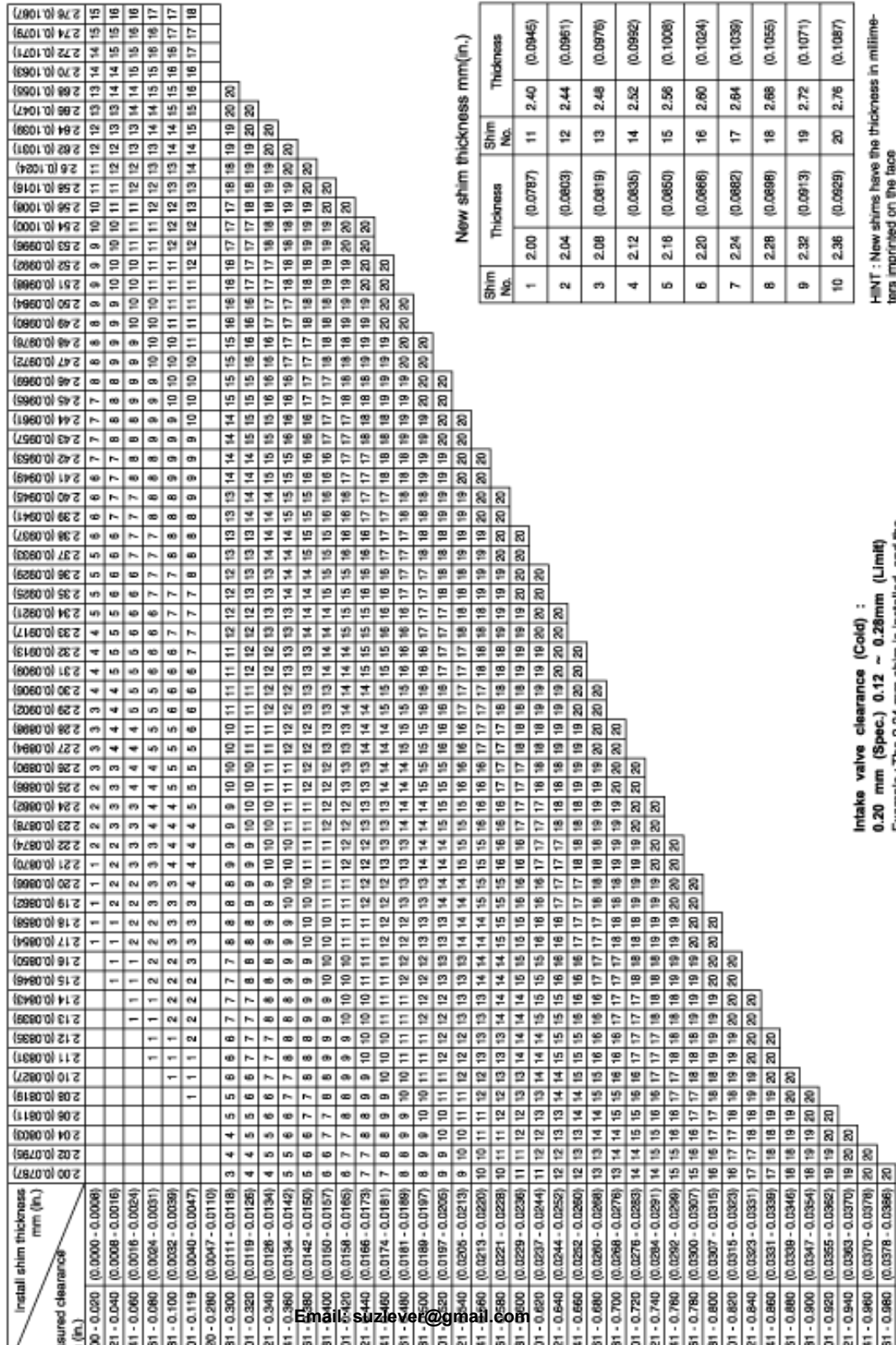
NOTE
 Shims are available in 20size increments of 0.04mm (0.0016in.) from 2.00mm (0.079in.) to 2.76mm (0.1087in.)

G. Place a new adjusting shim on the valve lifter.

H. Using the special tool (09220 - 2D000), press down the valve lifter and remove the stopper.

I. Recheck the valve clearance.

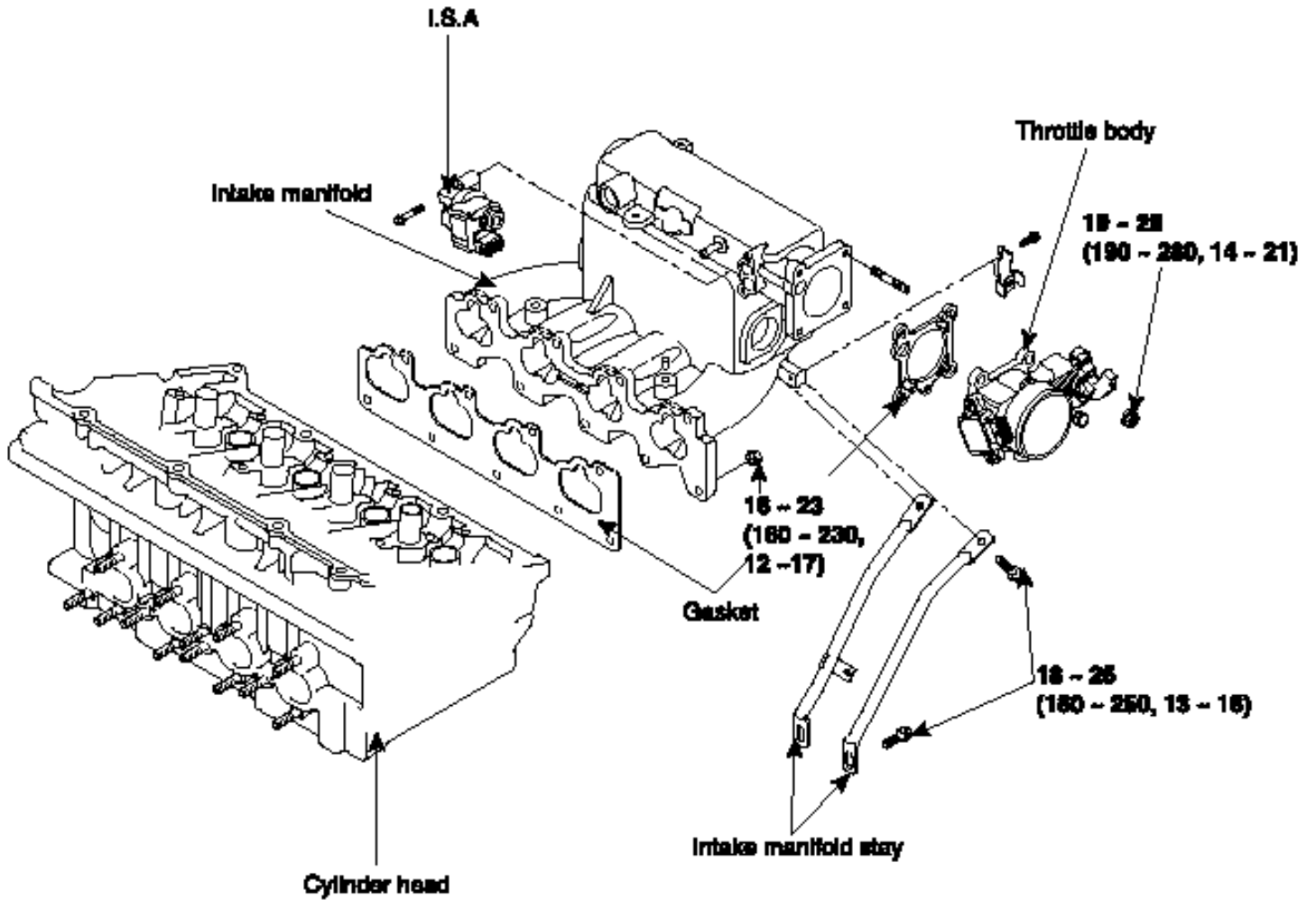
Adjusting Shim Selection Chart (Intake)



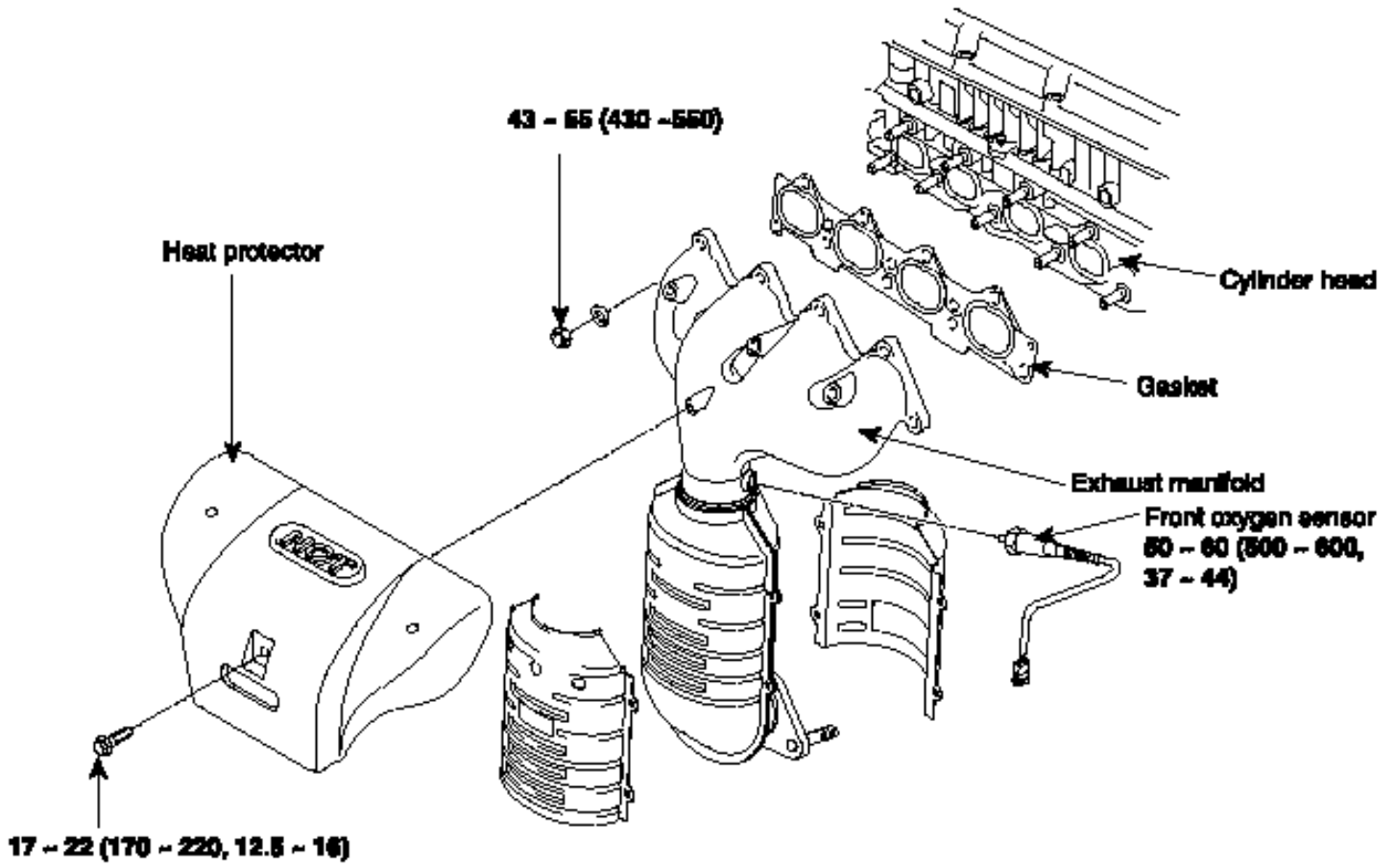
Email: Suzlevo@gmail.com

COMPONENT

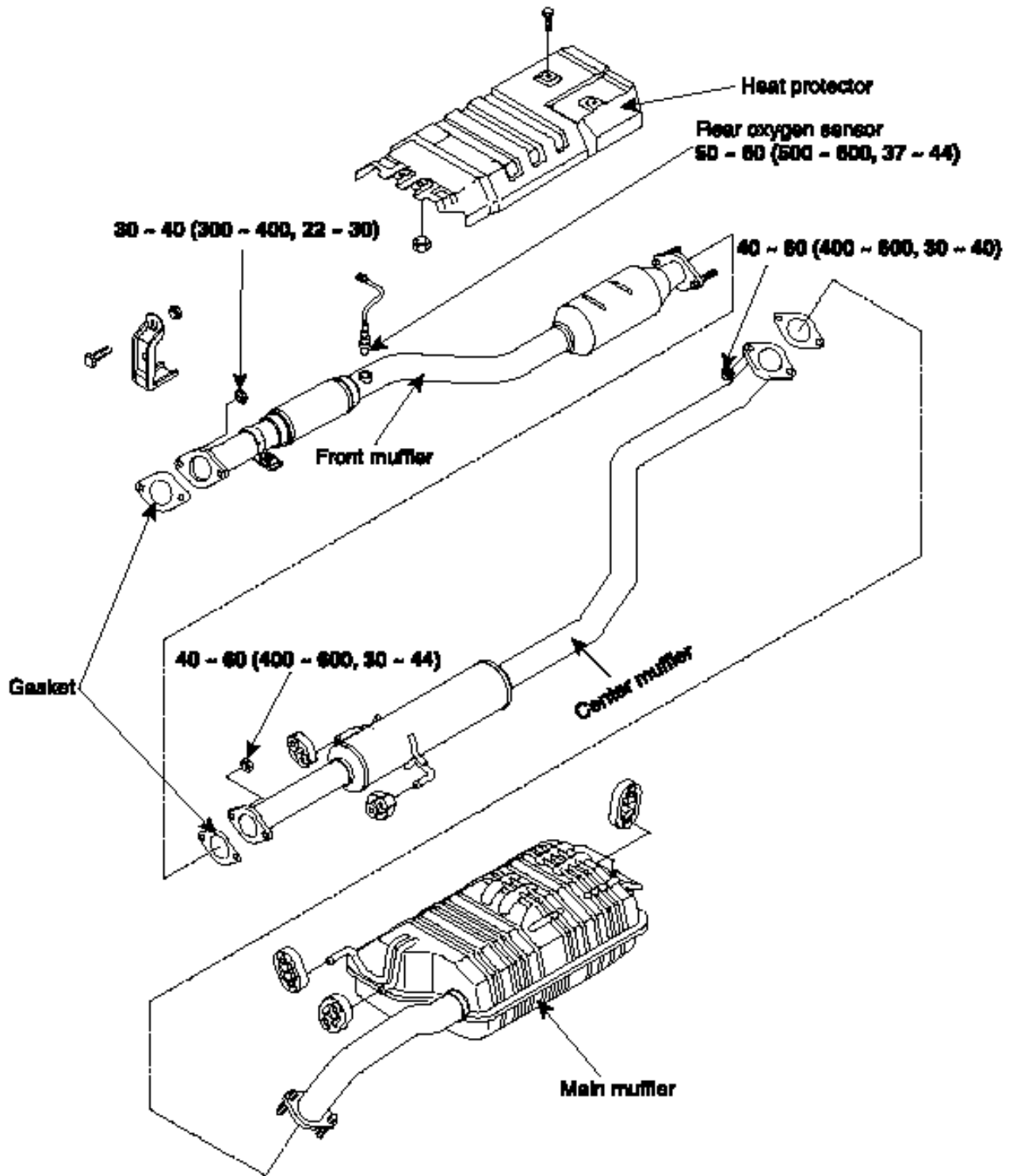
INTAKE MANIFOLD



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

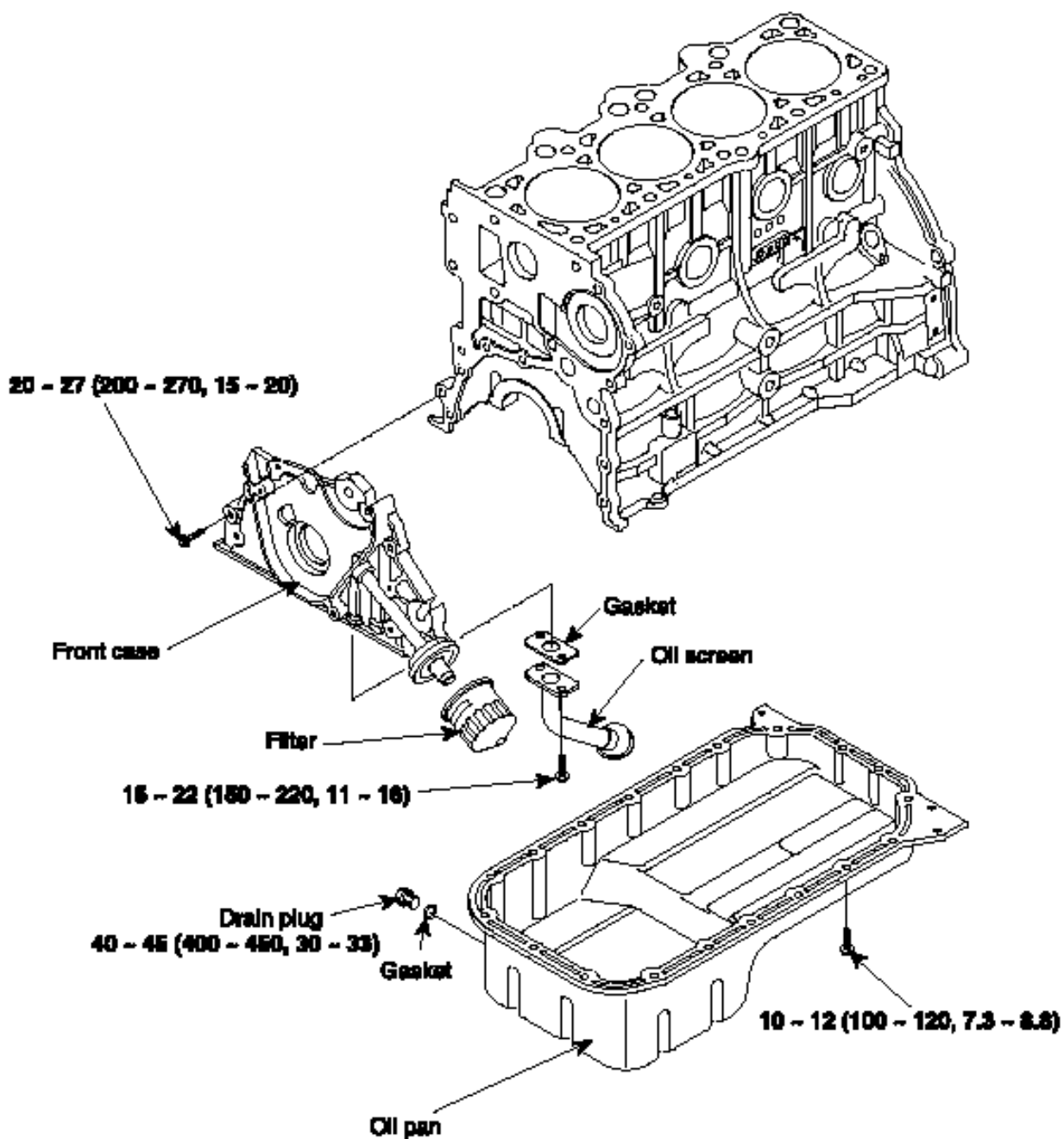


TORQUE : Nm (kgf.cm, lb.ft)

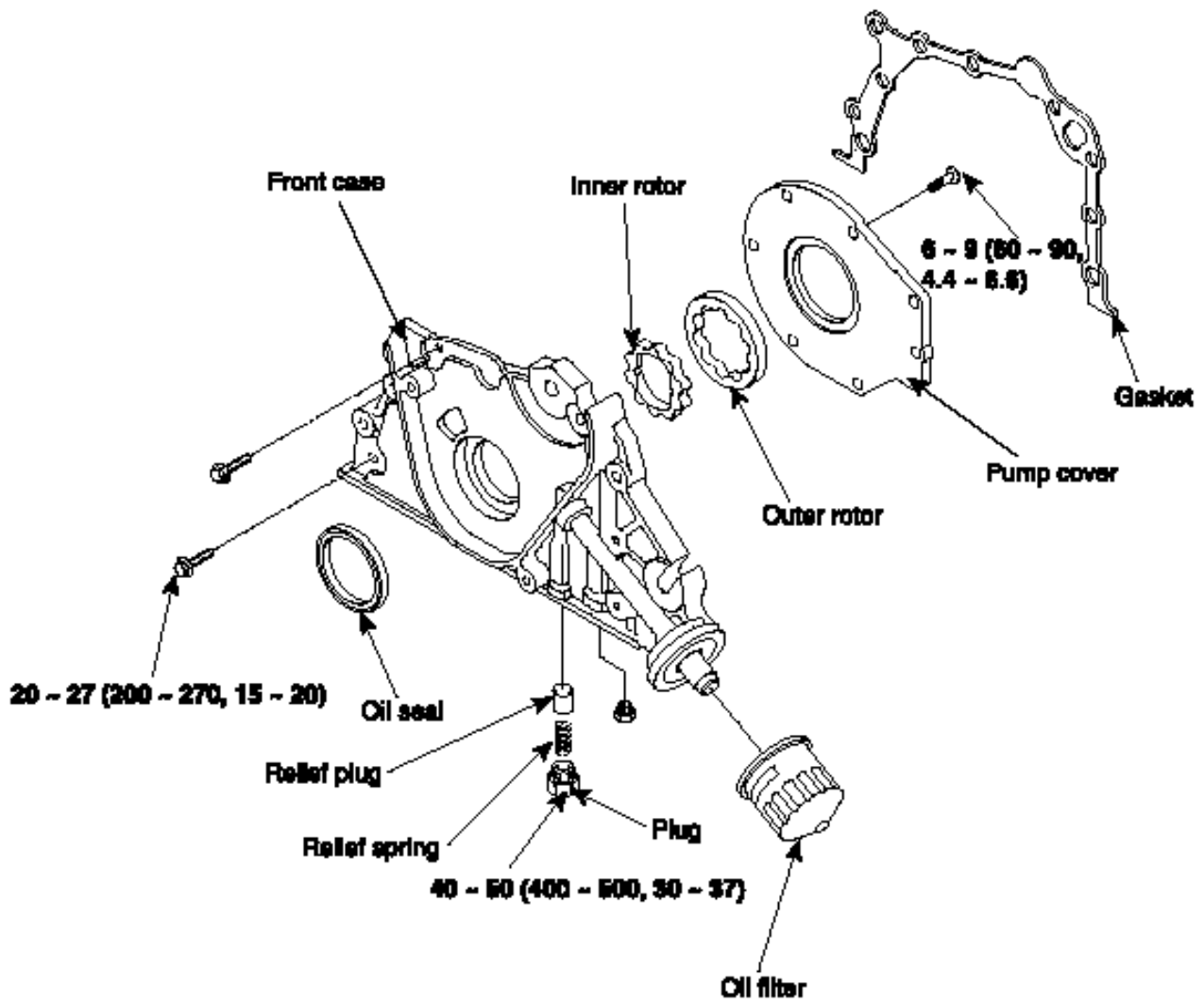


TORQUE : Nm (kgf.cm, lbf.ft)

COMPONENT



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



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



OIL AND FILTER

CAUTION

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

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

Tightening torque

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

- B. Fill with fresh engine oil
-

Capacity

Drain and refill :

W/Oil filter change : 3.85l (4.1U.S.qts, 3.4Imp qts)

W/O Oil filter change : 3.55l (3.75U.S.qts, 3.1Imp qts)

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

INSPECTION

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

2. Check engine oil level.

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

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

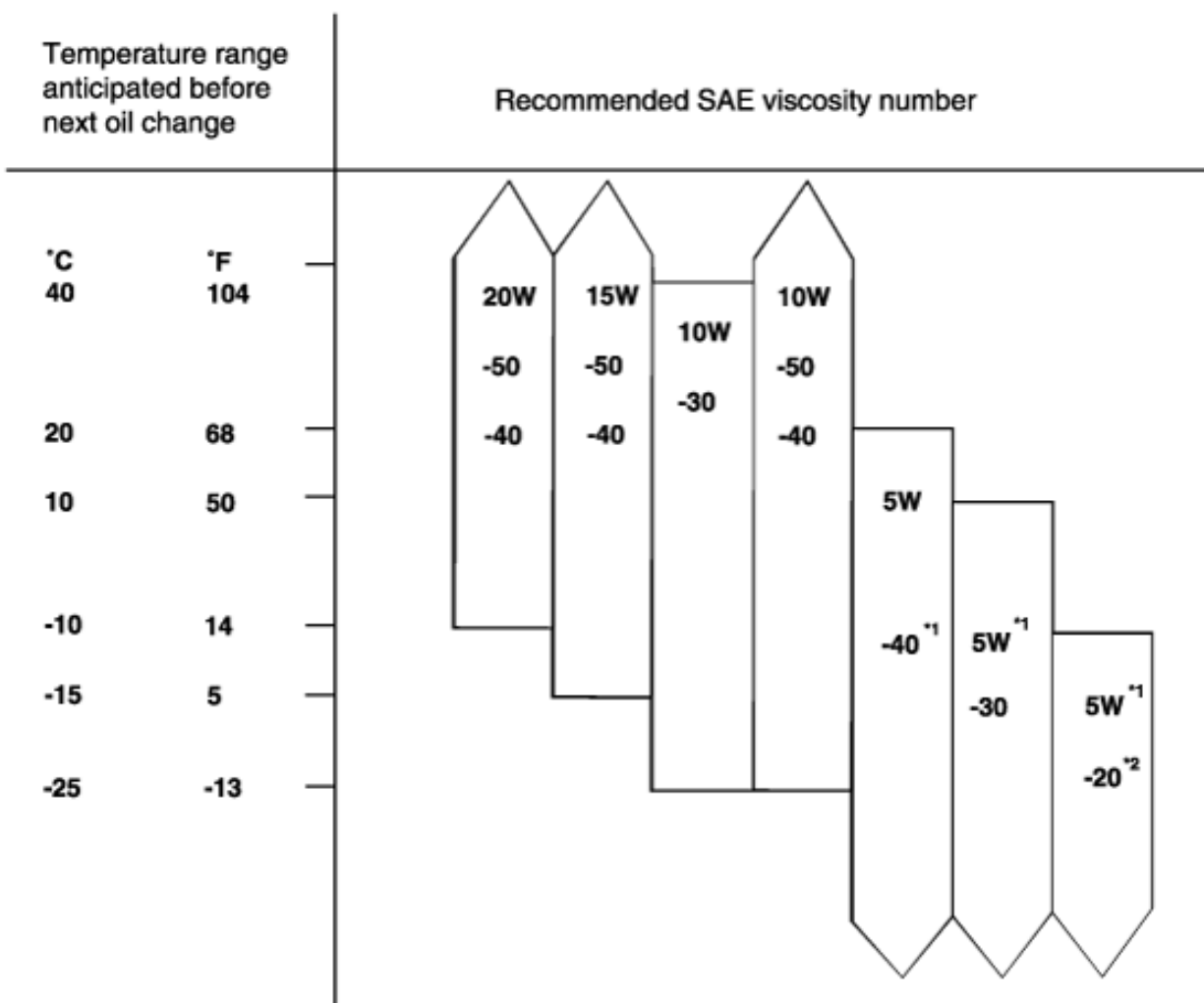
NOTE

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

SELECTION OF ENGINE OIL

Recommended SAE viscosity grades :

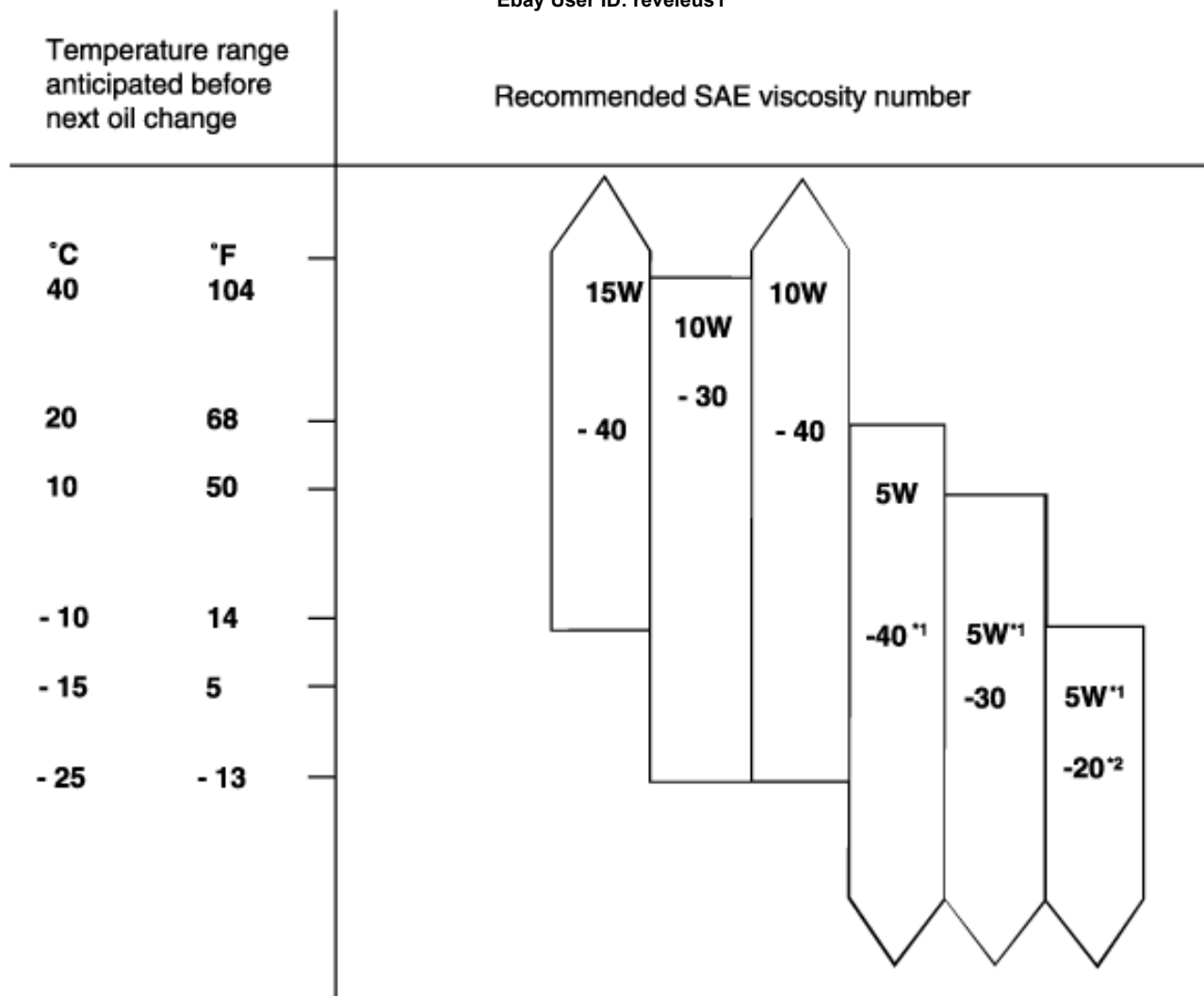
W/O-CVVT



*1 Restricted by driving condition and environment.

*2 Not recommended for sustained high speed vehicle operation

W/CVVT



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

NOTE

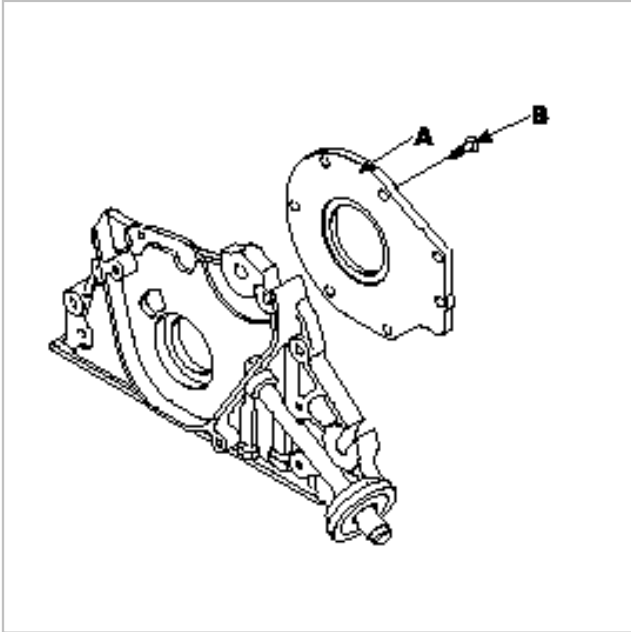
For best performance and maximum protection of all types of operation, select only those lubricants which :

1. Satisfy the requirement of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.

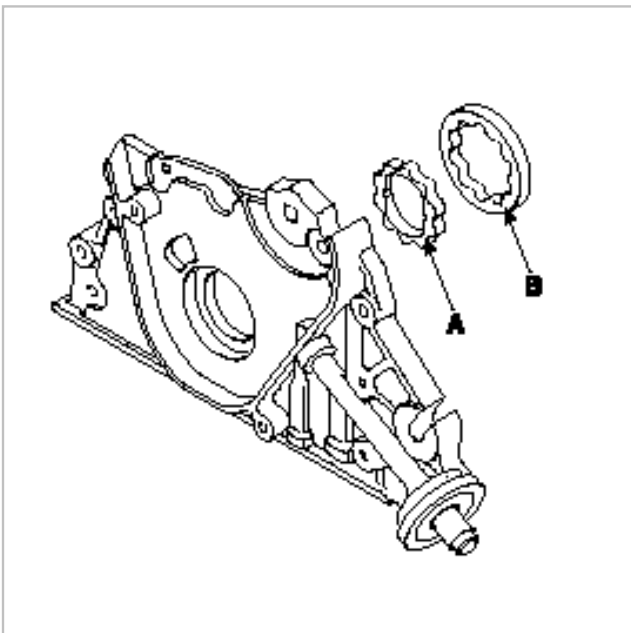
Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

REMOVAL

1. Drain engine oil.
2. Remove the drive belts.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.
(see page-)
4. Remove the timing belt.(see page EM-13)
5. Remove the oil pan and oil screen.(see page EM-25)
6. Remove the front case.
 - (1) Remove the screws from the pump housing, then separate the housing and cover (A).



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



INSTALLATION

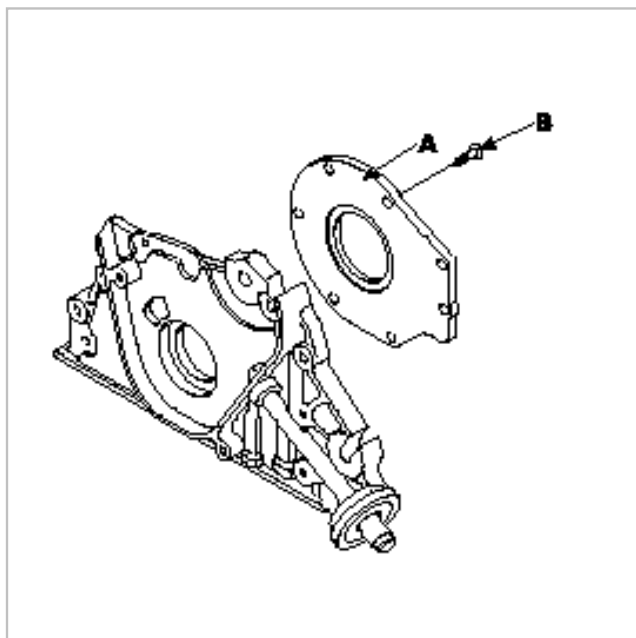
1. Install oil pump.

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

Tightening torque

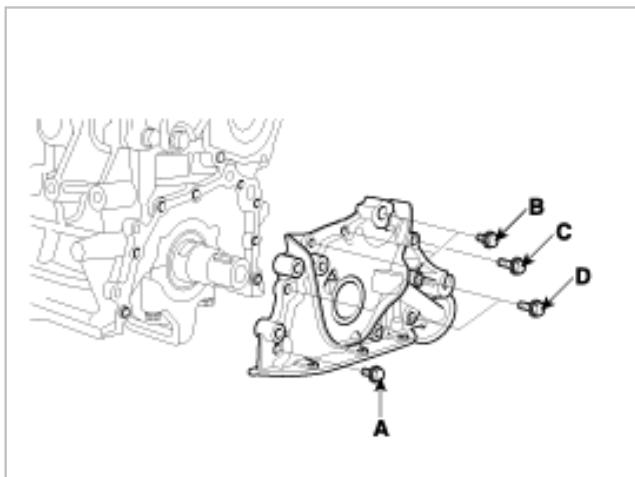
6 ~ 9Nm (60 ~ 90kgf.cm, 4.4 ~ 6.6lb.ft)



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.



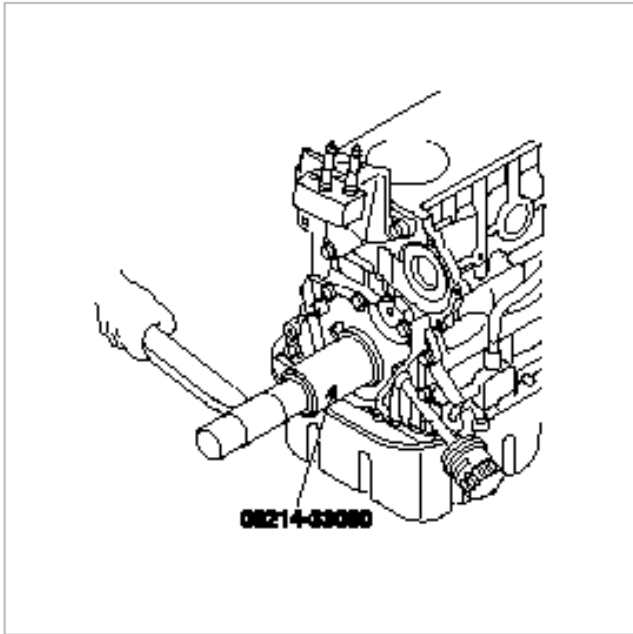
Body length

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

Tightening torque

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

4. Apply a light coat of oil to the seal lip.
5. Using the special tool(09214-33000), install the oil seal.



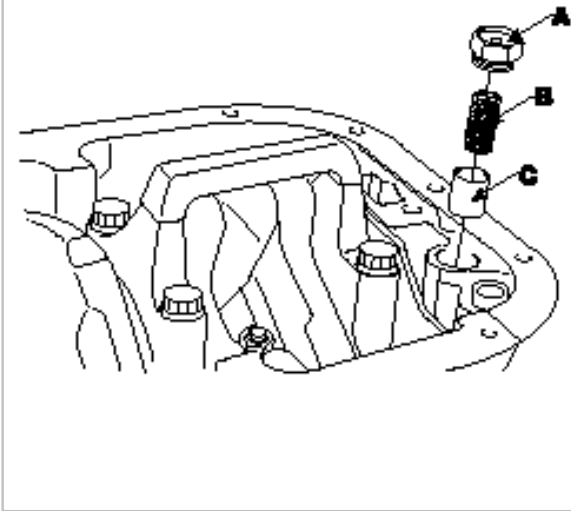
6. Install the oil screen.(see page-)
7. Install the oil pan.(see page-)

NOTE

Clean the oil pan gasket mating surfaces.

DISASSEMBLY

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



INSPECTION

1. Inspect relief plunger.

Coat the valve with engine oil and check that it falls smoothly into the plunger hole by its own weight.

If it does not, replace the relief plunger. If necessary, replace the front case.

2. Inspect relief valve spring.

Inspect for distorted or broken relief valve spring.

Standard value

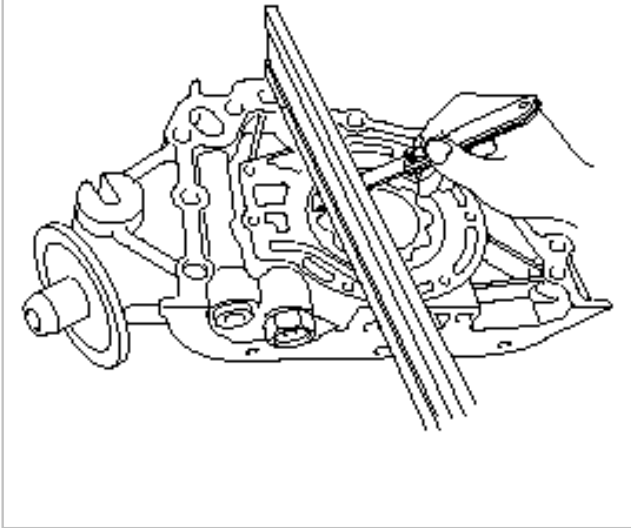
Free height : 43.8mm (91.724 in.)

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

3. Inspect rotor side clearance.

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

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



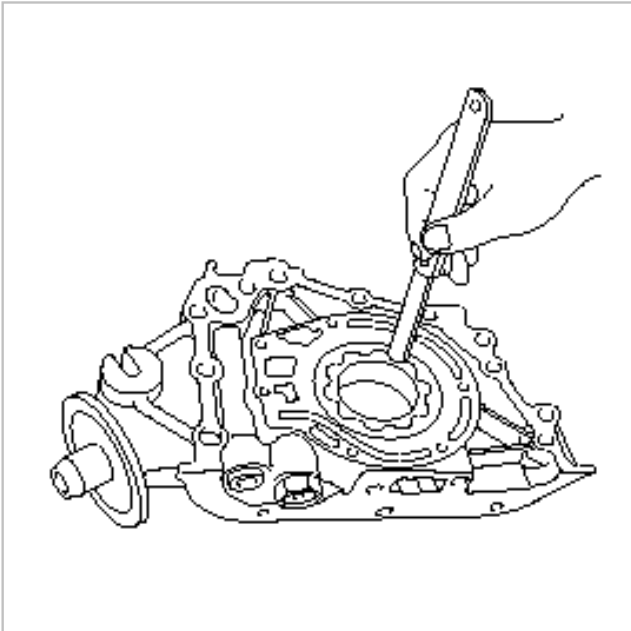
If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

4. Inspect rotor tip clearance.

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

Tip clearance

0.025 ~ 0.069 mm(0.0010 ~ 0.0027 in.)



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

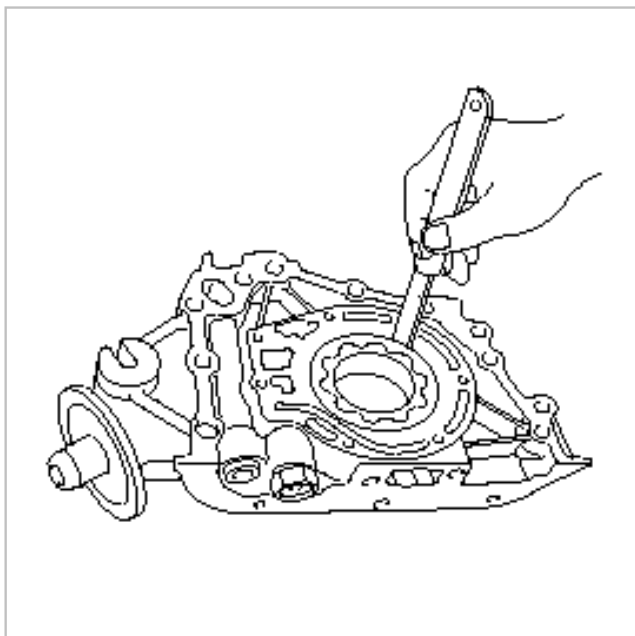
5. Inspect rotor body clearance.

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

Body clearance

0.12 ~ 0.185 mm(0.0047 ~ 0.0073 in.)



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

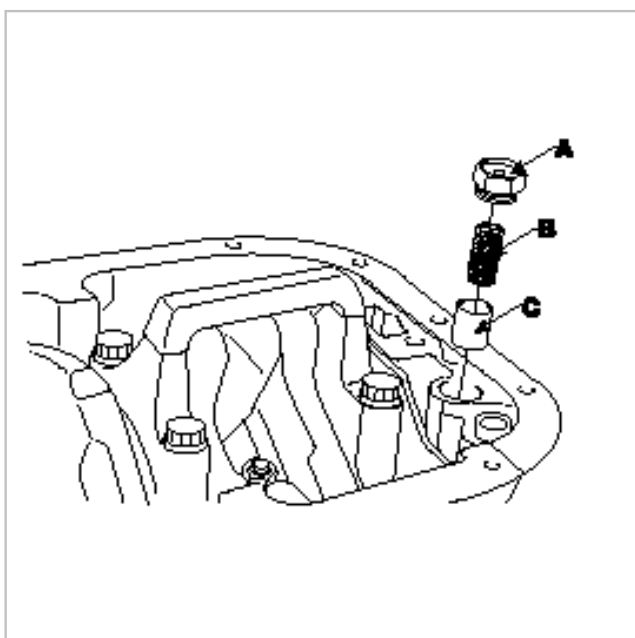
REASSEMBLY

1. Install relief plunger.

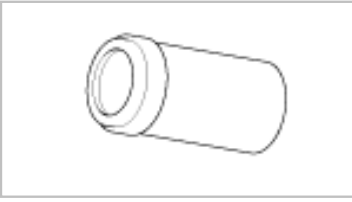
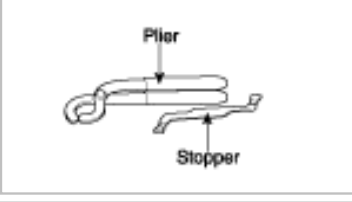
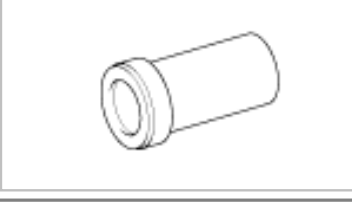
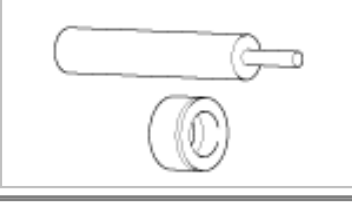
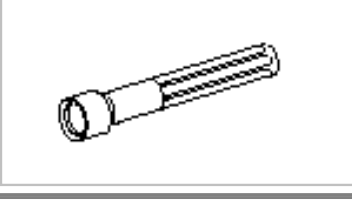


Install relief plunger (C) and spring (B) into the front case hole, and install the plug (A).

Tightening torque

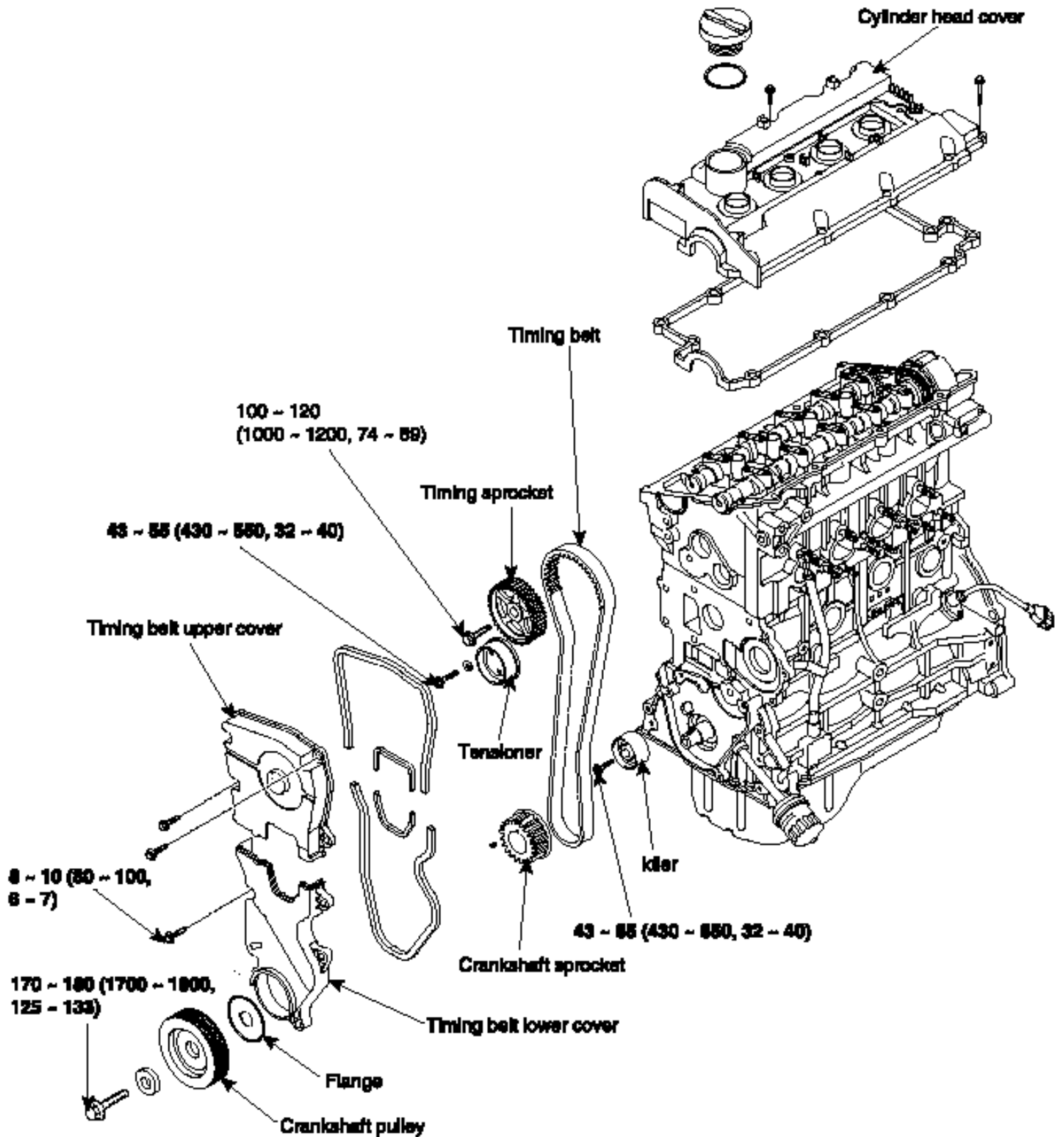
40 ~ 50Nm (400 ~ 500kgf.cm, 30 ~ 37lb.ft)



SPECIAL TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)		Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)		Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor & adaptor (09222-28000, 09222-28100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)		<ol style="list-style-type: none"> 1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal

COMPONENT

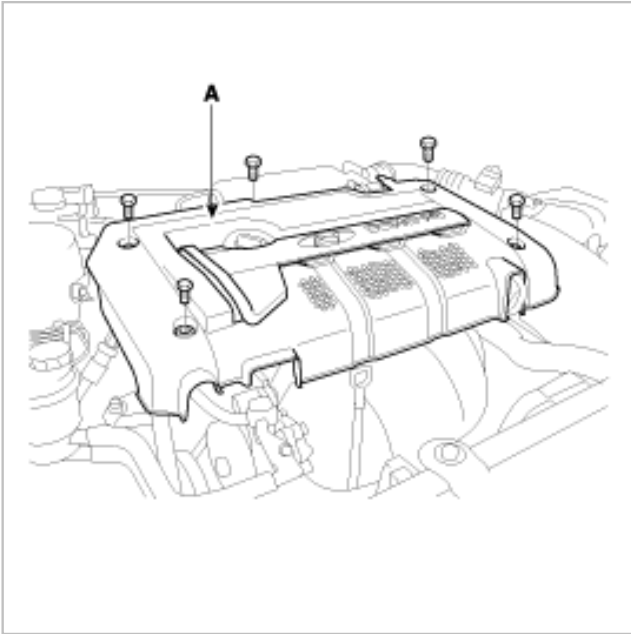


TORQUE : Nm (kgf.cm, lbf.ft)

REMOVAL

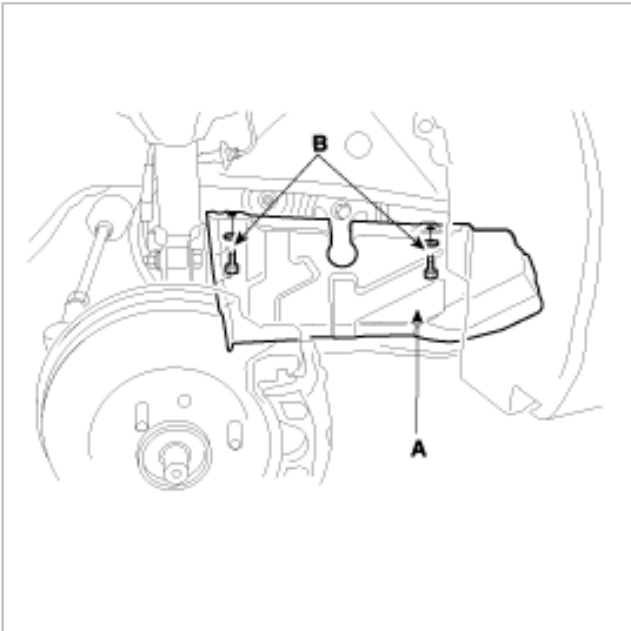
Engine removal is not required for this procedure.

1. Remove the engine cover (A).



2. Remove RH front wheel.

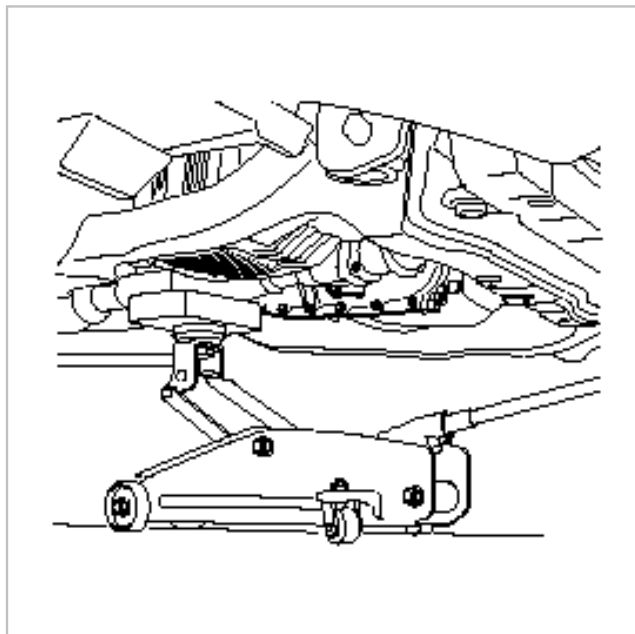
3. Remove 2bolts (B) and RH side cover (A).



4. Remove the engine mount bracket.

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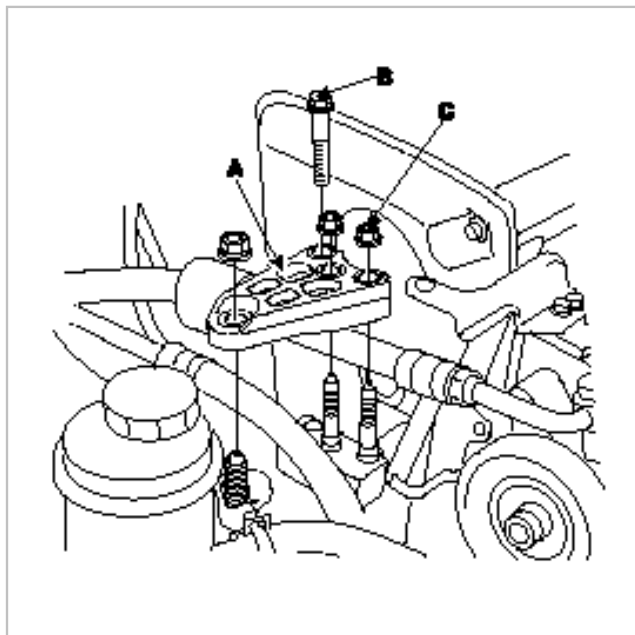
(1) Set the jack to the engine oil pan.



NOTE

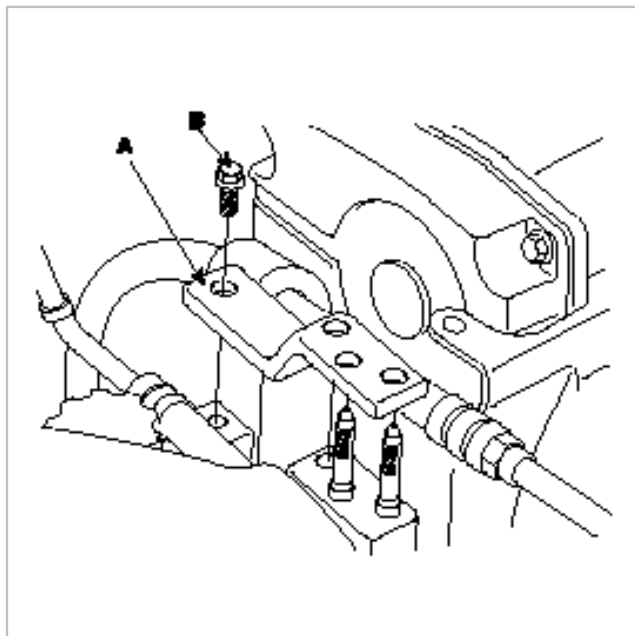
Place wooden block between the jack and engine oil pan.

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

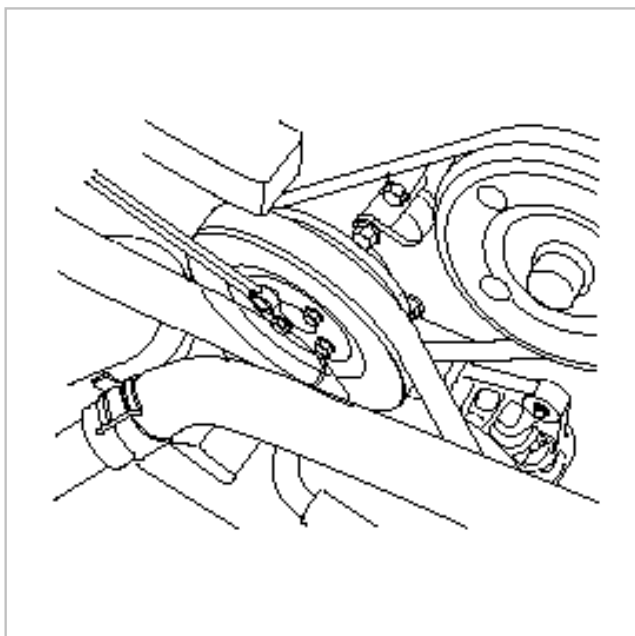


(3) Remove the bolt and stay plate (A).

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5. Temporarily loosen the water pump pulley bolts (B).



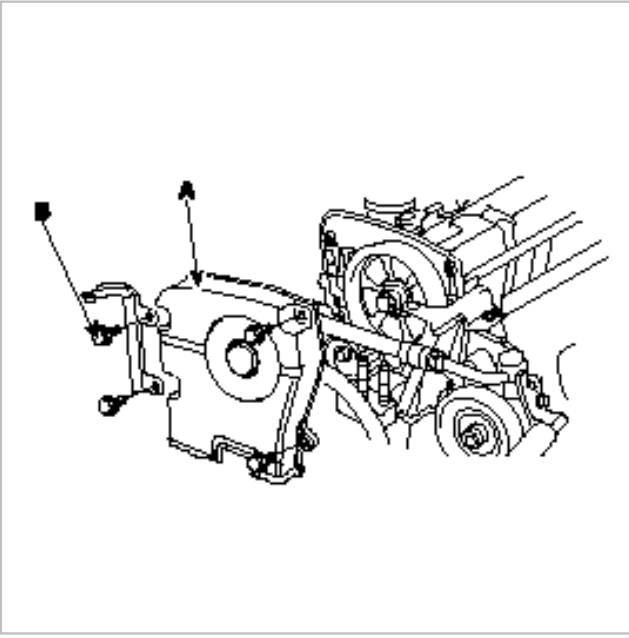
6. Remove alternator belt.(see EE group - alternator)

7. Remove air compressor belt.(see HA group - air compressor)

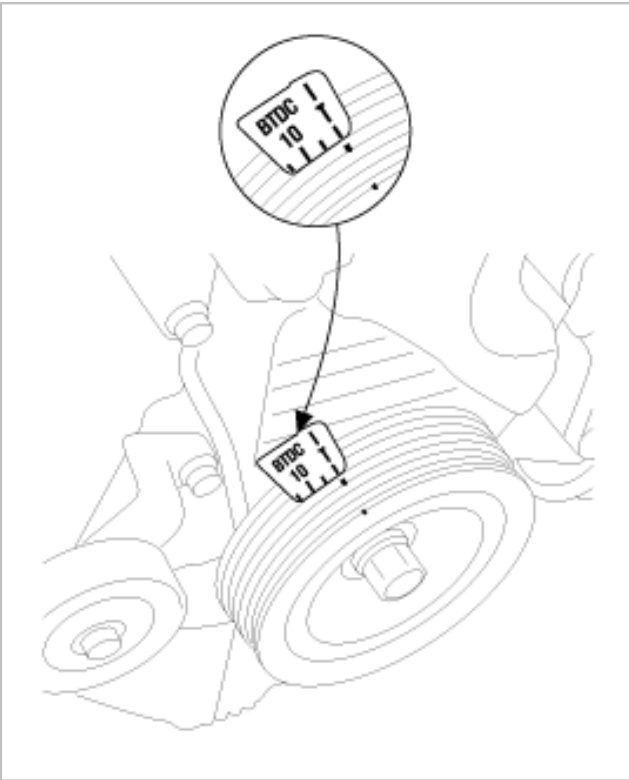
8. Remove power steering belt.(see ST group - power steering pump)

9. Remove 4bolts and water pump pulley.

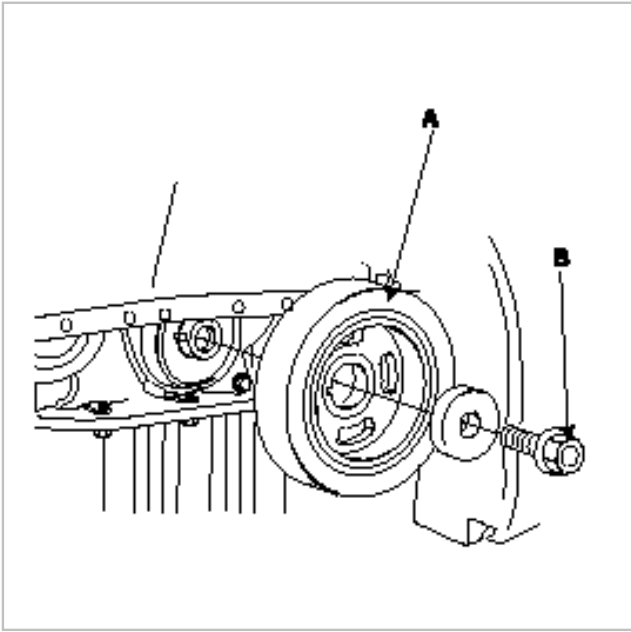
10. Remove the 4bolts and timing belt upper cover (A).
Ebay User ID: reveleus1



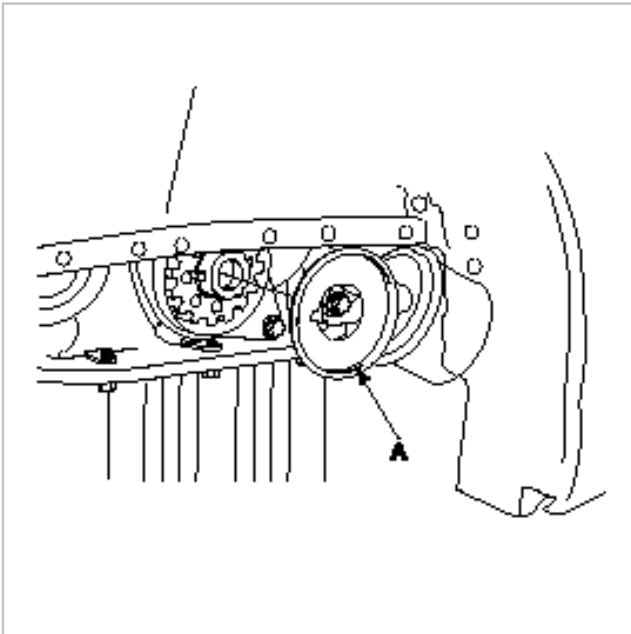
11. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.



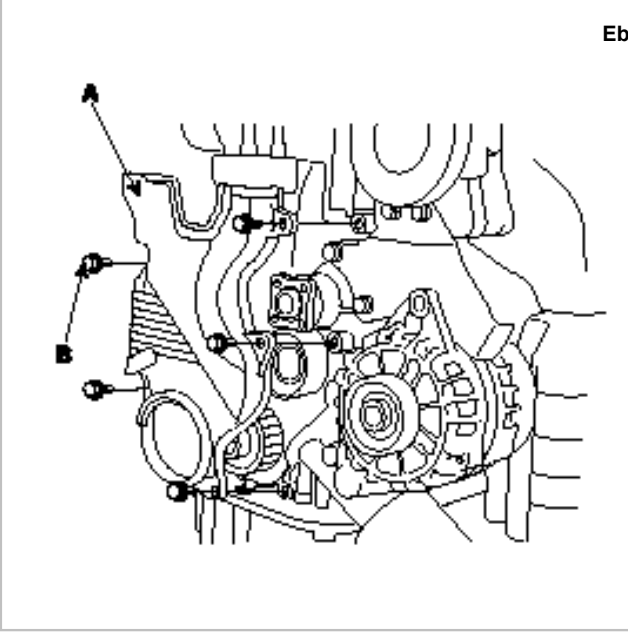
12. Remove the crankshaft pulley bolt and crankshaft pulley (A).
Ebay User ID: reveleus1



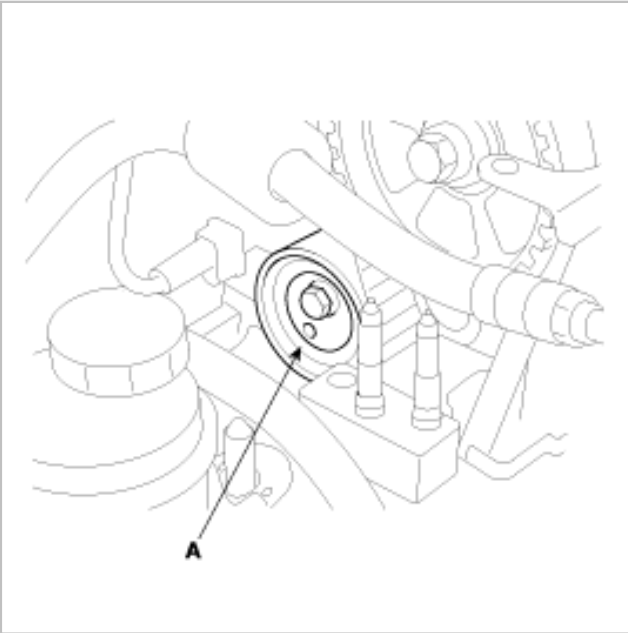
13. Remove the crankshaft flange (A).

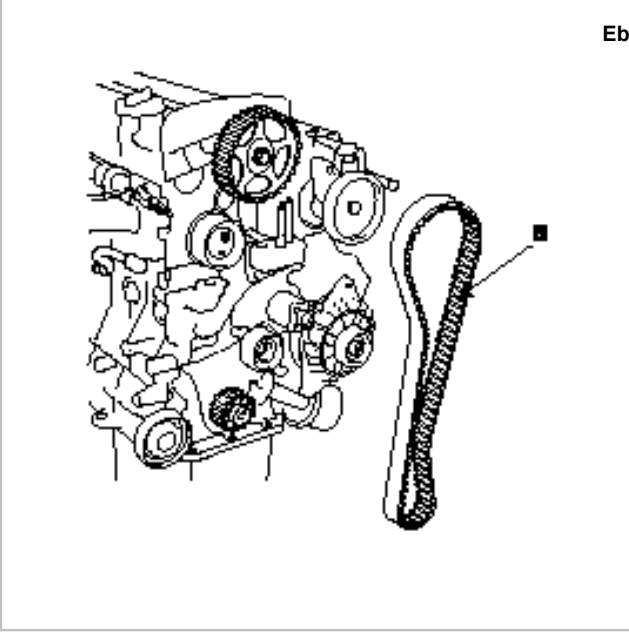


14. Remove the 5bolts and timing belt lower cover.



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

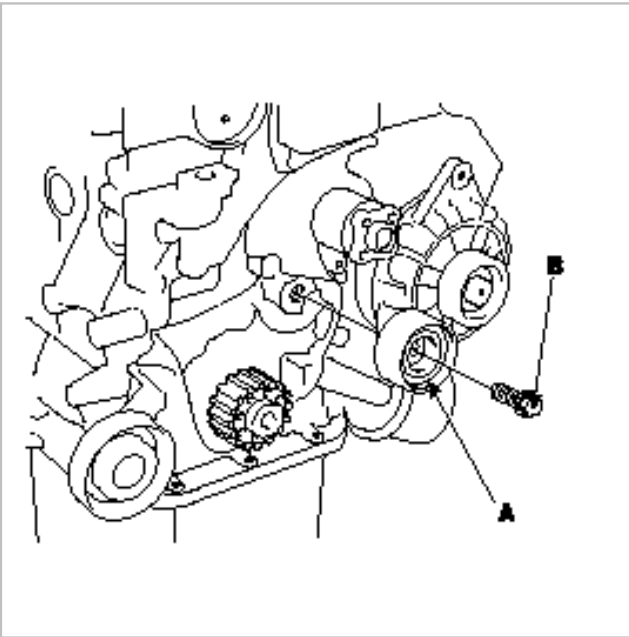




NOTE

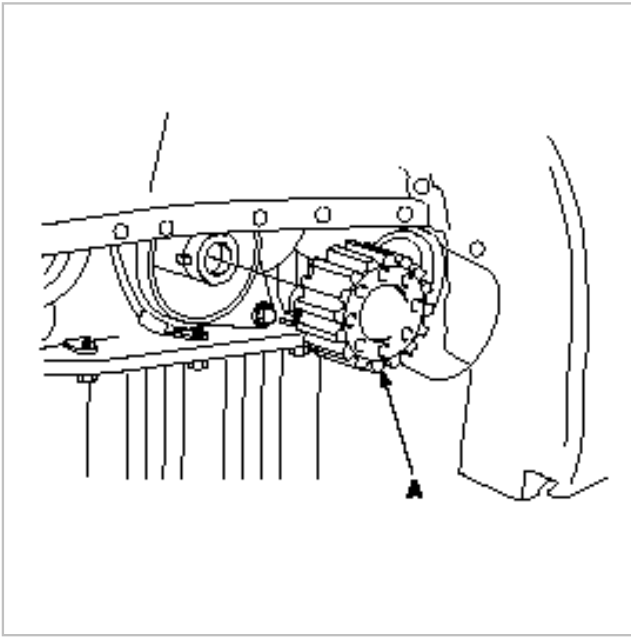
If the timing belt is reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

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



17. Remove the crankshaft sprocket (A).

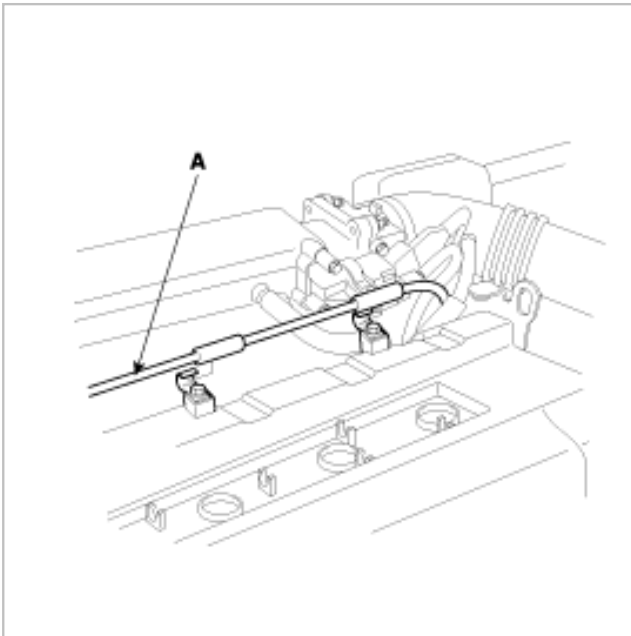
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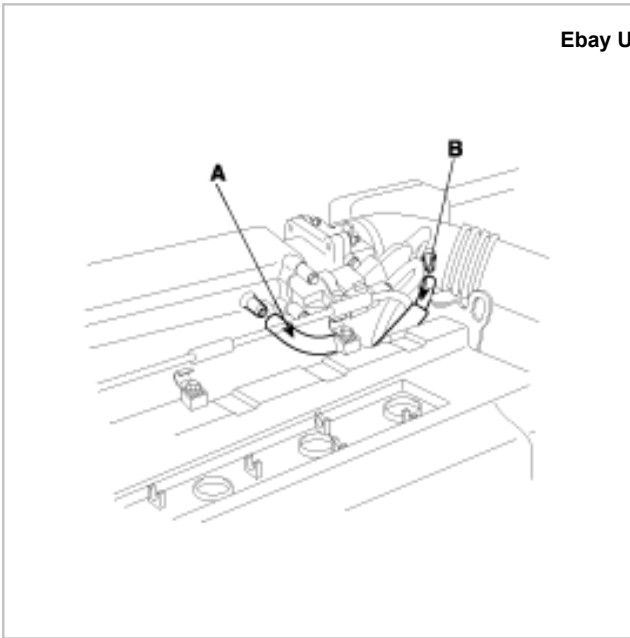
18. Remove the cylinder head cover.

(1) Remove the spark plug cable.

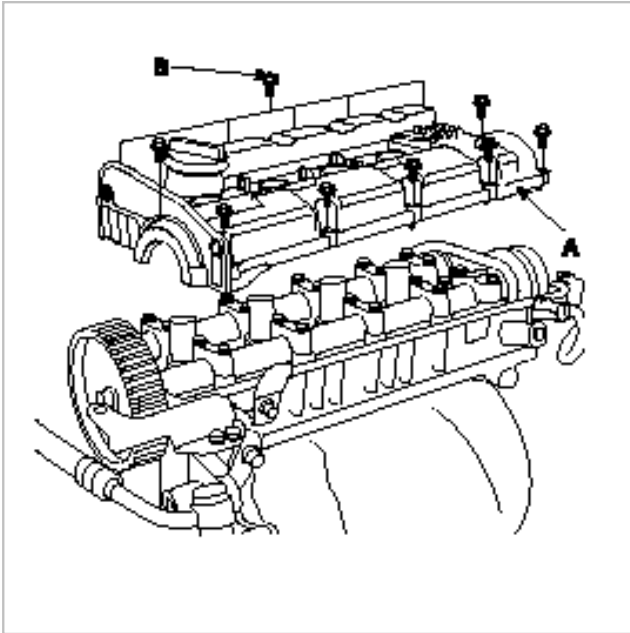
(2) Remove the accelerator cable (A) from the cylinder head cover.



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

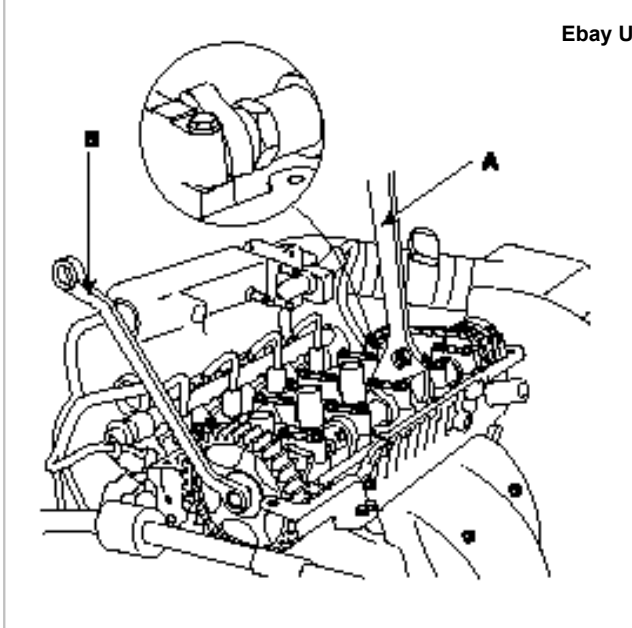


(4) Remove the 12bolts and cylinder head cover (A).



19. Remove camshaft sprocket.

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



CAUTION

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

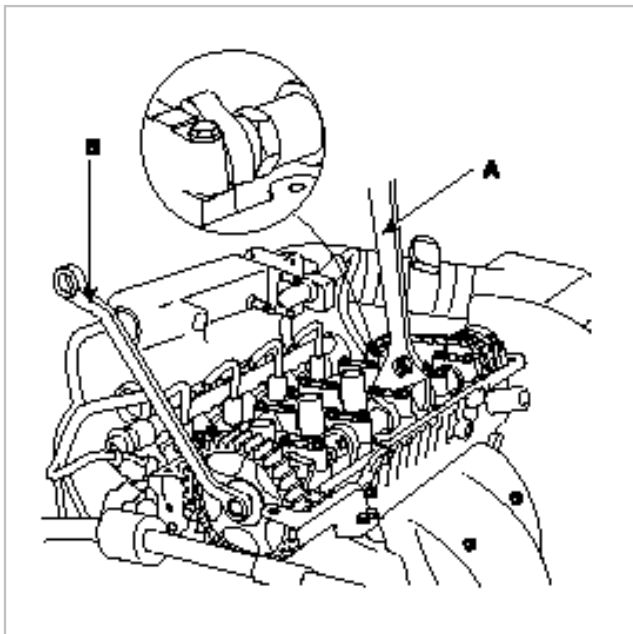
INSTALLATION

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

Tightening torque

Camshaft sprocket bolt

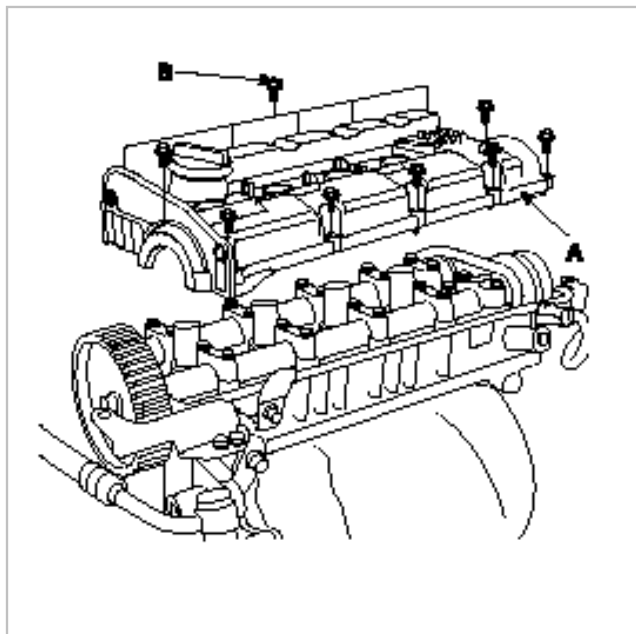
100 ~ 120Nm (1000 ~ 1200kgf.cm, 74 ~ 89lb.ft)



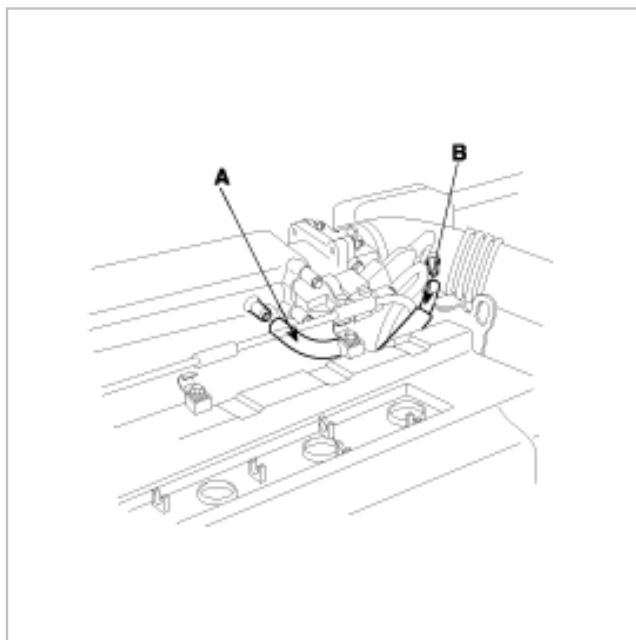
2. Install cylinder head cover

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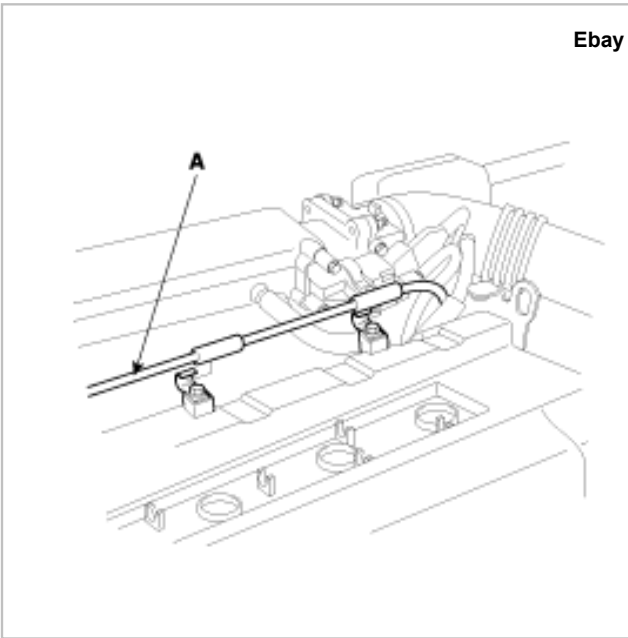
(1) Install cylinder head cover (A) and 12bolts.



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

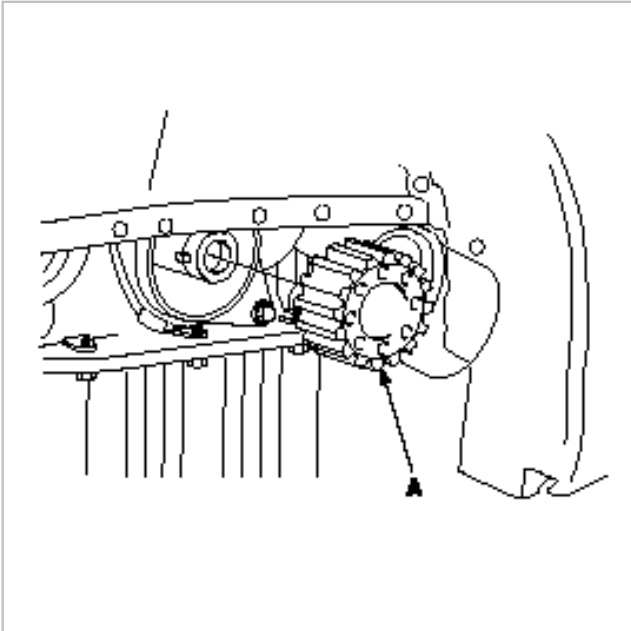


(3) Install the accelerator cable (A) from the cylinder head cover.

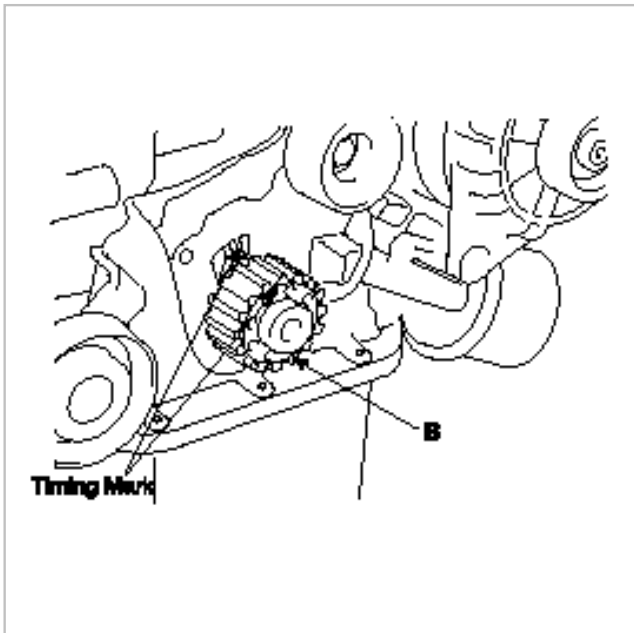
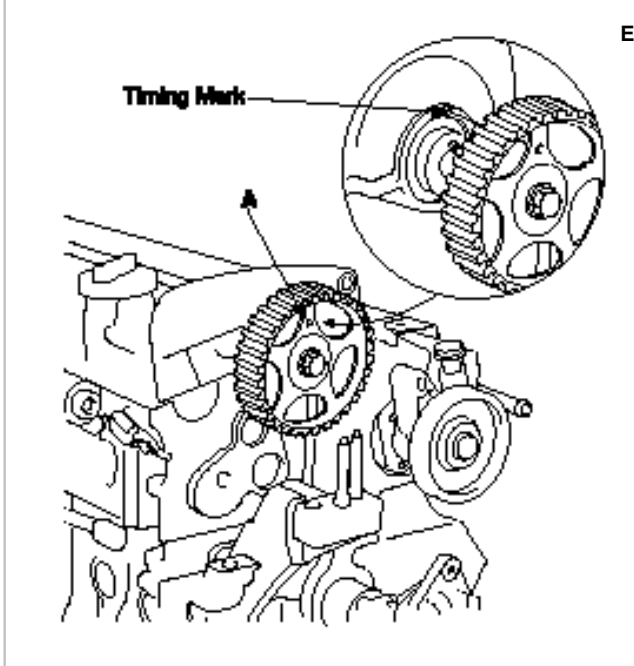


(4) Install the spark plug cable.

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.

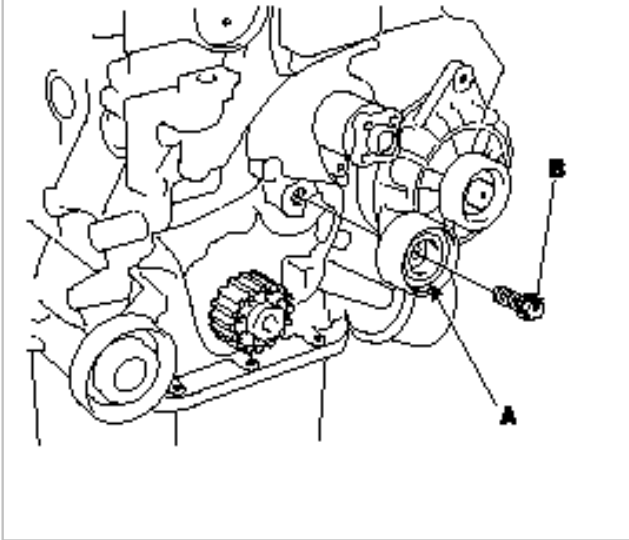


5. Install the idler pulley (A) and tighten the bolt to the specified torque.

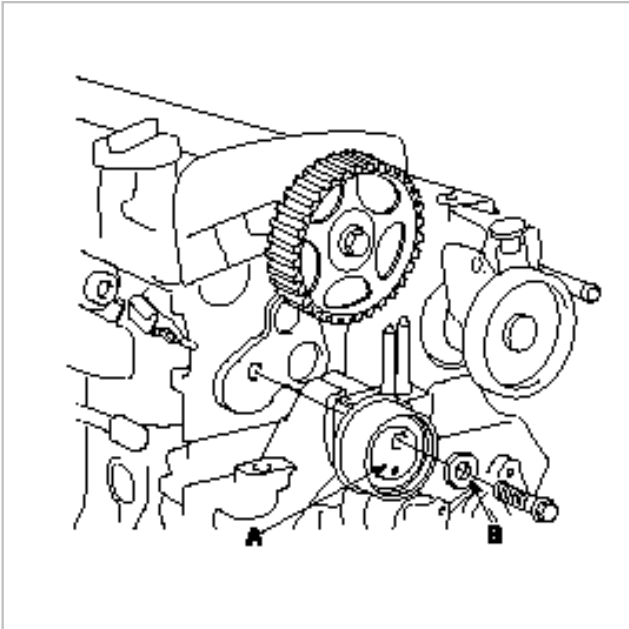
Tightening torque

Idler pulley bolt :

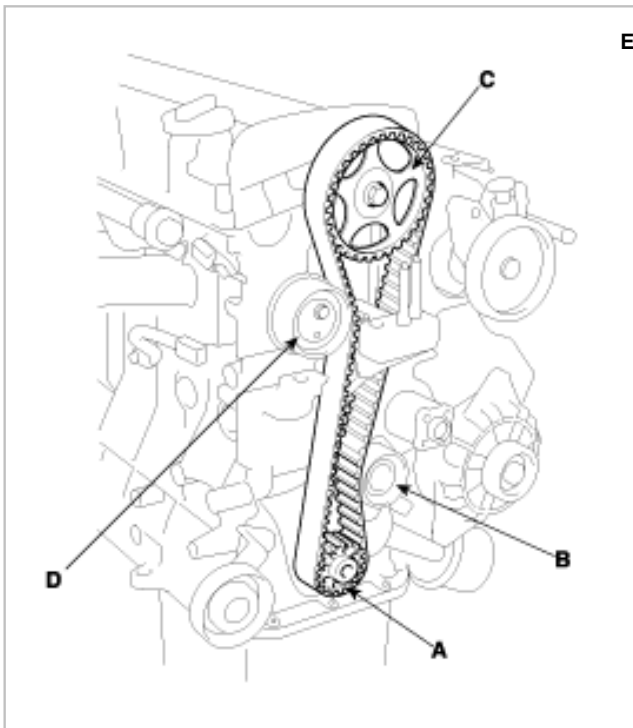
43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lb.ft)



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



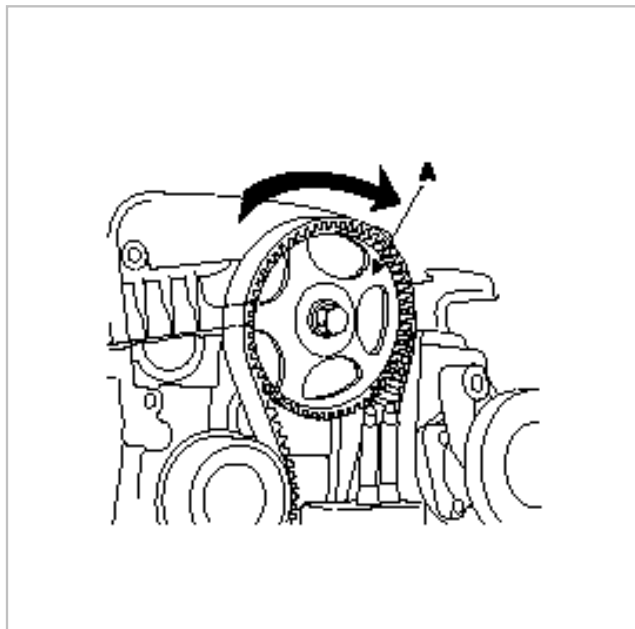
7. Belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt.
Crankshaft sprocket (A) → Idler pulley (B) → Camshaft sprocket (C) → timing belt tensioner (D).



8. Temporarily fasten tensioner pulley by center bolt to add force at belt.

9. Timing belt tension adjusting

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



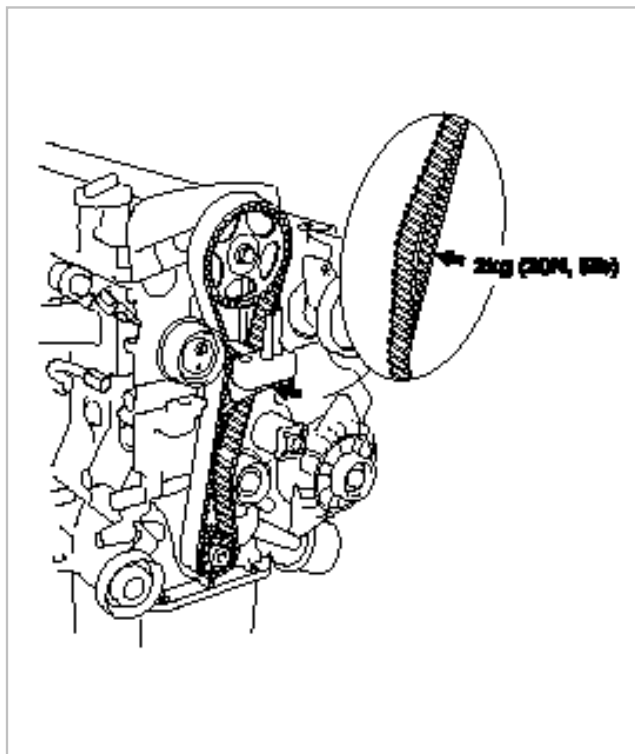
- (2) Give tension to timing belt by rotating tensioner in arrow direction with tool and set timing belt not to give slack to tension side

- (3) Tightening tensioner bolt.

Tightening torque

Tensioner bot : 43 ~ 55Nm (430 ~ 550kgf.cm, 32 ~ 40lb.ft)

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

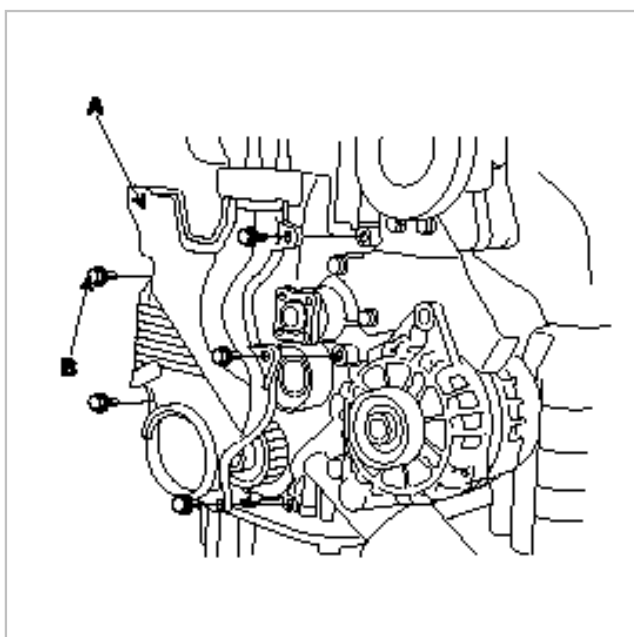


10. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
11. Install the timing belt lower cover with 5 bolts.

Tightening torque

Timing belt cover bolt :

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

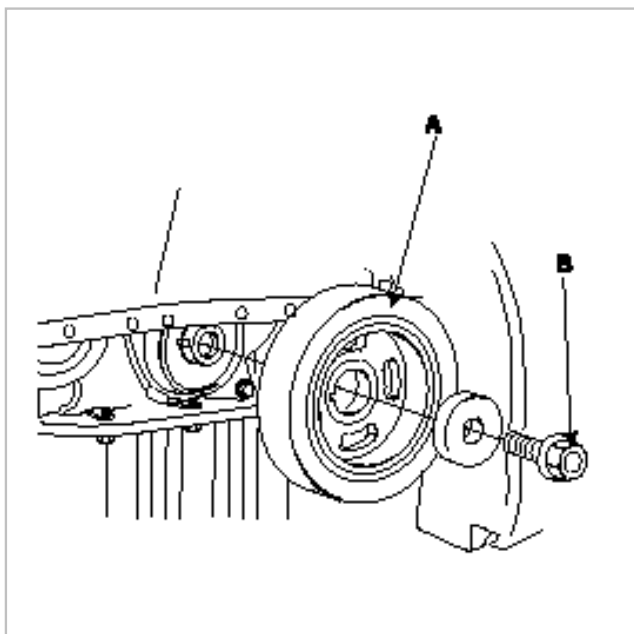


12. Install the flange and crankshaft pulley (A). Ebay User ID: reveleus1
Make sure that crankshaft sprocket pin fits the small hole in the pulley.
-

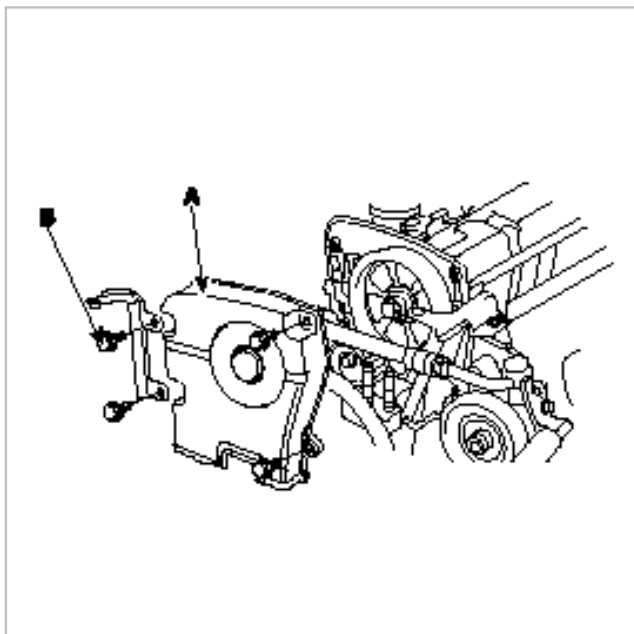
Tightening torque

Crankshaft pulley bolt :

170 ~ 180N.m (1700 ~ 1800kgf.cm, 125 ~ 133lb.ft)



13. Install the timing belt upper cover with 4bolts.



14. Install the coolant pump pulley with 4bolts.
15. Install power steering belt. (see ST group - power steering pump)
16. Install air compressor bolt. (see HA group - air compressor)
17. Install alternator belt. (see EE - alternator)

18. Install the engine mount bracket

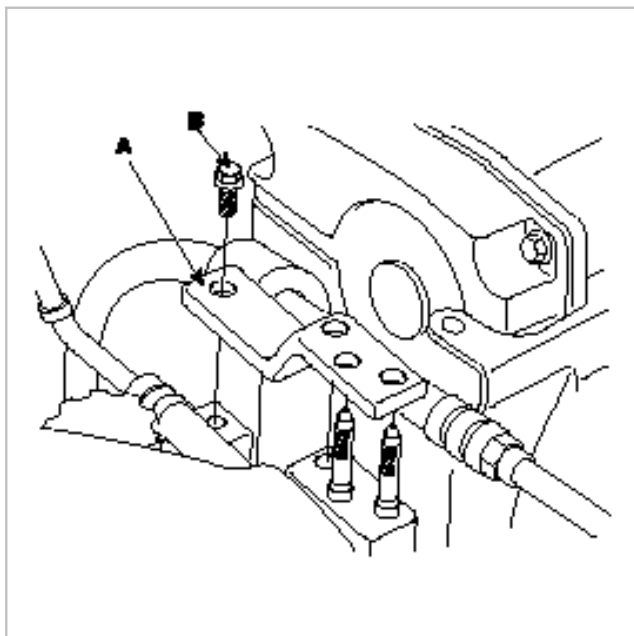
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- (1) Install the stay plate with bolt.

Tightening torque

Stay plate bolt :

43 ~ 55N.m (430 ~ 550kgf.cm 32 ~ 40lb.ft)

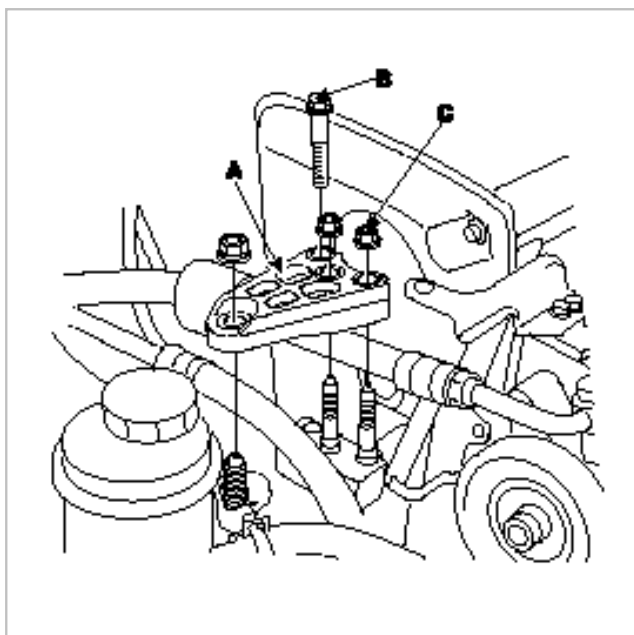


- (2) Install engine mount bracket with 3nuts and bolt.

Tightening torque

17mm nut : 60 ~ 80N.m (600 ~ 800kgf.cm 44 ~ 59lb.ft)

14mm nut : 50 ~ 65N.m (500 ~ 650kgf.cm 37 ~ 48lb.ft)



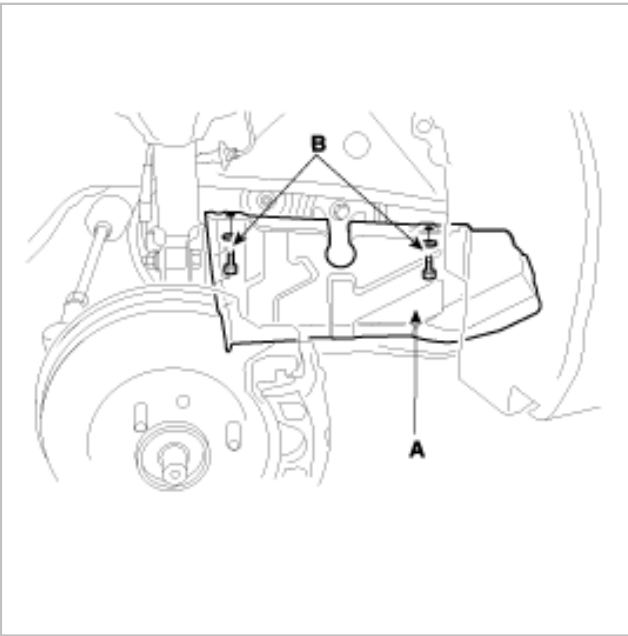
Purchased
from Ebay seller
Reveleus1

Thank-you for purchasing from me, it
is much appreciated.

To contact me please email
suzlever@gmail.com

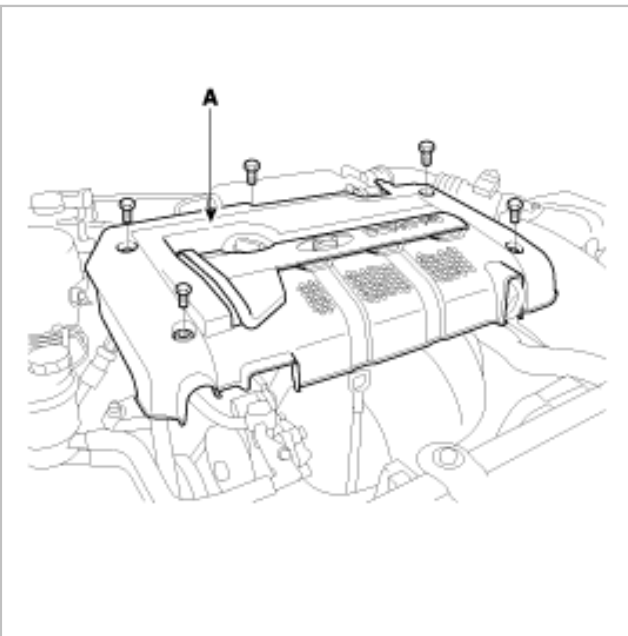
19. Install RH side cover (A) with 2bolts (B).

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20. Install RH front wheel.

21. Install engine cover (A) with 5bolts.



INSPECTION

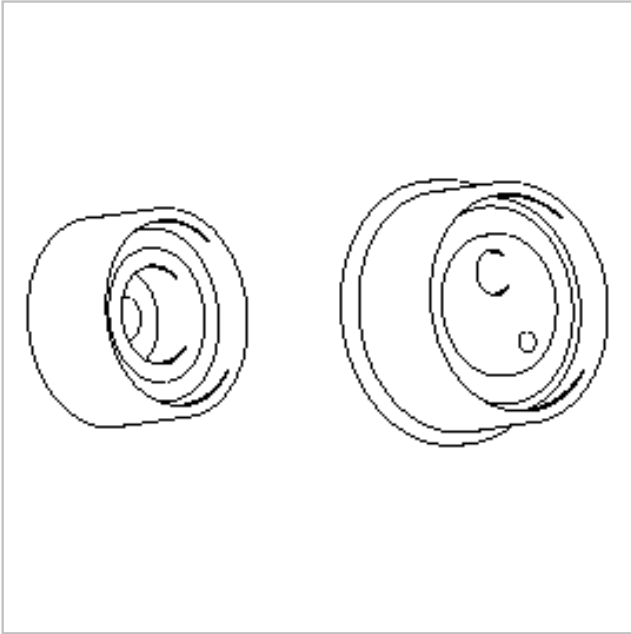
SPOCKETS, TENSIONER, IDLER

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.

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Replace as necessary.



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

TIMING BELT

1. Check the belt for oil or dust deposits.

Replace, if necessary.

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

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

NOTE

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



p

DTC

P0128

Coolant Thermostat Malfunction

DTC DETECTING CONDITION

DTC No	Detecting Condition & Limp Home	Suspected area
P0128	<p>Detecting Condition The engine coolant temperature does not reach warm state when model coolant temperature has reached a thermostat regulating temperature. Enable Condition</p> <ul style="list-style-type: none"> - No relevant failure - No high engine speed with vehicle stopped - Intake air temperature at start > -10°C(14°F) - 10°C(14°F) < engine coolant temperature at start < 74°C (165.2°F) - -10°C(14°) < engine coolant temperature at start < 74°C (165.2°F) <p>Limp Home None</p>	<ul style="list-style-type: none"> - Thermostat - ECM

SPECIFICATIONS

Thermostat	Normal Parameter
Valve opening temperature	82 ± 2°C (179.6 ± 35.6°F)
Valve closing temperature	77°C (170.6°F) or more
Full open lift	10mm or more (at 95°C)

INSPECTION PROCEDURES

1. CHECK DTC RELATING TO ECTS

1. Connect a Hi-Scan (Pro) to the data link connector.
2. Turn ignition to ON position and monitor other DTCs.

Are any DTC relating to ECTS set?

 No

 Yes

Do all repairs associated with those codes before proceeding with this procedure.

2. CHECK THERMOSTAT FOR NORMAL OPERATION

1. Remove the thermostat.
2. Check if the thermostat is stuck or damaged.
3. Check that the thermostat is operated normally.

• Refer to "Specifications" for more information.

Is thermostat normal?



No

Replace thermostat.

Proceed with ECM problem procedure.



TROUBLESHOOTING

Symptom	Suspect area	Remedy (See page)
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required
	Excessive worn or mis-aligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption	<ul style="list-style-type: none"> Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. Coolant consumption may or may not cause the engine to overheat. 	<ul style="list-style-type: none"> Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	<ul style="list-style-type: none"> Inspect the cylinder for a loss of compression. Repair or replace as required.
Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity	<ul style="list-style-type: none"> Drain the oil. Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	<ul style="list-style-type: none"> Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.

	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	<ul style="list-style-type: none"> • Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed	Low oli pressure.	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	<ul style="list-style-type: none"> • Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restrircted.	<ul style="list-style-type: none"> • Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	<ul style="list-style-type: none"> • Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-clearance	<ul style="list-style-type: none"> • Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing rod clearance	<p>Inspect the following components and repair as required.</p> <ul style="list-style-type: none"> • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.

	Ebay User ID: reveleus1 Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. <ul style="list-style-type: none"> •The crankshaft bearing. •The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation	<ul style="list-style-type: none"> •Verify the piston pins and connecting rods are installed correctly. •Repair as required.
Engine noise under load	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required : <ul style="list-style-type: none"> •The connecting rod bearings. •The connecting rods. •The crankshaft
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. <ul style="list-style-type: none"> •The crankshaft bearings. •The crankshaft journals. •The cylinder block crankshaft
Engine will not crank- crankshaft will not rotate	Hydraulically cylinder <ul style="list-style-type: none"> •Coolant/antifreeze in cylinder. •Oil in cylinder. •Fuel in cylinder 	<ol style="list-style-type: none"> 1.Remove spark plugs and check for fluid. 2.Inspect for broken head gasket. 3.Inspect for cracked engine block or cylinder head. 4.Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain and/or timing chain gears.	<ol style="list-style-type: none"> 1.Inspect timing chain and gears. 2.Repair as required.
	Material cylinder <ul style="list-style-type: none"> •Broken valve •Piston material •Foreign material 	<ol style="list-style-type: none"> 1. Inspect cylinder for damaged components and/or foreign materials. 2.Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	<ol style="list-style-type: none"> 1. Inspect crankshaft and connecting rod bearing. 2.Repair as required.

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Bent or broken connecting rod.

1. Inspect connecting rods.
2. Repair as required.

Broken crankshaft

1. Inspect crankshaft.
2. Repair as required.