



Engine Mechanical System

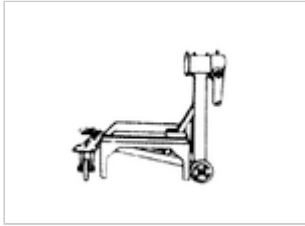
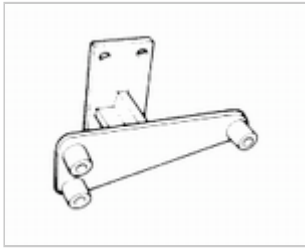
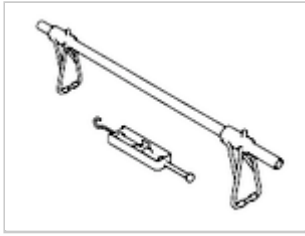
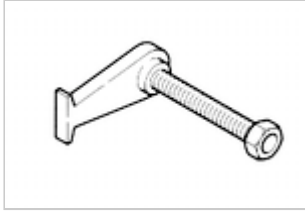
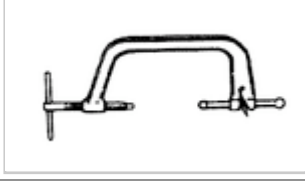
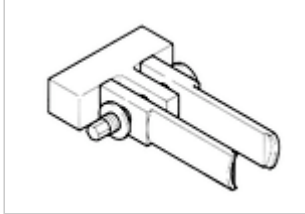
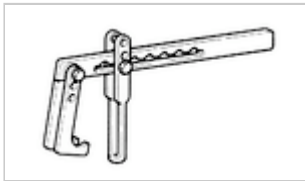


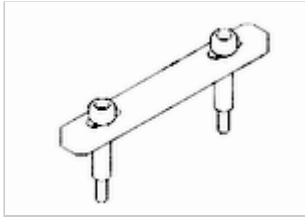
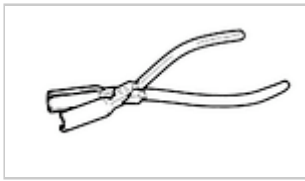
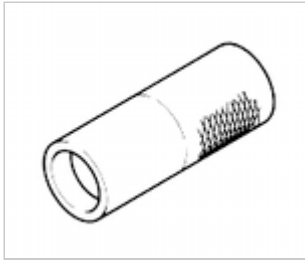
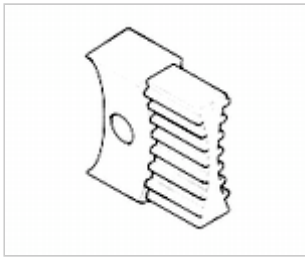
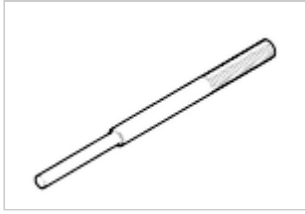
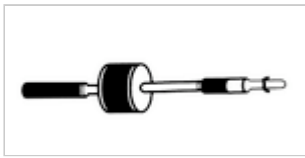
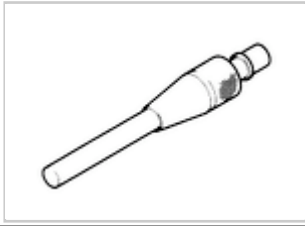
Engine Mechanical System

General Information

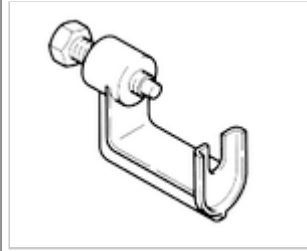


SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustrator	Used
OK130 990 007 Engine stand		Used to disassemble and assemble engine.
OK710 101 002 Hanger, engine stand		Used to disassemble and assemble engine.
OK201 170 AA0 Support, engine		Used to remove engine
OK590 111 001 Brake ring gear		Used to prevent engine rotation.
OK993 120 001 Arm, valve spring lifter		Used to remove and install valve.
OK993 120 004 Pivot, valve spring lifter		Used to remove and install valve.
OK2CA 120 AA0 Valve spring compressor set		Used to replace valve seal and valve spring

OK201 120 001 Valve spring compressor hook		Used to replace valve seal and valve spring
OK993 120 006 Remover, valve seal		Used to remove valve seal
OK2CA 120 005I(Intake)/OK2CA 120 005E(Exhaust) Installer, valve seal		Used to install valve seal
OK2CA 111 001 Holder, camshaft pulley		Used to Prevent camshaft pulley rotation.
OK201 120 011 Remover & installer, valve guide		Used to remove and install valve guide
OK710 110 010 Remover & installer, piston pin		Used to remove and install piston pin
OK410 111 012 Puller, bearing		Used to remove pilot bearing.
OK130 160 010 Centering tool, clutch disc		Used to install clutch disc

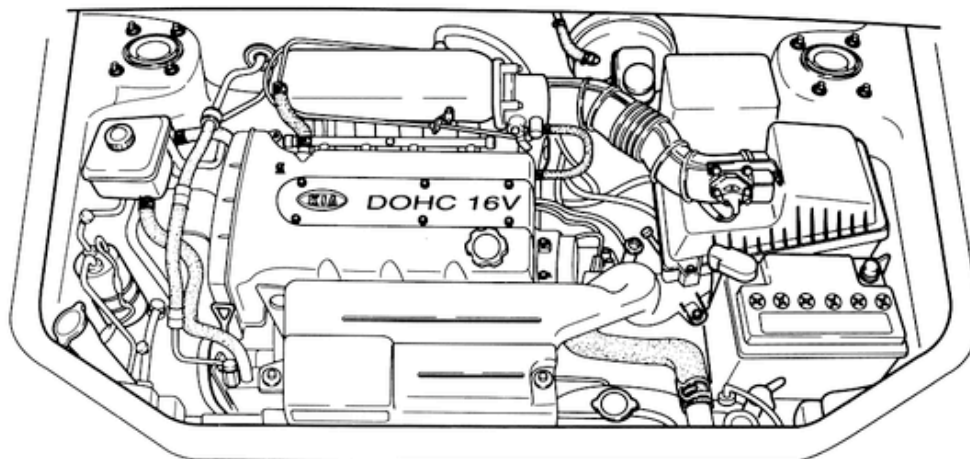
OK130 283 021
Puller, ball joint



Used to remove tie-rod end.



DESCRIPTION



The TBD engine is a 4cylinder overhead dual camshaft engine with a compression ratio of 9.5 : 1.



DIAGNOSTIC CHART

Engine

Problem	Possible cause	Action
Engine will not crank	Battery starting system or other electrical problems	Refer to starting system, charging system, wiring Diagram
	Liquid combustion chamber	Remove with suction gun, then crank engine over with spark plugs removed
	Seized engine	Repair
Engine cranks normally, but does not start	Fuel system malfunction	Refer to fuel system
	Ignition system malfunction	Refer to ignition system
	Improper valve clearance	Check HLA's
	Restricted exhaust system	Refer to exhaust system
	Timing belt and/or related parts	Inspect timing belt and related parts : replace if necessary
	Low compression due to : stuck or burned valves worn piston, piston ring or cylinder failed cylinder head gasket	Perform a compression test, as outlined in this section : repair engine as necessary
	Camshaft worn	Replace
Poor idle quality	Fuel system malfunction	Refer to fuel system
	Emission system malfunction	Refer to emission control system
	Ignition system malfunction	Refer to ignition system
	Improper valve clearance	Check HLA's
	Uneven cylinder compression	Perform a compression test, as outlined in this section : repair engine as necessary
	Poor valve-to-valve seat contact	Repair or replace
	Broken valve spring	Repair
	Failed cylinder head gasket	Replace
White exhaust smoke	Usually caused by water vapor, which is a normal by-product of combustion on cold days	None required
	Excessive white smoke with engine warmed up could be caused by a failed cylinder head or intake gasket. Could also be a cracked block, cylinder head or intake manifold	Repair or replace
Black exhaust smoke	Fuel system malfunction	Refer to fuel system
	Emission system malfunction	Refer to emission control system
Blue exhaust smoke	Usually caused by oil burning in the combustion chambers from worn valve seals failed cylinder head	Replace

	gasket	
Valve train noise	Worn valve guides	Repair
	Low oil pressure	Refer to lubrication system
	Improper valve clearance	Check HLA's
	Broken valve spring	Replace
	Sticking valves	Free valves
	Camshaft worn or faulty	Replace
Insufficient power	Insufficient compression caused by : 1. Improper valve clearance 2. Leakage from valve seat 3. Seized valve stem 4. Weak or broken valve spring 5. Failed cylinder head gasket 6. Cracked or distorted cylinder head 7. Sticking damaged or worn piston ring 8. Cracked or worn piston	1. Check HLA's 2. Repair or replace 3. Replace 4. Replace 5. Replace 6. Repair or replace 7. Replace 8. Replace
	Fuel system malfunction	Refer to fuel system
	Slipping clutch	Refer to clutch
	Dragging brakes	Refer to brake system
	Wrong tire size	Refer to wheel and tires
	Restricted exhaust system	Refer to exhaust system
Abnormal combustion	Improper valve clearance	Check HLA's
	Sticking or burned valve	Replace
	Weak or broken valve spring	Replace
	Carbon accumulation combustion chamber	Refer exhaust system
Engine knocks at idle when hot	Loose or worn accessory drive belt/tensioner	Check belts and tensioners Replace if necessary
	A/C compressor or generator bearing	Replace
	Improper oil viscosity	Install proper oil viscosity for expected temperatures
	Excessive piston pin clearance	Install new piston, pin and/or connecting rod
	Connecting rod clearance	Check and replace rods if necessary
	Insufficient piston-to-bore clearance	Relace piston if necessary
	Faulty timing belt tensioner or idler	Replace
	Loose Crank-shaft pulley	Tighten or replace if necessary
Slight at idle, becomes louder as engine speed is increased	Valve spring vlviking on valve cotter, off square or broken	Repair or replace
	Excessive stem to guide clearance	Repair
	Excessive valve spring seat runout	Repair

Engine knocks when cold	Excessive piston to wall clearance	Replace pistons
	Loose or broken damper pulley	Tighten or replace
Knock increases with torque	Excessive piston to bore clearance	Replace piston
	Bent connecting rod	Replace
Engine has heavy knock when hot and torque is applied	Broken damper pulley	Replace
	Accessory belts too tight or damaged	Adjust or replace belt
	Belt tensioned damaged	Replace
	Flywheel cracked or loose clutch plate	Replace flywheel or clutch plate
	Excessive main bearing clearance	Repair
	Excessive rod bearing clearance	Repair
Engine has light knock when hot and under light load conditions	Improper timing	Check timing
	Piston pin connecting rod	Replace piston pin and/or rod
	Poor quality fuel	Use recommended or higher grade fuel
	Exhaust leak at manifold	Tighten bolts and/or replace exhaust manifold gasket if necessary
Engine knocks during initial start up and lasts only a few seconds	Improper oil viscosity	Install proper oil viscosity for expected temperatures

Timing belt

Problem	Possible cause	Action
Tooth is broken or cracked	Camshaft jamming	Inspect camshaft by removing cylinder head cover Repair or replace if necessary
Back surface is cracked and/or worn	Tensioner jamming	Inspect cooling system Refer to engine cooling system
	Engine overheating	Remove timing belt cover and inspect Replace if necessary
	Interference with timing belt cover	Remove timing belt cover and inspect
Side surface is worn and/or frayed	Improper installation of timing belt	Remove timing belt and reinstall
	Malfunction of timing belt guide plate	Remove timing belt and inspect guide plate
Teeth are worn	Poor belt cover sealing	Remove timing belt cover and inspect Replace if necessary
	Coolant leak at water pump	Inspect water pump Replace if necessary
	Camshaft malfunction	Inspect camshaft by removing the cylinder head cover Repair or replace if necessary

	Excessive belt tension	Remove tensioner spring and inspect Replace if necessary
Oil or coolant is on the belt	Poor oil sealing	Inspect front oil seals Replace if necessary
	Coolant leak at water pump	Inspect water pump Replace if necessary
	Poor belt cover sealing	Remove timing belt cover and inspect Replace if necessary

HLA (Hydraulic lash adjuster)

Problem	Possible cause	Action
1. Noise when engine is started immediately after oil is changed 2. Noise when engine is started after setting approx. one day	Oil leakage in Oil passage	Run engine at 2,000~3,000rpm If noise stops after 2 seconds- 10 minutes*, HLA is normal If not, replace HLA
3. Noise when engine is started after cranking for 3 seconds or more 4. Noise when engine is started after new HLA installed.	Oil leakage in HLA	*Time required for engine oil to circulate with in engine includes tolerance for engine oil condition and ambient temperature.
5. Noise continues more than 10 minutes	Insufficient oil pressure	Check oil pressure. If lower than specification, check for cause. Oil pressure : 313.9~490.5kPa (3.2~5.0kg/cm ² , 45.5~71.1psi)-3,000rpm
	Faulty HLA	Press down HLA by hand. If it does not move, HLA is normal. If it moves, replace HLA. Measure valve clearance If more than 0mm (0in), replace HLA
6 Noise during idle after high-speed running	Incorrect oil amount	Check oil level. Drain or add oil as necessary
	Deteriorated Oil	Check oil quality If deteriorated, replace with specified type and amount oil

Cooling system

Problem	Possible Cause	Action
Overheating	Coolant level insufficient Coolant leakage Radiator fins clogged Radiator cap malfunction Fan motor malfunction Thermostat malfunction Water passage clogged Water pump malfunction	Add Repair Clean Replace Replace Replace Clean Repalce
Corrosion	Impurities in coolatn	Replace

Lubrication system

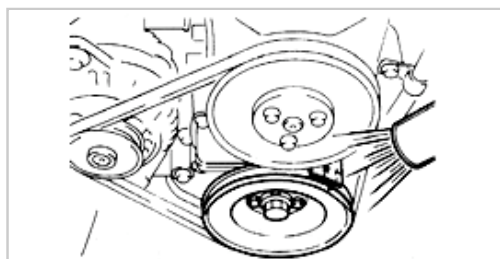
Problem	Possible cause	Action
Engine hard starting	Improper engine oil	Replace
	Insufficient engine oil	Add oil
Excessive oil consumption	Internal wear : Worn rings worn valve guides, worn valve seals or failed cylinder head gasket	Replace
	Oil leak	Repair
Oil pressure drop	Insufficient oil	Add oil
	Oil leakage	Repair
	Worn and/or damaged oil pump gear	Replace
	Worn plunger (inside oil pump) or weak spring	Replace
	Clogged oil strainer	Clean
	Excessive main bearing or connecting rod bearing clearance	Refer to Crankshaft inspection
Warning lamp illuminates while engine is running	Oil pressure drop	As described above
	Malfunction of oil pressure switch	Replace
	Malfunction of electrical system	Replace or repair warning lamp and/or related wire harness



ENGINE TUNE-UP

Ignition timing

1. Warm up the engine to normal operating temperature.
2. Turn all electric loads OFF.
3. Connect the timing light to to No. 1 high-tension cord.
4. Check that the timing mark (white) on the crankshaft pulley and the timing mark on the timing belt cover are aligned.



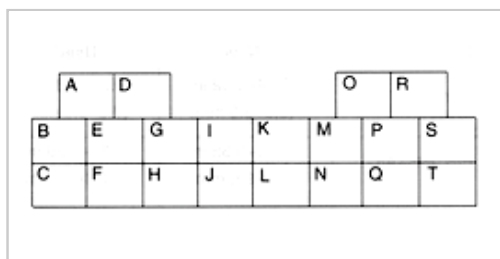
Ignition timing : $8^{\circ} \pm 5^{\circ}$ (BTDC)

NOTICE

It is not necessary to adjust the ignition timing.

Idle speed

1. Warm up the engine to normal operating temperature.
2. Turn all electrical loads OFF.
3. Connect a tachmeter to the diagnosis connector.
(O : RPM terminal)



4. Check that cooling fan dose not operate.
5. Check the idle speed.

Ignition timing : 800 ± 50 rpm

NOTICE

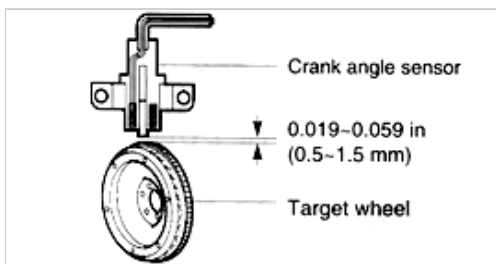
The idle speed is controlled automatically by Engine Control Unit(ECU) through the Idle Speed Control(ISC) valve, it is not necessary to adjust the idle speed.

6. If not as specified, check the following items.
 - (1) Check diagnostic trouble code.
 - (2) Check vacuum in intake manifold while engine is idling.

Vacuum : more than 480mmHg

Check air leakage at intake air system component, if not below specified.

- (3) Check the installation condition of crank angle sensor
 - A. Clearance : 0.019~0.059in (0.5~1.5mm)
 - B. Check the alignment between crank angle sensor and target wheel.



Compression

If the engine exhibits low power, poor fuel economy or poor idle check the following.

1. Ignition system.
2. Compression
 - 193psi (1,333kpa, 13.6kg/cm²) - 300rpm
3. Fuel system

Inspection

1. Check that the battery is fully charged. Recharge if necessary.
2. Warm up the engine to normal operating temperature.
3. Turn it off for about 10 minutes to allow the exhaust manifold to cool.
4. Remove all spark plugs.
5. Disconnect the high-tension cords.
6. Connect a compression gauge to No. 1 spark plug hole.
7. Fully depress the accelerator pedal and crank the engine.
8. Record the maximum gauge reading.

Engine modle		TBD
Item		
Compression	Standard	193psi (1,333kpa, 13.6kg/cm²) - 300rpm
	Max. difference between cylinder	26psi (196kpa, 2.0kg/cm²)

9. Check each cylinder.
10. If the compression in one or more cylinder is low, pour a small amount of engine oil into the cylinder and recheck the compression.
 - (1) If the compression increases, the piston, piston rings, or cylinder wall may be worn.
 - (2) If the compression stays low the valve may be stuck or seating improperly.
 - (3) If the compression in adjacent cylinder stays low the cylinder head gasket may be defective or the cylinder head distorted.
11. Connect the high-tension cords.
12. Install the spark plugs.

Tightening torque : 11~17lb·ft (15~23N·m, 1.5~2.3kg·m)

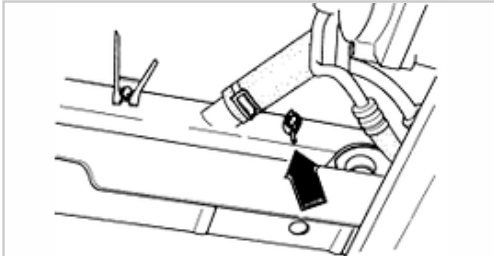
REMOVAL

Engine

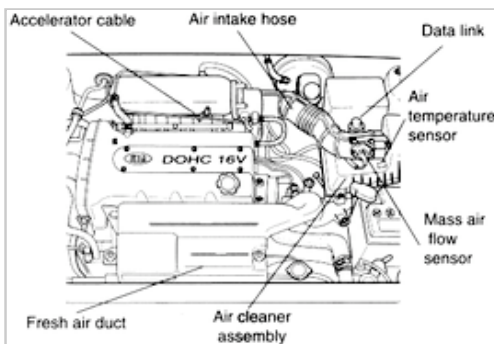
1. Relieve fuel system pressure.(Refer to Fuel system)
2. Disconnect negative battery cable(first) and positive battery cable(second).



3. Drain engine coolant.



4. Remove data link connector upward from mass airflow sensor bracket.



5. Disconnect intake air temperature sensor connector and mass air flow sensor connector.

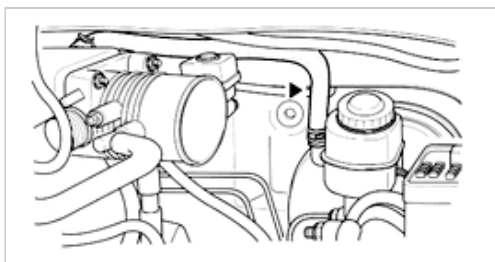
6. Disconnect air intake hose from throttle body.

7. Remove fresh air duct with two nuts.

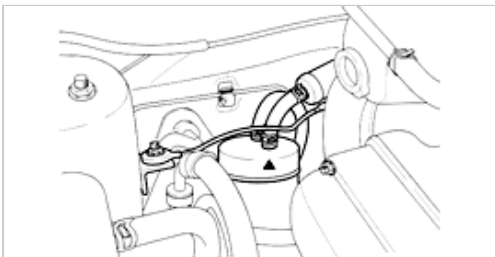
8. Remove accelerator cable and cruise control cable if equipped.

9. Remove air cleaner assembly with two bolts and one nut.

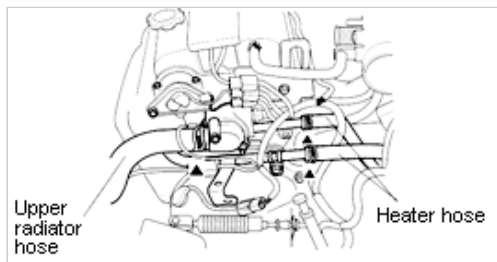
10. Disconnect brake vacuum hose from brake master vac.



11. Disconnect purge control vacuum (PCV) hose from charcoal canister.



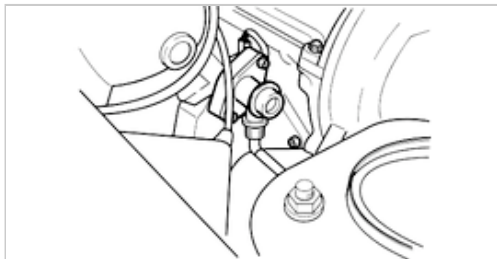
12. Remove upper radiator hose.



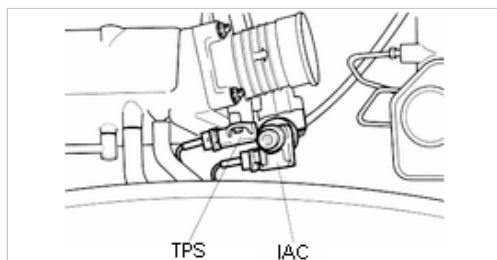
13. Remove heater hoses.
14. Disconnect fuel hose from injector rail.

WARNING

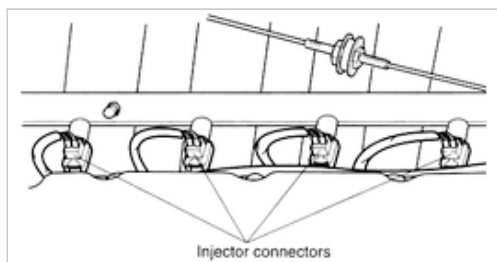
KEEP OPEN FLAMES AND SPARKS AWAY FROM OPEN FUEL LINES OR A FIRE OR EXPLOSION MAY RESULT.



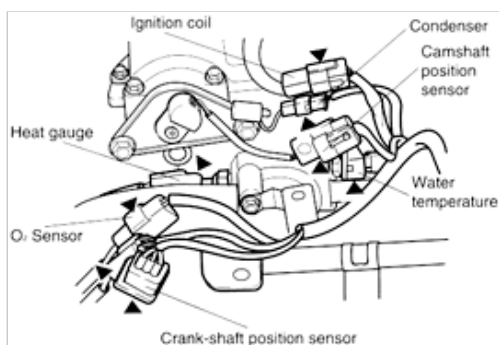
15. Disconnect IAC and throttle position sensor TPS connectors.



16. Disconnect injector connectors.



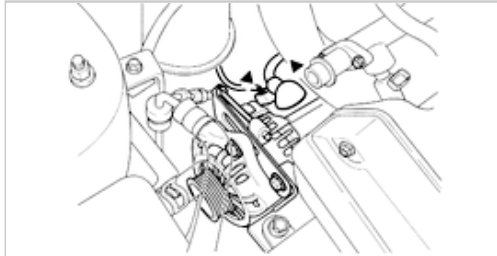
17. Disconnect electric connectors remove bracket and reinstall engine hanger.



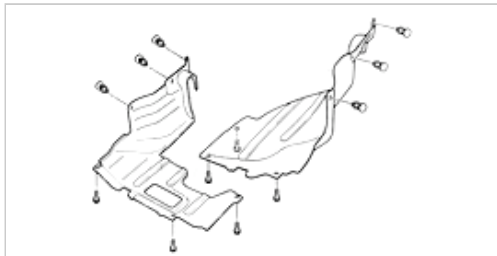
18. Disconnect engine ground strap.



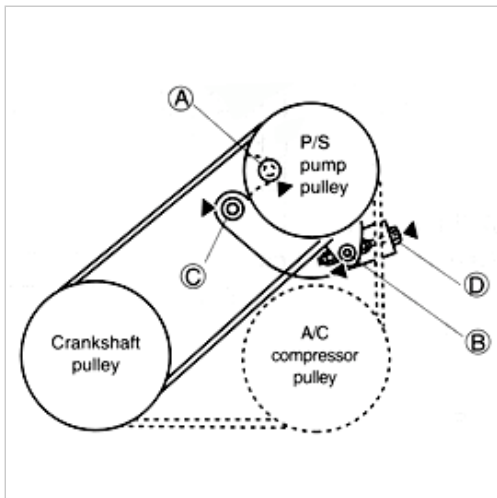
19. Disconnect generator B-terminal connector and C121 from generator.



20. Remove both right and left splash with three bolts and three fasteners each.



21. Loosen power steering pump lock bolt (A), nut (B), (C) and remove tension from power steering (P/S) pump and/or air conditioning (A/C) compressor drive belt by turn adjusting bolt(D).

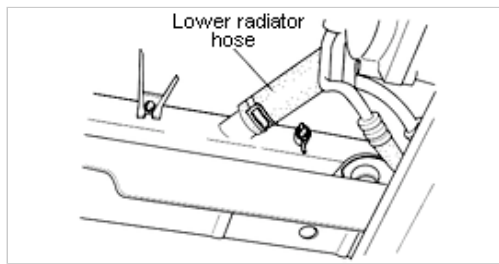


22. Remove P/S pump and/or A/C compressor drive belt.

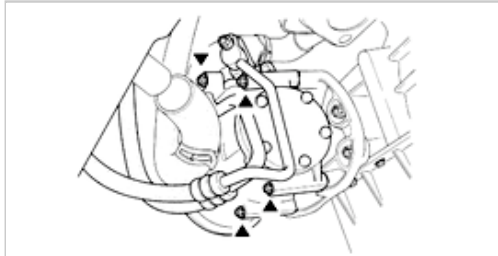
23. Remove P/S pump lock bolt (A), nut (C) and remove P/S pump.

24. Position P/S pump away from engine and affix it with wire.

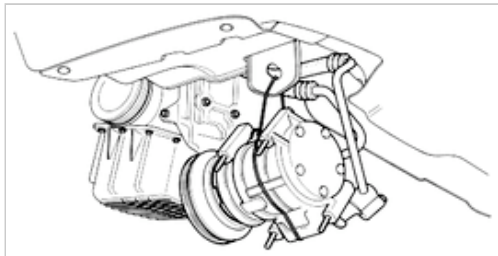
25. Disconnect lower radiator hose.



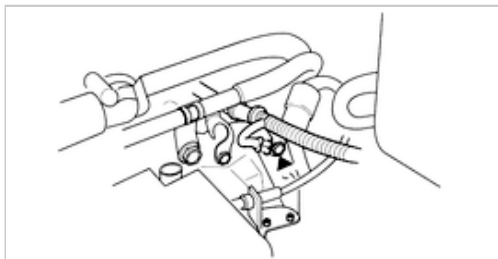
26. Remove four A/C compressor bolts and remove A/C compressor.



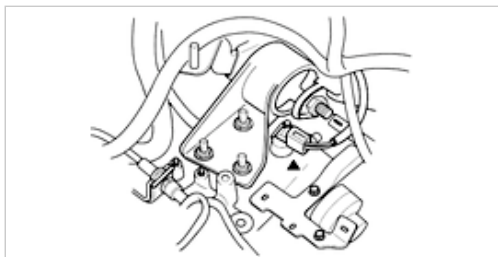
27. Position A/C compressor away from engine and affix it with wire.



28. Disconnect ground strap from top of transaxle.

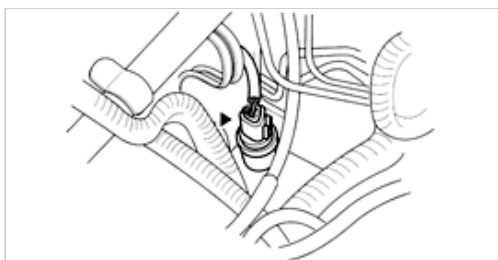


29. Disconnect input/turbine speed sensor connector(A/T).



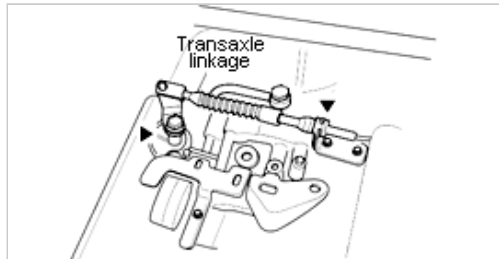
30. Disconnect back-up light switch connector (M/T).

31. Disconnect vehicle speed sensor connector.



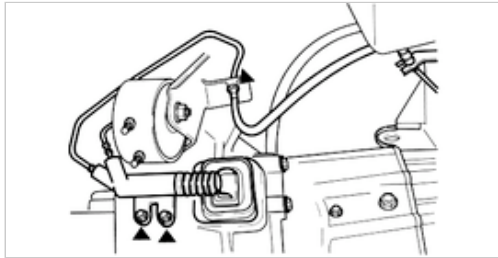
32. Remove U-clop from selector cable to transaxle linkage (A/T).

33. Remove nut and washer from transaxle linkage(A/T).

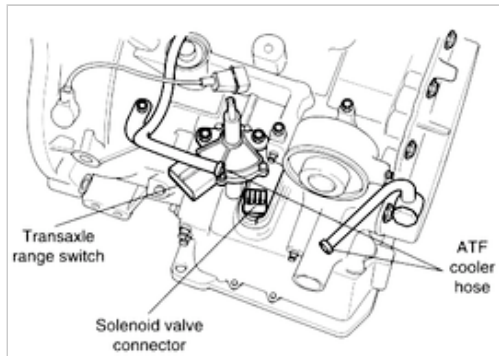


34. Remove manual transaxle linkage and extension bar (M/T).

35. Remove clutch release cylinder and pipe (M/T).



36. Disconnect transaxle ranges switch connector (A/T).



37. Disconnect solenoid valve connector (A/T).

38. Disconnect two ATF cooler hose (A/T).

39. Remove both front wheels (four lug nuts each).

40. Disconnect oxygen sensor connector.

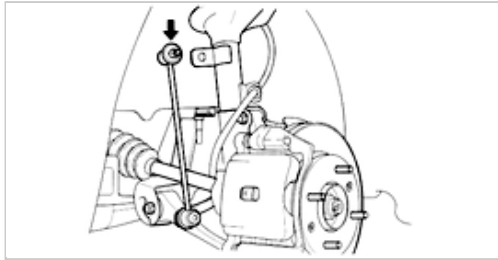
41. Remove front exhaust pipe.



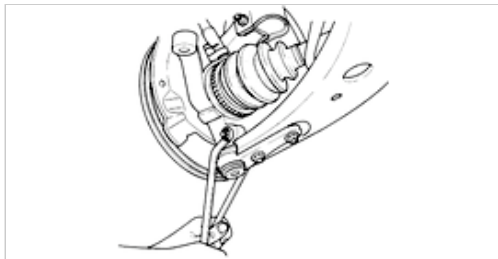
42. Remove both right and left tie rod ends from steering knuckles by removing one cotter pin and one nut each.



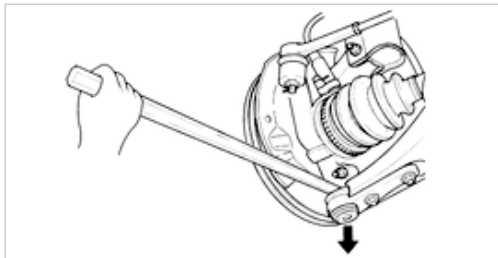
43. Remove both right and left stabilizer control link from bracket attached to shock absorber after remove the control link nut.



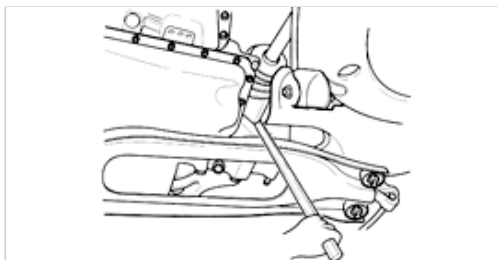
44. Remove pinch bolt and nut from both right and left ball joints.



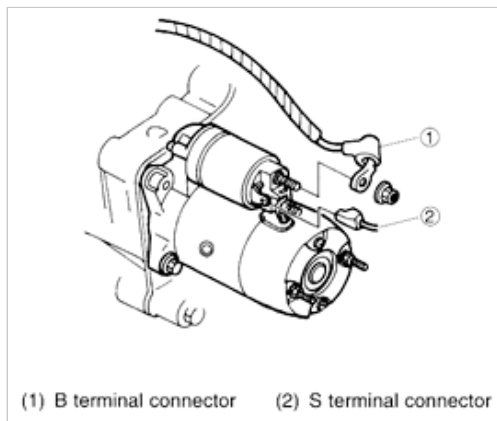
45. Remove both right and left ball joints from steering knuckles.



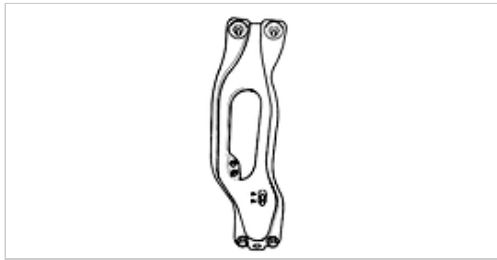
46. Gently pry both driveshafts from transaxle.



47. Disconnect B-terminal connector and S-terminal connector from starter.

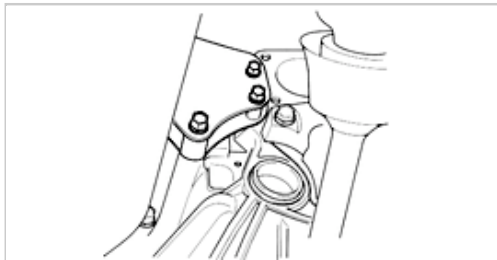


48. Remove two nuts from No.2 engine mount-to-mounting member.



49. Remove two and two nuts, then remove mounting member.

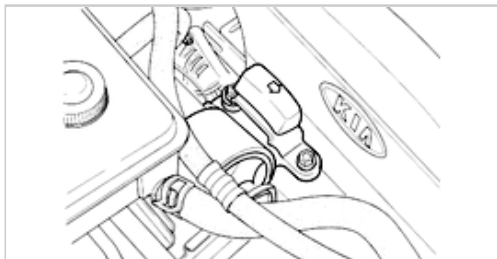
50. Remove three No.1 engine mount bolts.



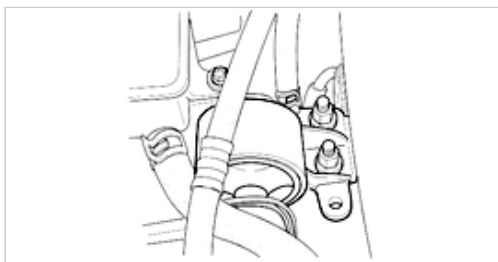
51. support engine with engine hoist and floor jack.



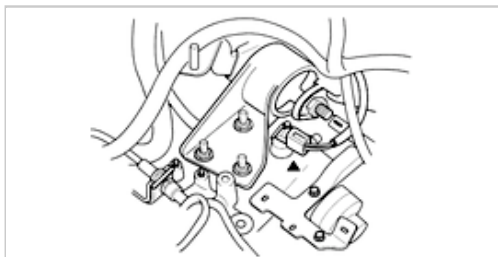
52. Remove one bolt and one nut, then remove dynamic damper.



53. Remove two nuts from No. 3 engine mount.



54. Remove three nuts from No. 4 engine mount.

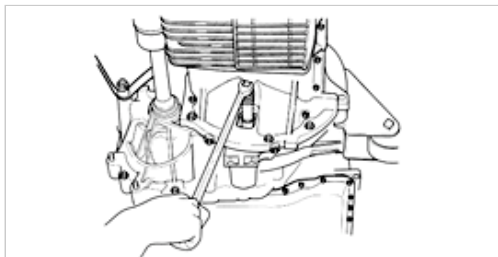


55. Slowly lower engine/transaxle assembly under the engine room with engine hoist and floor jack.

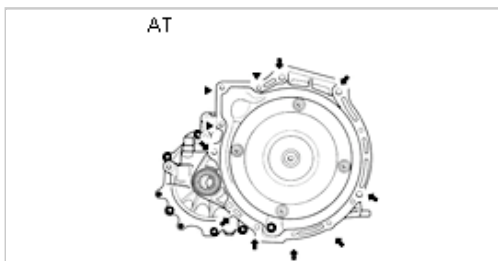
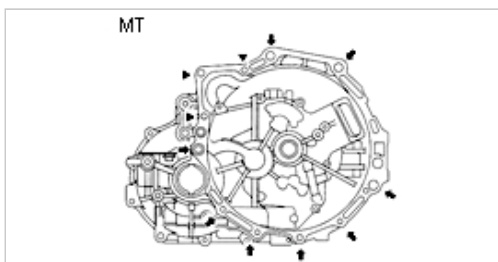
CAUTION

Be careful not to hurt the any other parts in the engine room.

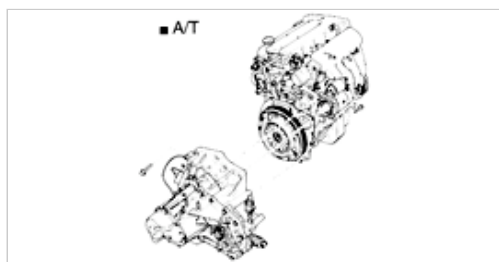
56. Remove converter housing access cover and remove four drive plate-to-torque converter mounting nuts. Rotate at crank pulley to gain access to all four nuts. (A/T)



57. Remove starter bolts and transaxle mounting bolts.



58. Separate transaxle from engine.



INSTALLATION

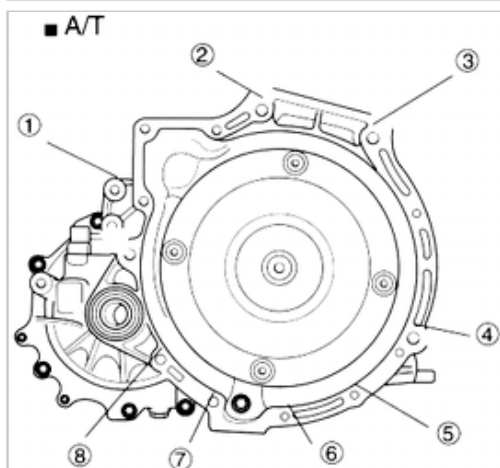
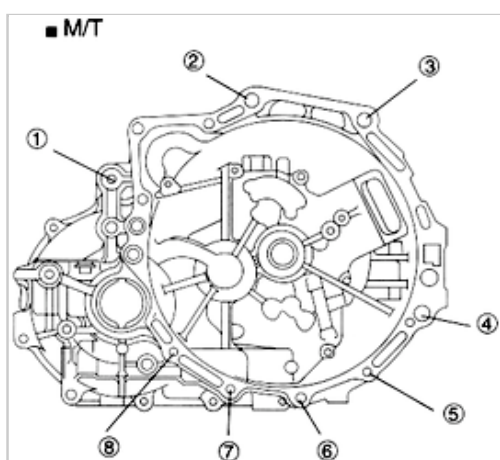
Engine

1. Install transaxle to engine.

Tightening torque :

4 Upper bolts (1, 2, 3, 4) : 65.8~86.1lb·ft (89~116N·m, 9.1~11.9kg-m)

4 Lower bolts (5, 6, 7, 8) : 27.5~38.3lb·ft (37~52N·m, 3.8~5.3kg-m)

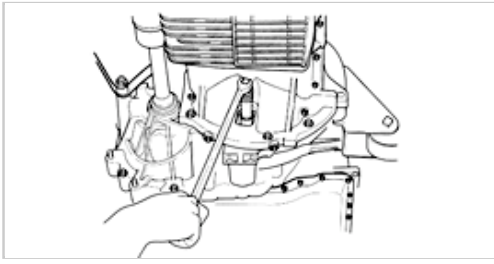


2. Install starter.

Tightening torque : 27~38lb·ft (37~52N·m, 3.7~5.8kg-m)

3. Install four drive plate-to-torque converter mounting nuts then install access cover. Rotate engine at crank pulley to gain access to all four nuts (A/T).

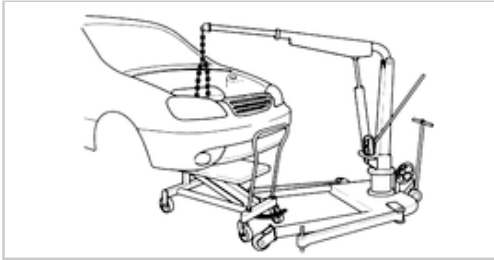
Tightening torque : 25~36lb·ft (34~49N·m, 3.5~5.0kg-m)



4. Slowly raise engine/transaxle assembly into the engine room with floor jack and engine hoist.

CAUTION

Be careful not to hurt the any other parts in the engine room.

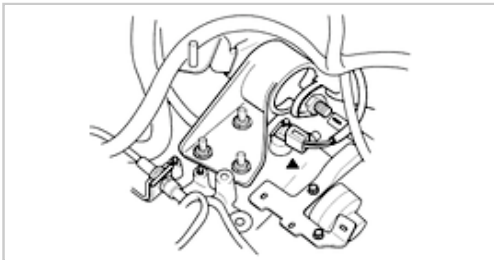


5. Install three nuts to nut No. 4 engine mount.

Tightening torque :

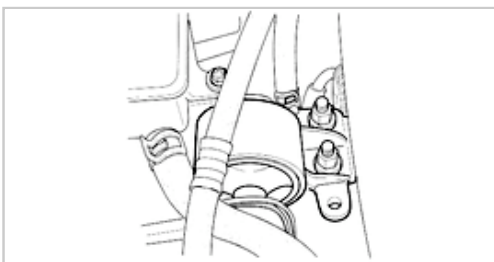
Nut : 49.2~68.7lb·ft (66.7~93.2N·m, 6.8~9.5kg-m)

Bolt : 47.0~65.8lb·ft (63.8~89.3N·m, 6.5~9.1kg-m)



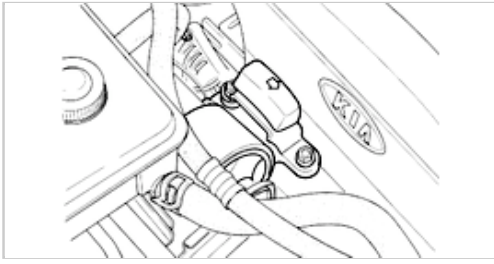
6. Install two nut to No.3 engine mount.

Tighten torque : 54.2~75.9lb·ft (73.6~103N·m, 7.5~10.5kg-m)



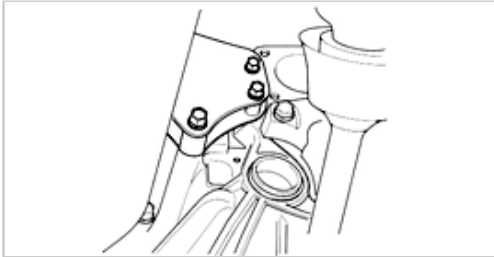
7. Install dynamic damper.

Tightening torque : 40.5~59.3lb·ft (54.9~80.4N·m, 5.6~8.2kg-m)



8. Remove engine hoist and floor jack.
9. Install three No. 1 engine mount bolts.

Tightening torque : 49.2~68.7lb·ft (66.7~93.2N·m, 6.8~9.5kg-m)

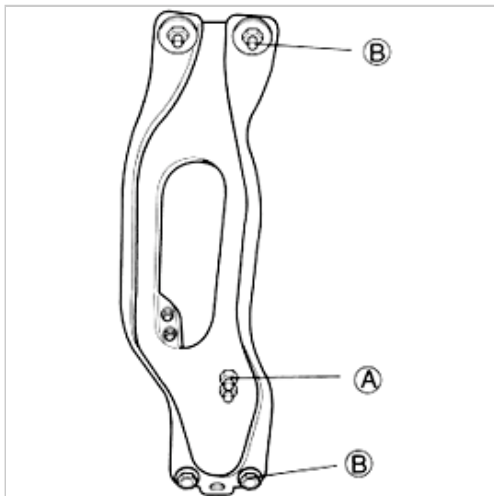


10. Install mounting member.

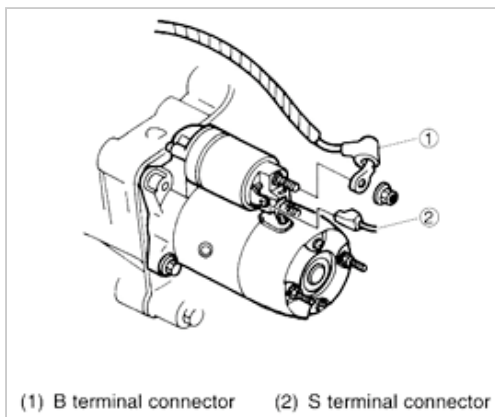
Tightening torque :

Mounting member bolts and nuts : (A) : 47.0~65.8lb·ft (63.8~89.3N·m, 6.5~9.1kg-m)

No. 2 engine mount-to-mounting member nuts : (B) : 27.5~38.3lb·ft (37.3~51.9N·m, 3.8~5.3)

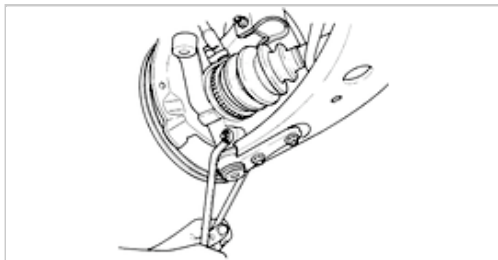


11. Connect B-terminal connector and S-terminal connector to starter.



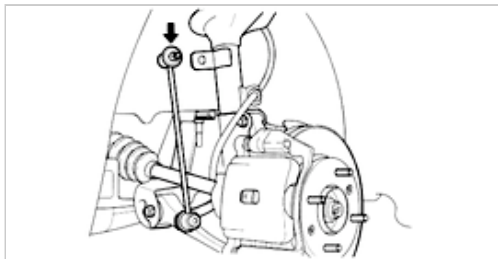
12. Install new clips on driveshaft.
13. Push driveshafts into transaxle with opening of clips pointing upward.
14. Install both right and left ball joint into steering knuckles then install pinch and nut.

Tightening torque : 32~39lb·ft (43~52N·m, 4.4~5.3kg-m)



15. Install both right and left stabilizer control link to bracket attached to shock absorber.

Tightening torque : 31.8~44.8lb·ft (43.2~60.8N·m, 4.4~6.2kg-m)



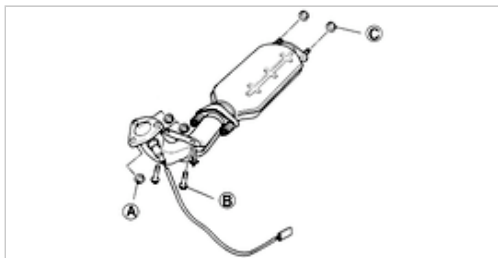
16. Install both right and left tie rod ends to steering knuckles then insert cotter pins.

Tightening torque : 27.7~32.5lb·ft (29.4~44.1N·m, 3.0~4.5kg-m)



17. Install front exhaust pipe.

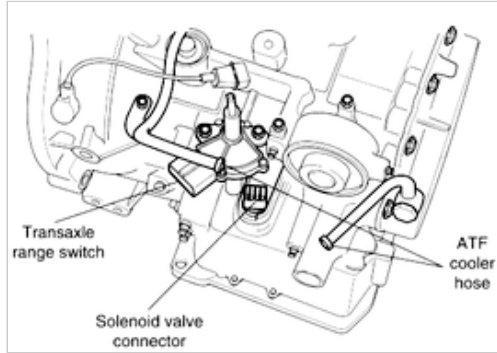
Tightening torque :
(A), (B) : 27.5~38.3lb·ft (37.3~51.9N·m, 3.8~5.3kg-m)
(C) : 31.3~44.8lb·ft (42.2~61.8N·m, 4.3~6.2kg-m)



18. Connect oxygen sensor connector.
19. Install both front wheels (four lug nuts each).

Tightening torque : 65.1~86.8lb·ft (88.3~117.7N·m, 9~12kg-m)

20. Connect two ATF cooler hose (A/T).

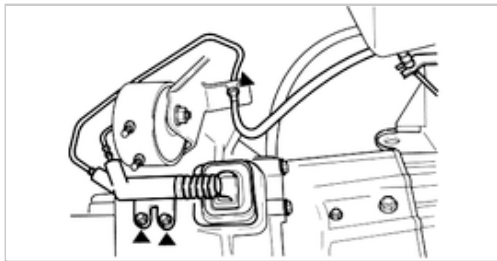


21. Connect solenoid valve connector (A/T).

22. Connect transaxle range switch connector (A/T).

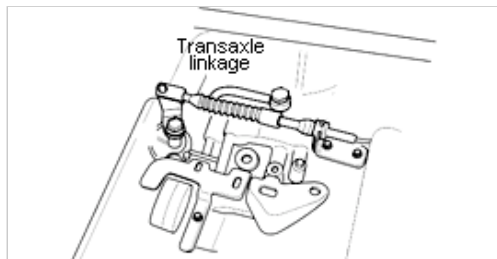
23. Install clutch release cylinder with two bolts and attach pipe to U-clip.

Tightening torque : 13.7~18.8lb·ft (18.6~25.5N·m, 1.9~2.6kg-m)



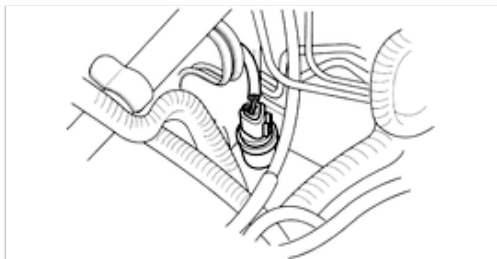
24. Install manual transaxle linkage and extension bar (M/T).

25. Install transaxle linkage with washer.



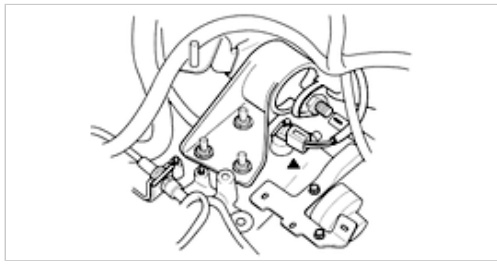
26. Attach selector cable to U-clip (A/T).

27. Connect vehicle speed sensor connector.

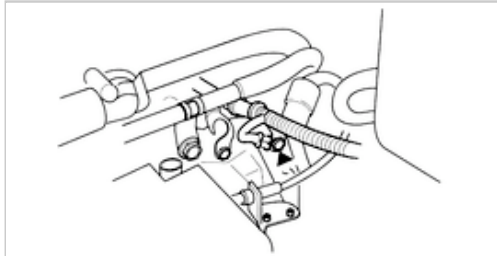


28. Connect back-up light switch connector (M/T).

29. Connect input/turbine speed sensor connector (A/T).

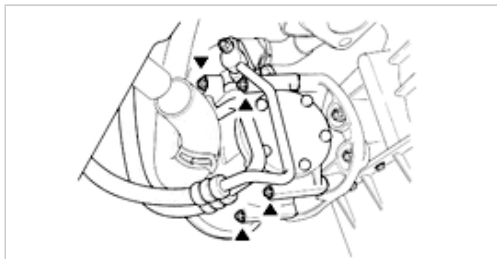


30. Connect ground strap to top of transaxle.

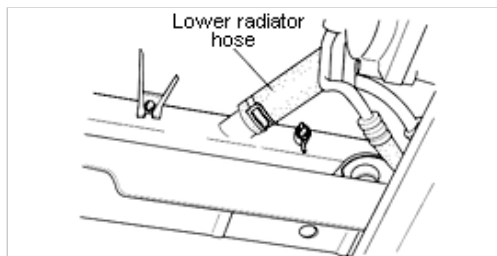


31. Install A/C compressor with four bolts.

Tightening torque : 28.2~38.3lb·ft (38.3~51.9N·m, 3.9~5.3kg-m)



32. Connect lower radiator hose.



33. Install P/S pump.

34. Install P/S pump and/or A/C compressor drive belt.

35. Adjust the belt deflection by turning the adjusting bolt (D).

Belt deflection :

New : 0.32~0.35in (8.0~9.0mm)

Used : 0.35~0.39in (9.0~10.0mm)

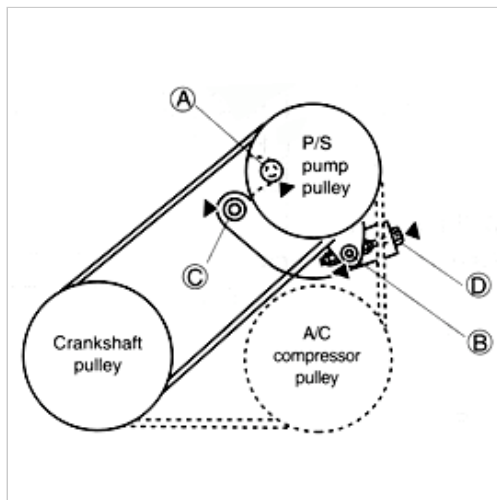
36. Tighten the bolt (A), nut (B), nut (C).

Tightening torque :

(A) : 27~40lb·ft (36~54N·m, 3.7~5.5kg-m)

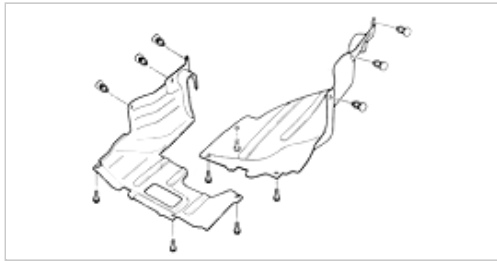
(B) : 14~19lb·ft (19~25N·m, 1.9~2.6kg-m)

(C) : 23~34lb·ft (31~46N·m, 3.2~4.7kg-m)

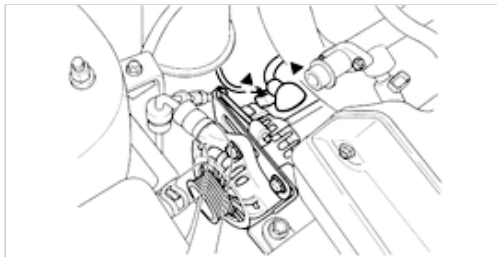


37. Install both right and left splash shield with three bolts and three fasteners each.

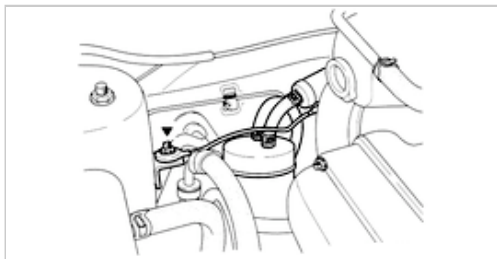
Tightening torque : 10.1~11.6lb·ft (13.7~15.7N·m, 1.4~1.6kg-m)



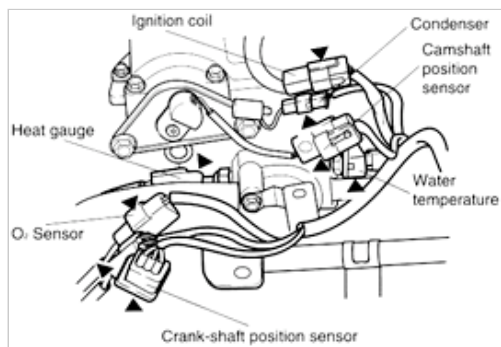
38. Connect generator B-terminal connector and connector C121 from generator.



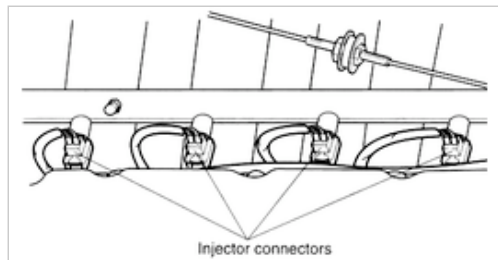
39. Connect engine ground strap.



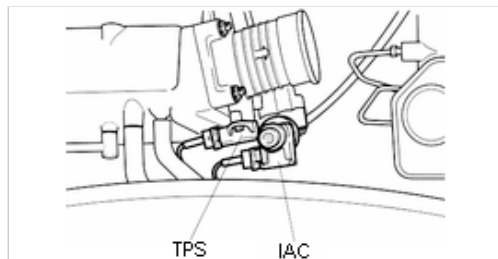
40. Install connector bracket and connect electric connectors.



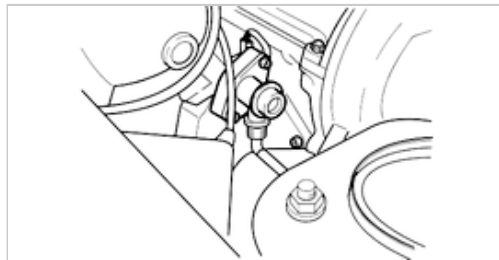
41. Connect injector connectors.



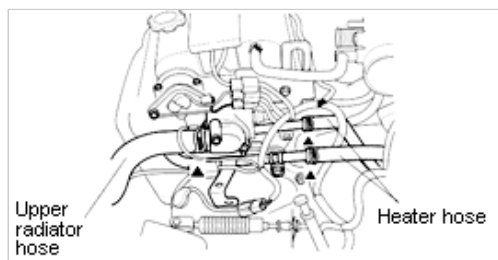
42. Connect IAC and throttle position sensor (TPS) connectors.



43. Connect fuel hose to injector rail.

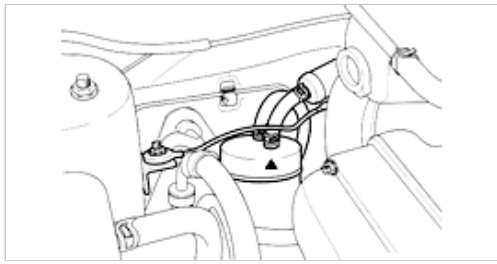


44. Connect heater hoses.

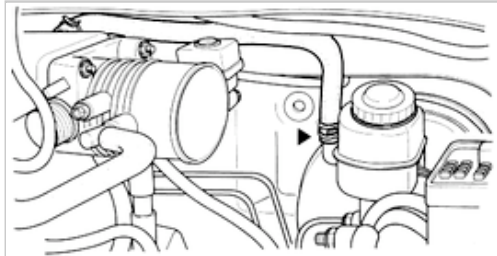


45. Connect upper radiator hose.

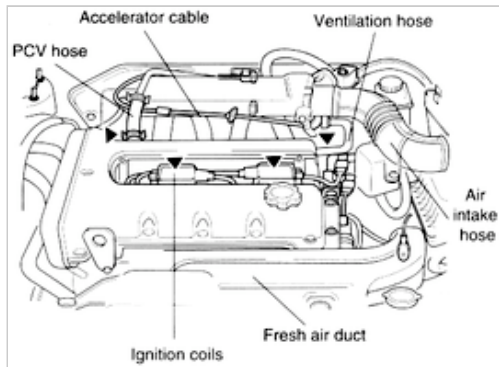
46. Connect purge vacuum (PCV) hose to charcoal canister.



47. Connect brake vacuum hose to brake master vac.



48. Install air cleaner assembly with two bolts and one nut.

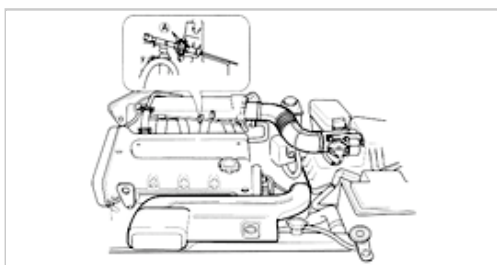


49. Connect air intake hose to throttle body.

50. Install accelerator cable and cruise control cable if equipped.

51. Check accelerator cable deflection. If deflection is not correct, adjust by turning nut (A).

Deflection : 0.04~0.12in (1~3mm)



52. Install fresh air duct with two nuts.

53. Connect intake air temperature sensor connector and mass air flow sensor connector.

54. Insert data link connector into mass air flow sensor bracket.

55. Fill engine coolant with specified type and amount.

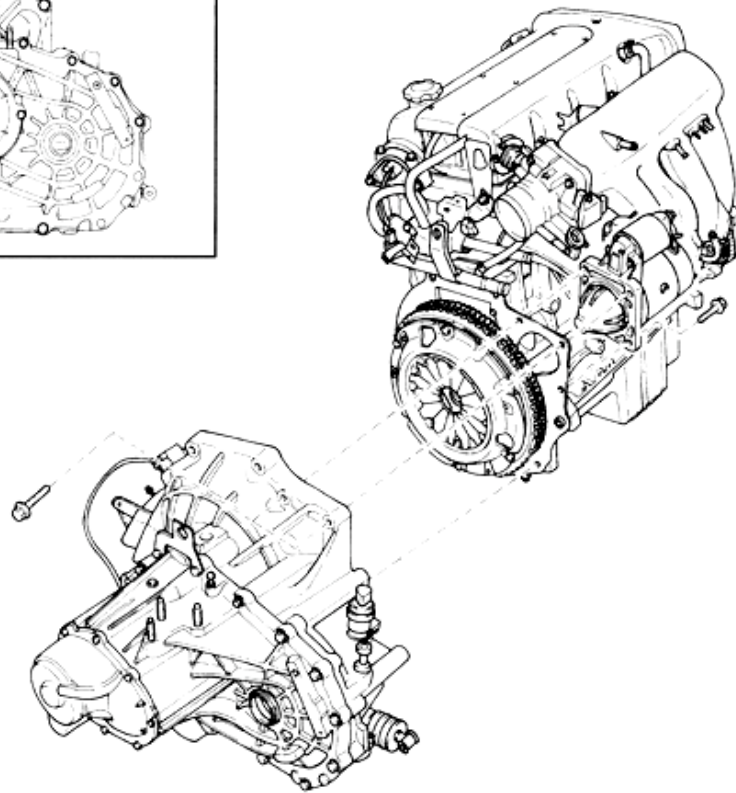
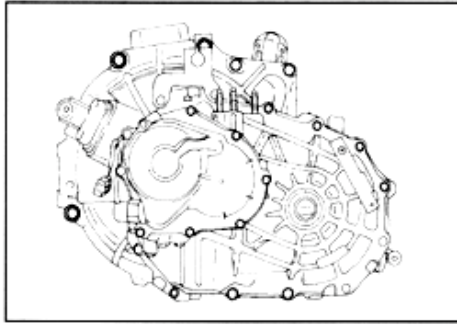
56. Connect both battery cables.

57. Check and/or fill all fluids.

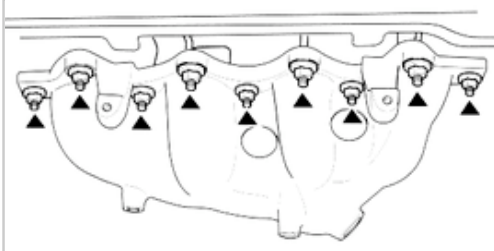
58. Test run engine and perform an overall check.

DISASSEMBLY

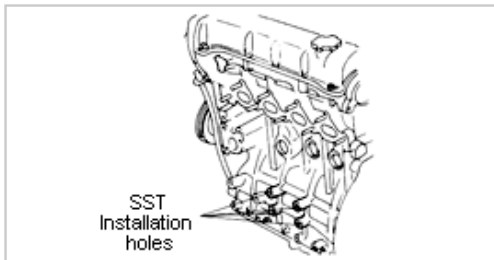
Engine



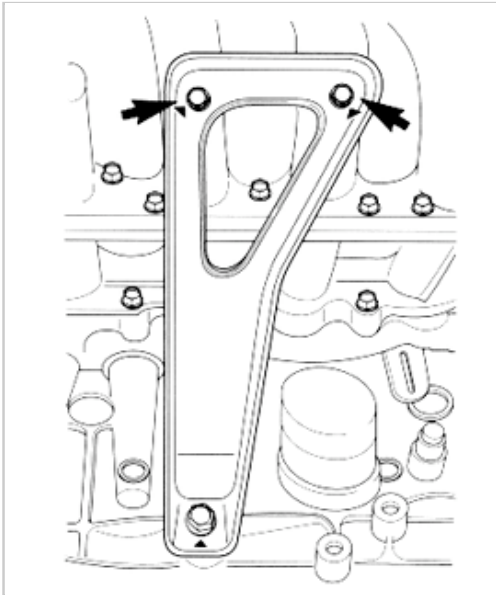
1. Remove exhaust manifold and coolant bypass pipe.



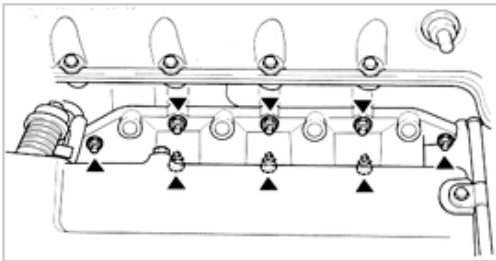
2. Install engine to SST.



3. Drain engine oil.
4. Remove front and rear engine hangers.
5. Remove generator by loosening adjusting bolt and removing bolts and pivot bolt.
6. Remove intake manifold support bracket.

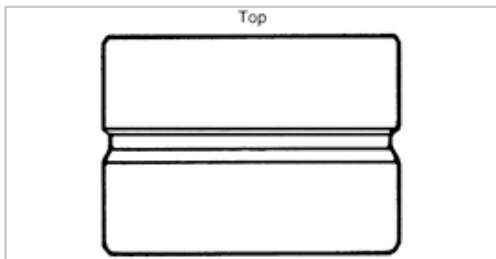


7. Remove intake manifold.

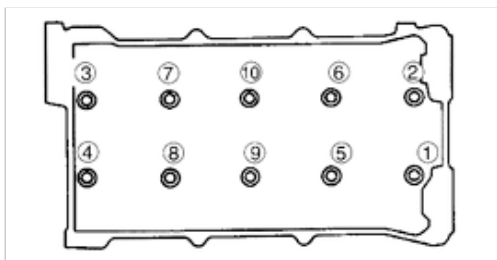


8. Remove HLA's.

9. Store HLA's upside down in an oil filled container.



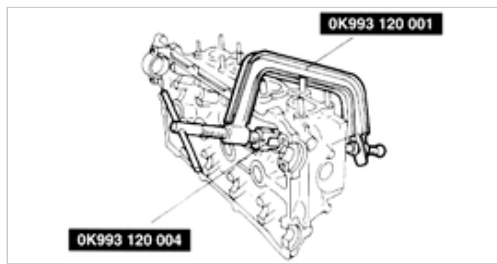
10. Loosen cylinder head bolts in two or three steps following order in figure.



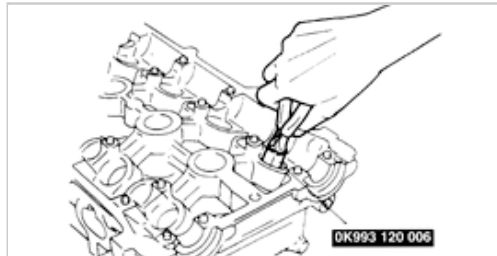
11. Remove cylinder head by lifting it off from cylinder block.

12. Protect HLA bore with SST (K95A-1000-E) or equivalent. Compress valve springs with SST or equivalent and allow enough room to remove valve locks.

13. Slowly release pressure and remove valve spring from cylinder head.



14. Remove valve seals with SST or equivalent.



15. Repeat same procedure on all 16 valves.

16. Keep valves in correct order if they are to be reused.

17. Mark cylinder so that valves can be installed to their original positions.

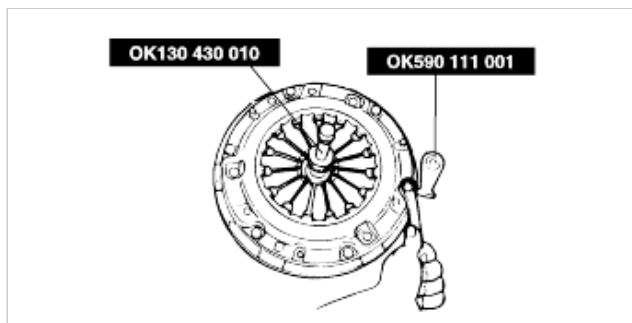
18. Remove valves from cylinder head.

19. Remove lower spring seals from cylinder head.

20. Install SST or equivalent.

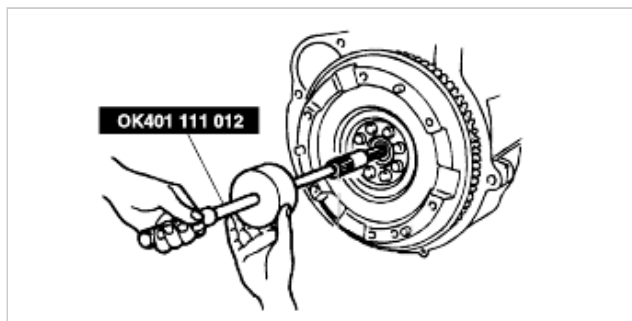
(Clutch disc centering tool and ring gear brake)

21. Loosen each bolt one turn at a time in a crisscross pattern, until spring tension is released then remove clutch cover and disc.

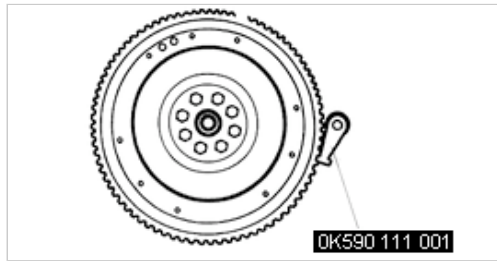


22. Remove pilot bearing with SST (Bearing puller) or equivalent if necessary.

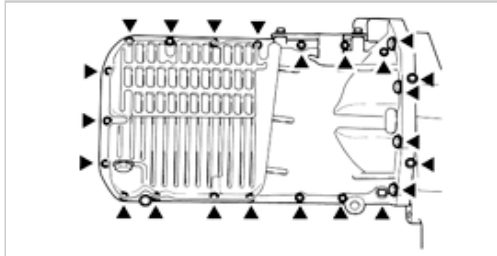
23. Hold flywheel with SST (Ring rear brake) or equivalent.



24. Remove eight bolt to remove flywheel.



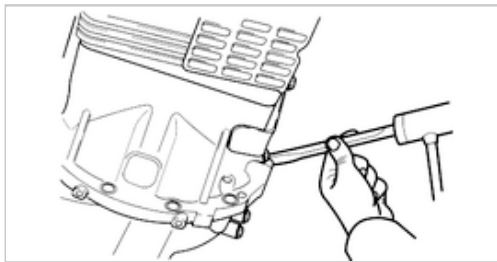
25. Remove oil pan mounting bolts.



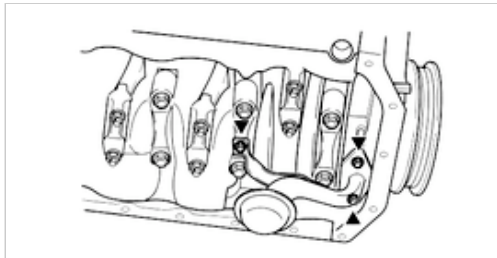
26. Remove oil pan with a screwdriver or suitable tool as shown in figure.

CAUTION

- Do not force tools between cylinder block and oil pan as this may damage sealing surface.
- Do not damage sealing surface when removing old sealant.

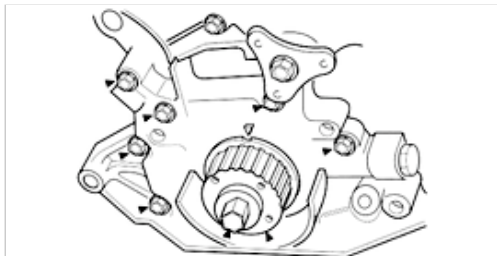


27. Remove oil strainer.

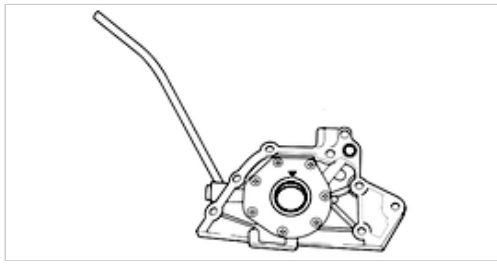


28. Remove timing belt pulley.

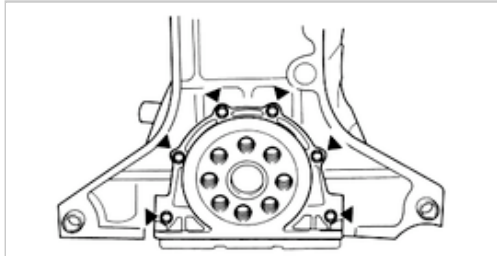
29. Remove oil pump mounting bolt and oil pump.



30. Using a screwdriver covered by a rag, remove oil seal from pump cover side.



31. Remove rear cover.



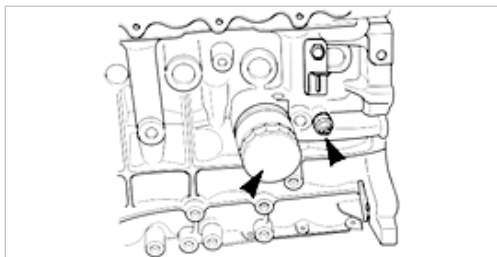
32. Wrap a prying with a shop towel and slowly pry out rear oil seal.



33. Remove water pump.



34. Remove oil filter and oil pressure switch.

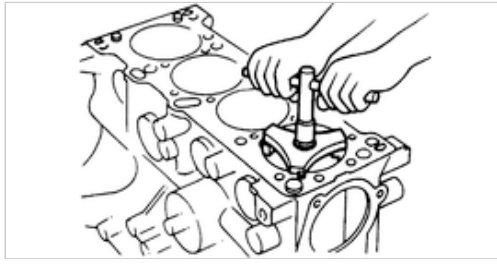


35. Check top of each cylinder for ridges.

NOTICE

Failure to remove a ridge before removing piston will result in damaged ring-lands, cracked piston rings, or cracked piston.

36. If a ridge can be felt, use a ridge reamer to remove ridge before attempting to remove piston from cylinder.



37. Rotate engine block so that crankshaft is at Top Dead Center (TDC).
38. Rotate crankshaft so that No.1 and No. 4 cylinders are at Bottom Dead Center (BDC).
39. Use a numbering stamp and mark rod cap and connecting rod their corresponding cylinder number.

NOTICE

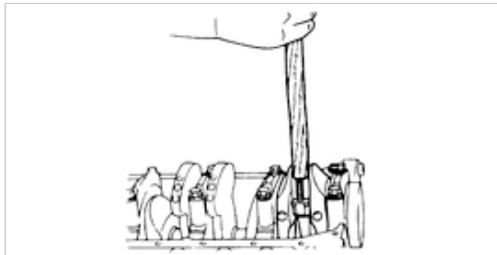
Mark all rods on same side and make a reference mark on block so that rods are installed in correct position and direction. Failure to install rods properly will result in starvation, spun bearings, or damage internal engine components.

40. Rotate crankshaft so that cylinders No. 2 and No.3 are at Bottom Dead Center (BDC) and repeat marking procedure.
41. Remove connecting rod nuts and gently loosen rod caps by tapping cap with a light plastic mallet.
42. Remove rod caps.

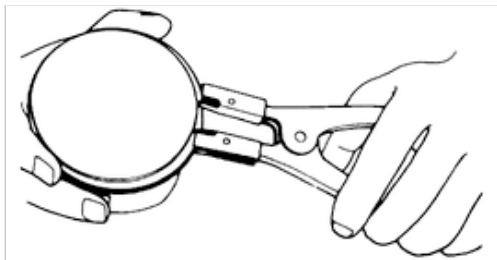
NOTICE

Cover connecting rod bolts to protect crankshaft journals.

43. Push connecting rod and piston as far up into cylinder as possible. Using wooden dowel, tap gently on piston to release it from cylinder.
44. Repeat this procedure for each cylinder.



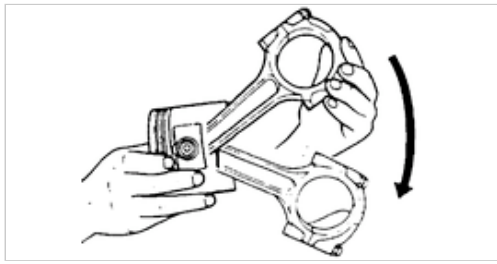
45. Mark tops of pistons with corresponding cylinder numbers they were removed from.
46. Using a piston ring expander, remove piston rings.



47. Hold piston upright and gently move connecting rod.
48. Release connecting rod and observe its movement.

NOTICE

Do not swing connecting rod wildly. Constant hard contact with piston will cause a bell-mouth condition that will require piston replacement.



49. If connecting rod does not move freely, check piston pin bore and connecting rod for straightness and deformation.
50. Remove piston pin clip from ends of piston pin bore.
51. Tilt piston pin clip to slide out to slide into your hand. Piston pins may need to be pressed out.

NOTICE

Do not allow pins to drop to the ground.

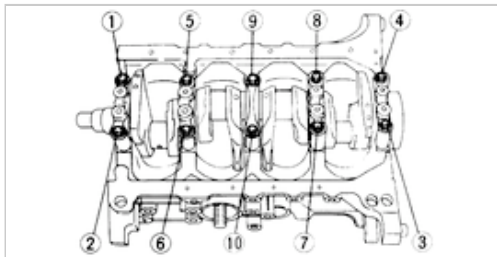


52. Remove connecting rod from piston. Keep individual piston pin and piston pin bore.
53. Mark main bearing caps (front to back) including direction.

NOTICE

Each main bearing cap is matched to that particular journal. Installing a cap wrong journal will cause an alignment problem that will require an expensive machine process to correct.

54. Loosen main bearing caps in two or three steps following order shown in figure.



55. Remove main bearing caps.
56. Grasp crankshaft and lift straight out.
57. Remove main bearings and thrust bearing from cylinder block saddles.

REASSEMBLY

Engine

1. Clean all parts before assembly.
2. Apply a coat of clean engine oil to all sliding and rotating parts before assembly.
3. Replace main bearing and rod bearing if they are peeling if they are peeling, burned or otherwise damaged.

NOTICE

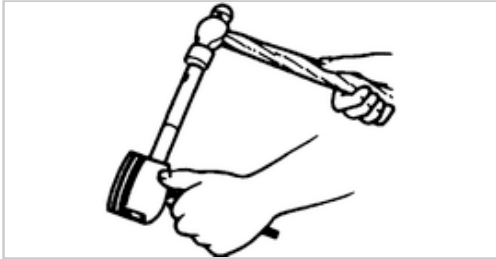
Do not reuse old gasket or seals.

4. Install one piston pin clip grooves on piston.

5. Install connecting rod into piston and slide piston pin through piston and through connecting rod until it makes contact with the piston pin clip already installed.

NOTICE

Verify that piston and rod are assembled in same direction as they were prior to disassembly.



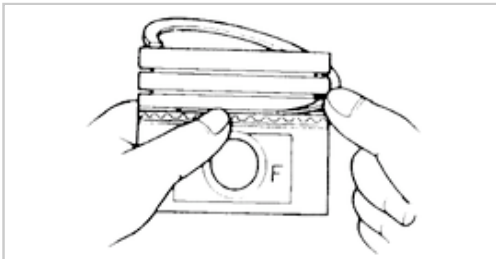
6. Install second piston pin clip into clip grooves on opposite side of piston.



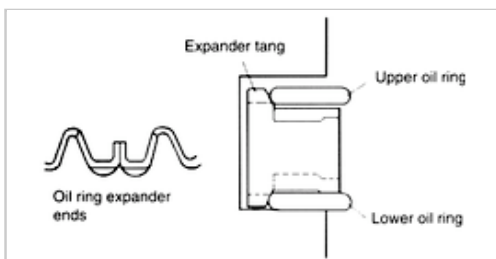
7. Hold piston upright and move connecting rod back and forth. Check that rod moves freely.

8. Install three piece oil ring onto piston.

- A. Apply clean engine oil to the oil ring expander and upper and lower oil rings.
- B. Install expander onto piston so that expander ends face upward.
- C. Install lower oil ring onto piston. Ring may be installed with either face upward.
- D. Install upper oil ring onto piston. Ring may be installed with either face upward.



9. Check that oil ring expander separates upper and lower oil rings and that oil ring assembly spins freely on piston.

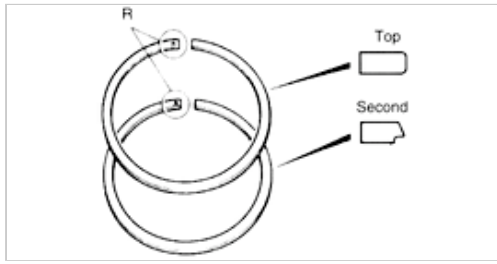


10. Use a ring expander and install second rod.

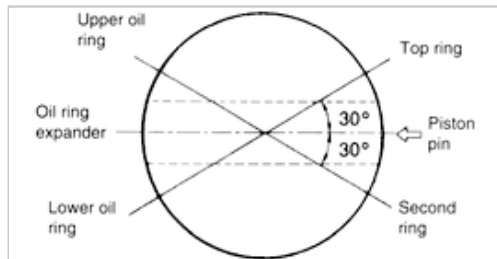
11. Use a ring expander and install top ring.

NOTICE

Top ring and second ring should be installed with "R" mark facing up.



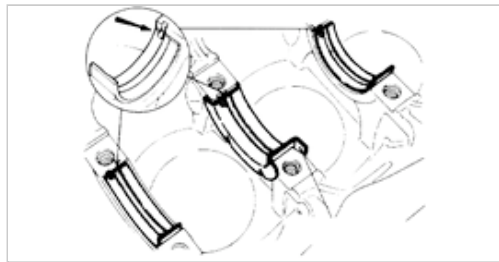
12. Align piston ring gaps as shown.



13. Inspect journals and bearing for any foreign material. Clean crankshaft. Oil holes and main bearing journals thoroughly and dry components with compressed air.

14. Install grooved main bearing into saddles on engine block.

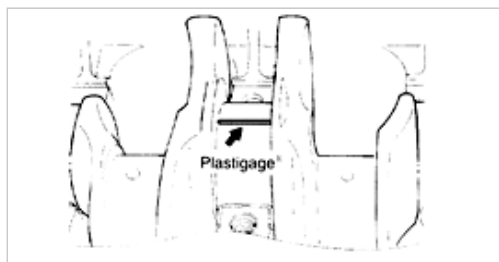
15. Install thrust bearing with oil groove facing crankshaft.



16. Set crankshaft on installed bearings.

17. Install remaining main bearing into main bearing caps.

18. Position Plastigage® on crankshaft journals.



19. Install main bearing cap along with lower main bearing according to cap number and ←mark.

20. Tighten main bearing cap bolts according to the following procedure.

A. Tighten bolts in order shown.

Tightening torque : 28.9lb·ft (39.2N·m, 4kg-m)

B. Loosen bolts in reverse of order shown.

C. Retighten bolts in order shown.

Tightening torque : 14.5lb·ft (19.6N·m, 2kg-m)

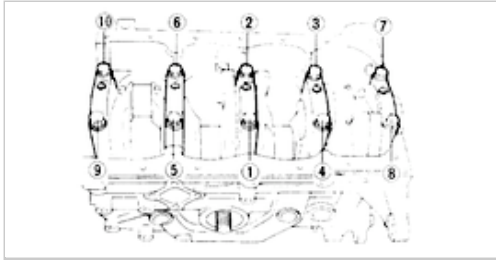
D. Mark bolts for rotational reference.

E. Rotate bolts 90°(1/4turn) in order shown.

F. Rotate bolts another 60°(1/6 turn) in order shown.

CAUTION

Do not rotate crankshaft with Plastigage® on crankshaft journals.



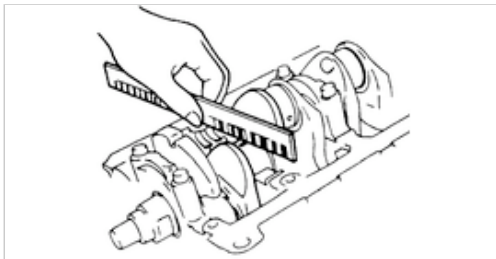
21. Remove main bearing cap and check bearing clearance.

NOTICE

The widest point of Plastigage® is the smallest clearance, and the narrowest point of Plastigage is the largest clearance.

22. If oil clearance exceeds specification grind and polish crankshaft and use undersized main bearings.

Oil clearance : 0.00095~0.00165in (0.024~0.042mm)



23. Lift crankshaft out of cylinder block and carefully remove Plastigage® from main bearings and crankshaft journals.

24. Apply a light coat of engine oil on main bearing and install crankshaft by gently lowering it onto bearing.

25. Apply a light coat of oil on crankshaft main bearing journals and on main bearing on main bearing cap.

26. Install main bearing caps along with lower main bearings according to cap number and ←mark.

27. Tighten main bearing cap bolts according to the following procedure :

- A. Tighten bolts in order shown.

Tightening torque : 28.9lb·ft (39.2N·m, 4kg-m)

- B. Loosen bolts in reverse or order shown.

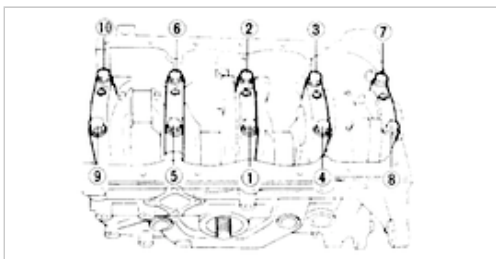
- C. Retighten bolts in order shown

Tightening torque : 14.5lb·ft (19.6N·m, 2kg-m)

- D. Mark bolts for rotational reference.

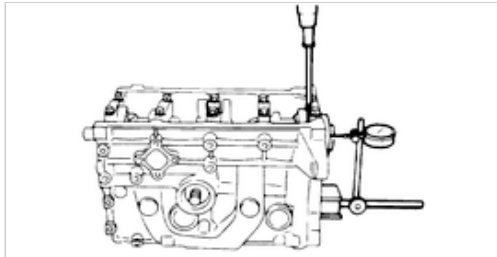
- E. Rotate bolt 90° (1/4turn) in order shown.

- F. Rotate bolts another 60° (1/6 turn) in order shown.



28. Rotate crankshaft to ensure it does not bind.
29. Place a dial indicator against front of cranksjaft and zero gauge.
30. Using a prying tool move crankshaft forward and zero dial indicator.
31. Move the crankshaft toward the rear of block with prying tool and check the amount of movement on dial indicator.

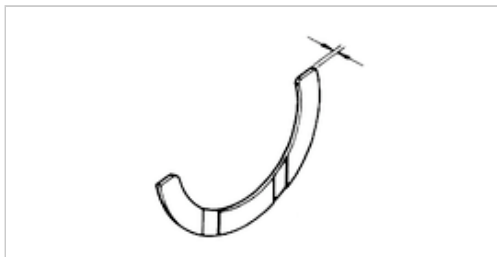
End play : 0.0032~0.0111in (0.080~0.282mm)



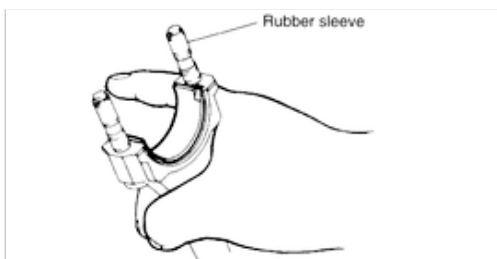
32. If end play exceeds specification grind crankshaft and install oversized thrust bearings or replace crankshaft and thrust bearing.

Thrust bearing width

Ring	Specification
Standard	0.0985~0.1003in (2.500~2.550mm)
Standard + 0.010in (0.25mm)	0.1034~0.1053in ()2.625~2.675mm)
Standard + 0.020in (0.50mm)	0.1083~0.1102in (2.750~2.800mm)
Standard + 0.030in (0.75mm)	0.1132~0.1151in (2.875~2.925mm)



33. Install a bearing into connecting rod.
34. Place rubber sleeves (Rubber fuel line work well) on connecting rod bolts to protect crankshaft from damage.



35. Check piston rings for correct end gap stagger.
36. Place piston (Cylinder number one) with "F" mark facing front of engine block, then slip piston and connecting rod assembly into a piston ring compressor.
37. Rotate crankshaft so that crank pin journal for specific cylinder is at its lowest point (bottlm dead center).
38. Lower piston and connecting rod assembly until piston ring compressor makes contact with deck surface of engine block.



39. Using butt end of a hammer, tap the top of piston into cylinder and continue tapping until connecting rod makes contact with crankshaft.

NOTICE

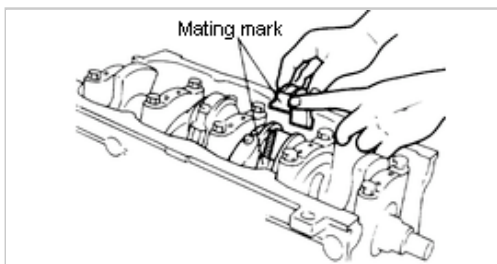
Follow this procedure for remaining piston and connecting rod assemblies.

40. Install a connecting rod bearing in each connecting rod cap.
 41. Place a piece of Plastigage® on crank pin journals.
 42. Install connecting rod caps aligning marks made previous to disassembly and torque to specification.

Tightening torque : 34.7~36.9lb·ft (47~50N·m, 4.8~5.1kg-m)

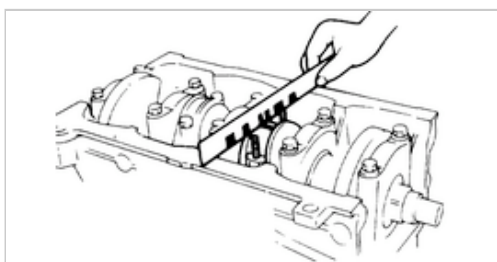
NOTICE

When installing the connecting rods, match marks made on the connecting rod cap to reference mark made on cylinder block to prevent oil starvation to the connecting rod bearings.



43. Loosen and remove connecting rod caps.
 44. Check the connecting rod bearing clearance.

Oil clearance : 0.0008~0.0019in (0.020~0.05mm)
 Maximum : 0.004in (0.10mm)



45. If oil clearance exceeds maximum oil clearance specification grind the crankshaft and use undersized connecting rod bearings.
 46. Apply a coat of clean engine oil to connecting rod bearing in connecting rod cap.
 47. Install connecting rod cap and torque to specification.

Tightening torque : 34.7~36.9lb·ft (47~50N·m, 4.8~5.1kg-m)

48. Insert a thickness gauge between connecting rod and crankshaft and check connecting rod and crankshaft check

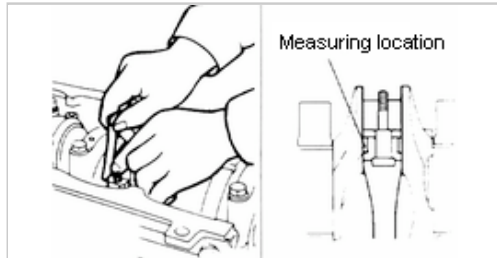
connecting rod side clearance.

NOTICE

Do not measure between connecting rod cap and crankshaft.

Side clearance : 0.0044~0.0103in (0.110~0.262mm)

Maximum : 0.012in (0.30mm)



49. If side clearance exceeds maximum side clearance specification, replace connecting rod and cap.
50. Apply a light coat of clean engine oil to rear oil seal.
51. Install rear oil seal into rear cover by hand.
52. Press oil seal into rear cover.

NOTICE

Oil seal must be pressed in until it is nearly flush surface of rear cover.

Protrusion : 0~0.02in (0~0.5mm)



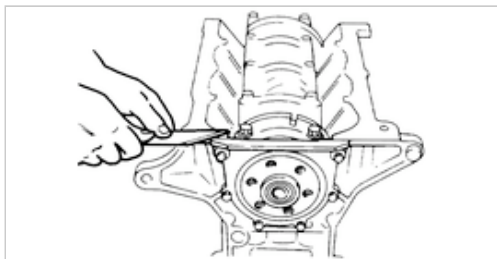
53. Apply a coat of silicone sealer to rear cover

Thickness : $\varnothing$ 0.08in (2mm)

54. Install the rear cover.

Tightening torque : 5.8~8.0lb·ft (7.8~10.8N·m, 0.8~1.1kg-m)

55. Remove any sealant that protrudes from rear cover onto oil pan mounting surface.



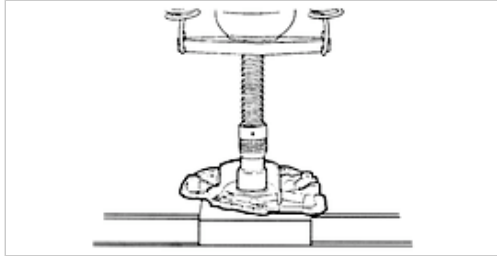
56. Apply clean engine oil to new front oil seal and oil pump body.
57. Install front oil seal by hand.

58. Press oil seal by hand.

NOTICE

Oil seal must be pressed in until it is nearly flush with front surface of oil pump body.

Protrusion : -0.02~0in (-0.5~0mm)



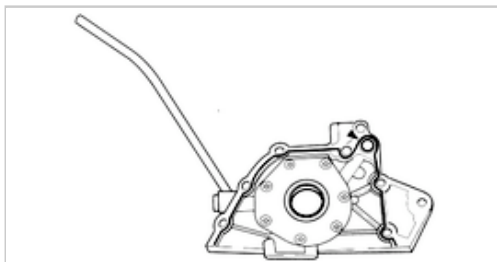
59. Install a new O-ring seal.

60. Apply a bead of silicone sealant to oil pump body as shown.

Thickness : ϕ 0.04~0.08in (1~2mm)

CAUTION

Oil pump body must be installed within 5 minutes after silicone sealant is applied.



61. Install oil pump with six bolts.

Tightening torque : 14~19lb·ft (19~26N·m, 1.9~2.6kg-m)

62. Remove any sealant that protrudes from oil pump onto oil surface.

63. Remove all foreign material from water pump mounting surface.

64. Install water pump with a new gasket and torque to specification.

Tightening torque : 14~19lb·ft (19~26N·m, 1.9~2.6kg-m)

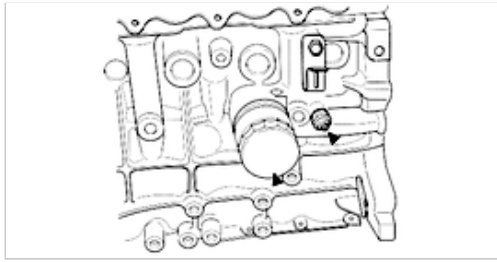


65. Install oil pressure switch.

Tightening torque : 8.7~13.79lb·ft (11.7~17.6N·m, 1.2~1.8kg-m)

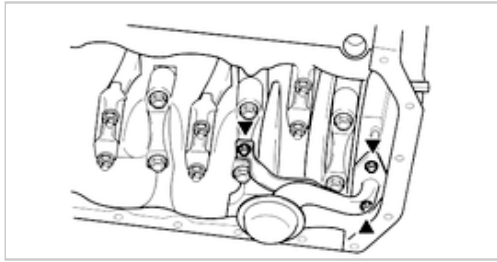
66. Apply a small amount of engine oil to rubber seal of oil filter.

67. Install oil filter rubber seal contacts base and then tighten filter 1 and 1/6 turn using an oil filter wrench.



68. Install oil strainer with a new gasket.

Tightening torque : 5.8~8.7lb·ft (7.8~11.8N·m, 0.8~1.2kg-m)



69. Remove all foreign material from gasket surface.

70. Apply a continuous bead of silicone sealant to oil pan contact surfaces.

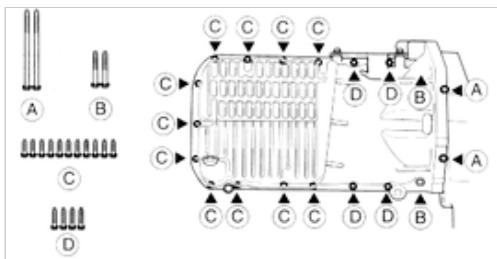
NOTICE

Install oil pan with five minutes of applying silicone sealer.



71. Install oil pan tighten oil pan bolts.

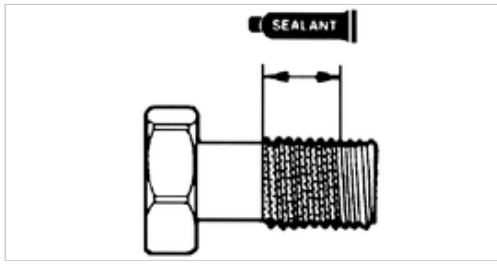
Tightening torque : 5.8-8.0lb·ft (7.8~10.8N·m, 0.8~1.1kg-m)



72. Clean thread sealant from flywheel bolts and bolt holes in crankshaft.

NOTICE

If thread sealant cannot be removed from bolt, replace flywheel bolt. If you are using new flywheel bolts, do not apply sealant : new bolts have sealant already applied to thread.



73. Install separator plate onto cylinder block.

Tightening torque : 13.7~22.4lb·ft (18.6~30.4N·m, 1.9~3.1kg-m)

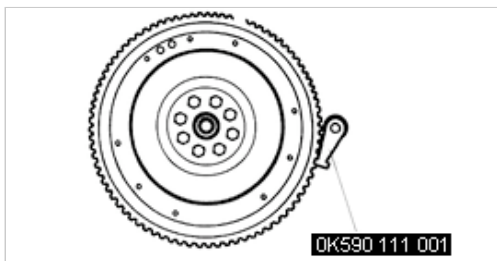
74. Install flywheel (M/T) or drove plate/backing plate/adapter(A/T) assembly onto crankshaft.

75. Install bolts (apply sealant to reused bolts.)

76. Install locking tool.

77. Tighten bolt in two or three steps to the specified torque.

Tightening torque : 71~75.9lb·ft (97~103N·m, 9.8~10.5kg-m)



78. Install clutch disc and clutch cover (M/T).

79. Center the clutch disc with SST or equivalent and torque clutch cover bolts to specification (M/T).

Tightening torque : 16-24lb·ft (22~32N·m, 2.2~3.3kg-m)

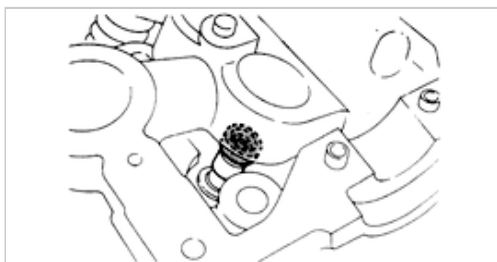


80. Remove locking tool.

81. Install valve, then slide valve seal over valve stem and onto valve guide.

NOTICE

Intake and exhaust valve seals are different. Only exhaust valve seals have four teeth.

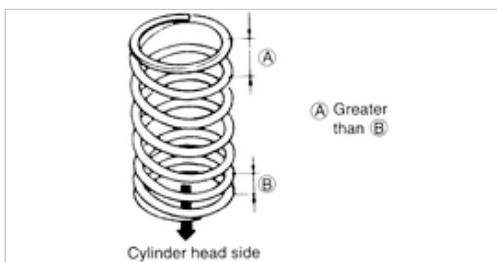


CAUTION

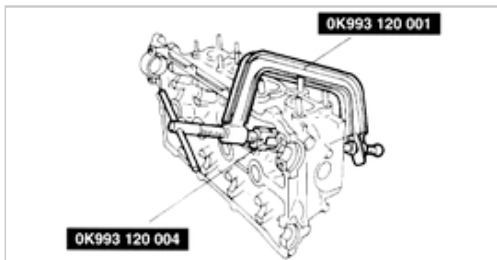
Using a hammer will damage valve seals.



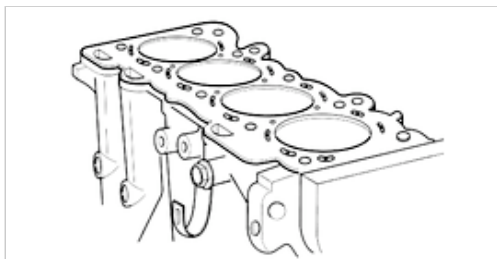
82. Remove the valve guide seal installer.
83. Install lower spring seat on cylinder head.
84. Install HLA protector SST if available.
85. Install valve spring with narrow spring coils (B) toward cylinder head and wider coils (A) toward upper spring seat.



86. Install upper spring seat and compress valve spring with SST or equivalent.



87. Install valve locks and release SST or equivalent from valve spring.
88. Tap end of valve stem lightly two or three times with a plastic hammer to verify that valve locks are fully seated.
89. Remove HLA protector if used. Repeat procedure for remaining valve assemblies.
90. Remove all foreign material from contact surface of cylinder head and cylinder block.
91. Place cylinder head gasket onto cylinder block and lower cylinder head onto cylinder block.



92. Install cylinder head bolts.
93. Tighten cylinder head bolts according to following procedure :
 - A. Tighten cylinder head bolts in order shown.

Tightening torque : 36.1lb·ft (49N·m, 5kg-m)

- B. Loosen bolts in reverse or order shown.

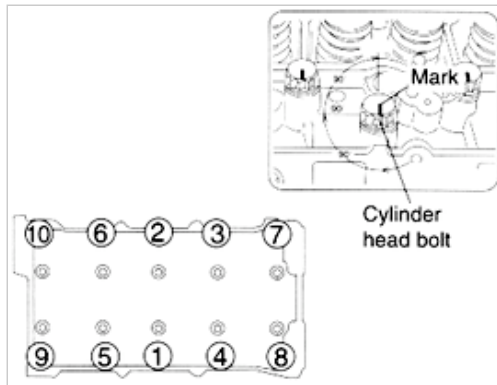
C. Retighten cylinder head bolts in order shown.

Tightening torque : 28.9lb·ft (39.2N·m, 4kg-m)

D. Mark cylinder head bolts for rotational reference.

E. Rotate cylinder head bolts 90° (1/4turn) in order shown.

F. Rotate cylinder head bolt another 90° (1/4turn) in order shown.



94. Install HLA's (Refer to HLA Replacement procedure)

95. Install new intake manifold gasket.

96. Install intake manifold.

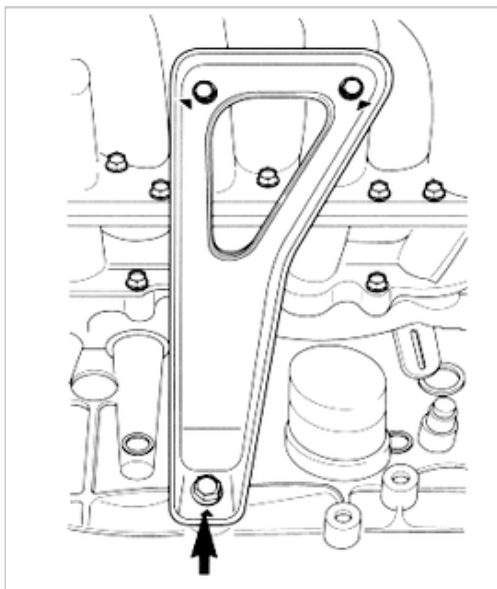
Tightening torque : 1.7~18.8lb·ft (18.6~25.5N·m, 1.9~2.6kg-m)

97. Install intake manifold bracket.

Tightening torque :

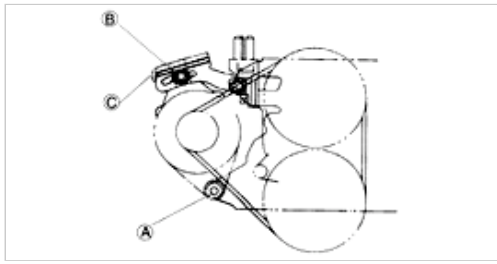
(A) - 11.6~16.6lb·ft (15.7~22.5N·m, 1.6~2.3kg-m)

(B) - 26.8-39.8lb·ft (36.5~53.9N·m, 3.7~5.5kg-m)



98. Install generator and generator mounting bolts and adjusting bolt (C).

99. Install generator drive belt and adjust the belt deflection by turning the adjust bolt (C).



Belt deflection :

New : 0.24~0.32in (6.0~8.0mm)

Used : 0.28~0.35in (7.0~9.0mm)

100. Tighten the mounting bolts (A), (B)

Tightening torque :

(A) : 27~38lb·ft (37~52N·m, 3.8~5.3kg-m)

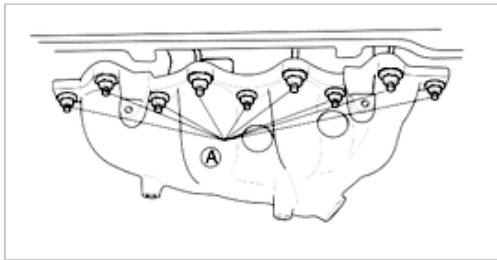
(B) : 14~19lb·ft (19~52N·m, 4kg-m)

101. Install front and rear engine hangers.

102. Hang engine with baby crane from engine stand.

103. Install exhaust manifold and coolant bypass pipe.

Tightening torque : (A) : 28.2~34lb·ft (38.2~46.1N·m, 3.9~4.7kg-m)



104. Fill with specified type and amount engine oil and check for leaks.



SPECIFICATION

Engine

Engine model			TBD
Item			
Type			Gasoline, 4 cycle
Cylinder arrangement and number			In line, 4 cylinder
Combustion chamber			Pentroof
Valve system			DOHC, belt driven (IN : 2, EX : 2)
Displacement			109.4cu-in (1,793cc)
Bore and stroke			3.19×3.43in (81.0×87.0mm)
Compression ratio			9.4 : 1
Compression pressure			193psi (1,333kpa, 13.6kg/cm²)-300rpm
Valve timing	IN	Open	6°
		Close	46°
	EX	Open	50°
		Close	10°
Valve clearance	IN		0 : Maintenance-free
	EX		0 : Maintenance-free
Idle speed *1			800 ± 50rpm
Ignition timing *2			8° ± 5° BTDC
Firing order			1-3-4-2

*1.A/T - "P" range position, M/T - Neutral position

Cooling system

Item			Engine
			TBD
Cooling system			Water-cooled, forced circulation
Cooling capacity US qt (liters, Impqt)			6.3 (6.0, 5.3)
Water pump	Type		Centrifugal
	Water seal		Unified mechanical seal
Thermostat	Type		WAX 86.5~89.5
	Initial opening temperature		188~193 (86.5~89.5)
	Full-open temperature		212(100)
	Full-open lift in(mm)	Main	0.31 (8.0) minimum
	Type		Corrugated fin
Radiator	Core size in(mm)	Width	27.5 (699)
		Height	13.6 (345)
		Thickness	1.1(28)

	Heat dissipation capacity kcal/h		46,000
	Automatic transaxle oil cooler	Type	Double tube type
		Heat dissipation capacity kcal/h	1,700
Cooling fan	Type		Electric
	Number of blades		7
	Outer diameter in(mm)		12.6 (320)
	Capacity W-V		160-12
	Current A		13

Lubrication system

Item		Specifications (TBD Engine)
Lubrication system		Force-fed type
Oil pump	Type	Duo-Centric rotor
	Relief pressure	64~78psi (441~539kPa, 4.5~5.5kg/cm ²)
Oil filter	Type	Full-flow, paper element
	Relief pressure differential	11~17psi (78~118kPa, 0.8~1.2kg/cm ²)
Oil pressure switch activation pressure		3.6psi (25kPa, 3.5kg/cm ²)
Oil capacity	Total	4.2US qt (4.0liters, 3.5Imp qt)
	Oil pan	3.8US qt (3.6liters, 3.2Imp qt)
	Oil filter	0.21US qt (0.20liters, 0.18Imp qt)
Engine oil		API service SG

Intake and exhaust system

Item	Engine
	TBD (1800cc)
Air cleaner Element type	Dried
Accekeratir cable Free play	0.16~0.28in (4~7mm)

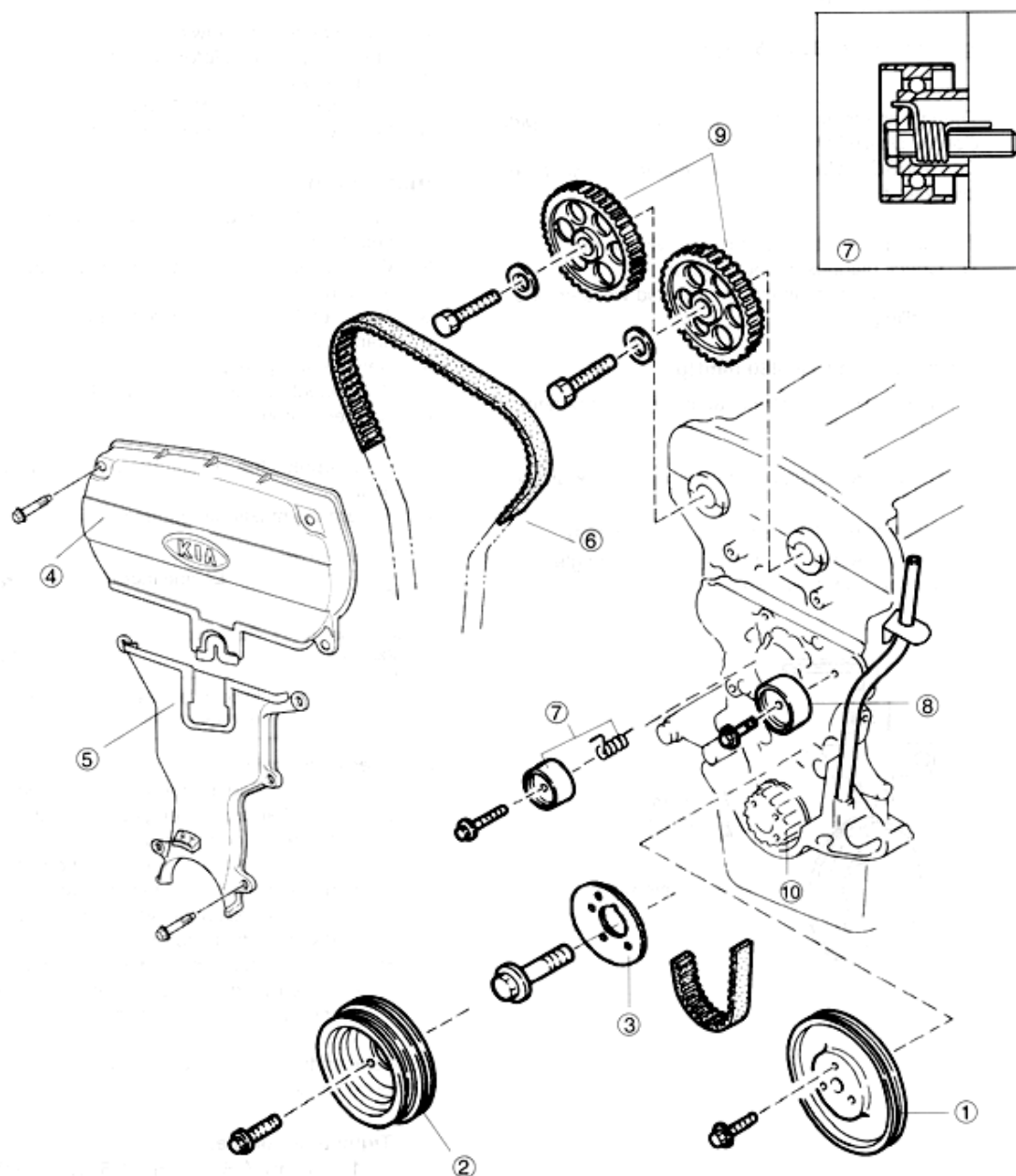


Engine Mechanical System

Timing System - Timing Belt



COMPONENTS



- (1) Water pump pulley
- (2) Crankshaft pulley
- (3) Timing belt guide plate
- (4) Timing belt cover (Upper)
- (5) Timing belt cover (Lower)

- (6) Timing belt
- (7) Timing belt tensioner pulley & spring
- (8) Idler pulley
- (9) Camshaft pulley
- (10) Timing belt pulley

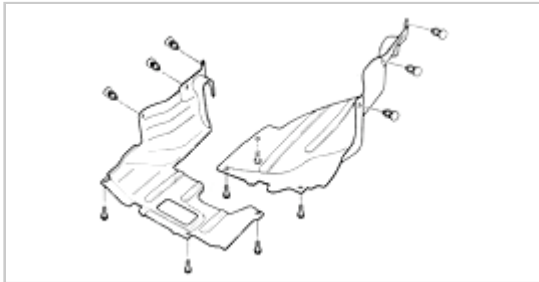


REMOVAL

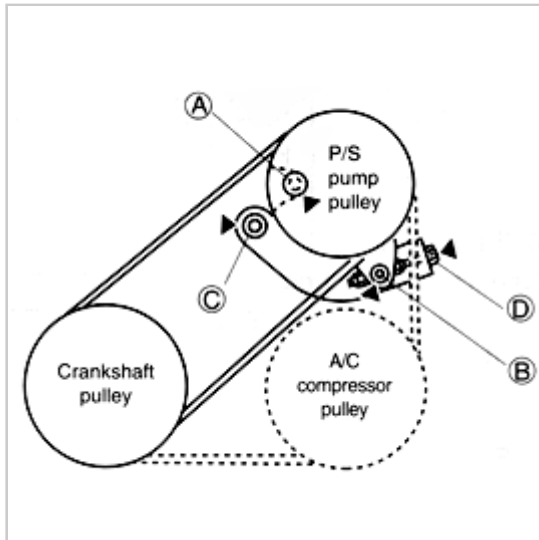
1. Disconnect negative battery cable.



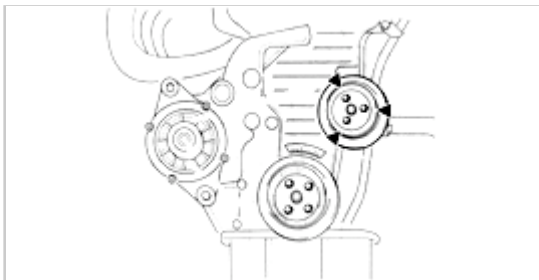
2. Remove right splash shield with three bolts and three fasteners.



3. Loosen power steering pump lock bolt (A), nuts (B), (C) and remove tension from power steering (P/S) pump and/or air conditioning (A/C) compressor drive belt by turn adjusting bolt (D).

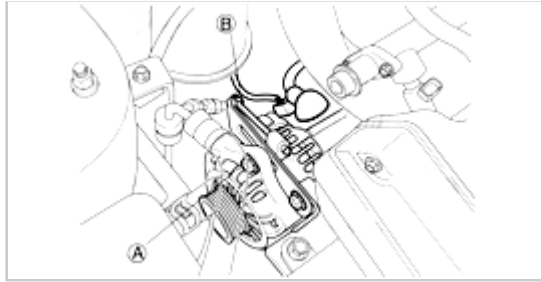


4. Remove P/S pump and/or A/C compressor drive belt.
5. Loosen water pump pulley bolts.



6. Loosen generator mounting bolt (A) and remove tension from generator drive belt by turn adjusting bolt (B).

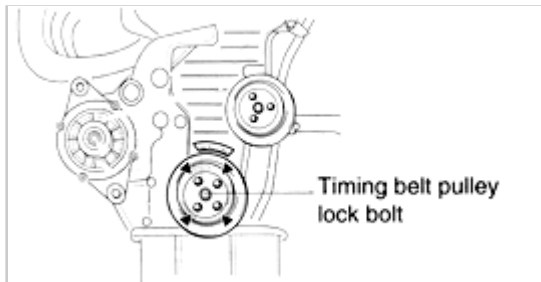
7. Remove generator drive belt.



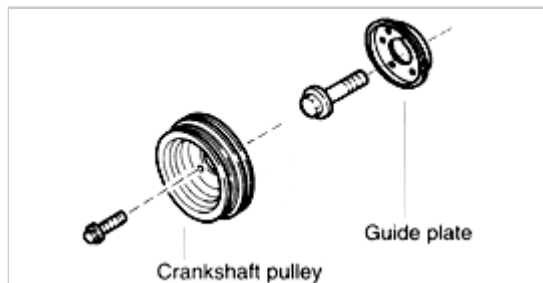
8. Remove water pump pulley.



9. Remove four crankshaft pulley bolts and timing belt pulley lock bolt.

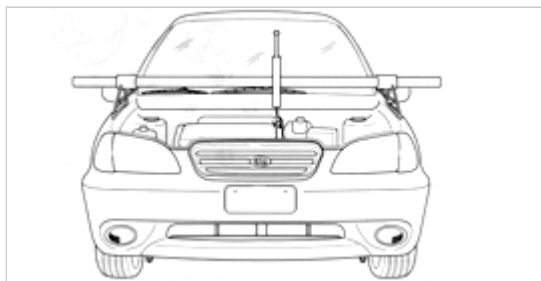


10. Remove crankshaft pulley and timing belt guide plate.

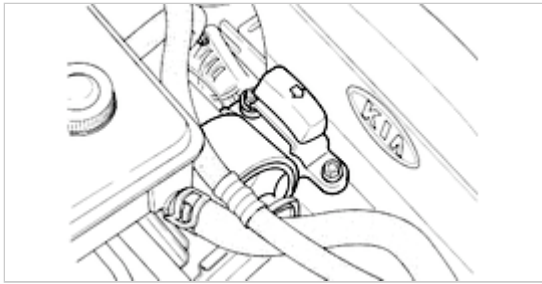


11. Reinstall timing belt pulley lock bolt.

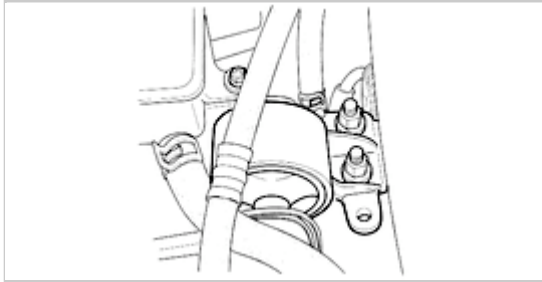
12. Support engine with engine support bar SST (OK201 170 AA0).



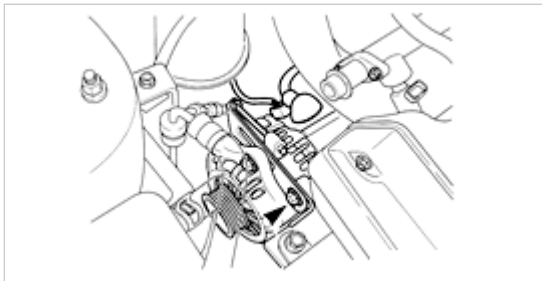
13. Remove one bolt and one nut, then remove dynamic damper.



14. Remove two No. 3 engine mount.



15. Remove generator bracket bolt.



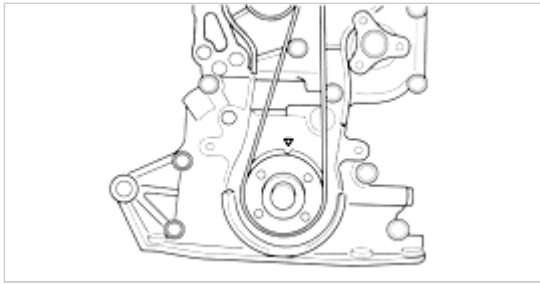
16. Remove No. 3 engine mounting bracket with three bolts.



17. Remove upper and lower timing belt covers.



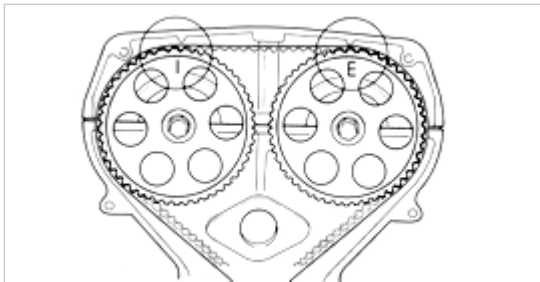
18. Turn crankshaft so that timing mark on timing belt pulley is aligned with timing mark on engine.



19. Check that "I" mark on intake camshaft pulley is aligned with mark on cylinder head cover and "E" mark on exhaust camshaft pulley is aligned with mark on cylinder head cover.

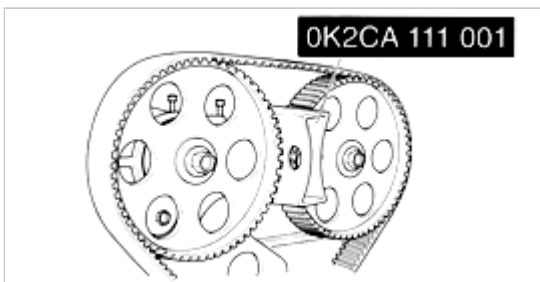
NOTICE

Do not move camshaft or crankshaft once timing marks have been correctly positioned.

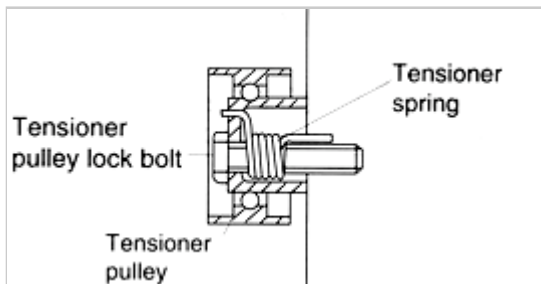


NOTICE

Prevent camshaft pulley rotation with SST (OK2CA 111 001).



20. Remove tensioner pulley lock bolt and remove tensioner pulley and tensioner spring.



21. Remove timing belt

NOTICE

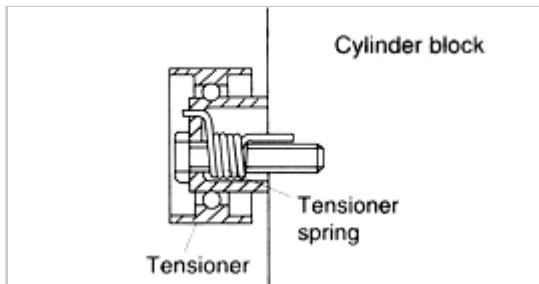
Mark the direction of timing belt rotation (on the timing belt) for proper reinstallation.

INSTALLATION

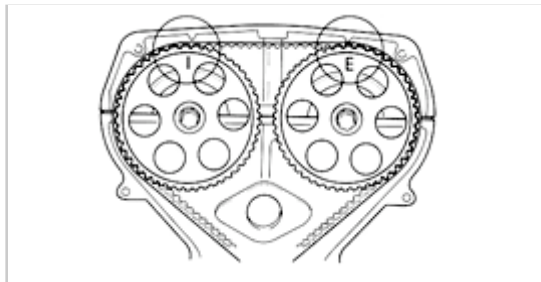
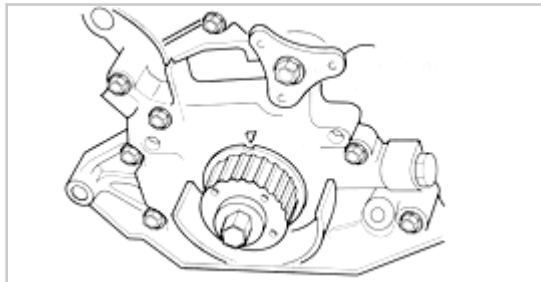
1. Install tensioner pulley.

NOTICE

Replace tensioner spring whenever timing belt is replaced.

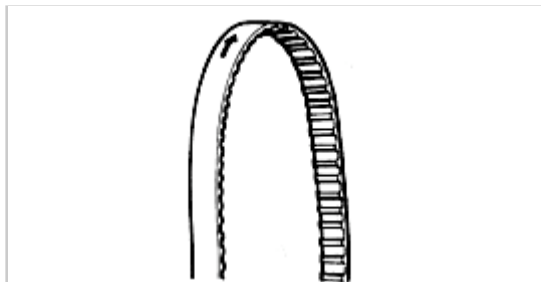


2. Pull tensioner pulley to its furthest point and tighten lock bolt.
3. Check that timing mark on timing belt pulley is aligned with timing mark on engine.



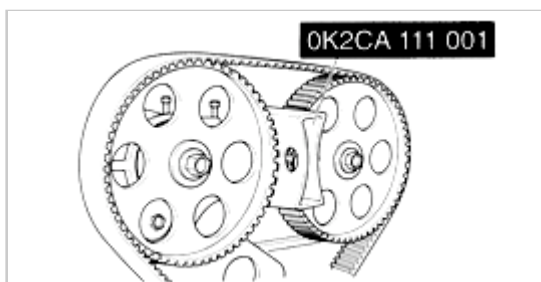
NOTICE

If existing timing belt is being reused, install belt in proper rotation direction marked prior to removal.

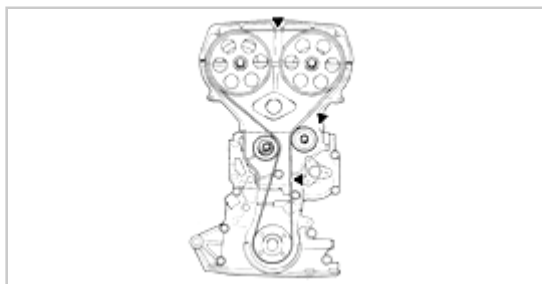


NOTICE

Prevent camshaft pulley rotation with SST (OK2CA 111 001).



4. Install timing belt onto belt pulley first, then idler pulley exhaust camshaft pulley, intake camshaft pulley and tensioner pulley in that order.
5. Check that there is no looseness in belt between idler pulley and exhaust camshaft pulley or between intake and exhaust camshaft pulleys.



6. Loosen tensioner pulley lock bolt and allow tensioner spring to apply tension to timing belt.

NOTICE

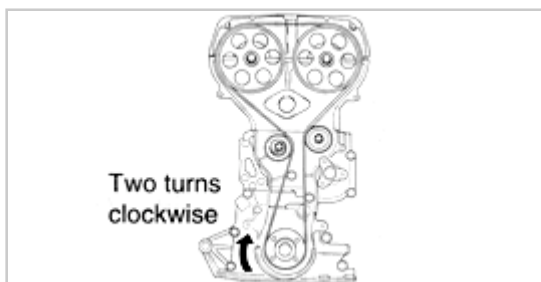
Do not add additional tension.

7. Tighten tensioner pulley lock bolt to specified torque.

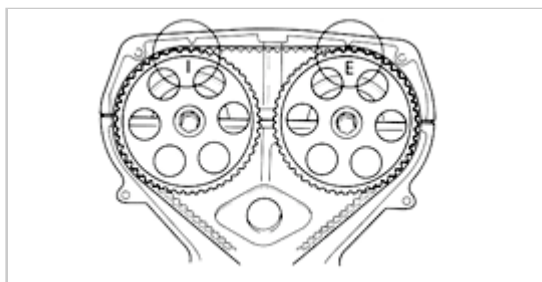
Tightening torque : 28~36lb·ft (37~52N·m, 3.8~6.3kg-m)



8. Rotate crankshaft two full revolutions (clockwise only) and align timing mark on timing belt pulley with timing mark on engine block.

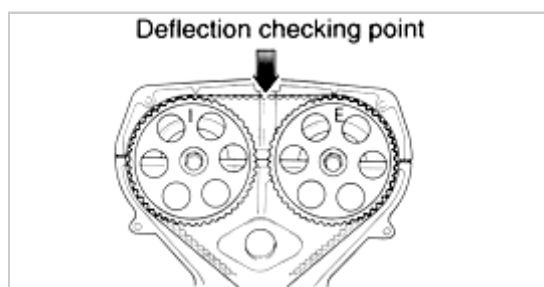


9. Check that "I" mark on intake camshaft pulley "E" mark on exhaust camshaft pulley are aligned with marks on cylinder head cover.



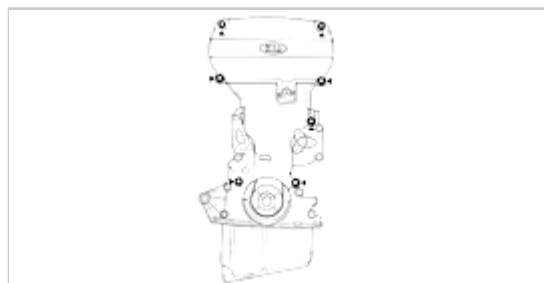
10. If they are not aligned, remove timing belt and start process from tensioner installation.
11. Measure timing belt deflection by applying moderate pressure midway between camshaft pulleys. If deflection is not correct, repeat from tensioner installation.

Deflection pressure : 22lb (98N, 10kg)
 Deflection : 0.36~0.45in. (9.0~11.5mm)



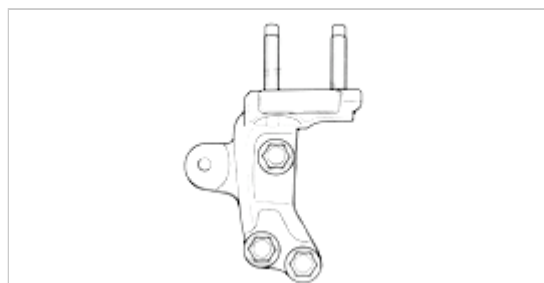
12. Install lower and upper timing belt covers.

Tightening torque : 5.8~7.9lb·ft (7.8~10.8N·m, 0.8~1.1kg-m)

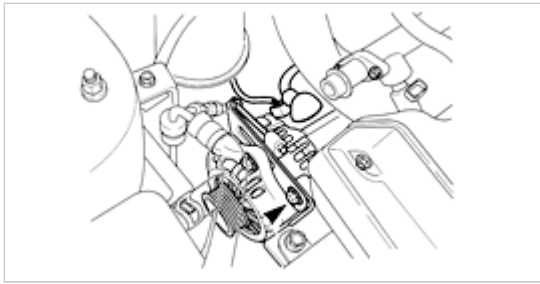


13. Install No. 3 engine mounting bracket with three bolts.

Tightening torque : 49.2~68.7lb·ft (66.7~93.2N·m, 6.8~9.5kg-m)

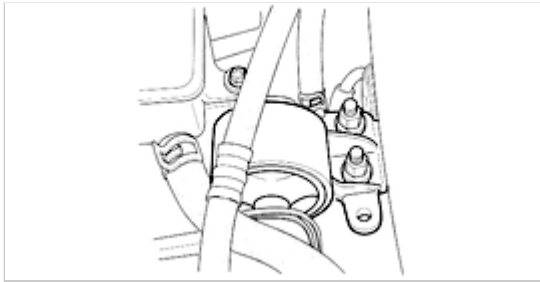


14. Install generator bracket bolt.



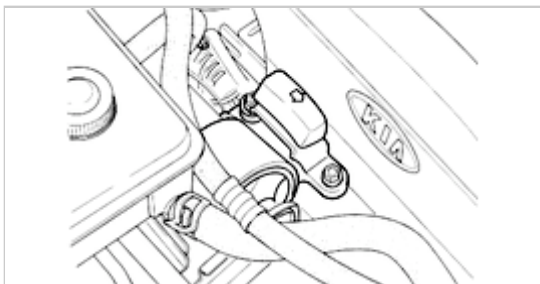
15. Tighten two nuts to No. 3 engine mount.

Tightening torque : 54.2~75.9lb·ft (73.6~103N·m, 7.5~10.5kg-m)



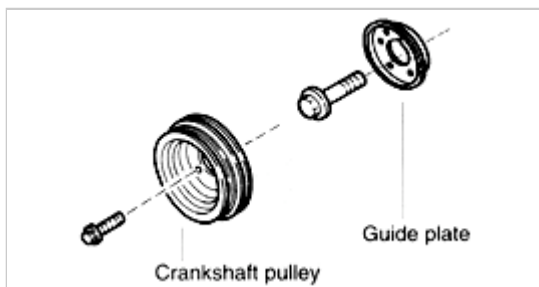
16. Install dynamic damper.

Tightening torque : 40.5~53.9lb·ft (54.9~80.4N·m, 5.6~8.2kg-m)



17. Remove timing belt pulley lock bolt.

18. Install timing belt guide plate and crankshaft pulley.



19. Tighten four crankshaft pulley bolts and timing belt pulley lock bolt.

Tightening torque :

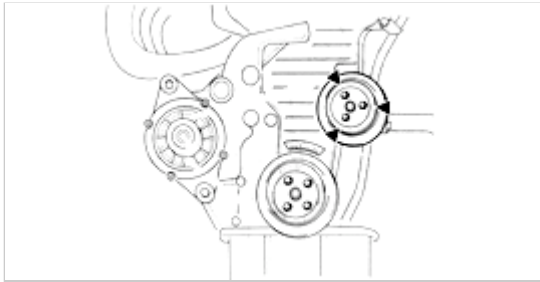
Crankshaft pulley bolts : 9.0~12.7lb·ft (12.3~17.2N·m, 1.25~1.75kg-m)

Timing belt pulley lock bolt : 116~123lb·ft (157~167N·m, 16~17kg-m)



20. Install water pump pulley.

Tightening torque : 6.5~9.4lb·ft (8.8~12.8N·m, 0.9~1.3kg-m)



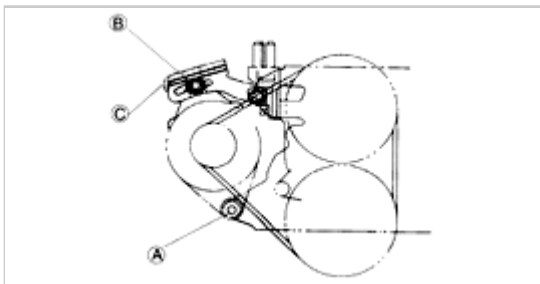
21. Install generator drive belt.

22. Adjust the belt deflection by turning the adjusting bolt (C).

Belt deflection

New : 0.24~0.32in (6.0~8.0mm)

Used : 0.28~0.35in (7.0~9.0mm)



23. Tighten the mounting bolt (A), (B).

Tightening torque :

(A) : 28~38lb·ft (37~52N·m, 3.8~5.3kg-m)

(B) : 14~19lb·ft (19~25.4N·m, 1.9~2.6kg-m)

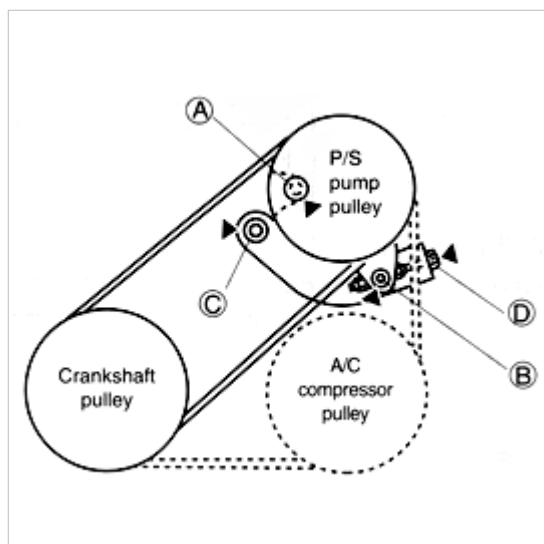
24. Install P/S pump and/or A/C compressor drive belt.

25. Adjust the belt deflection by turning the adjusting bolt (D).

Belt deflection :

New : 0.32~0.35in (8.0~9.0mm)

Used : 0.35~0.39in (9.0~10.0mm)



26. Tighten the bolt (A), nut (B), nut (C).

Tightening torque :

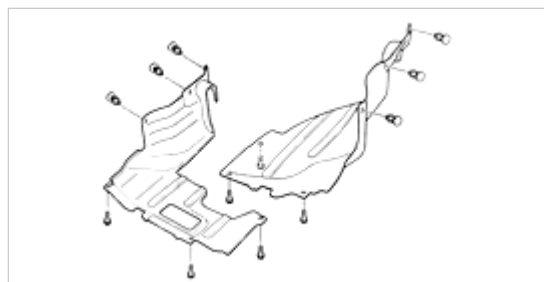
(A) : 27~40lb·ft (36~52N·m, 3.7~5.5kg-m)

(B) : 14~19lb·ft (19~25N·m, 1.9~5.2kg-m)

(C) : 23~34lb·ft (31~46N·m, 3.2~4.7kg-m)

27. Install right splash shield with three bolts and three fasteners.

Tightening : 10.1~11.6lb·ft (13.7~15.7N·m, 1.4~1.6kg-m)



28. Connect negative battery cable.



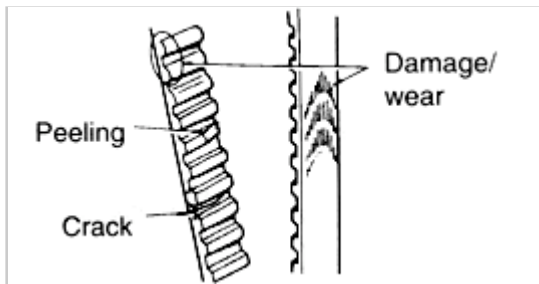
INSPECTION

NOTICE

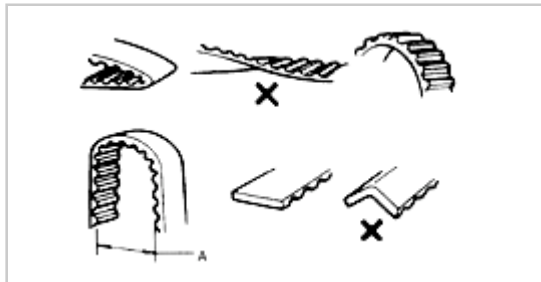
Never forcefully twist, turn inside out or bent timing belt. Do not allow oil or grease to come in contact with timing belt.

1. Replace timing belt if it is contaminated with oil or grease.

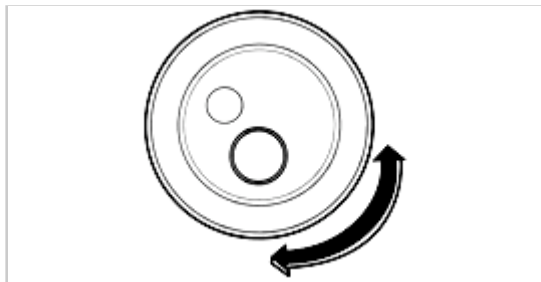
2. Check timing belt for uneven wear, fraying, peeling, cracking and hardening. Replace timing belt as necessary.



3. Bend timing belt into a "U" shape as shown in figure. Distance "A" must be at least 1.0 in (25mm).



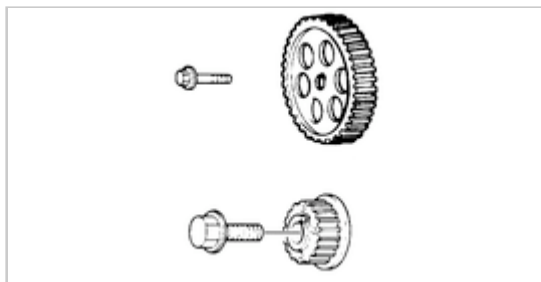
4. Inspect both idler pulley and tensioner pulley for uneven wear and smooth bearing operation.



5. Inspect camshaft pulleys and timing belt pulley for broken teeth or damage.

NOTICE

Replace any component shows damage, excessive wear, or that appears prone to a possible failure.

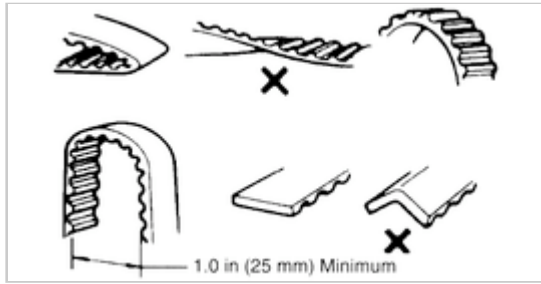


Timing belt

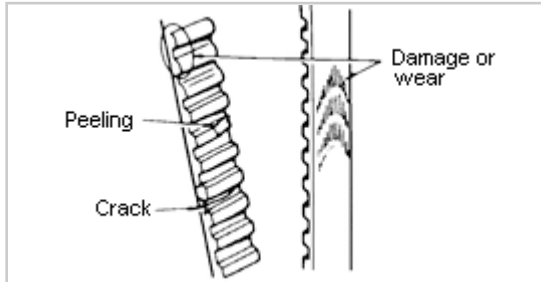
NOTICE

Never forcibly twist turn inside-out or bend timing belt. Do not allow oil or grease to contact belt.

1. Replace timing if it is contaminated with oil or gearse.



2. Check the timing belt for damage, wear, peeling, cracking and hardening. Replace timing belt if necessary.

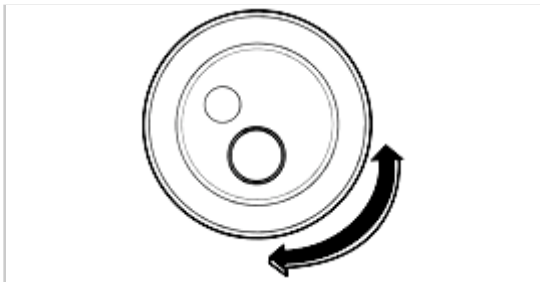


Timing belt tensioner pulley and idler pulley

NOTICE

Do not clean tensioner pulley or idler pulley with cleaning fluids. If needed, use a soft rag to wipe them clean. Avoid scratching tensioner pulley or idler pulley as it can affect integrity of timing belt.

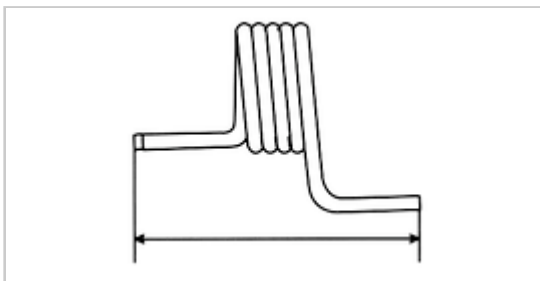
1. Check tensioner pulley and idler for smooth rotation and proper sound. Replace tensioner pulley and idler pulley if necessary.



Tensioner spring

1. Check the free length of tensioner spring. Replace spring if necessary.

Free Length : 1.402in (35.6mm)

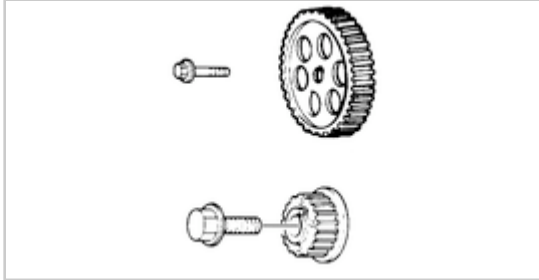


Timing belt and camshaft pulleys

NOTICE

Do not clean pulleys with cleaning fluids. If needed use a soft cloth to wipe them clean, and avoid scratching the pulleys as it will affect integrity of the timing belt.

1. Check pulley teeth for wear deformities and other damage. Replace pulleys if necessary.





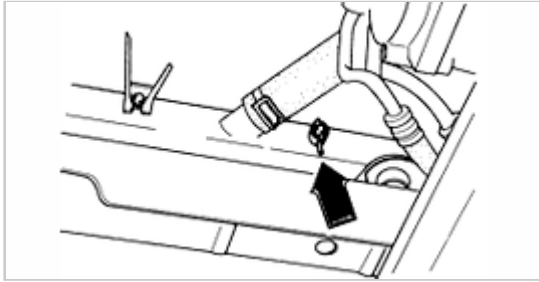
Engine Mechanical System

Cylinder Head Assembly - Valve

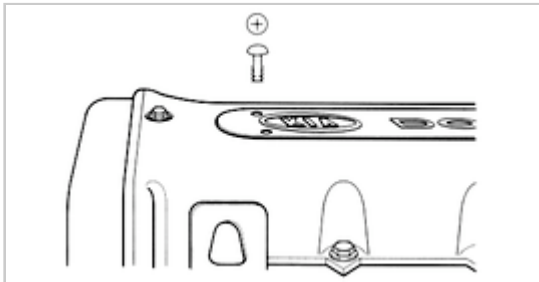


REMOVAL

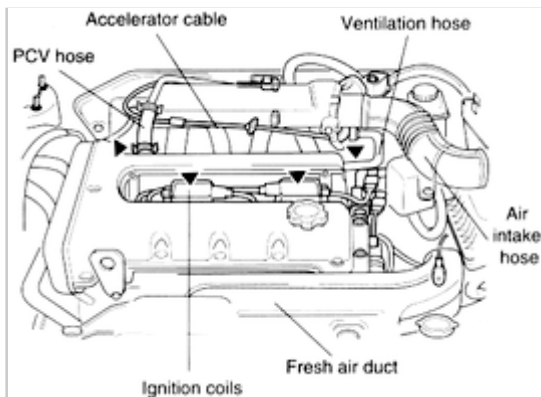
1. Drain engine coolant.



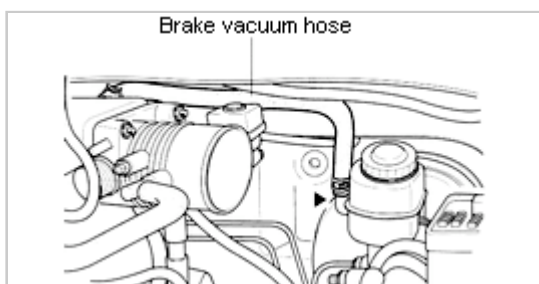
2. Remove timing belt.
(Refer to Timing belt removal)
3. Remove center cover.



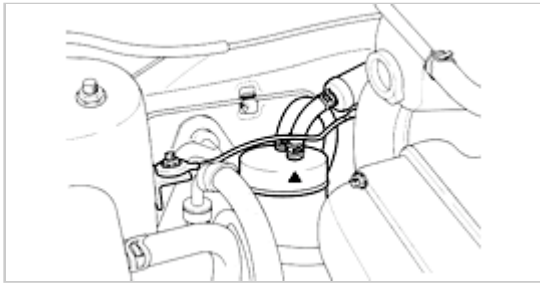
4. Remove ignition coils and high-tension cords.



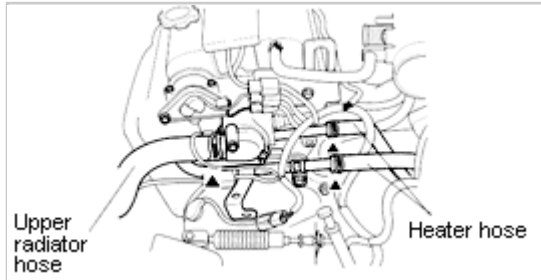
5. Disconnect PCV hose and ventilation hose.
6. Remove accelerator cable and cruise control cable if equipped.
7. Remove air intake hose and fresh air duct.
8. Disconnect bracket vacuum hose from brake master vac.



9. Disconnect purge control vacuum (PCV) hose from charcoal canister.



10. Remove upper radiator hose.

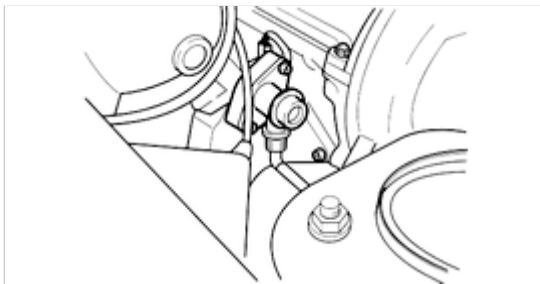


11. Remove heater hoses.

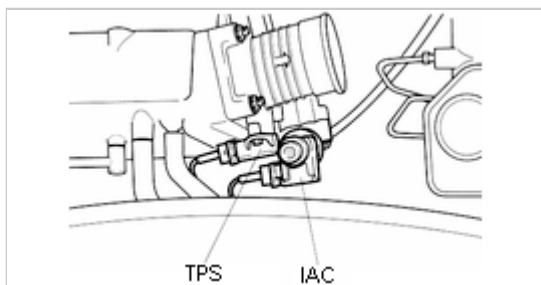
12. Disconnect fuel hose from injector rail.

WARNING

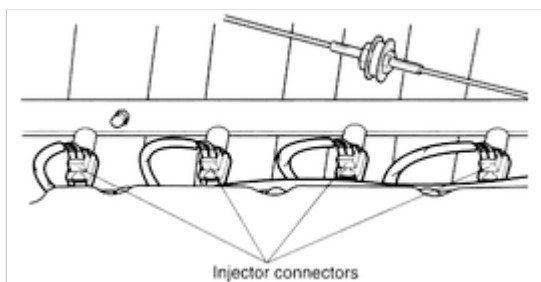
KEEP OPEN FLAMES AND SPARKS AWAY FROM OPEN FUEL LINES OR A FIRE OR EXPLOSION MAY RESULT.



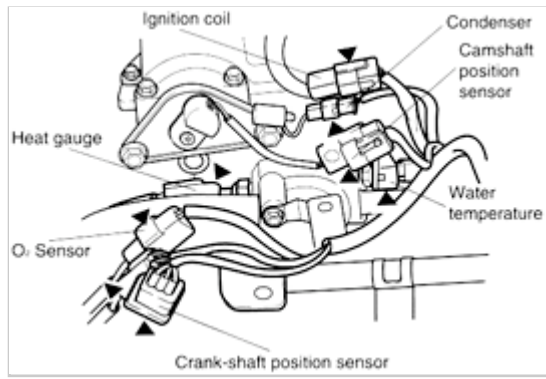
13. Disconnect IAC and throttle position sensor (TPS) connectors.



14. Disconnect injector connectors.



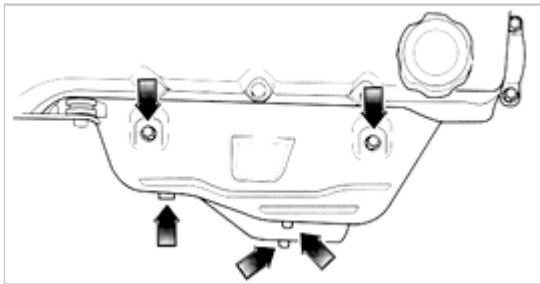
15. Disconnect electric connectors and remove connector bracket.



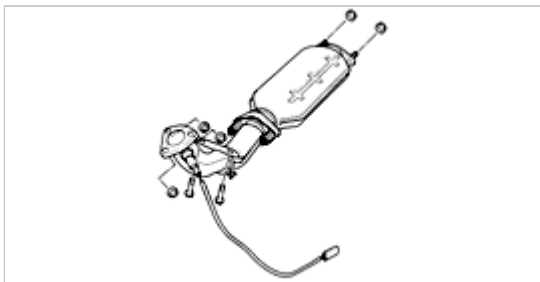
16. Disconnect engine ground strap.



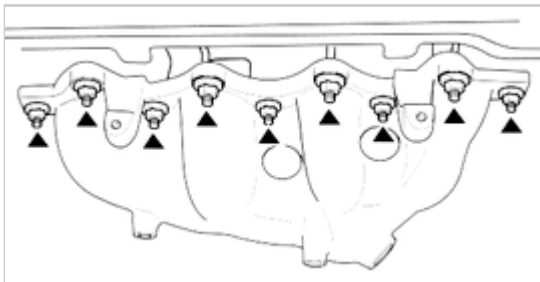
17. Remove exhaust manifold heat shield.



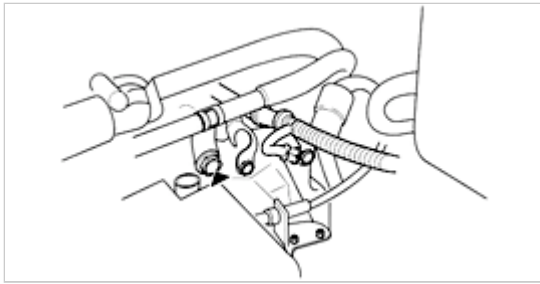
18. Remove front exhaust pipe.



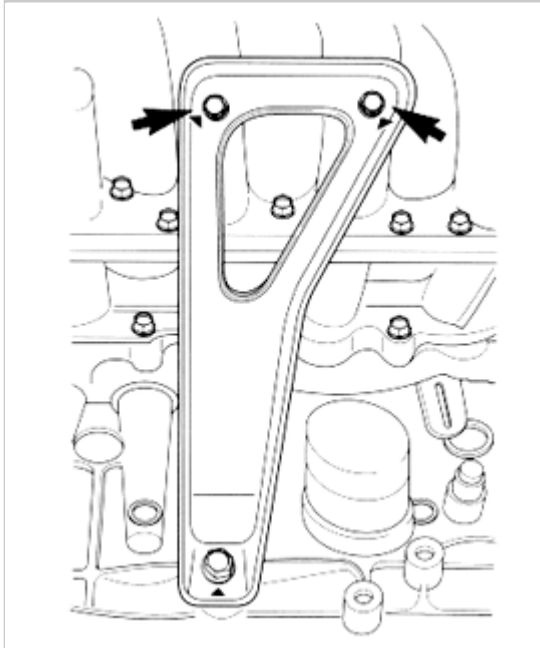
19. Remove exhaust manifold pipe.



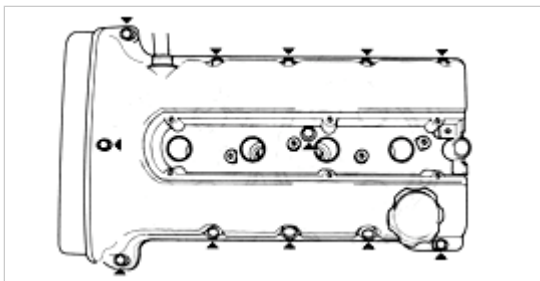
20. Remove coolant bypass pipe.



21. Remove intake manifold support bracket.

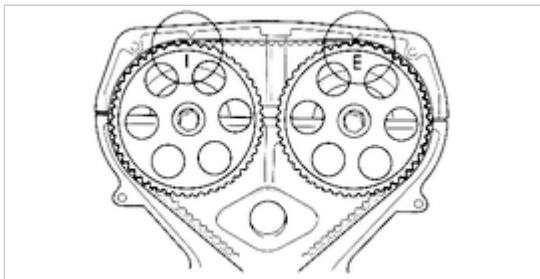


22. Remove cylinder head cover.

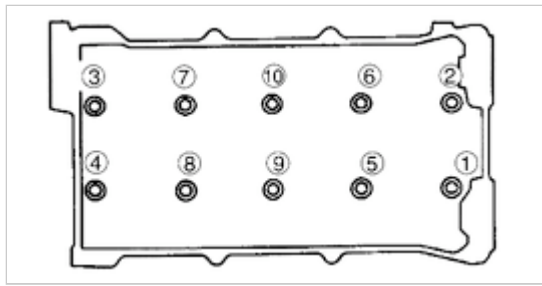


NOTICE

Align camshaft and crankshaft timing alignment marks.



23. Loosen cylinder head bolts in two or three steps following order shown in figure.



24. Remove cylinder head.

INSTALLATION

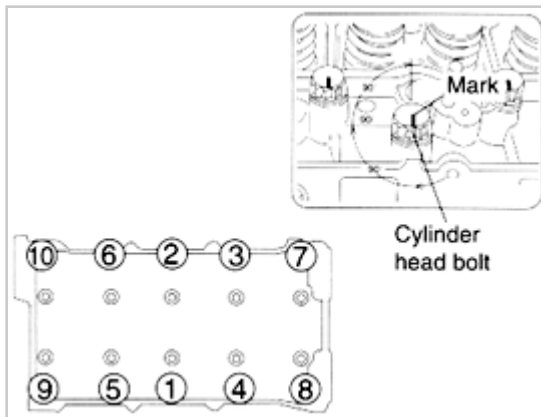
1. Install new cylinder head gasket onto cylinder block and lower cylinder onto engine.
2. Install cylinder head bolts.
3. Tighten cylinder head bolts according to following procedurw :
 - A. Tighten cylinder head bolts in order shown.
 - B. Retighten cylinder head bolts in order shown0

Tightening torque : 36.1lb·ft (49N·m, 5kg-m)

- C. Loosen bolts in reverse of order shown.
- D. Retighten cylinder head bolts in order shown.

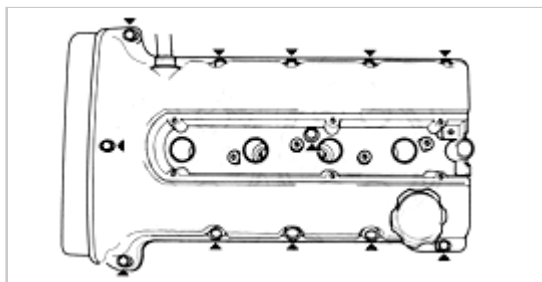
Tightening torque : 28.9lb·ft (39.2N·m, 4kg-m)

- E. Mark cylinder head bolts for rotational reference.
- F. Rotate cylinder head bolts 90°(1/4 Turn) in order shown.
- G. Rotate cylinder head bolts another 90°(1/4 Turn) in order shown.



4. Install cylinder head cover.

Tightening torque : 5.8~8.7lb·ft (7.8~11.8N·m, 0.8~1.2kg-m)

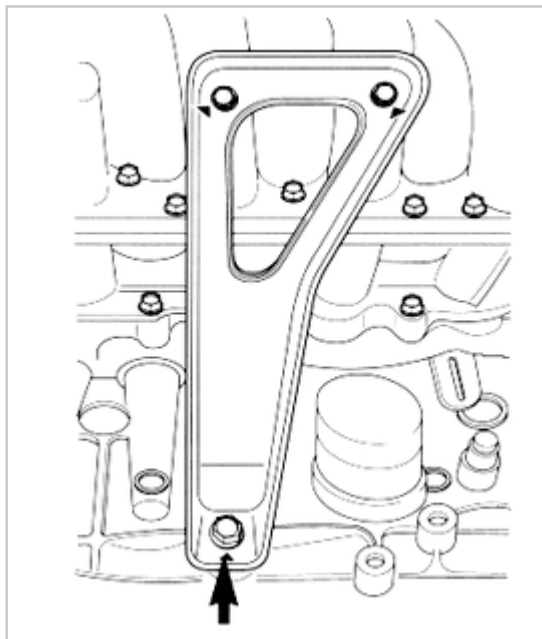


5. Install intake manifold support bracket.

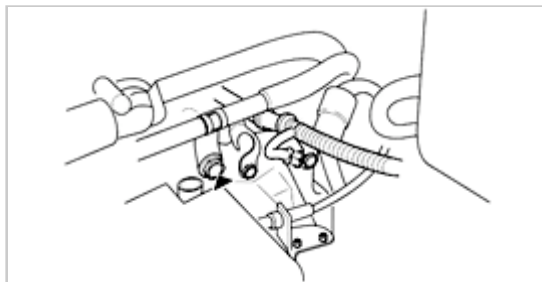
Tightening torque :

(A) : 11.6~16.6lb·ft (15.7~22.5N·m, 1.6~2.3kg-m)

(B) : 26.8~39.8lb·ft (36.3~53.9N·m, 3.7~5.5kg-m)

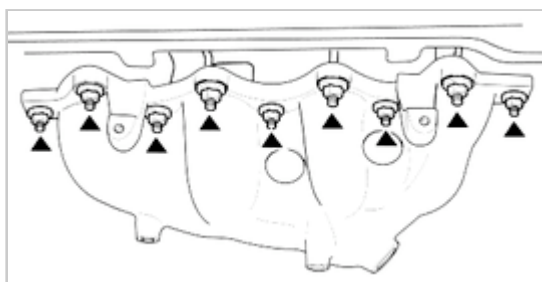


6. Install coolant bypass pipe.



7. Install exhaust manifold pipe.

Tightening torque : 28~34lb·ft (38~46N·m, 3.9~4.7kg-m)

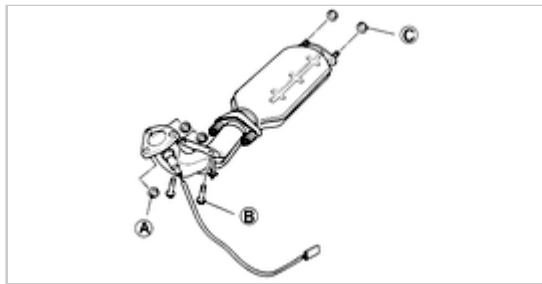


8. Install front exhaust pipe.

Tightening torque :

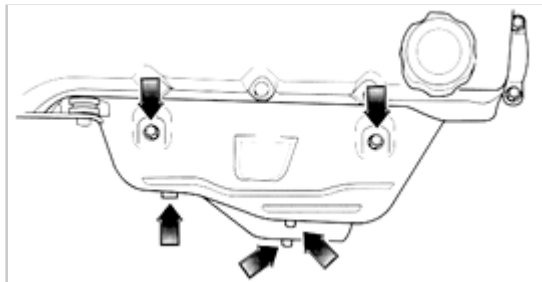
(A), (B) : 27.5~38.3lb·ft (37.3~51.9N·m, 3.8~5.3kg-m)

(C) : 31.1~44.8lb·ft (42.2~60.8N·m, 4.3~6.2kg-m)

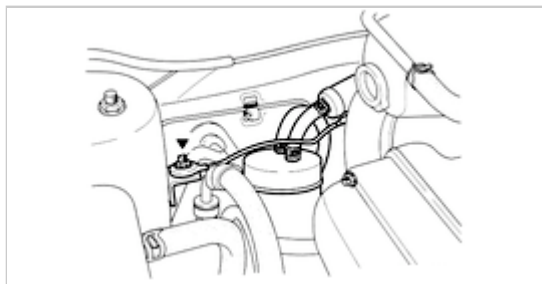


9. Install exhaust manifold heat shield.

Tightening torque : 13.7~18.8lb·ft (18.6~25.5N·m, 1.9~2.6kg-m)

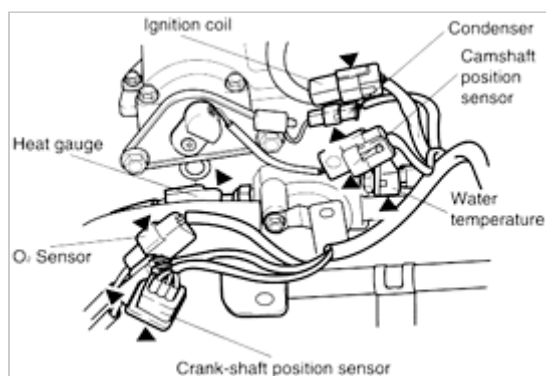


10. Reconnect engine ground strap.

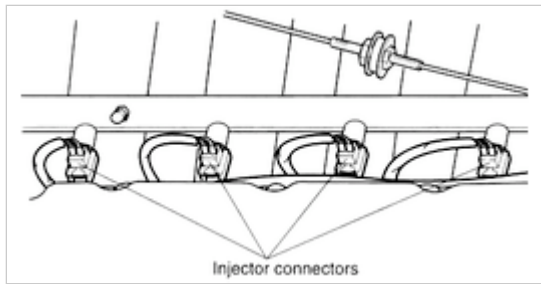


11. Install connector bracket and connect electrical connectors.

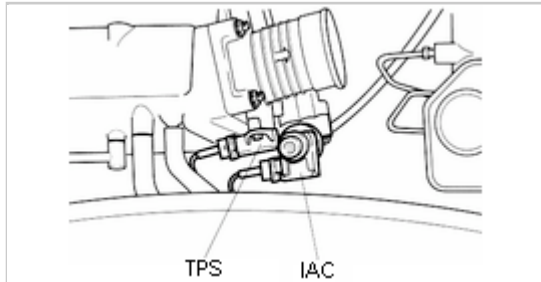
Tightening torque (engine hanger bolt): 27.5~38.3lb·ft (37.2~51.9N·m, 3.8~5.3kg-m)



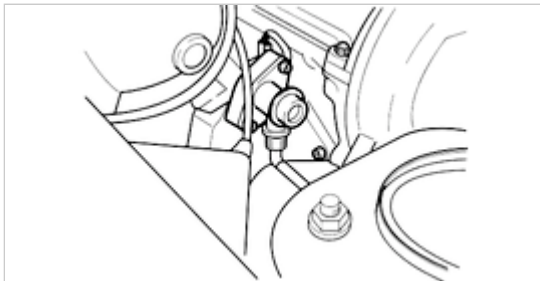
12. Connect injector connectors.



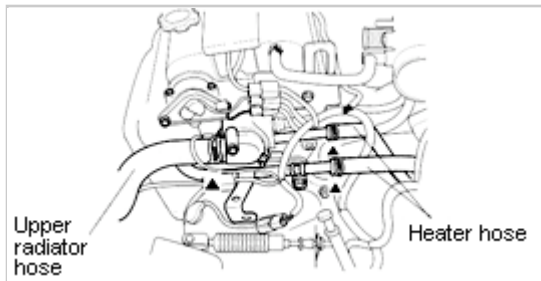
13. Connect IAC and throttle position sensor (TPS) connectors.



14. Connect fuel hose to fuel injector rail.

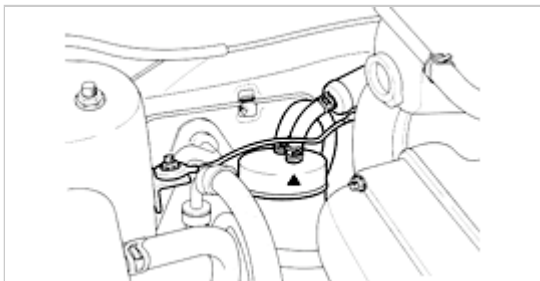


15. Install heater hoses.

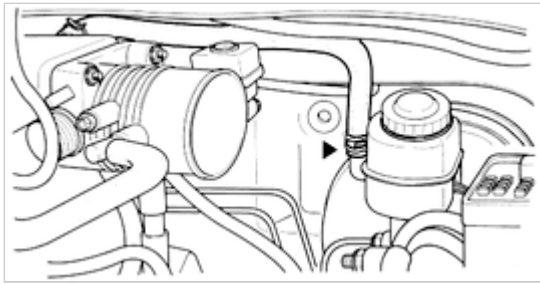


16. Install upper radiator hose.

17. Connect purge control vacuum (PCV) hose to charcoal canister.

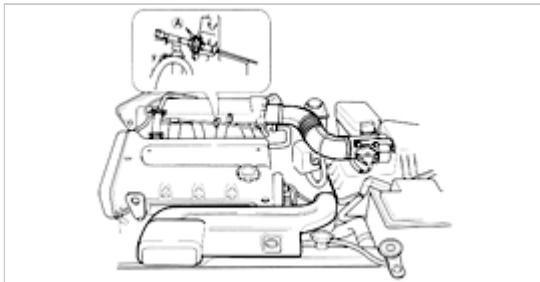


18. Connect brake vacuum hose to brake master vac.

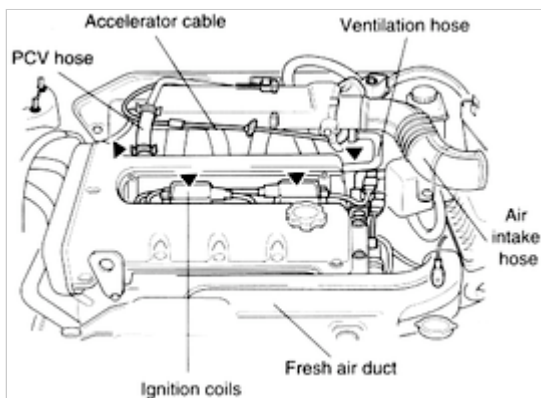


19. Install air intake hose and fresh air duct.
20. Install accelerator cable and cruise control cable if equipped.
21. Check accelerator cable deflection. If deflection is not correct adjust by turning nut/ (A).

Deflection : 0.04~0.12in (1~3mm)

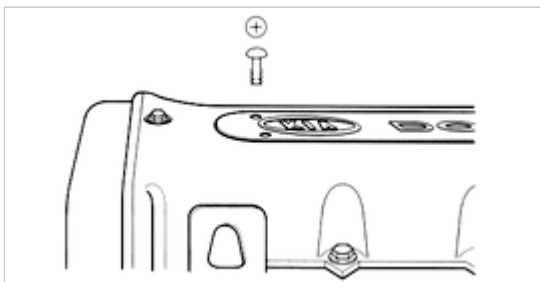


22. Connect PCV hose and ventilation hose.



23. Install ignition coils and high-tension cords.
24. Install center cover.

Tightening torque : 2.9~5.1lb·ft (3.9~6.9N·m, 0.4~0.7kg-m)



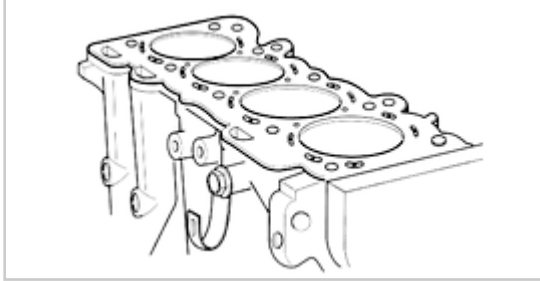
25. Connect negative battery cable.
(Refer to Timing belt installation)
26. Fill engine coolant with specified type and amount. (Refer to cooling system)

27. Start engine and check for oil and coolant leaks.

INSPECTION

Cylinder head and cylinder head gasket

1. Check cylinder head gasket for obvious signs of leakage, coolant stains on gasket, or combustion burns across cylinder.



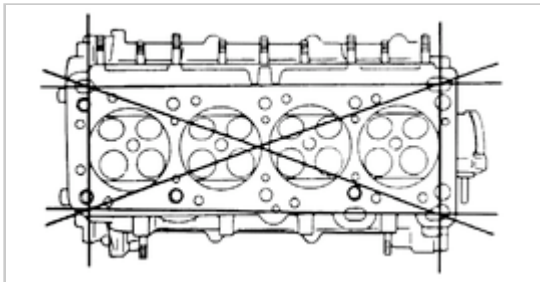
2. Clean cylinder head and cylinder block mounting surfaces of all gasket material.

NOTICE

Do not allow gasket material to fall oil passages or oil control plug.

3. Measure cylinder head for straightness in six directions as shown in figure.

Distortion : 0.004in (0.10mm) Maximum

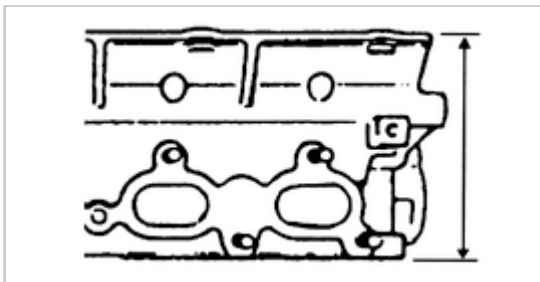


4. If distortion exceed specification, resurface or replace cylinder head. Only remove the amount of material required to achieve a flat surface.

Maximum material removal : 0.004in. (0.1mm)

5. Check cylinder head height.

Height : 5.272~5.276in (133.9~134.1mm)



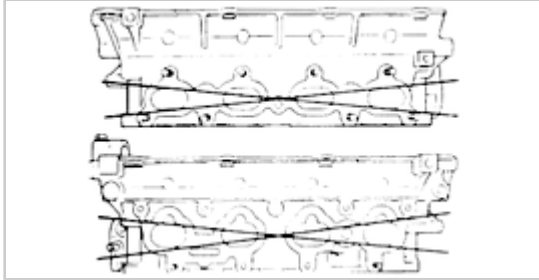
6. If cylinder head height is not within specification, replace cylinder head.

NOTICE

If cylinder head requires machining, remove intake and exhaust manifolds and check their mount surfaces for straightness.

7. Measure intake and exhaust manifold mating surface distortion at two directions shown in figure.

Distortion : 0.008in (0.20mm) Maximum

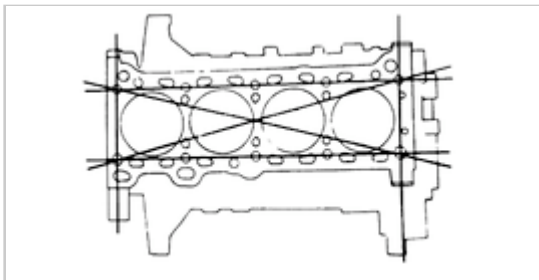


8. If distortion exceeds specification resurface or replace cylinder head.

Maximum material removal : 0.008in (0.20mm)

9. Check cylinder block for distortion of cylinder head mating surface (block deck) in six directions shown in figure.

Disctorion : 0.006in (0.15mm) Maximum



10. If distortion exceeds specification, resurface block deck.

Maximum material removal : 0.0008in (0.20mm)

Cylinder head

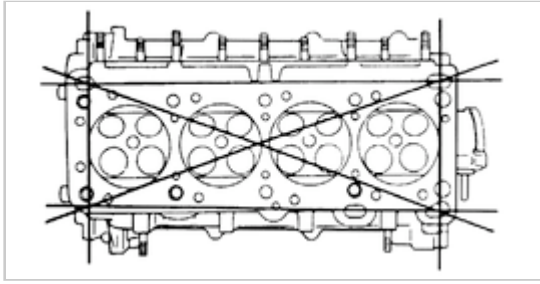
1. Inspect cylinder head for damage, cracks and leakage of oil and water. Replace cylinder head if necessary.
2. Measure cylinder head mating surface in six directions as shown in figure.

Distortion : 0.004in (0.10mm) maximum

NOTICE

Before resurfacing cylinder head, check following repair or replace cylinder head if necessary.

- Sunken valve seats.
- Damage at intake and exhaust manifold mating surfaces.
- Camshaft oil clearances and end play.

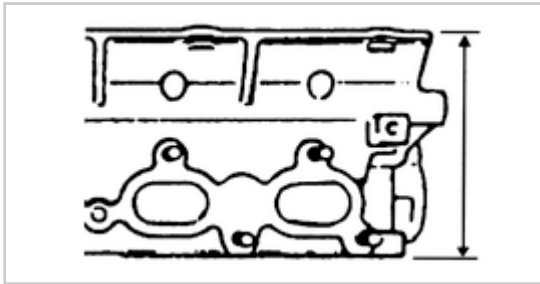


3. Grind cylinder head mating surface if distortion exceeds specification.

Distortion : 0.004in (0.10mm) maximum

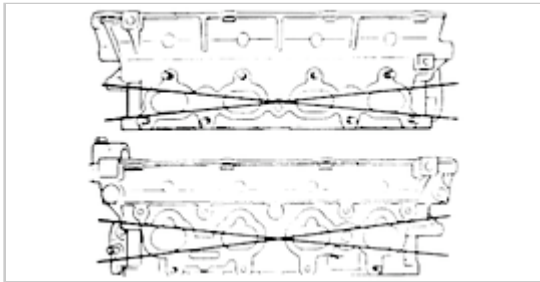
4. Check cylinder head height by measuring from cylinder deck surface to cylinder head cover gasket surface.
 5. If cylinder head height is not within specification, replace cylinder head.

Height : 5.272~5.28in (133.9~134.1mm)



6. Measure intake and exhaust manifold mating surface distortion at two direction at two directions shown in figure.

Distortion : 0.008in (0.20mm) maximum



7. If distortion exceeds specification, resurface or replace cylinder head.

Distortion : 0.008in (0.20mm) maximum



Engine Mechanical System

Cylinder Head Assembly - Cylinder Head



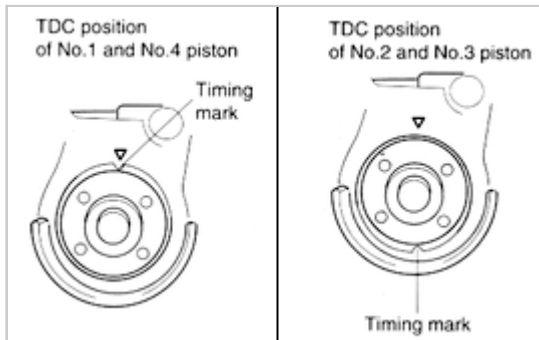
REMOVAL

Valve seal

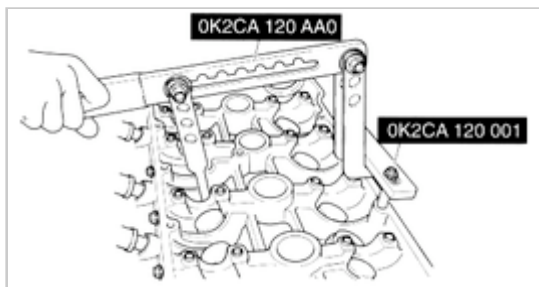
1. Removal HLA.
2. Set piston to TDC position for removing valve seal by rotate crankshaft.

NOTICE

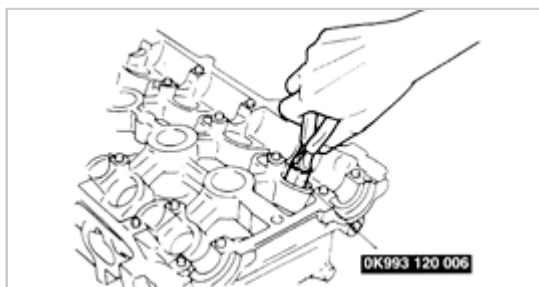
If timing mark on crankshaft pulley is aligned with timing mark on engine No.1 and No.4 piston are located on TDC position.



3. Install SST (OK2CA 120 AA0, OK2CA 120 001) on cylinder head.



4. Compress valve spring with SST and allow enough room to remove valve locks.
5. Slow release pressure and remove upper spring seat and valve spring from cylinder head.
6. Remove valve seal with SST (OK993 120 006).



INSTALLATION

Valve seal

1. Install valve seal with SST (OK2CA 120 005I-Intake/OK2CA 120 005E-Exhaust).



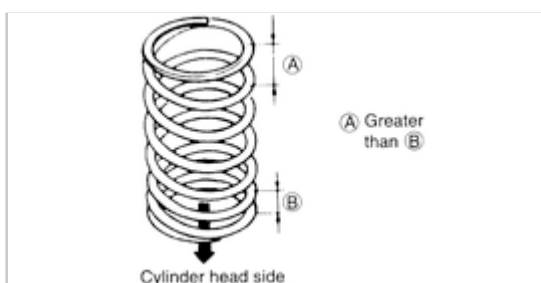
NOTICE

Intake and exhaust valve seals are different.
Only exhaust valve seals have four teeth.

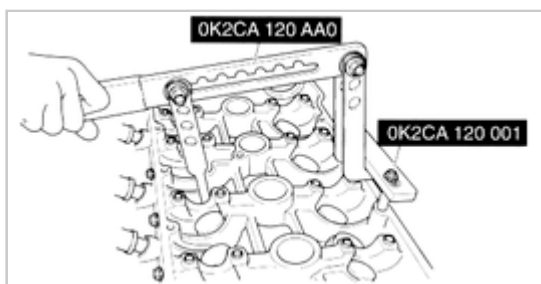
CAUTION

Using a hammer will damage valve seals.

2. Install valve spring with narrow spring coil (B) toward cylinder head.



3. Install upper spring seat and compress valve spring with SST(OK2CA 120 AA0, OK2CA 120 001).



4. Install valve locks and release SST from valve spring.
5. Tap end of valve stem lightly two or three times with a plastic hammer to verify that valve locks are fully seated.
6. Install HLA. (Refer to HLA replacement).

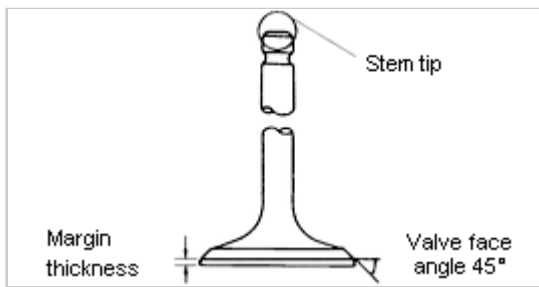
INSPECTION

1. Inspect each valve for following :
 - A. Damaged or bent valve stem
 - B. Rough or damaged face
 - C. Damaged or unevenly worn stem tip
2. Resurface or replace valve as needed.

Margin thickness

Intake : 0.0472in (1.2mm)

Exhaust : 0.0472in (1.2mm)

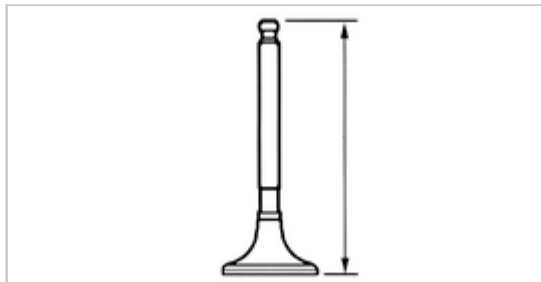


3. Measure length of each valve.

Length

Intake : 4.052in (1.2mm)

Exhaust : 0.0472 (1.2mm)

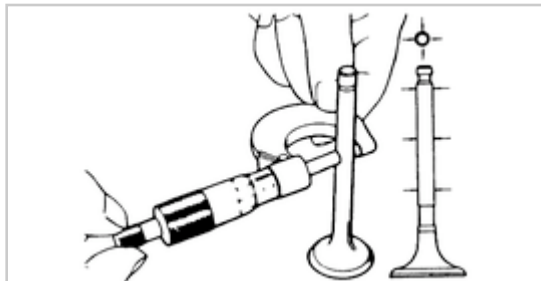


4. Measure diameter of each valve stem.

Diameter

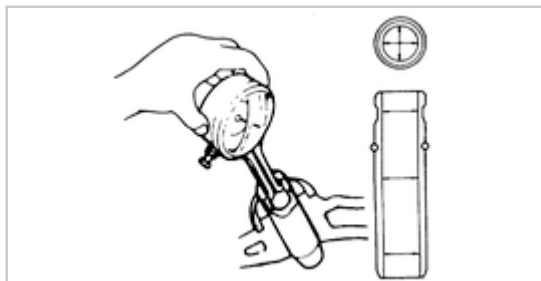
Intake : 0.2350~0.2356in (5.970~5.985mm)

Exhaust : 0.2348~0.2354in (5.965~5.980mm)



5. Measure inside diameter of each valve guide at points shown in figure.

Diameter intake and exhaust valve guide : 0.2367~0.2374in (6.01~6.03mm)



6. Calculate valve stem-to-valve guide clearance.

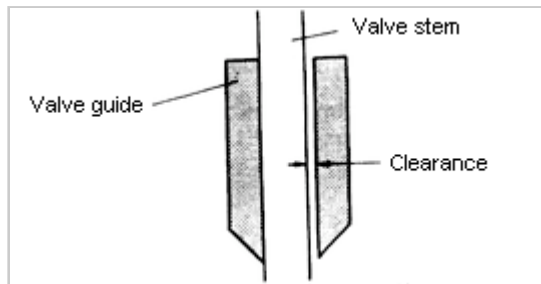
Subtract outer diameter of valve stem from inside diameter of respective valve guide.

Clearance

Intake valve : 0.0019~0.0023in (0.05~0.0023in (0.05~0.060mm)

Exhaust valve : 0.0012~0.0025in (0.030~0.065mm)

Max : 0.008in (0.20mm)



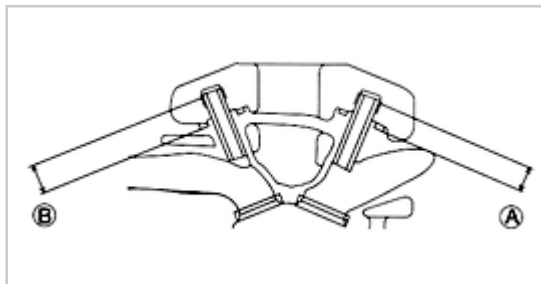
7. If clearance exceeds specification, replace valve and or valve guide.

8. Measure protrusion height of each valve guide.

Replace valve guide as needed.

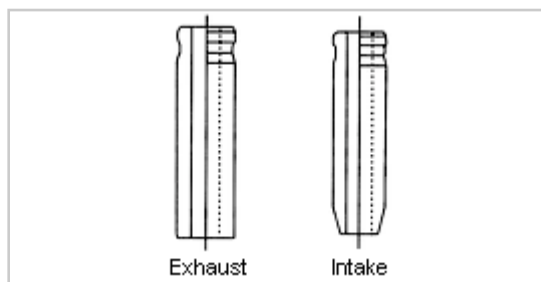
(A) : Intake : 0.539~0.536in (13.7~14.3mm)

(B) : Exhaust : 0.658~0.681in (16.7~17.3mm)



NOTICE

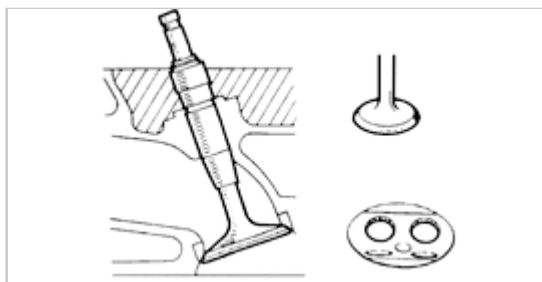
Intake and exhaust valve guides are different. Be sure to use correct valve guide.



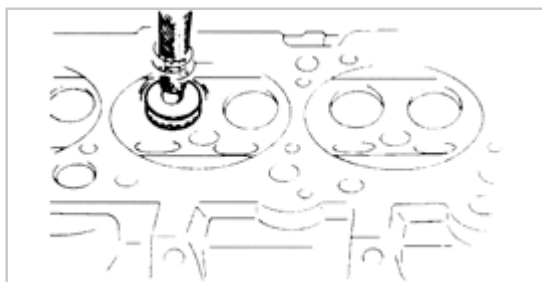
Valve seat

1. Inspect contact surface of each valve seat and valve face for following :

- A. Roughness
- B. Damage
- C. Pitting
- D. Cracks

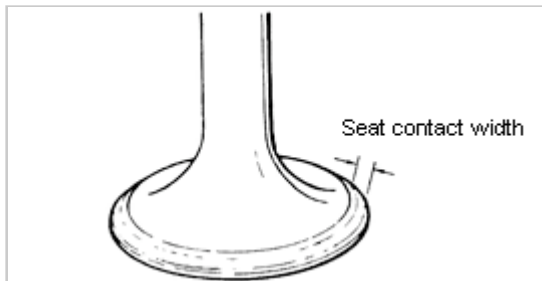


2. Resurface valve seats with a 45° valve seat cutter.
Resurface valve faces as needed.

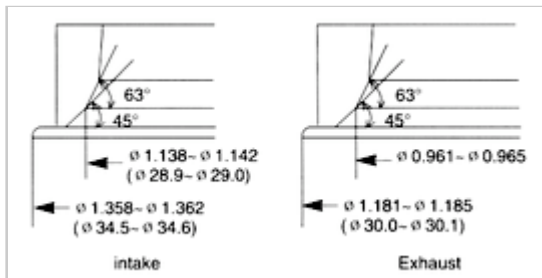


3. Apply a coat of Dychem blue to valve face and valve seat and allow to dry.
4. Inspect valve seating by pressing valve against seat and rotating valve 360°.
 - A. If Dychem blue is not removed 360° around valve face, replace valve.
 - B. If Dychem blue is not removed 360° around valve seat resurface valve seat.
5. Measure seat contact width.

Width : 0.078~1.059in (1.98~2.69mm)



6. Check that seat contact area is at center of valve face.
 - A. If valve seating position is too high, correct valve seat with a 63° valve seat cutter, and a 45° cutter.
 - B. If seating position is too low correct valve seat with a 0° and a 45° cutter.



7. Complete seat-cutting process by lapping valve to seat using valve lapping compound.
8. Inspect valve seat for sinking.

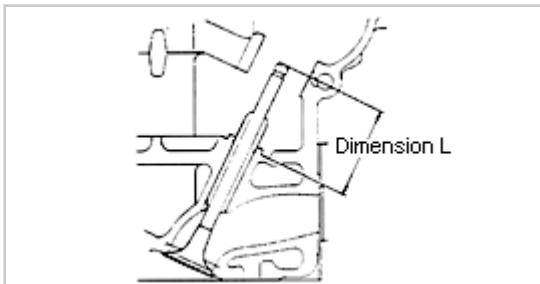
NOTICE

Clean valves thoroughly before reassembly and insure that all traces of lapping compound has been removed.



9. Check for valve sink by measuring protruding length (Dimension L) of valve stem to lower valve spring seat.

Dimension L measurement	Action
IN : 1.432~1.467in (36.37~37.27mm) EX : 1.431~1.467in (36.36~37.26mm)	No correction needed
IN : 1.467~1.495in (37.27~37.97mm) EX : 1.467~1.494in (37.26~37.96mm)	Adjust with washer on spring seat area of cylinder head
IN : 1.495in (37.97mm) EX : 1.494in (37.96mm)	Replace the cylinder head

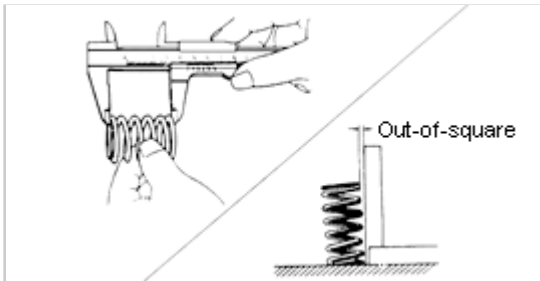


Valve spring

1. Inspect each valve spring for cracks and damage.
2. Measure free length and out-of-square. Replace valve spring as needed.

Free length : 1.77in (44.92mm)

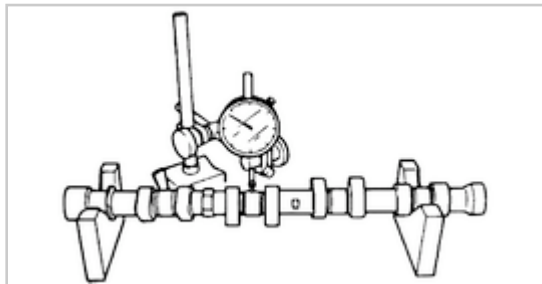
Out-of-square : 0.0618in (1.57mm) maximum



Camshaft

1. Set front and rear camshaft bearing journals on V-blocks.
2. Position a dial indicator on center bearing journal and zero dial.
3. Rotate camshaft if V-blocks and check runout.

Runout : 0.0012in (0.03mm) maximum

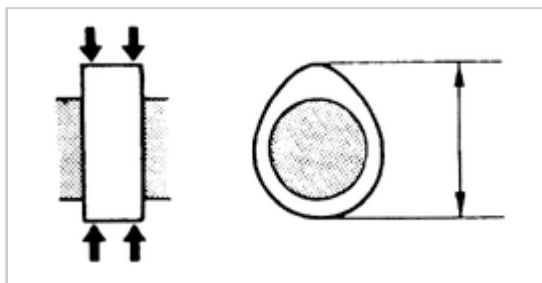


4. Check camshaft for even wear patterns, cracks, or damage.
 5. Measure cam lobe heights at two points as shown.
-

Lobe height

Intake : 1.6415in (41.6949mm)

Exhaust : 1.6629in (42.2369mm)

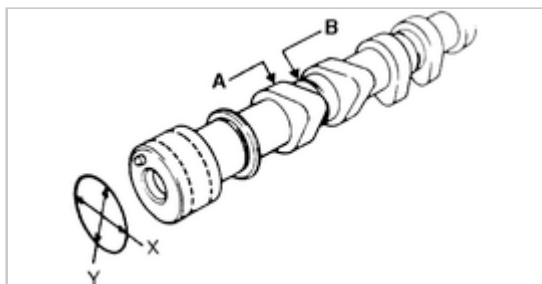


6. Check camshaft bearing journal diameter (X and Y directions) on both sides (A and B) of journal as shown in figure.
-

Standard diameter : 1.0606~1.0616in (26.940~26.965mm)

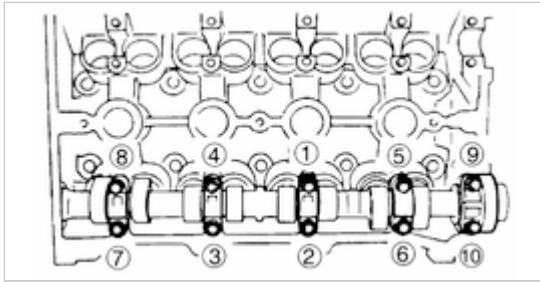
Minimum diameter : 1.0594in (26.910mm)

Out-of-round : 0.002in (0.05mm) maximum

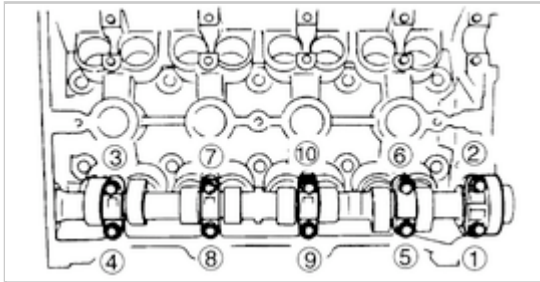


7. Replace camshaft if necessary.
 8. Measure camshaft journal oil clearance with HLA's removed.
 9. Remove all foreign material and oil from journals and bearing surfaces.
 10. Set camshafts onto cylinder head.
 11. Position Plastigage® on journals in axial direction.
 12. Do not rotate camshafts.
 13. Install camshaft caps according to cap number and arrow mark.
 14. Install cap bolts. Tighten them in five or six steps in order shown.
-

Tightening torque : 8.32~10.49lb·ft (11.28~14.22N·m, 1.15~1.45kg·m)



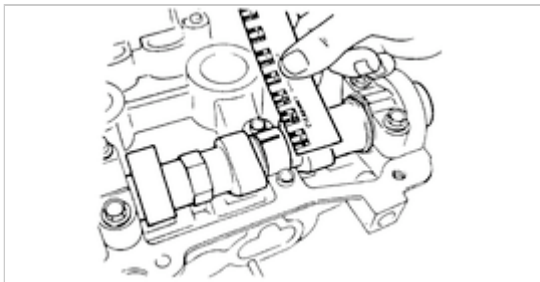
15. Loosen camshaft cap bolts in five or six steps in order shown.
16. Remove camshaft caps.



17. Measure oil clearance.

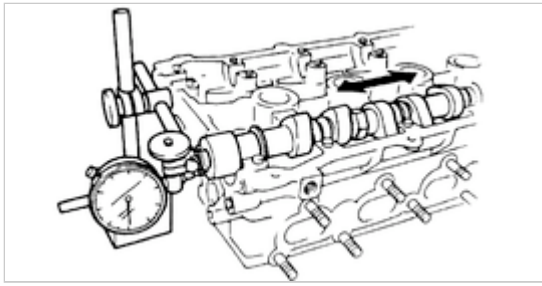
Oil clearance : 0.0014~0.0031in (0.035~0.081mm)
Maximum : 0.006in (0.15mm)

18. If oil clearance exceeds specification, replace cylinder head.



19. Install camshafts.
20. Place a dial indicator against end of camshaft.
21. Using a prying tool, move camshaft as far forward as possible.
22. Zero dial.
23. Using prying tool, move camshaft as far forward as possible.
24. Check gauge to determine how much end play in present.

End play : 0.0003~0.004in (0.08~0.10mm)
Maximum : 0.008in (0.20mm)





Engine Mechanical System

Engine Mechanical System

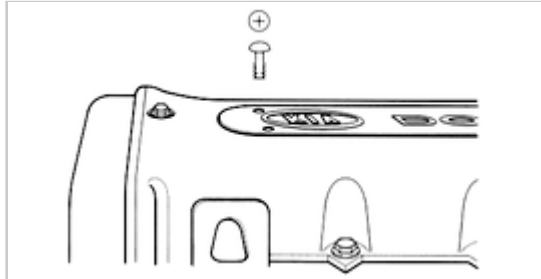
Cylinder Head Assembly - HLA

(Hydraulic Lash Adjuster)

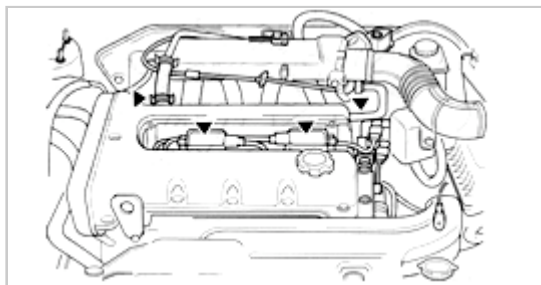


REMOVAL

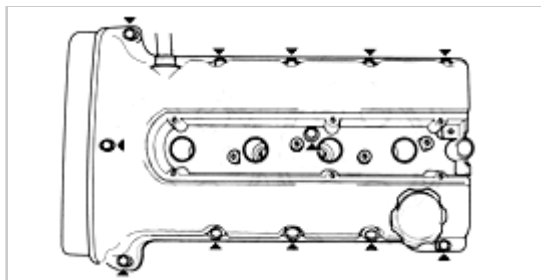
1. Remove timing belt.
(Refer to timing belt removal)
2. Remove center cover.



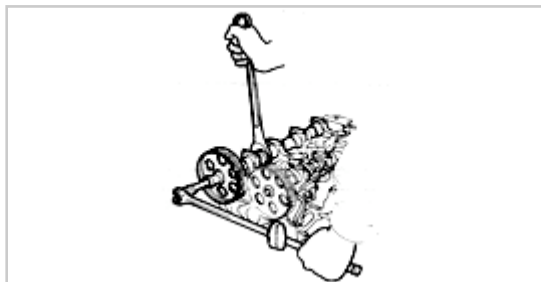
3. Remove ignition coils and high-tension cords.



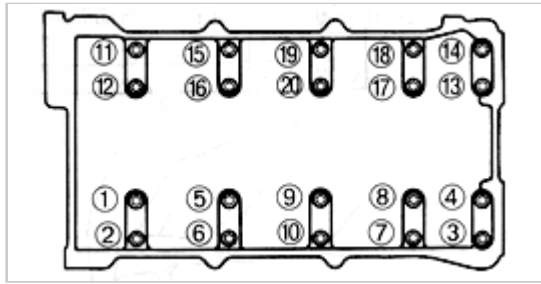
4. Disconnect PCV hose and ventilation hose.
5. Remove cylinder head cover.



6. Remove camshaft pulleys.



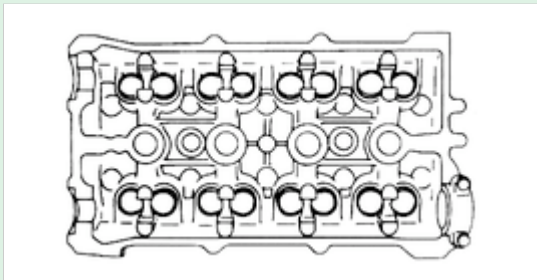
7. Loosen camshaft bearing cap bolts in five or six steps in order shown in figure.



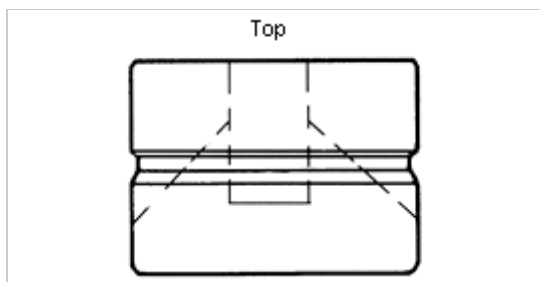
8. Remove camshafts.
9. Mark HLA's to identify their original position if they will be reused.

NOTICE

Hydraulic Lash Adjusters (HLA) must be installed on location from which they were removed. Failure to install HLA's in their original location will result in premature and uneven wear of HLA's and camshaft.

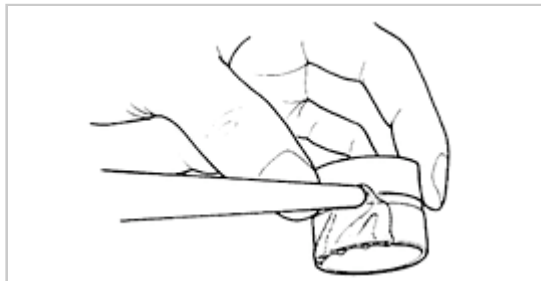


10. Remove HLA's from cylinder head.
11. Store HLA's upside-down in an oil-filled container.



INSTALLATION

1. Apply a coat clean engine oil to friction surfaces of HLA.



2. Install HLA into cylinder head bore.

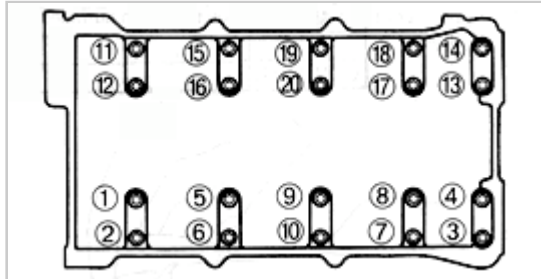
NOTICE

If HLA is being reused, install it in its original position.

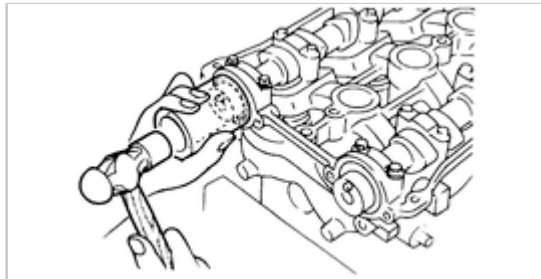
3. Check that HLA moves smoothly in its bore.

4. Apply clean engine oil to camshaft and camshaft bearing surfaces and install camshaft so that camshaft dowel pins point straight up.
5. Install camshaft bearing caps according to cap number with the directional arrows pointing forward.
6. Install bolts to camshaft bearing caps and tighten in five or six steps in order shown in figure.

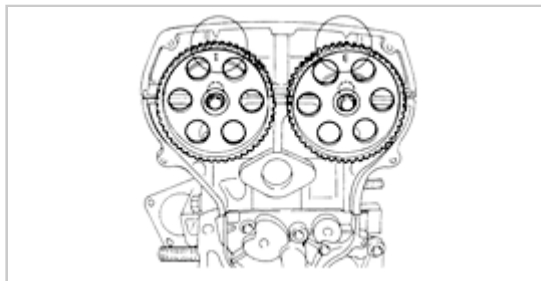
Tightening torque : 8.32~10.49lb·ft (11.28~14.22N·m, 1.15~1.45kg-m)



7. Apply a coat of clean engine oil to the lip of new camshaft seal.
8. Seat camshaft seal by hand and tap the seal in place until it is flush with the edge of camshaft bearing cap.

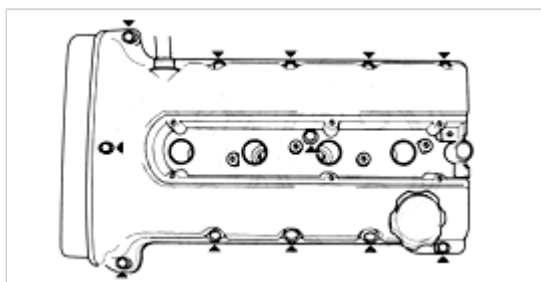


9. Install camshaft pulleys onto camshaft aligning "I" mark with the intake camshaft dowel pin and "E" mark with exhaust camshaft dowel pin.

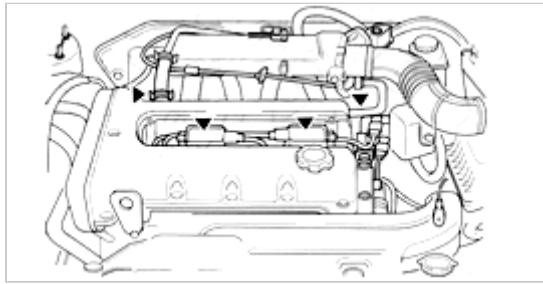


10. Install cylinder head cover.

Tightening torque : 5.8~8.7lb·ft (7.8~11.8N·m, 0.8~1.2kg-m)

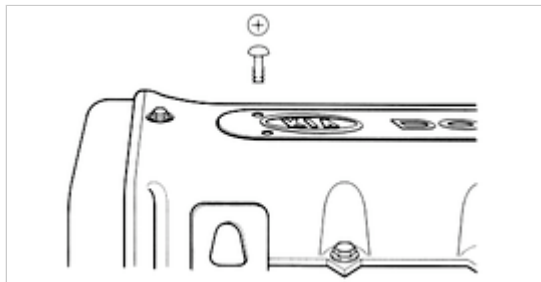


11. Connect PCV hose and ventilation hose.



12. Install high tension cords and ignition coils.
13. Install center cover.

Tightening torque : 2.9~5.1lb·ft (3.9~6.9N·m, 0.4~0.7kg-m)



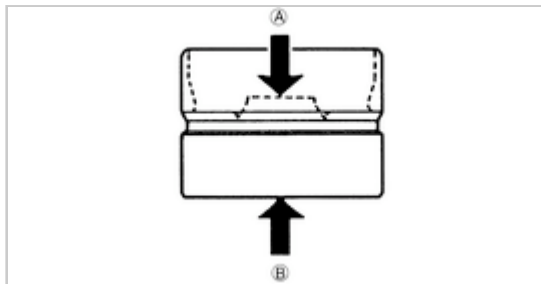
14. Connect negative battery cable.
(Refer to Timing belt replacement)

INSPECTION

1. Check HLA face for wear or damage, and replace if necessary.
2. With HLA with engine oil, hold (A) and press down on (B) by hand. If (B) moves, Replace HLA.

NOTICE

Never attempt to repair or disassemble an HLA.



3. Measure HLA bore diameters (X and Y directions) at two points (A and B) as shown.

Distirtion : 1.1812~1.1820 in (30.000~30.025mm)



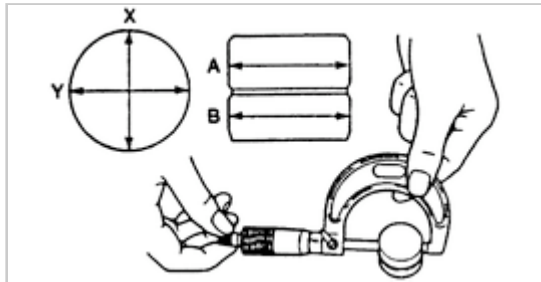
4. Measure HLA diameters (X and Y directions) at two points (A and B) as shown.

Diameter : 1.1795~1.1801in (29.959~29.975mm)

5. Calculate clearance between HLA diameter and related HLA bore. Replace HLA and/or cylinder head if necessary.

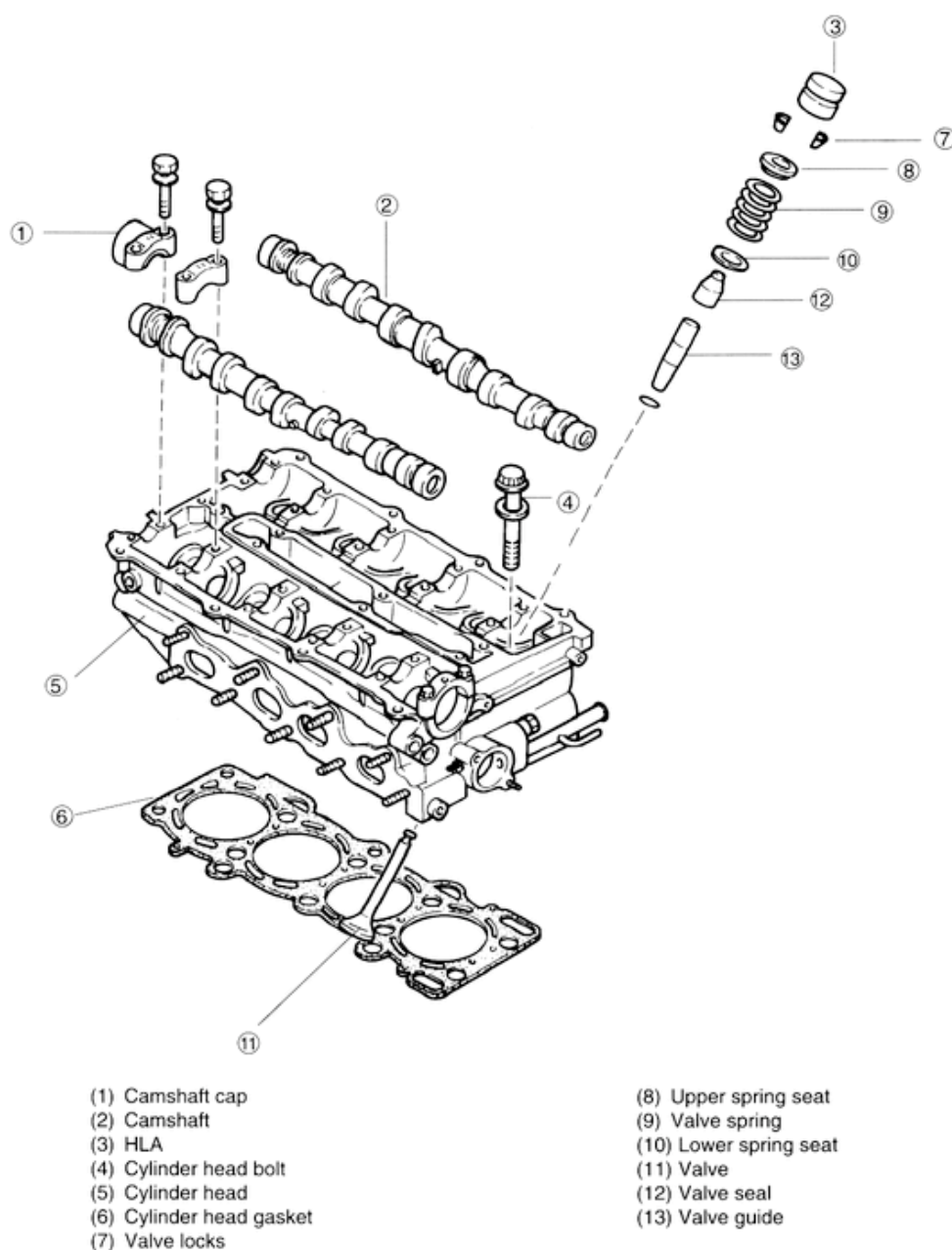
Clearance : 0.00099~0.00259in (0.025~0.066mm)

Maximum : 0.0071in. (0.180mm)





COMPONENT





Engine Mechanical System

Cylinder Block - Piston and Connecting Rod



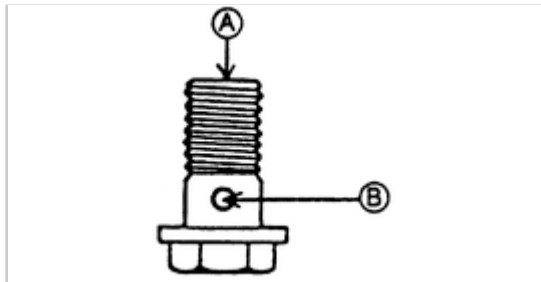
INSPECTION

Piston cooling jets

1. Apply compressed air to each piston cooling jet valve at (A) and verify that air passes through piston cooling jet valve at (B). If air does not pass, replace piston cooling jet valve.

Air pressure : 24.2~32.7psi (166.8~225.6kpa, 1.7~2.3kg/cm²) maximum

2. Check piston cooling jet nozzle for clogs. Replace nozzle if necessary.

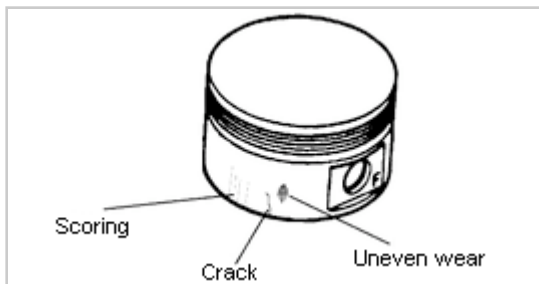


Piston

NOTICE

Replacing a piston also requires replacing piston ring.

1. Check circumference of damage, scoring, or unusual wear patterns. Replace piston as needed.



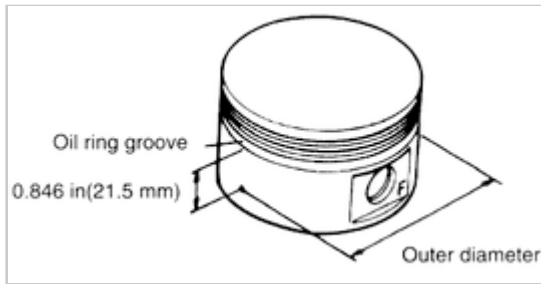
2. Check outside diameter of each piston at a 90° right angle to piston pin, 0.846in (21.5mm) below oil ring land's lower edge.

Piston diameter

Bore size	TBD
standard	3.1872~3.1879in (90.954~90.9720mm)
Standard + 0.010in (0.25mm)	3.197~3.1977in (81.204~81.222mm)
Standard + 0.020in (0.50mm)	3.2069~3.2076in (81.454~81.472mm)

NOTICE

If piston is collapsed or ball mouthed, replace piston.

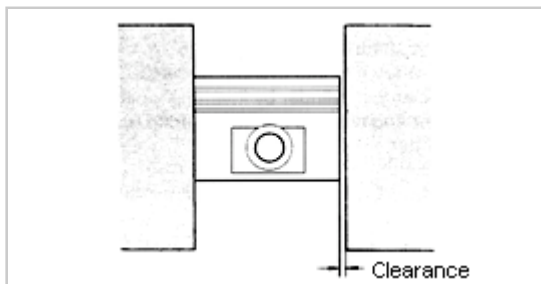


3. Check piston-to-cylinder wall clearance by subtracting piston diameter from the large cylinder subtracting piston diameter from the largest cylinder wall diameter at each cylinder.

Clearance : 0.00157~0.0021in (0.040~0.053mm)

Maximum : 0.006in (0.15mm)

4. If clearance exceeds maximum, replace piston or rebore cylinders and fit oversized pistons to all cylinder.



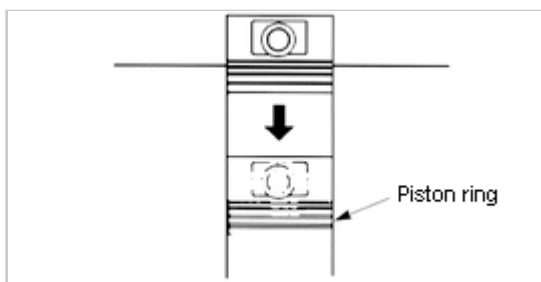
Piston ring

1. Insert a new piston ring into a piston ring groove and check piston ring-to side clearance.

Ring	Standard clearance	Maximum clearance
Top	0.002~0.003in (0.04~0.08mm)	0.006in (0.15mm)
Second	0.001~0.003in (0.03~0.07mm)	0.006in (0.15mm)



2. If clearance exceeds the maximum replace piston.
3. Inspect piston rings for damage, abnormal wear or breakage.
4. Replace piston rings if necessary.
5. Insert piston ring into cylinder by hand.
6. Square ring in cylinder by inverting a piston into cylinder and pushing ring to the bottom of its travel in cylinder.



7. Replace a feeler gauge in end gap and check end gap clearance.

End gap clearance

Ring	Specification
Top ring	0.006~0.011in (0.15~0.30mm)
Second ring	0.012~0.018in (0.30~0.45mm)
Oil rail	0.008~0.027in (0.20~0.70mm)
Maximum	0.039in (1.0mm)

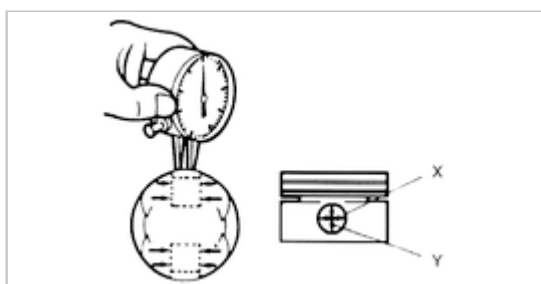


8. Replace piston ring if necessary.

Piston pin

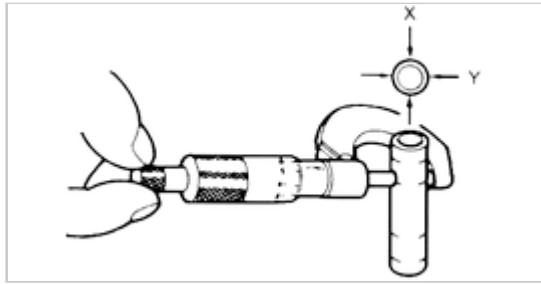
1. Measure each piston pin hole diameter at X and Y directions in four locations shown in figure.

Diameter : 0.7872~0.7875in (19.994~20.002mm)



2. Measure each piston pin diameter at X and Y direction at four locations shown.

Diameter : 0.7869~0.7871in (19.987~19.993mm)



3. Subtract piston pin diameter from pin hole diameter to determine piston to piston clearance.

Clearance : 0.00004~0.0006in (0.001~0.015mm)

4. If clearance exceeds specification, replace piston and piston pin.

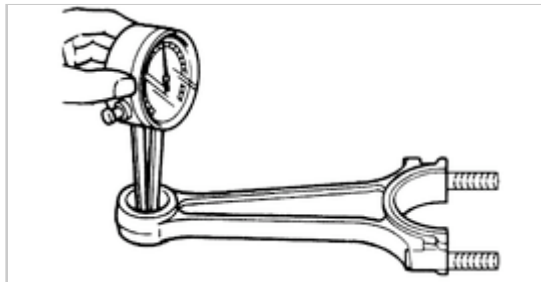
NOTICE

Piston and piston pin are a matched set.

INSPECTION

1. Check connecting rod bushing inside diameter.

Inside diameter : 0.7875~0.7880in (20.003~20.014mm)



2. Subtract piston pin diameter from connecting rod bushing inside diameter to determine piston pin fit.

Clearance : 0.0004~0.0010in (0.010~0.027mm)

3. If clearance is not within specification, replace connector rod bushing.
4. Check each connecting rod for bending.



5. Replace connecting rod if necessary.

NOTICE

Connecting rods must always be replaced as an assembly. Rod cap, rod bolts and nuts are matched set.



Engine Mechanical System

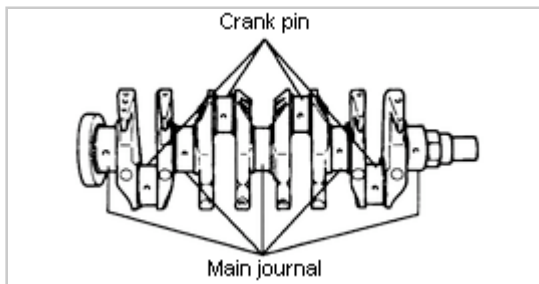
Cylinder Block - Crankshaft



INSPECTION

1. Check crankshaft bearing and crank pin journal for damage and scoring.
2. Check oil holes for clogging.
3. Set crankshaft on V-blocks.
4. Measure crankshaft run-out at center journal.
Replace crankshaft if it is not within specification.

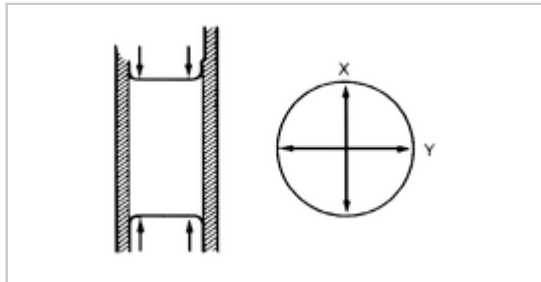
Runout : 0.0016in (0.04mm)



5. Use a micrometer to measure crankshaft main bearing journals and crank pin journals at X and Y direction as shown.

Crankshaft journal diameter

Journal	Diameter	Out of round
Main	2.1629~2.1639in (54.938~54.956mm)	0.0020in (0.05mm)
Crank pin	1.7693~1.77in (44.940~44.958mm)	0.0020in (0.05mm)



6. Grind crankshaft only if there is visible scoring or if out-of-round is excessive.
7. Only grind crankshaft amount necessary to correct condition.
8. If crankshaft must be ground 0.020in (0.50mm) or more, heat-treat crankshaft to ensure durability.

Main journal diameter undersizes :

Bearing size	Journal diameter
0.010in (0.25mm) undersize	2.1531~2.1538in (54.688~54.706mm)
0.020in (0.50mm) undersize	2.1432~2.1439in (54.438~54.456mm)
0.030in (0.75mm) undersize	2.1334~2.1341in (54.188~54.206mm)

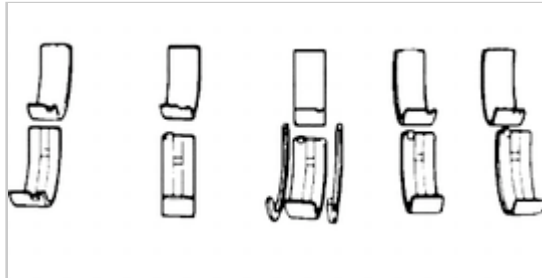
Crank pin journal undersizes

Bearing size	Journal diameter
--------------	------------------

0.010in (0.25mm) undersize	1.7594~1.7602in (44.690~44.708mm)
0.020in (0.50mm) undersize	1.7496~1.7503in (44.440~44.458mm)
0.030in (0.75mm) undersize	1.7308~1.7505in (44.190~44.208mm)

Main bearing and connecting rod bearing

1. Check main and connecting rod bearing for peeling, scoring and other damage.





Engine Mechanical System

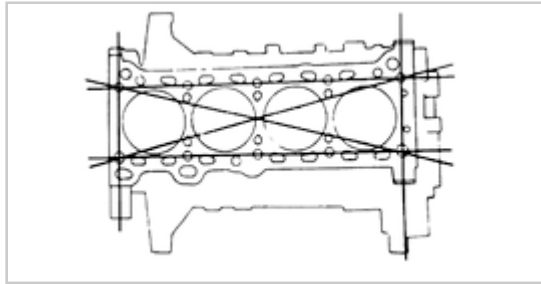
Cylinder Block - Cylinder Block



INSPECTION

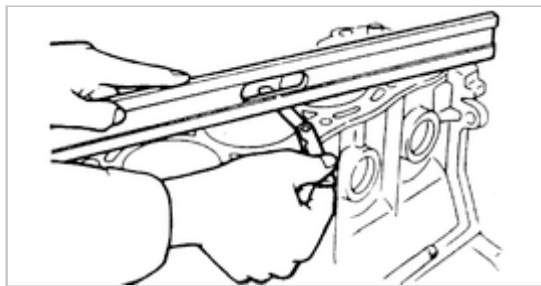
1. Check cylinder block for following conditions and repair or replace cylinder block as needed.
 - (1) A. Leakage damage
 - B. Cracks
 - C. Scoring of cylinders
2. Check distortion of cylinder head mating surface (block deck) in six directions shown in figure.

Distortion : 0.006i (0.15mm) maximum



3. Repair block deck by surface grinding block, or in extreme cases replace cylinder block.

Maximum resurface amount : 0.008in (0.20mm)



4. If deck is at or below this specification, replace cylinder block.

NOTICE

Before surfacing cylinder block, check deck height from center line of crankshaft to deck surface.

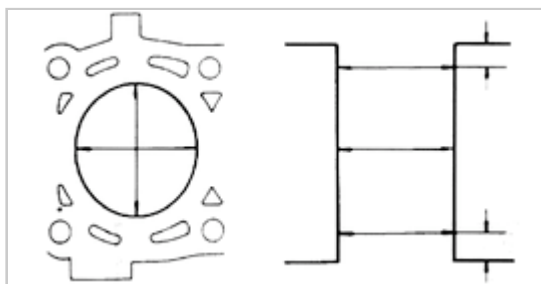
5. Measure cylinder bore with a dial gauge at X and Y vectors shown in figure.

Cylinder bore size :

Standard : 3.1892~3.1897in (81.006~81.019mm)

Bore + 0.010 in (0.25mm) : 3.1990~3.1996in (81.256~81.269mm)

Bore + 0.020in (0.50mm) : 3.2089~3.2094in (81.506~81.519mm)



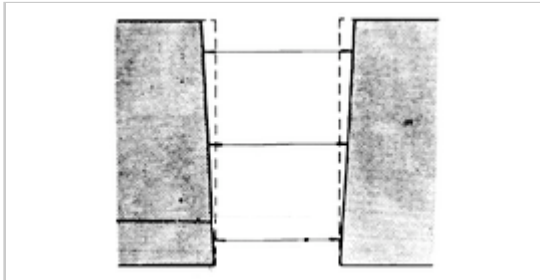
6. Take cylinder measurements at top center and bottom of cylinder to check for cylinder diameter, taper and out of round.
-

Taper : 0.0007in (0.019mm) Maximum

Out-of-round : 0.0007in (0.019mm) Maximum

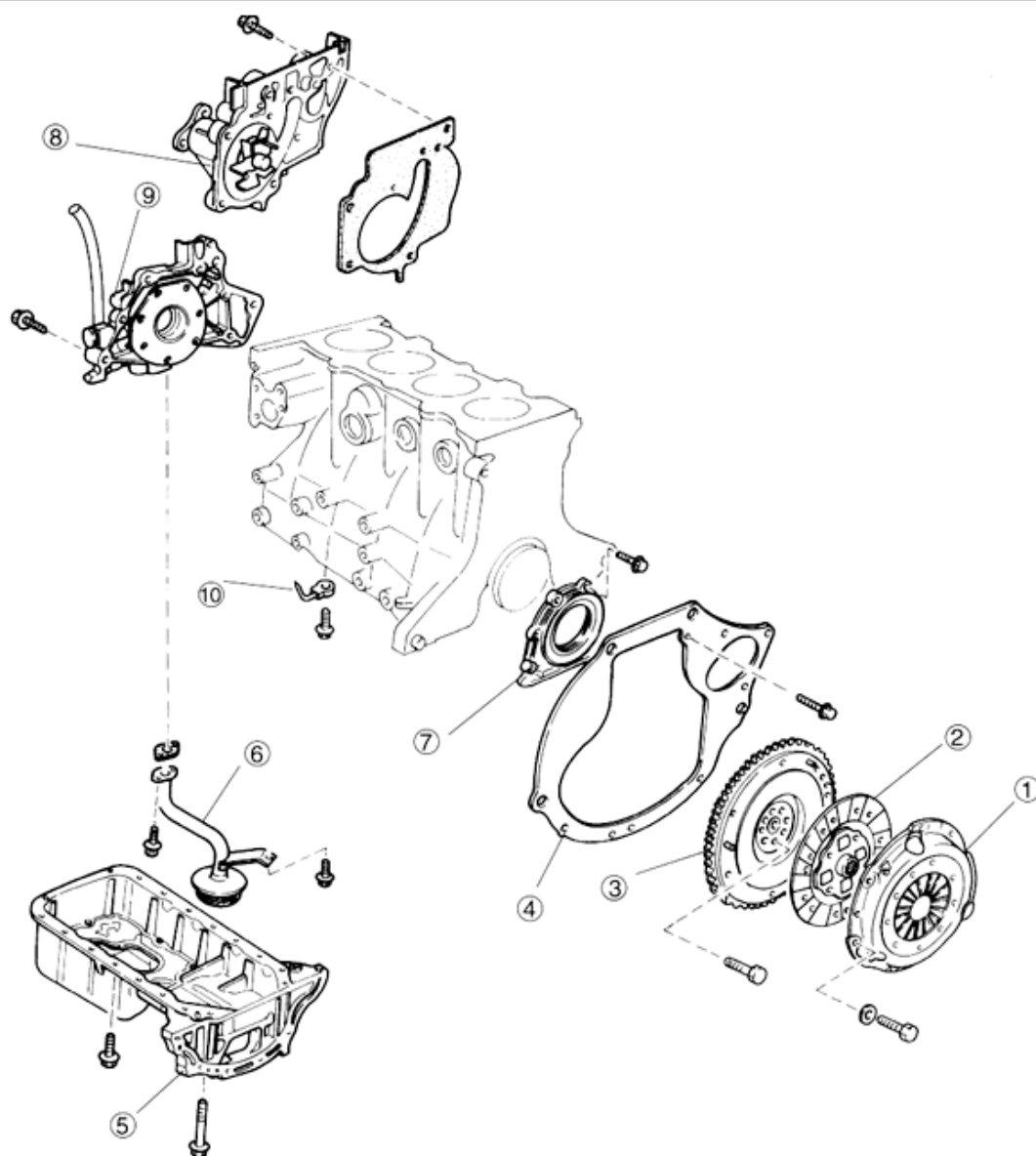
NOTICE

Boring cylinder should be based on maximum oversized piston that can be installed without exceeding maximum overbore.





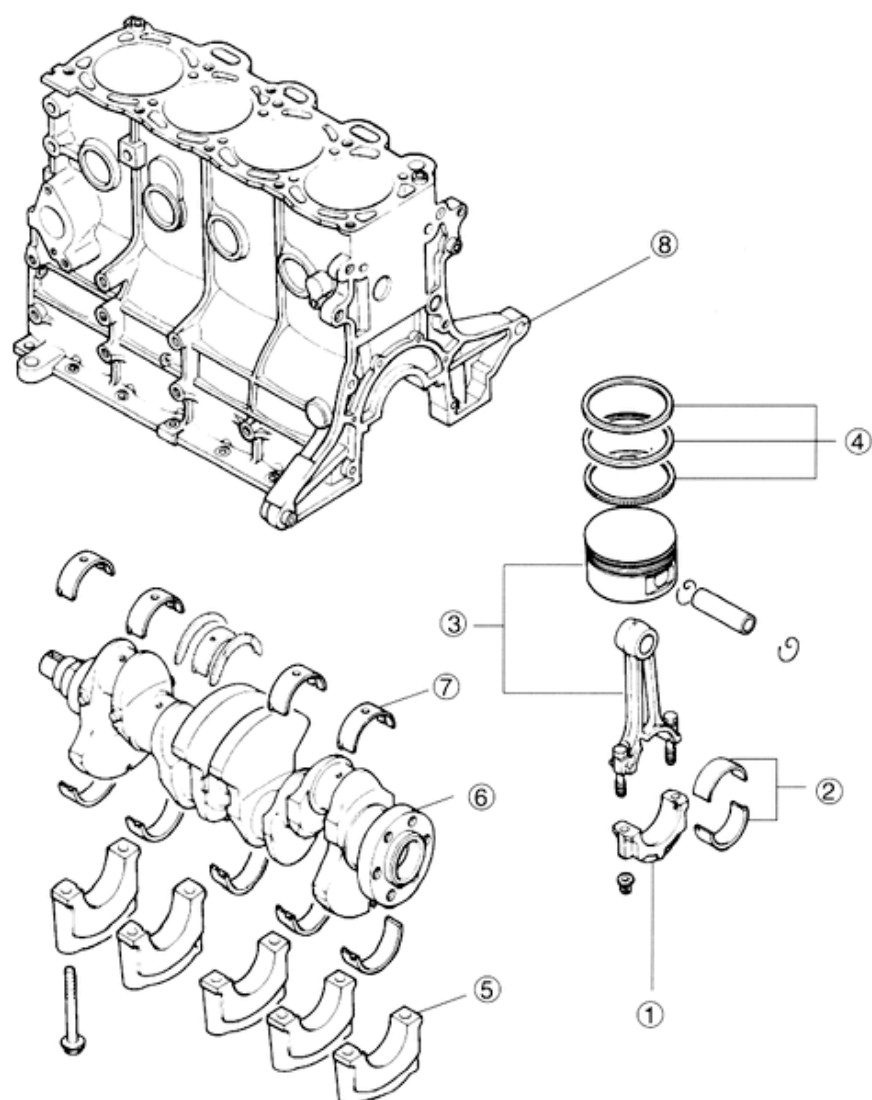
COMPONENT



- (1) Clutch cover
- (2) Clutch disk
- (3) Flywheel
- (4) Separator plate
- (5) Oil pan

- (6) Oil strainer
- (7) Rear cover
- (8) Water pump
- (9) Oil pump
- (10) Oil jet

COMPONENT



- (1) Connecting rod cap
- (2) Connecting rod bearing
- (3) Connecting rod & piston
- (4) Piston rings

- (5) Main bearing cap
- (6) Crankshaft
- (7) Main bearing
- (8) Cylinder block

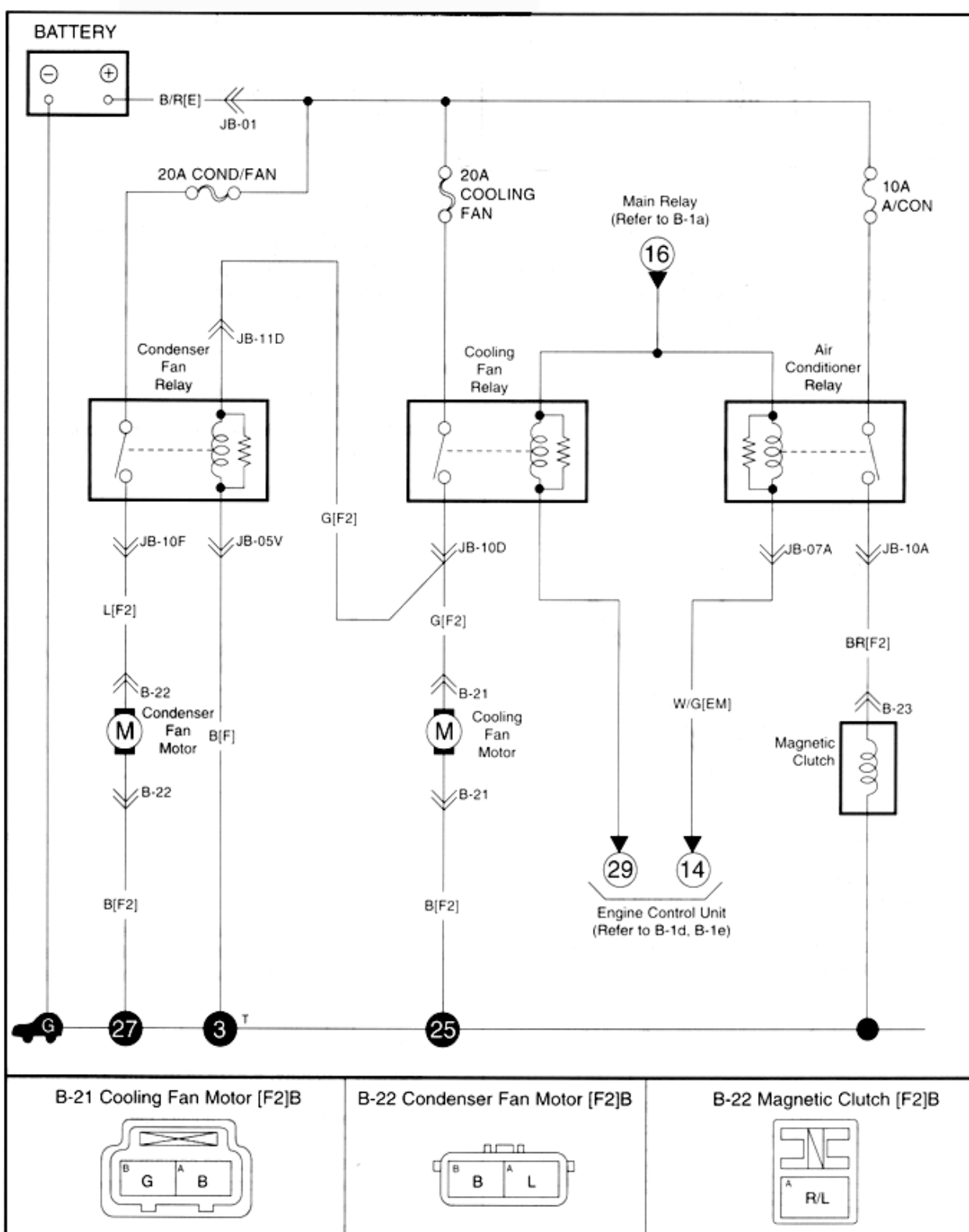


Engine Mechanical System

Cooling System



Circuit diagram





Engine Mechanical System

Cooling System - Coolant



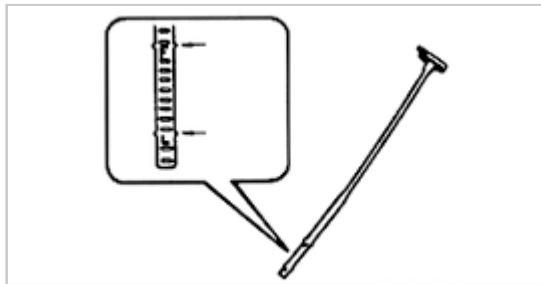
Inspection

WARNING

- NEVER REMOVE RADIATOR CAP WHILE ENGINE IS HOT.
- WRAP A THICK CLOTH AROUND RADIATOR CAP BEFORE REMOING.
- WHEN REMOVING RADIATOR CAP, LOOSEN SLOWLY TO FIRS STOP AND WAIT UNTIL PRESSURE IN RADIATOR IS RELEASED, THEN COMPLETELY REMOVE.

Level (engine cold)

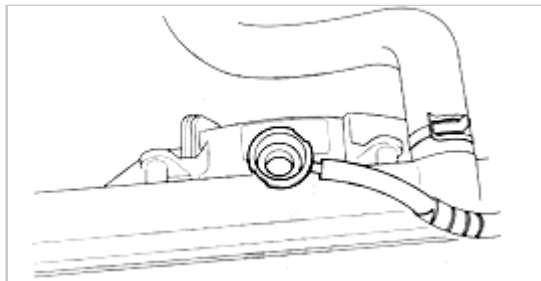
1. Verify that the coolant level is near the radiator filler neck.
2. Check that the level on the coolant level gauge is between the "F" and "L" marks.



3. Add coolant if necessary.

Coolant quality

1. Verify that there is no build-up of rust or scale around radiator cap pr radiator filler neck.
2. Verify that coolant is free of contaminants. Replace coolant if necessary.



Leakage

1. Connect a coolant system pressure tester to the radiator filler neck.
2. Apply 15 psi (103 kPa, 1.05kg/cm²) pressure to the system.
3. Verify that the pressure remains steady at 15 psi(103 kPa, 1.05kg/cm²).
4. If not, check system for coolant leakage.

Replacement

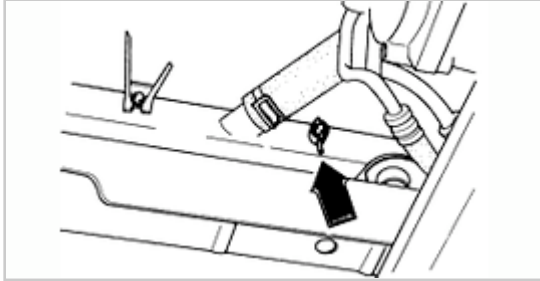
WARNING

- NEVER OPEN RADIATOR CAP WHILE ENGINE IS HOT.
- WRAP A THICK CLOTH AROUND CAP BEFORE LOOSENING.
- USE CAUTION WHEN DRAINING HOT COOLANT.

CAUTION

- Do not use alcohol or methanol-based coolant.
- Use only demineralized water in coolant mixture.

1. Remove radiator cap and loosen drain plug.



2. Drain coolant into a suitable container.
3. Flush cooling system with water until all traces of color are gone ; then let system drain completely.
4. Install drain plug.
5. Fill with proper mixture of ethylene glycol-based coolant.

Coolant Capacity : 6.3 US qt (6.0 liters, 5.3 Impqt)

6. Run the engine with the radiator cap removed until the upper radiator hose is hot.
7. With the engine idling, add coolant to the radiator until it reaches the bottom of the filler neck.
8. Install the radiator cap.
9. Allow engine to cool and check coolant level.



Engine Mechanical System

Cooling System - Water Pump



Removal

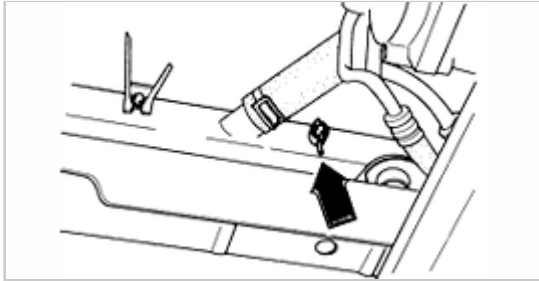
CAUTION

Do not disassemble water pump assembly. If a problem is found, replace assembly as a unit.

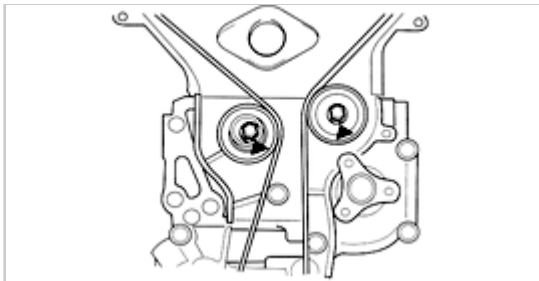
1. Disconnect negative battery cable.



2. Drain engine coolant.



3. Remove timing belt (Refer to timing belt removal).
4. Remove tensioner and idler.



5. Remove water pump.



Installation

1. Remove any gasket fragments, dirt or oil from sealing surfaces.
2. Install new gasket on water pump.

NOTICE

To prevent dropping the gasket when installing, put sealant in gasket groove. But do not apply to sealing surfaces.

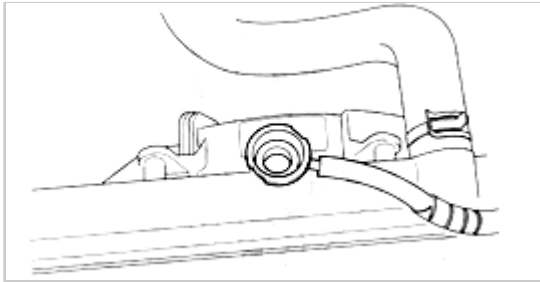
3. Install water pump.

Tightening torque : 14~19 lb-ft(19~26 N·m, 1.9~2.6 kg-m)



4. Install tensioner, idler and timing belt.(Refer to timing belt replacement)

5. Fill engine coolant.



6. Connect negative battery cable.



7. Start engine and check for leaks.

Inspection

1. Check water pump for cracks and damage.
2. Check for abnormal noise, bearing sticking or loose.
3. Replace water pump if necessary.



Engine Mechanical System

Cooling System - Thermostat

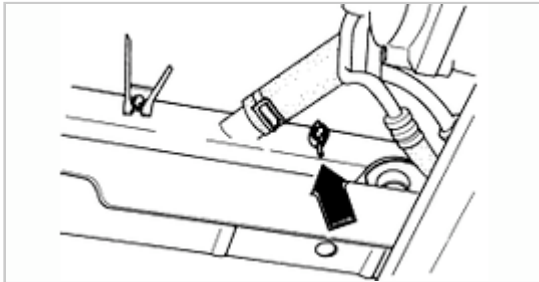


Removal

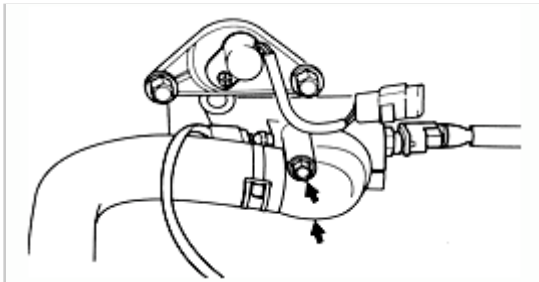
1. Disconnect negative battery cable.



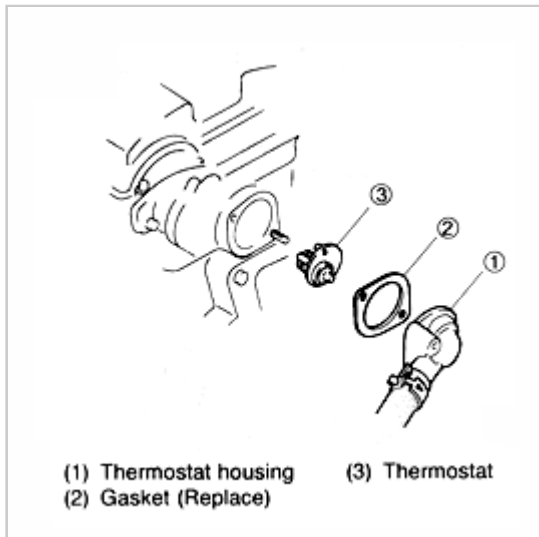
2. Drain engine coolant.



3. Remove bolt and nut of thermostat housing.

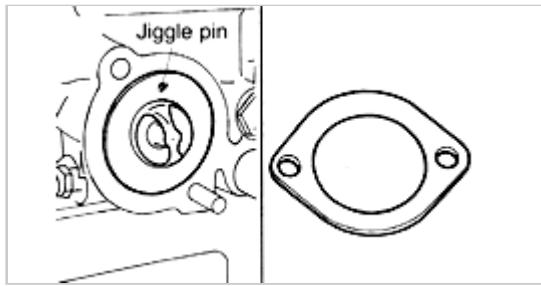


4. Remove thermostat housing and thermostat.

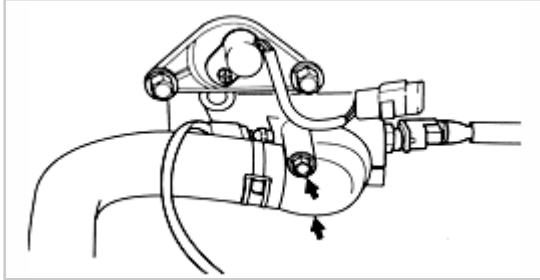


Installation

1. Install thermostat into cylinder head with jiggle pin positioned up.
2. Install new gasket.



3. Place thermostat housing and tighten bolt and nut.



Tightening torque : 14~19 lb-ft(19~26 N·m, 1.9~2.6 kg-m)

4. Fill radiator with specified amount and type of engine coolant.
5. Connect negative battery cable.



6. Start engine and check for leaks.

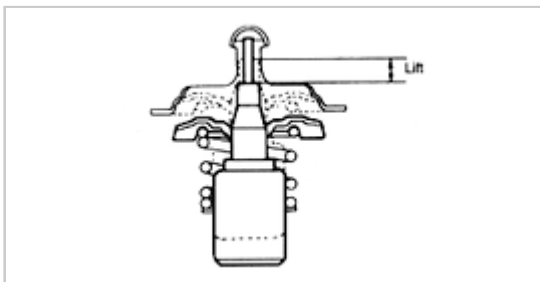
Inspection

1. Visually check that thermostat is airtight.
2. Place thermostat and a thermometer in water.
3. Gradually heat water and check following.

Initial opening temperature : 188~93°F(86.5~89.5°C)°F(°C)

Full open temperature : 212°F(100°C)

Full open lift : 0.31 in (8.0 mm) min.



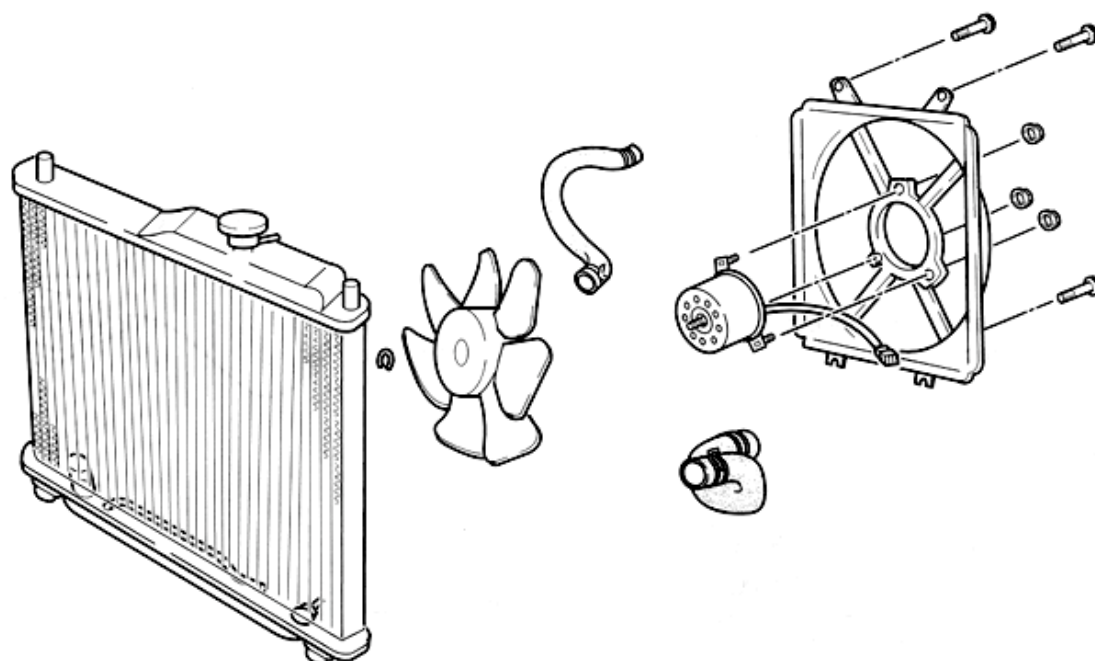


Engine Mechanical System

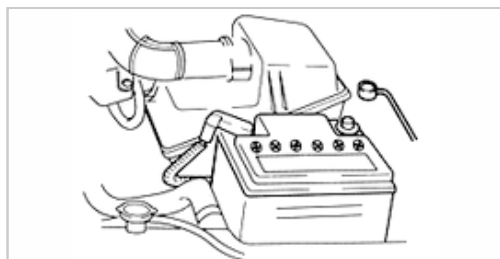
Cooling System - Radiator



Removal



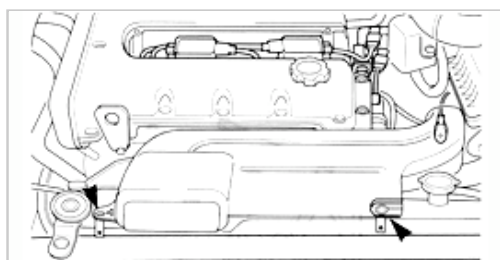
1. Disconnect negative battery cable.



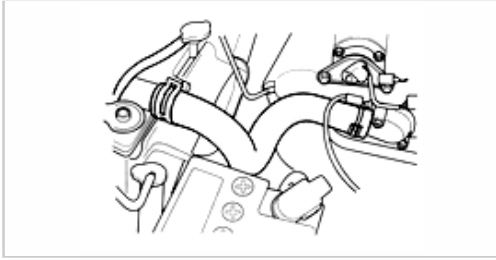
2. Drain engine coolant.



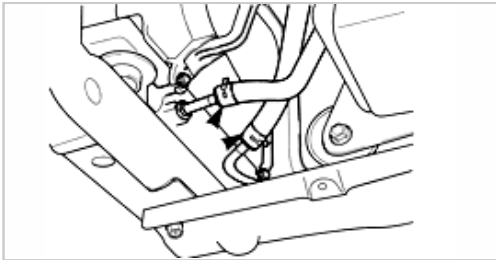
3. Remove fresh air duct.



4. Disconnect upper radiator hose.



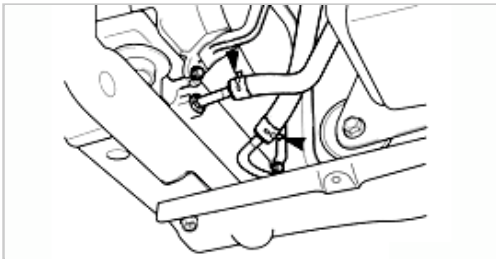
5. Disconnect cooling fan motor connector.
6. Disconnect condense fan motor connector.
7. Disconnect coolant reservoir hose.
8. Remove radiator upper brackets.
9. Disconnect Automatic Transaxle Fluid (ATF) inlet and outlet pipe.



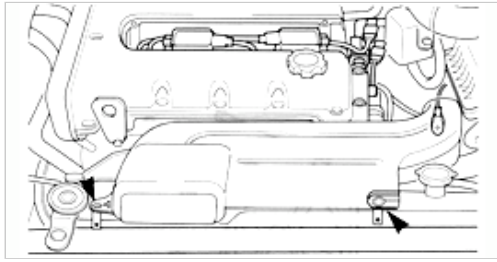
10. Disconnect lower radiator hose.
11. Lift radiator assembly from engine compartment.
12. Remove cooling fan assembly and condenser fan assembly.

Installation

1. Install cooling fan assembly and condenser fan assembly.
2. Install radiator assembly into engine compartment.
3. Connect lower radiator hose.
4. Connect ATF inlet and outlet pipes.



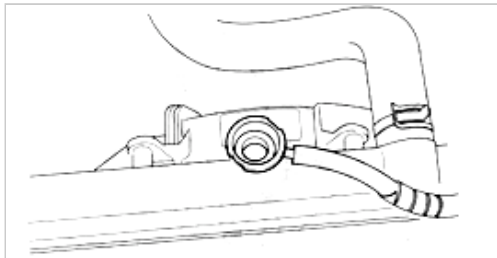
5. Install radiator upper brackets.
6. Connect coolant reservoir hose.
7. Connect condenser fan motor connector.
8. Connect cooling fan motor connector.
9. Connect upper radiator hose.
10. Install fresh air duct.



11. Connect negative battery cable.



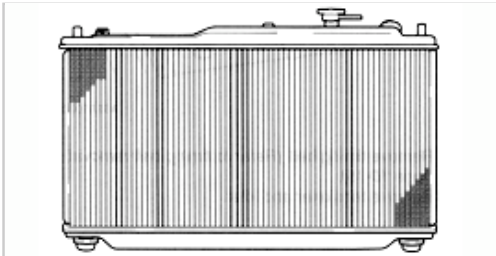
12. Fill engine coolant (Refer to engine coolant replacement)



13. Start engine and check for leaks.

Inspection

1. Check for cracks, damage or wear leakage.
2. Check for bent fins. if bent, repair with a fin comb or similar tool.



3. Check for damaged radiator inlet and outlet and hose connections.



Engine Mechanical System

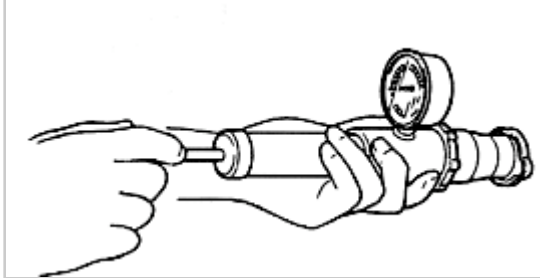
Cooling System - Radiator Cap



Inspection

Radiator cap valve

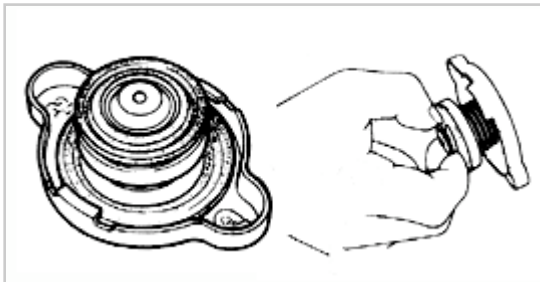
1. Remove foreign material from radiator cap valve and the valve seat.
2. Attach radiator cap to a radiator cap tester. Apply pressure gradually to 15 psi(103 kPa, 1.05 kg/cm²).



3. Wait about 10seconds. Verify that pressure has not decreased.
4. Replace radiator cap as necessary.

Negative pressure valve

1. Pull negative pressure valve to open it. Verify that it closes completely when released.
2. Check for damage on contact surfaces, and for a cracked or deformed seal.



3. Replace radiator cap as necessary.



Engine Mechanical System

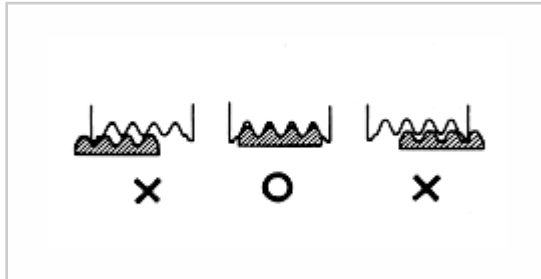
Cooling System - Drive Belt



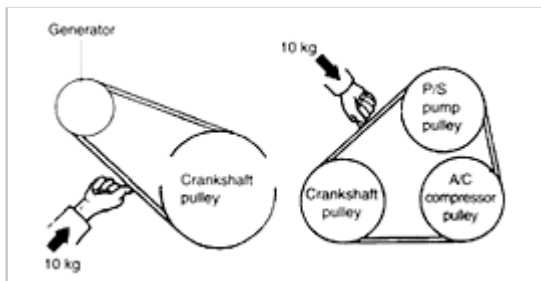
INSPECTION

Drive belt

1. Check the drive belts for wear cracks and fraying.
Replace if necessary.
2. Verify that the drive belts are correctly mounted on the pulley.



3. Check the drive belt deflection by applying moderate pressure 98N(10kg, 22lb) midway between the pulleys.



Deflection

Drive belt	New	Used
Generator	0.24~0.32in (6.0~8.0mm)	0.28~0.35in (7.0~9.0mm)
P/S, P/S+A/C	0.32~0.35in (8.0~9.0mm)	0.36~0.39in (9.0~10.0mm)

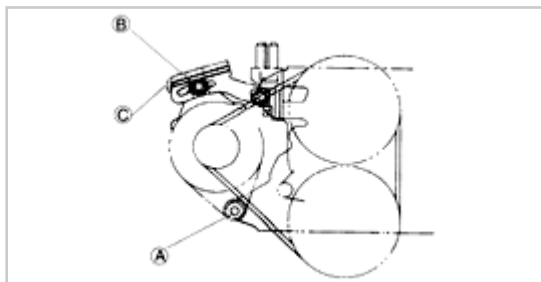
NOTICE

- Measure the belt deflection between the specified pulleys.
- Consider the belt as a new one if it has been used on a running engine for less than five minutes.
- Check the belt deflection when the engine is cold or at less 30minutes after the engine is stopped.

ADJUSTMENT

Generator drive belt

1. Loosen the mounting bolt (A), (B) and adjust the belt deflection by turning the adjusting bolt (C).



2. Tighten the mounting bolts (A), (B)

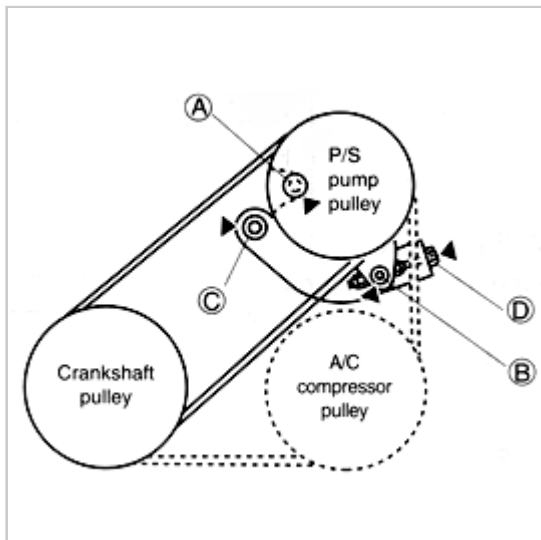
Tightening torque

(A) : 28~38lb·ft (37~52N·m, 3.8~5.3kg-m)

(B) : 14~19lb·ft (19~25N·m, 1.9~2.6kg-m)

Power steering + Air conditioner drive belt

1. Loosen the bolt (A), nut (B), nut (C), for power steering pump.



2. Adjust the belt deflection by turning the adjusting bolt (D)
3. Tighten the bolt (A), nut (B), nut(C).

Tightening torque

(A) : 27~40lb·ft (36~54N·m, 3.7~5.5kg-m)

(B) : 14~19lb·ft (19~25N·m, 1.9~2.6kg-m)

(C) : 23~34lb·ft (31~46N·m, 3.2~4.7kg-m)

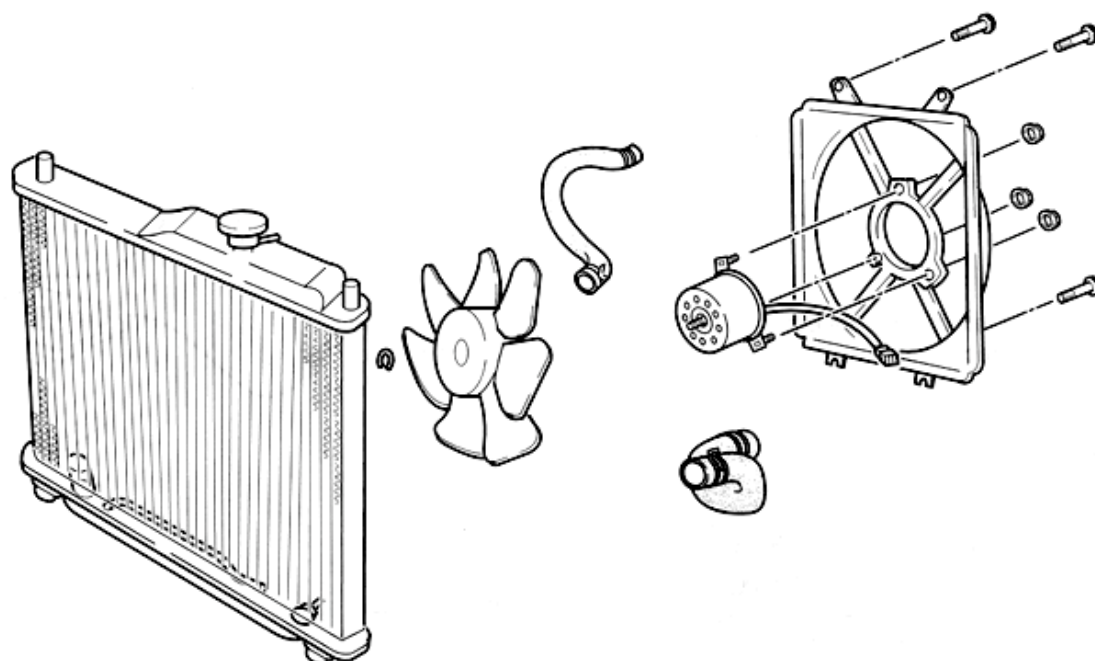


Engine Mechanical System

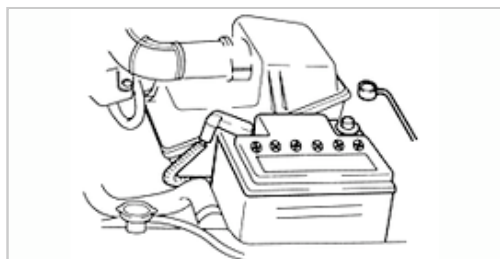
Cooling System - Cooling Fan Motor Assembly



Removal



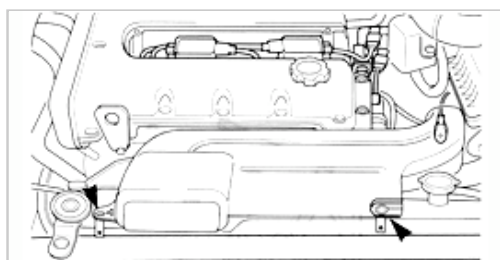
1. Disconnect negative battery cable.



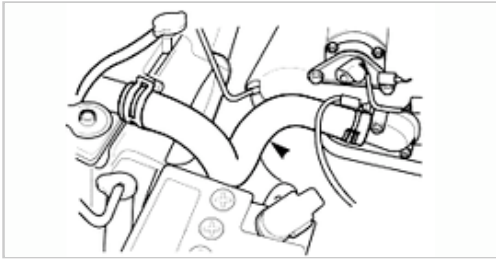
2. Drain engine coolant.



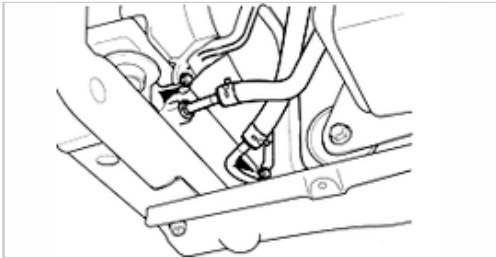
3. Remove fresh air duct.



4. Disconnect cooling fan motor connector.
5. Remove upper radiator hose.



6. Remove upper two cooling fan cowling bolts.
7. Remove lower two cooling fan cowling bolts.



8. Lift cooling fan cowling from radiator.
9. Remove clip and fan.
10. Remove three fan motor bolts and nuts.

Installation

1. Install fan motor and tighten three fan motor bolts and nuts.
2. Install fan and clip.
3. Install cooling fan to radiator.
4. Install and tighten two upper cooling fan cowling bolts.

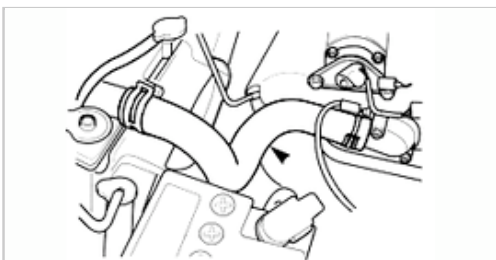
Tightening torque : 5.8~7.9 lb-ft (7.8~10.8 N·m, 0.8~1.1 kg-m)

5. Install and tighten lower two cooling fan cowling bolts.

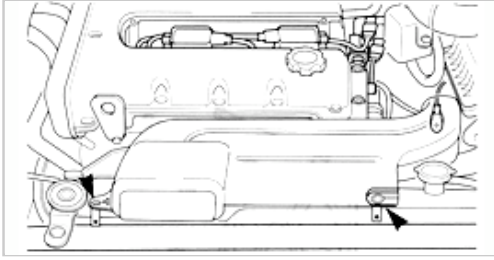
Tightening torque : 5.8~7.9 lb-ft(7.8~10.8 N·m, 0.8~1.1 kg-m)



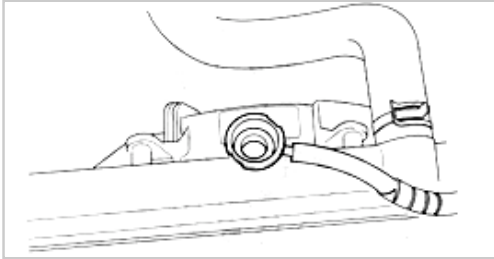
6. Install upper radiator hose.



7. Connect cooling fan motor connector.
8. Install fresh air duct and tighten bolt and nut.



9. Fill engine coolant (Refer to engine coolant replacement.)



10. Connect negative battery cable.

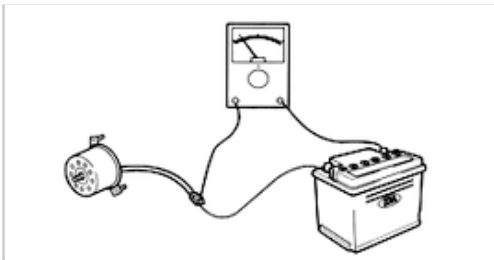


11. Start engine and check for leaks.

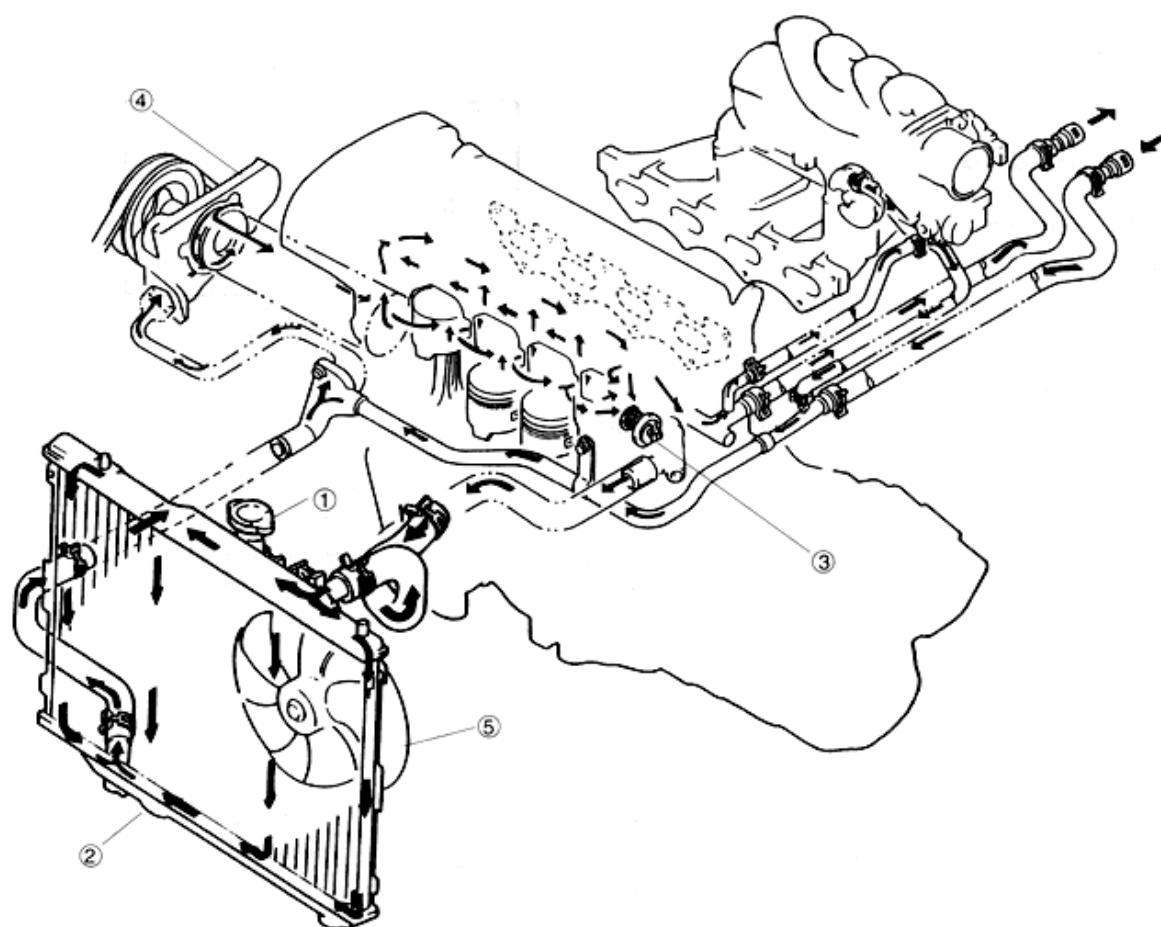
Inspection

1. Check current as shown with an ammeter.

Current (A) : 8~13A



Functional diagram



- (1) Radiator cap
- (2) Radiator
- (3) Thermostat

- (4) Water pump
- (5) Engine cooling fan



Engine Mechanical System

Lubrication System - Engine Oil



INSPECTION

1. Be sure the vehicle is on level ground.
2. Warm up the engine to normal operating temperature and stop it.
3. Wait for 5 minutes.
4. Remove the oil level gauge and check the oil level and condition.



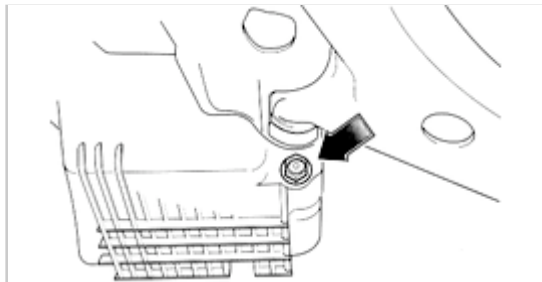
5. Add or replace oil if necessary.

REPLACEMENT

WARNING

BE CAREFUL WHEN DRAINING BECAUSE OIL IS HOT AND COULD CAUSE PERSONAL INJURY.

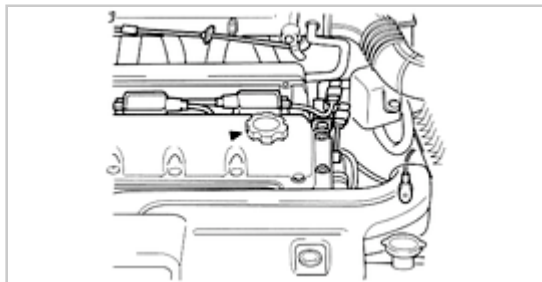
1. Warm engine to normal operating temperature and turn engine off. Position a suitable container under oil pan.
2. Remove oil filler cap and oil pan drain plug.



3. Allow oil to be fully drained.
4. Install drain plug with new gasket.

Tightening torque : 22~30lb-ft (29~41N·m, 3.0~4.2kg-m)

5. Refill engine with specified type and amount of engine oil.
6. Install oil filler cap.



7. Run engine and check for leaks.

8. Check oil level and add oil if necessary.

Oil pan capacity : 3.8US qt (3.6liters, 3.2Imp qt)





Engine Mechanical System

Lubrication System - Oil Pan

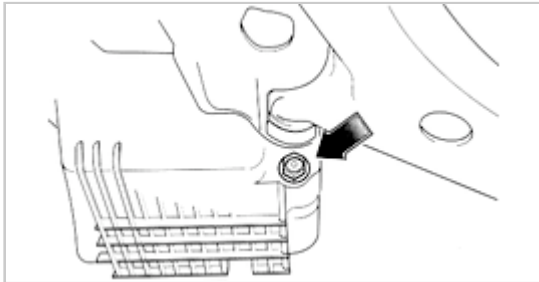


REMOVAL

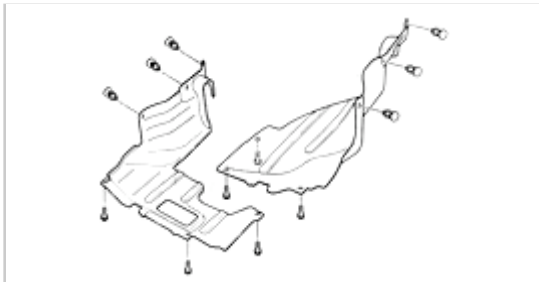
1. Disconnect negative battery cable.



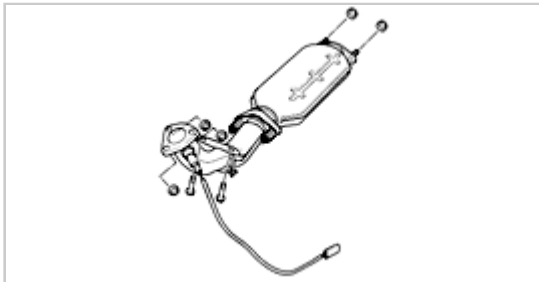
2. Drain engine oil.



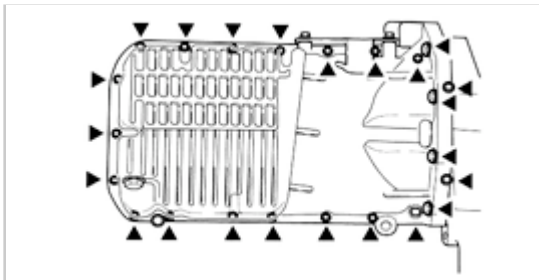
3. Remove LH and RH side splash shields.



4. remove front exhaust pipe.



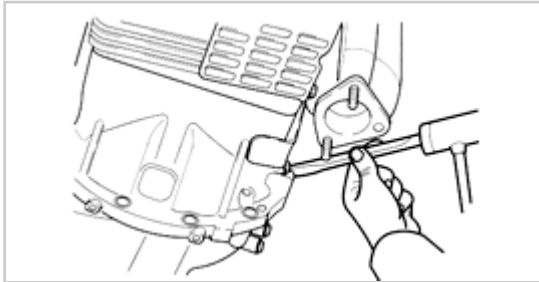
5. Remove oil pan mounting bolts.



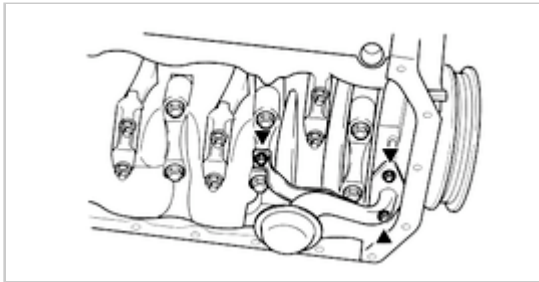
6. Remove oil pan with screwdriver or suitable tool as shown in figure.

CAUTION

- Do not force tools between cylinder block and oil pan because this damage sealing surfaces.
- Do not damage sealing surfaces when removing old sealant.



7. Remove oil strainer.



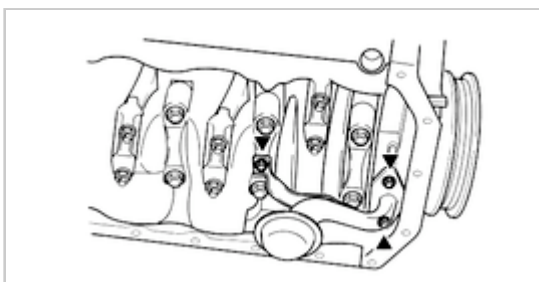
INSTALLATION

CAUTION

- If oil pan reused remove all foreign material from sealing surfaces of cylinder block and oil pan.
- If bolts are reused remove old sealant from bolt threads.

1. Install oil strainer.

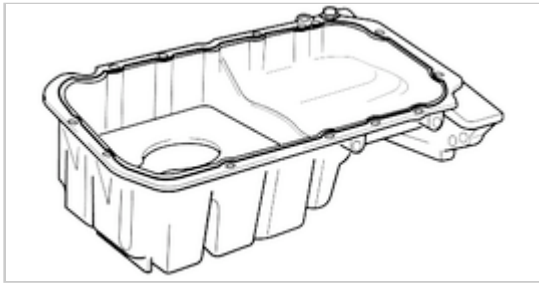
Tightening torque : 5.8~8.7lb-ft (7.8~11.8N·m, 0.8~1.2kg-m)



2. Apply a continuous bead of silicone sealant to baffle plate along inside of bolt holes on contact surface.

CAUTION

The oil pan must be installed no longer than 5 minutes after silicone sealant is applied.

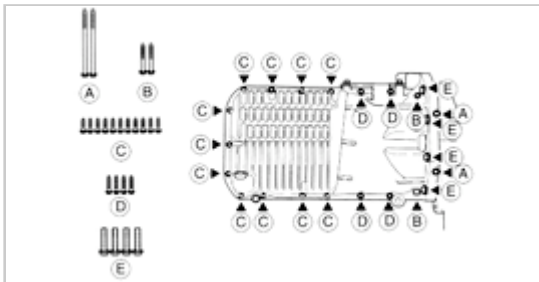


3. Install oil pan.

Tightening torque :

(A), (B), (C), (D) : 5.8~8.0lb-ft (7.8~10.8N·m, 0.8~1.1kg-m)

(E) : 28~38lb-ft (38~51N·m, 3.8~5.3kg-m)

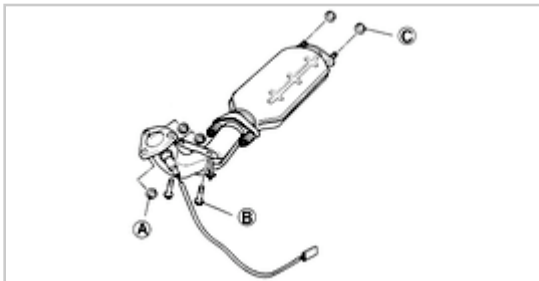


4. Install front exhaust pipe.

Tightening torque :

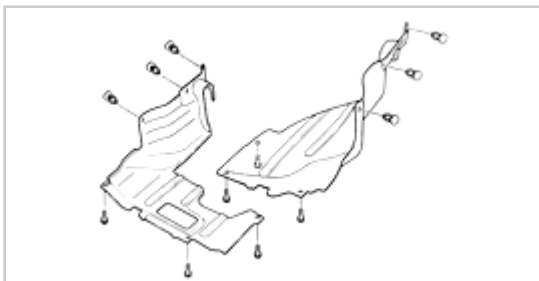
(A), (B) : 27.5~38.3lb-ft (37.3~51.9N·m, 3.8~5.3kg-m)

(C) : 31.1~44.8lb-ft (42.2~60.8N·m, 4.3~6.2kg-m)



5. Install LH and RH side splash shields.

Tightening torque : 12~18lb-ft (16~24N·m, 1.6~2.4kg-m)



6. Fill with specified amount and type of engine oil.

7. Connect negative battery cable.



8. Start engine and check for leaks.
9. Check oil level and add oil if necessary.

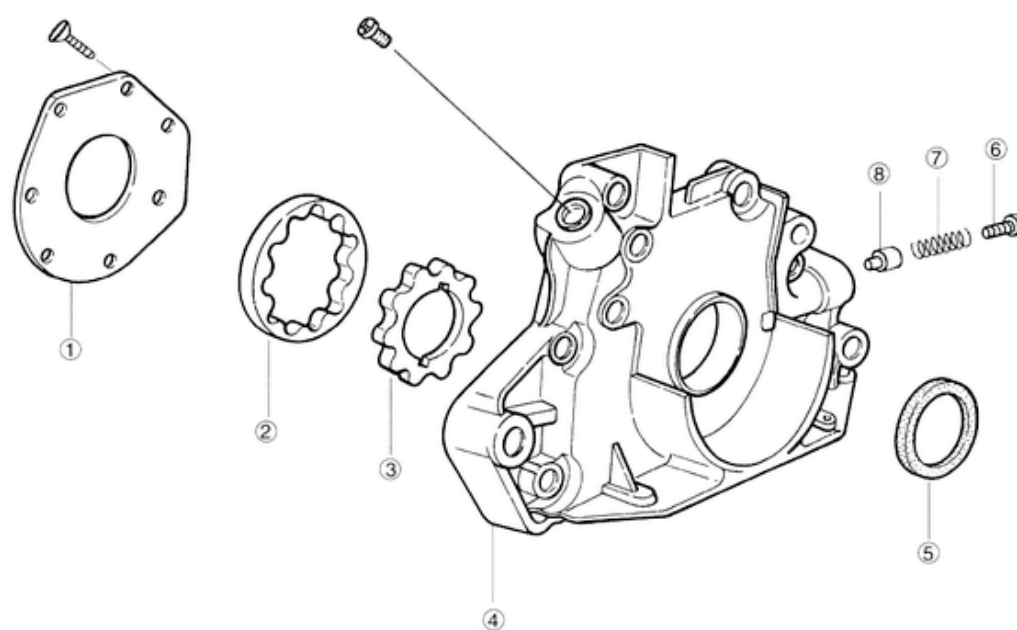


Engine Mechanical System

Lubrication System - Oil Pump



COMPONENT



- (1) Pump cover
- (2) Outer rotor
- (3) Inner rotor
- (4) Oil pump body

- (5) Oil seal
- (6) Oil pressure relief valve plug
- (7) Oil pressure relief valve spring
- (8) Oil pressure relief valve plunger

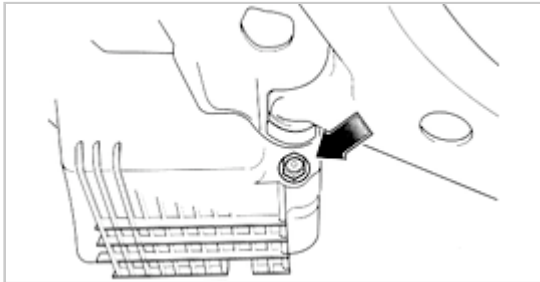


REMOVAL

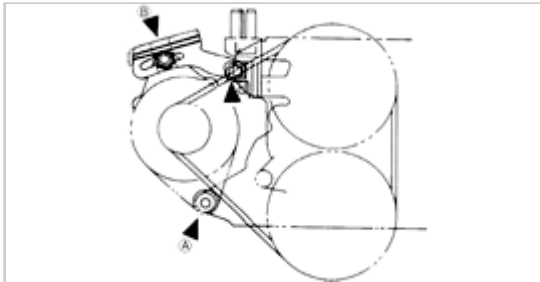
1. Disconnect negative battery cable.



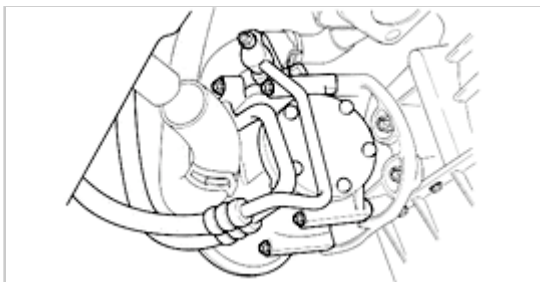
2. Drain engine oil.



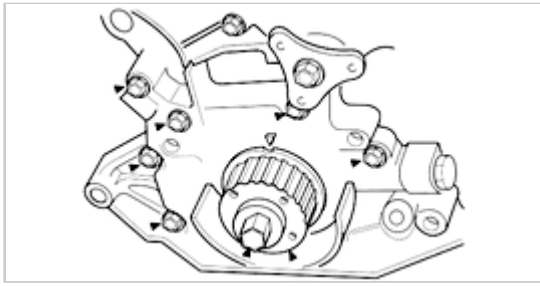
3. Remove timing belt. (Refer to timing belt removal)
4. Remove oil pan and oil strainer.
5. Remove generator.



6. Remove A/C compressor and A/C compressor bracket if equipped.



7. Remove crankshaft pulley lock bolt.
8. Remove timing belt pulley.
9. Remove oil pump mounting bolt.



10. Remove oil pump.

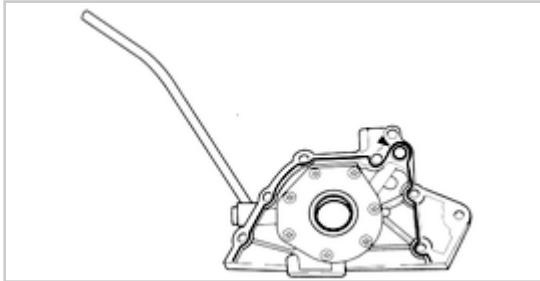
INSTALLATION

1. Apply a continuous bead of silicone sealant to oil pump sealing surface.

CAUTION

The oil pump must be installed no longer than 5 minutes after silicone sealant is applied.

2. Apply grease to a new O-ring and install it in oil pump.

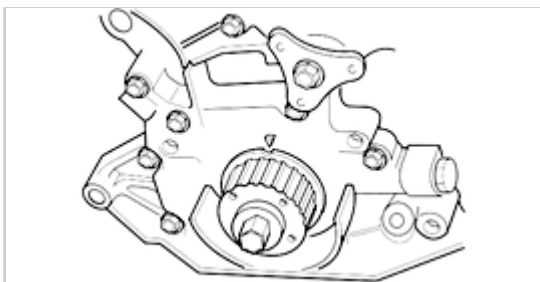


3. Install oil pump.

Tightening torque : 14~19lb-ft (19~26N·m, 1.9~2.6kg-m)

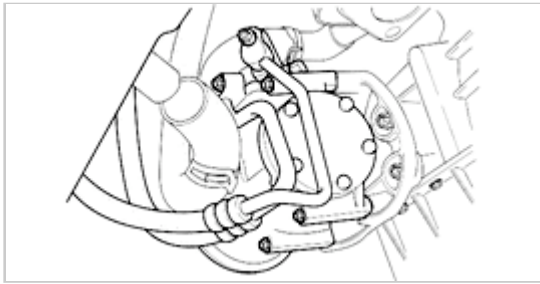
4. Install timing belt pulley and crankshaft pulley lock bolt.

Tightening torque : 115.7~122.9lb-ft (158.8~166.6N·m, 16~17kg-m)

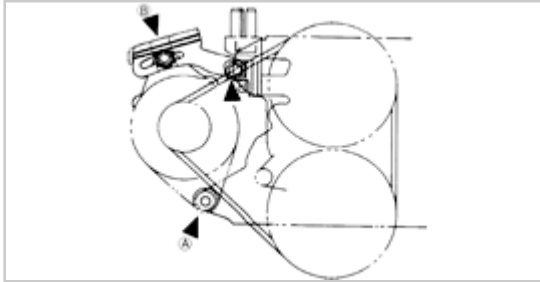


5. Install A/C compressor bracket and A/C compressor.

Tightening torque : A/C compressor mounting bolts : 28.2~38.3lb-ft (38.3~51.9N·m, 3.9~5.3kg-m)



6. Install generator.



Tightening torque :

(A) : 28~38lb-ft (37~52N·m, 3.8~5.3kg-m)

(B) : 14~19lb-ft (19~26N·m, 1.9~2.6kg-m)

7. Install oil strainer and oil pan. (Refer to oil pan replacement.)

8. Install timing belt.

9. Fill with specified amount and type of engine oil.

10. Connect negative battery cable.

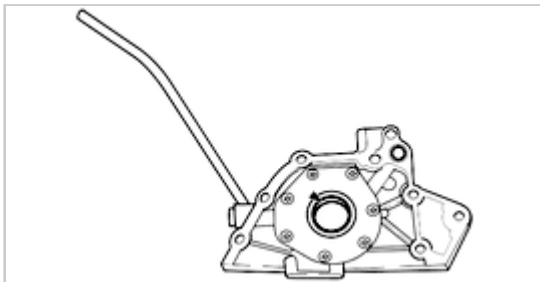


11. Start engine and check for leaks.

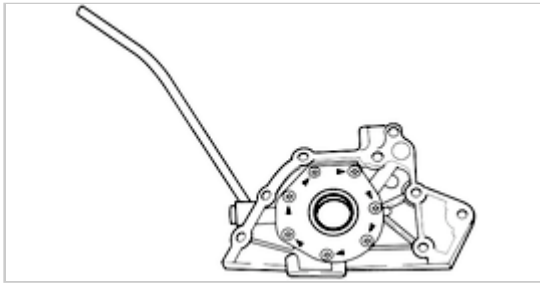
12. Check oil level and add oil if necessary.

DISASSEMBLY

1. Remove oil seal using a screwdriver covered by a rag to protect sealing surface from pump cover side.



2. Remove seven screws and remove pump cover.

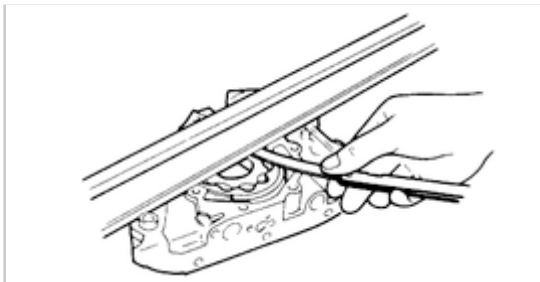


3. Remove outer rotor and inner rotor.

INSPECTION

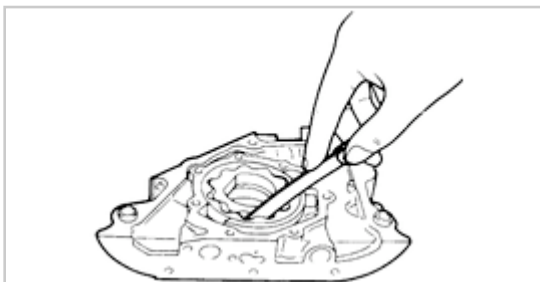
1. Check the following and replace any faulty parts.
 - A. Distorted or damaged oil pump body or cover.
 - B. Worn or damaged plunger.
 - C. Weak or broken plunger spring.
2. Measure side clearance.

Clearance : 0.0035in (0.09mm) max.



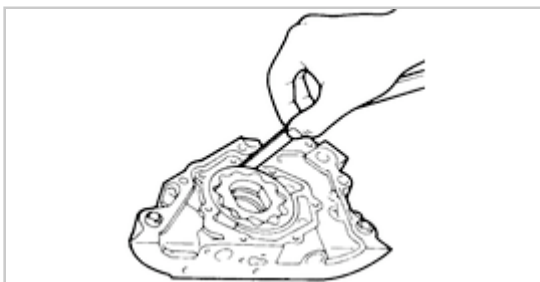
3. Measure tooth clearance.

Clearance : 0.007in (0.18mm) Max.



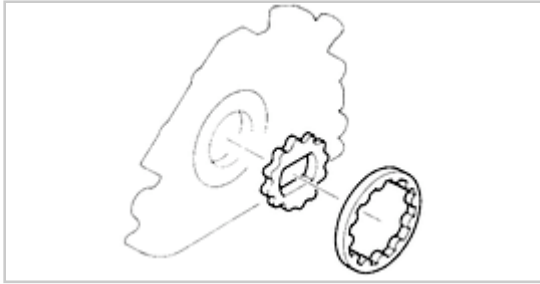
4. Measure outer rotor to pump body clearance.

Clearance : 0.015in (0.376mm) Max.



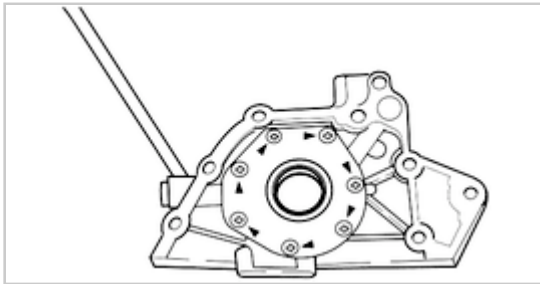
REASSEMBLY

1. Assemble outer rotor and inner rotor into oil pump body.



2. Apply thread locking compound to cover mounting screw threads.
3. Assemble oil pump cover to oil pump body.

Tightening torque : 4.3~6.5lb-ft (6~9N·m, 0.6~0.9kg-m)

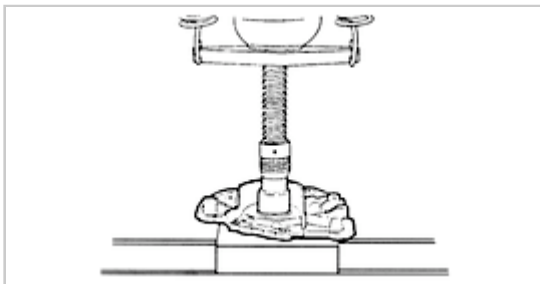


4. Apply engine oil to outside of new oil seal and oil pump body.
5. Press oil seal into pump body.

CAUTION

Oil seal must be pressed in until it is protruding with front face of oil pump body.

Protrusion : -0.02~0in (-0.5~0mm)





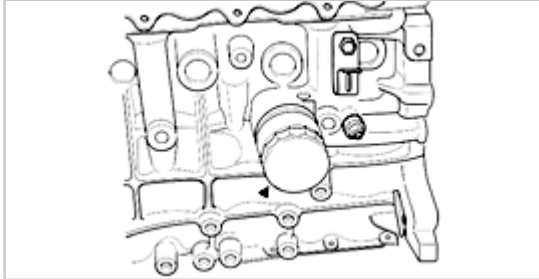
Engine Mechanical System

Lubrication System - Oil Filter



REPLACEMENT

1. Raise vehicle.
2. Remove oil filter with oil filter wrench. If rubber seal is stuck to engine remove it.
3. Apply a small amount of clean engine oil to rubber seal of new filter.



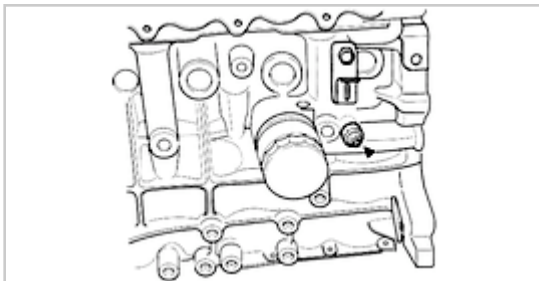
4. Install oil filter and turn it by hand until rubber seal contacts base.
5. Tighten filter 1-1/6 turns with filter wrench.
6. Start engine and check for leaks.
7. Turn engine off and wait 5 minutes. Check oil level and add oil necessary.

Oil filter capacity : 0.21US qt (0.2liters, 0.18Imp qt)

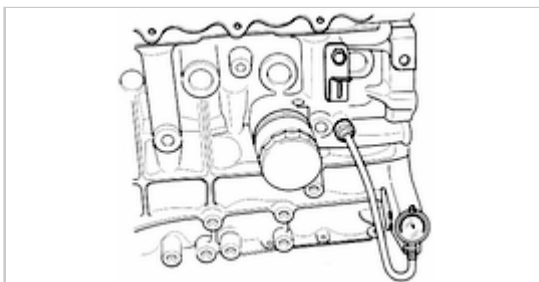
INSPECTION

Oil pressure check

1. Disconnect and remove oil pressure switch.



2. Install oil pressure gauge into oil pressure switch installation hole.



3. Warm engine to normal operating temperature.
4. Run engine at 3,000rpm and note gauge readings.

Oil pressure : 43~57psi (294~392kPa, 3.0~4.0kg/cm²)

5. If pressure is not within specification, check for cause and repair. (Refer to troubleshooting guide).

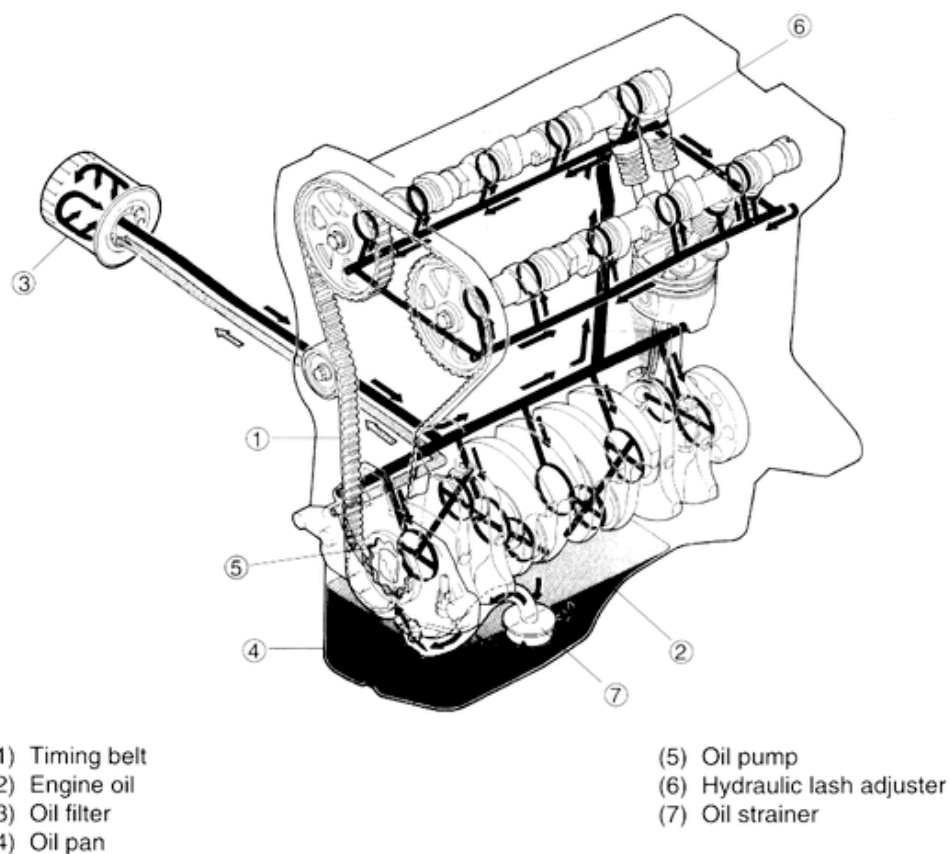
6. Remove oil pressure gauge and install oil pressure switch.

Tightening torque : 8.7~13.0lb-ft (12~18N·m, 1.2~1.8kg-m)



GENERAL DESCRIPTION

The engine lubrication system consists of an oil pan, oil pump, oil filter and various oil passages. A rotor-type oil pump is driven by crankshaft. The oil pump has a pressure relief valve which controls lubrication system pressure by bypassing oil back to oil pan. The oil pump rotates and draws oil from the oil pan through an oil strainer. The oil is pressurized as it passes through the pump.





REMOVAL

Front oil seal

1. Remove oil pump.(Refer to oil pump removal)
2. Remove front oil seal. (Refer to oil pump disassembly)

REMOVAL

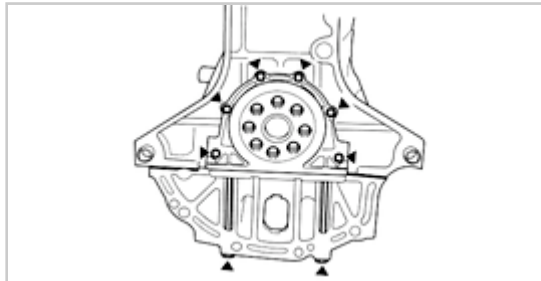
Rear oil seal

1. Disconnect negative battery cable.
2. Remove flywheel. (Refer to clutch removal)
In case of A/T remove drive plate.(Refer to A/T removal).

NOTICE

Use a flywheel locking tool or equivalent when removing flywheel or drive plate)

3. Remove rear cover.



4. Wrap a prying tool with a shop towel and slowly pry old seal out.



INSTALLATION

Front oil seal

1. Install oil seal. (Refer to oil pump reassembly procedure.)
2. Install oil pump. (Refer to oil pump installation)

INSTALLATION

Rear oil seal

1. Apply engine oil to rear cover, oil seal and oil seal lip.
2. Press oil seal into rear cover.

NOTICE

Oil seal must be tapped in until is nearly flush with surface of rear cover.

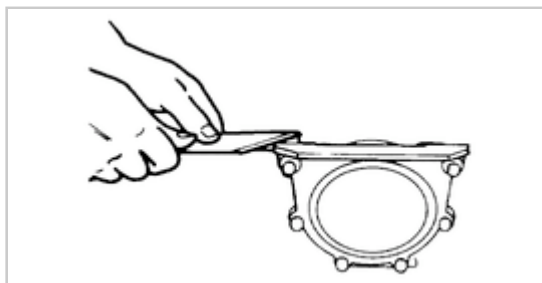
Protrusion : 0~0.02in (0~0.5mm)



3. Cut away silicon sealer that has been squeezed out from rear cover assembly toward oil pan mounting surface.

CAUTION

Do not scratch rear cover assembly.

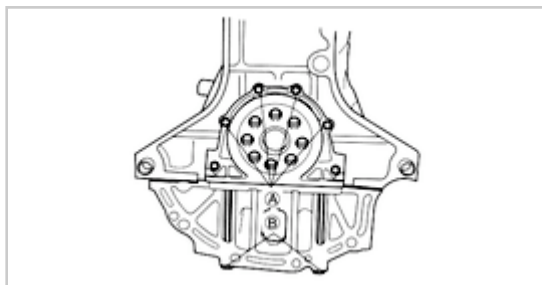


4. Install rear cover.

Tightening torque :

(A) : 5.8~8.0lb·ft (7.8~10.8N·m, 0.8~1.1kg-m)

(B) : 29.7~40.5lb·ft (40.2~54.9N·m, 4.1~5.6kg-m)



5. Install flywheel and manual transaxle.
6. Connect negative battery cable.





Engine Mechanical System

Intake And Exhaust System - Air Cleaner



INSPECTION

1. Loosen air intake hose clamp at the mass air flow sensor.
2. Disconnect air hose from mass air flow sensor.
3. Remove six screws retaining air cleaner housing and lift housing unit.
4. Remove air cleaner from beneath air cleaner housing.

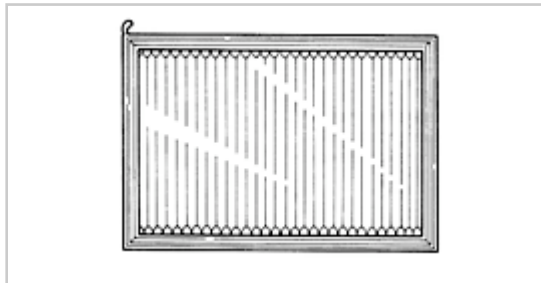
NOTICE

Do not use compressed air to clean the air cleaner element.

5. Inspect air cleaner element for excessive dirt, damage, or oil.
6. Replace the cleaner element if necessary.

Air cleaner element

1. Check the air cleaner element for excessive dirt, damage or oil replace or clean if necessary.

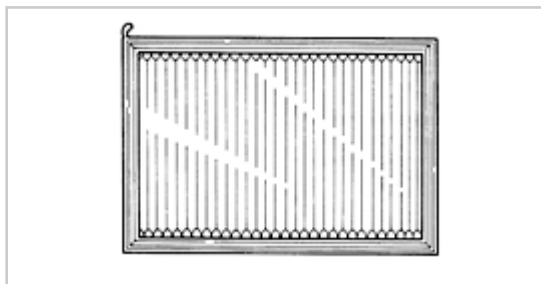


NOTICE

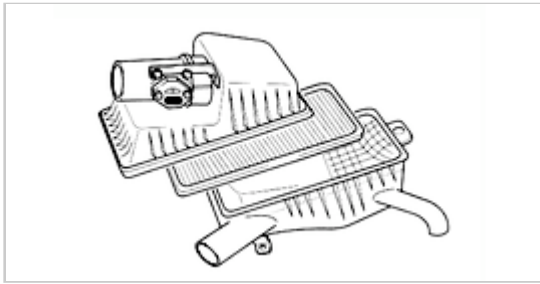
Use a compressed air to clean the element from the internal side to the external side, or from the upper to the lower.

Installation

1. Lift the air cleaner housing unit and install the air cleaner beneath the housing unit.
2. Lower the housing unit and replace six retaining screws to hold the unit in place.



3. Reattach air intake hose to mass air flow sensor and tighten retaining clamp.





DESCRIPTION AND OPERATION

Intake system

The air induction system supplies filtered air to the engine to mix with the fuel for combustion. It consists of :

- Air cleaner assembly
- Resonance chamber
- Mass air flow sensor
- Throttle body
- Intake manifold
- Idle air control (IAC) valve

Throttle position (TP) sensor

Idle air control (IAC) valve

Exhaust system

The engine exhaust consists mainly of nitrogen (N_2), however, it also contains Carbon Monoxide (CO), Carbon Dioxide (CO_2), Water Vapor (H_2O), Oxygen (O_2), Nitrogen Oxides (NO_x), and Hydrogen (H_2) as well as various, Unburned Hydrocarbons (HC). Three of these exhaust components - CO, NO_x , and HC - are major air pollutants, so their emission to the atmosphere must be controlled.

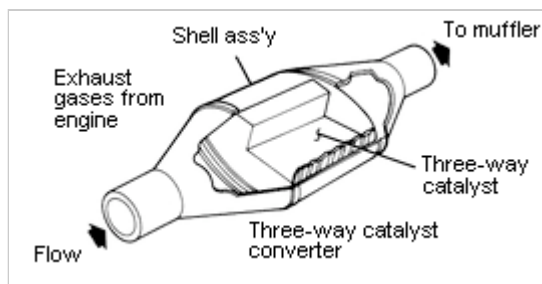
The three-way catalytic (TWC) converter, mounted in the engine system, works as a gas reactor to convert and reduce the pollutant levels to within legally prescribed limits.

The catalyst metals are thin coated onto and supported by a honeycomb shaped high temperature ceramic, mounted inside the converter, mounted in the engine system, works as a gas reactor to convert and reduce the pollutant levels to within legally prescribed limits.

The catalyst metals are thin coated onto and supported by a honeycomb shaped high temperature ceramic, mounted inside the converter shell. The result is a highly effective converter shell. The result is a highly effective converter design having minimum restriction to exhaust gas flow and good durability.

CAUTION

Do not touch the catalytic converter heat shield when the engine is running. The conversion process produces high heat. Even when the engine is not running it remains hot a long time. It will remain hot after other pipes have cooled. Touching the heat shield may produce a serious burn.

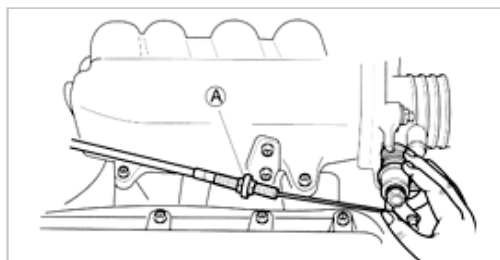




INSPECTION

Accelerator cable.

1. Depress the accelerator pedal to the floor and check that the throttle valve is opened.
Adjust with nut (A) if necessary.



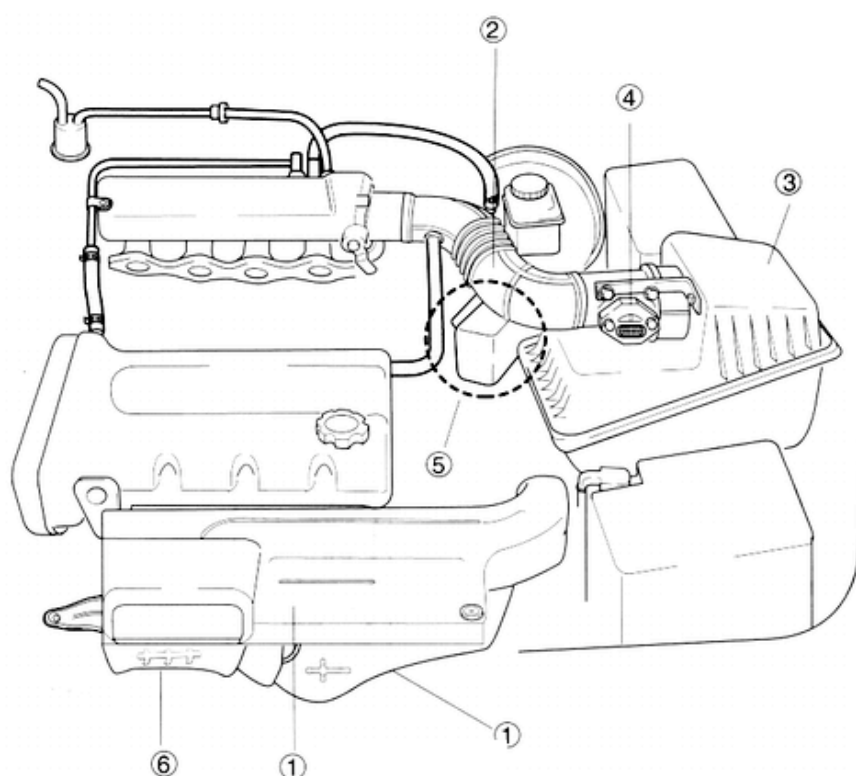
2. Measure the free play of the accelerator cable.

Free play : 0.16~0.28in (4~7mm)

REMOVAL AND INSTALLATION

1. Remove in the order shown in the figure.
2. Inspect the intake air system components visually and repair or replace if necessary.
3. Install in the reverse order of removal.

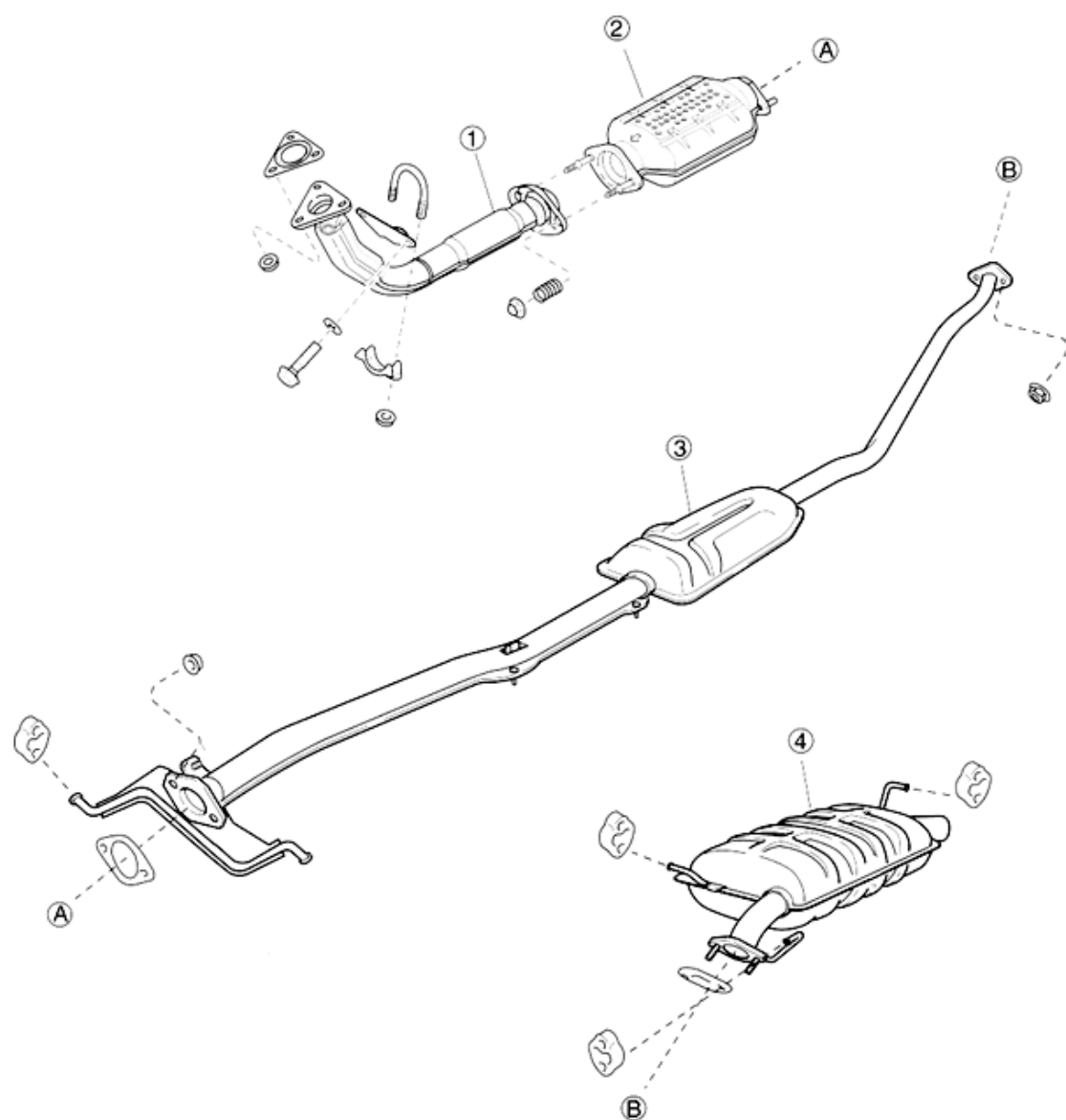
Intake system



- (1) Fresh air duct
- (2) Air intake hose assembly
- (3) Air cleaner element
- (4) Mass air flow sensor

- (5) Resonance chamber
- (6) Resonance chamber
- (7) Resonance chamber

Exhaust system



- (1) Front pipe assembly
- (2) Catalytic converter assembly

- (3) Pre-silencer assembly
- (4) Main-silencer assembly