SECTION 6A1

ENGINE MECHANICAL (G13B, 1-CAM 16-VALVES ENGINE)

WARNING:
For vehicles equipped with Supplement Restraint (Air Bag) System:
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either or these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

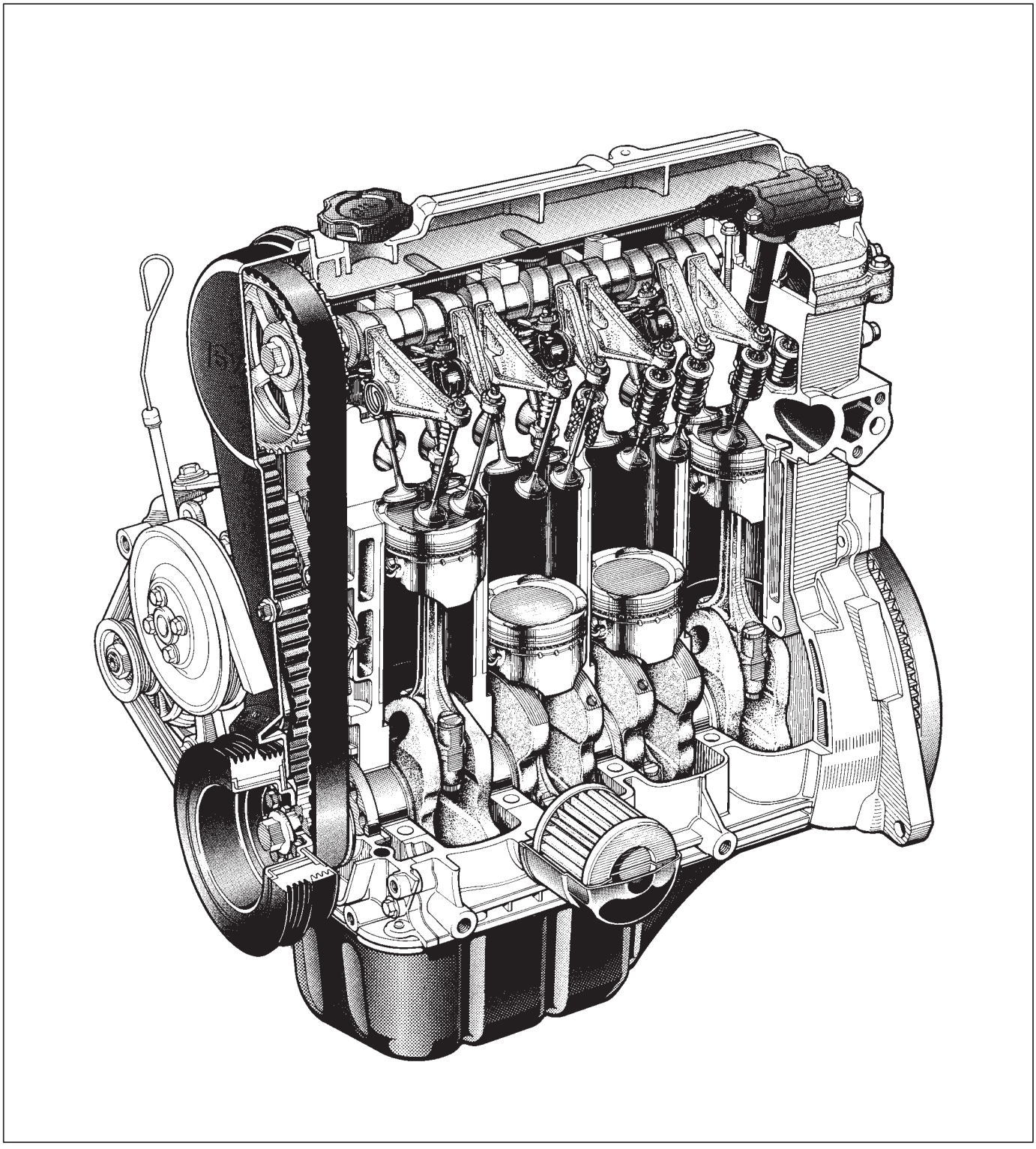
CONTENTS

NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit equipped with its S.O.H.C. (Single Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration and 16 valves (IN 2 and EX 2/one cylinder).
The single overhead camshaft is mounted over the cylinder head: it is driven from crankshaft through timing belt and opens and closes its valves via the rocker arms.

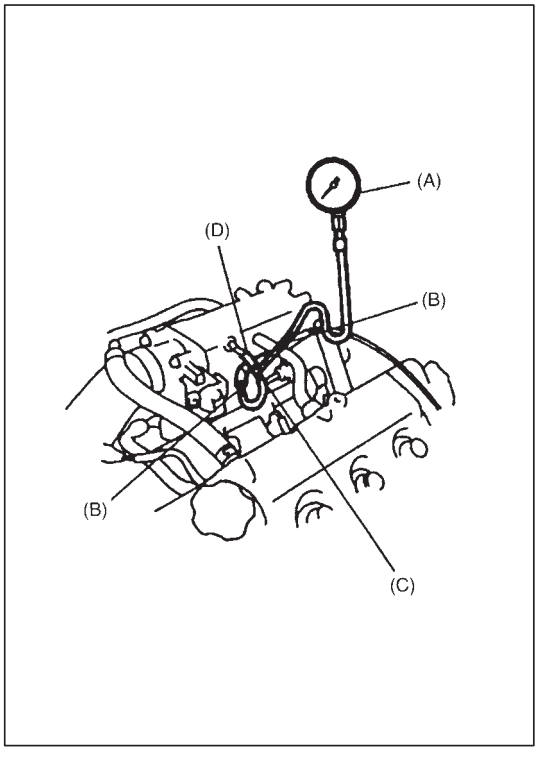


ENGINE VACUUM CHECK

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature.

   NOTE:
   After warming up engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.



2) With engine stopped, disconnect EVAP canister purge valve hose from intake manifold and connect 3-way joint, hoses and special tools (vacuum gauge and joint) between intake manifold and vacuum hose disconnected.

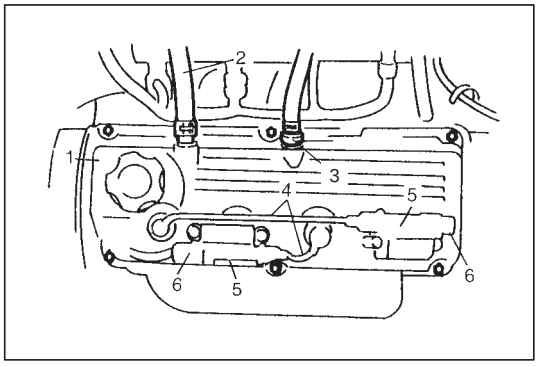
   Special Tool
   (A): 09915-67311
   (B): 09918-08210

   SUZUKI GENUINE PARTS
   (C): Hose 09343-03087
   (D): 3-way joint 09367-04002

3) Run engine at specified idle speed, and read vacuum gauge. Vacuum should be within the following specification.

   Vacuum specification (at sea level):
   52.6 – 65.8 kPa (40 – 50 cm·Hg, 15.7 – 19.7 in.Hg) at specified idling speed

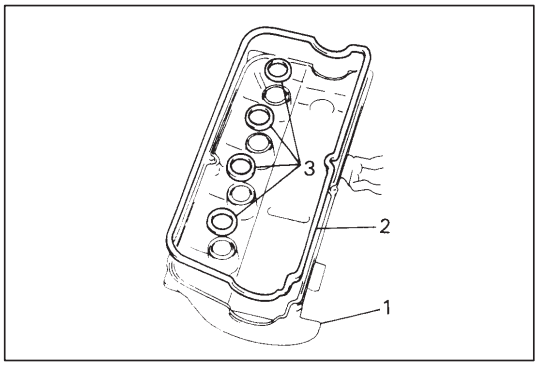
4) After checking, connect vacuum hose to intake surge tank.



CYLINDER HEAD COVER

REMOVAL

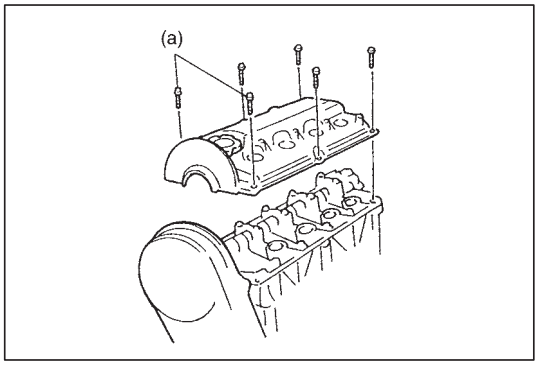
1) Disconnect negative cable at battery.
2) Disconnect breather hose (2) and PCV valve (3) from head cover.
3) Disconnect ignition coil couplers (6).
4) Remove ignition coil assemblies (5) with high-tension cord (4).
5) Remove cylinder head cover (1) with cylinder head cover gasket and O-rings.



INSTALLATION

1) Install O-rings (3) and cylinder head cover gasket (2) to cylinder head cover (1).

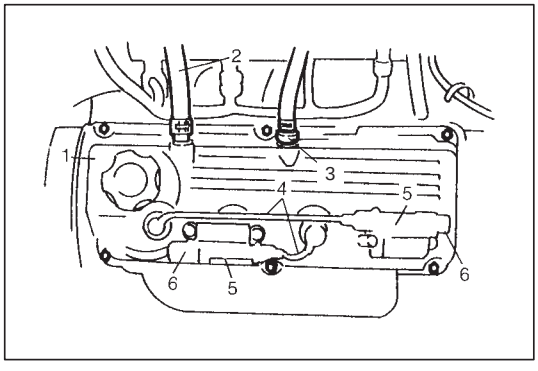
NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.



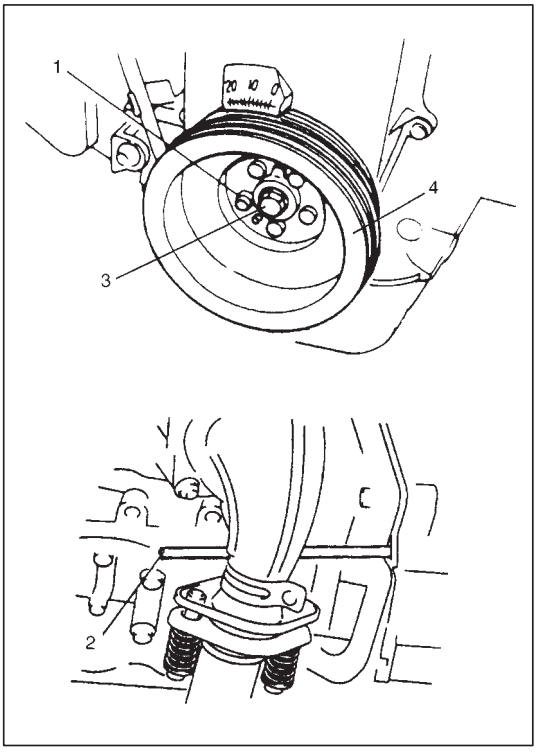
2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

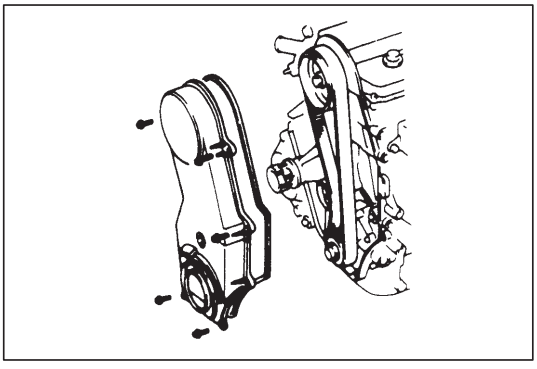
NOTE:
When installing cylinder head cover, use care so that cylinder head cover gasket or O-rings will not get out of place or fall off.



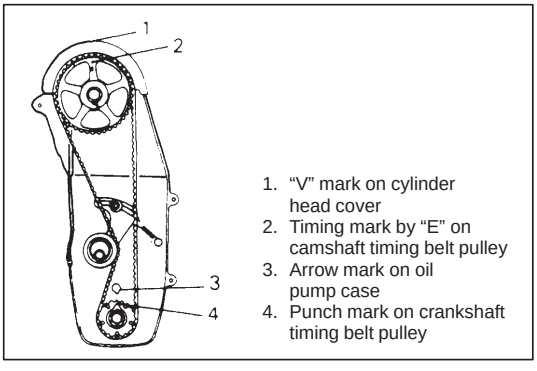
3) Install ignition coil assemblies (5) with high-tension cord (4).
4) Connect ignition coil couplers (6).
5) Connect breather hose (2) and PCV valve (3) to head cover (1).
6) Connect negative cable at battery.



8) Lock crankshaft inserting flat end rod or the like (2) between flywheel ring gear and transmission case, after removing clutch housing (torque converter housing for A/T) lower plate.
   With crankshaft locked, remove crankshaft timing belt pulley bolt (3).
9) Remove crankshaft pulley bolts (1).
10) Remove crankshaft pulley (4).
11) Install crankshaft timing belt pulley bolt temporarily to turn crankshaft.

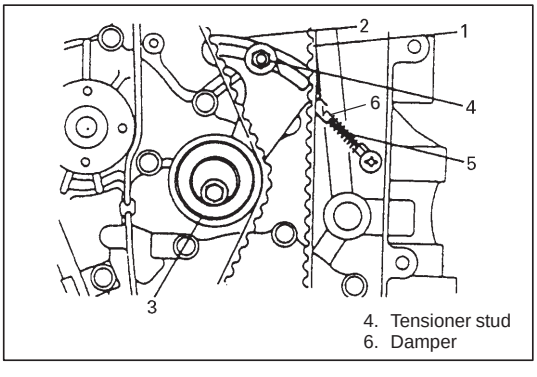


12) Release harness clamps.
13) Remove timing belt outside cover.



1. "V" mark on cylinder head cover
2. Timing mark by "E" on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

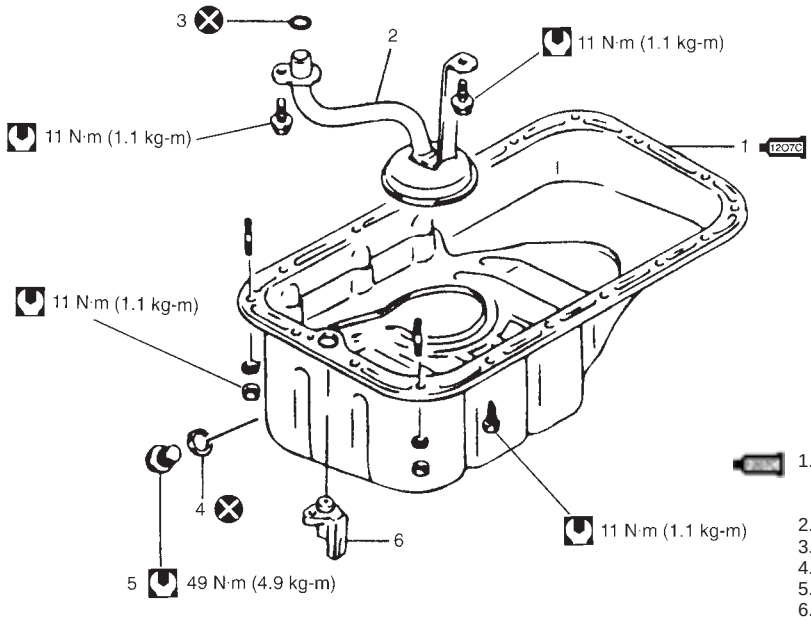
14) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



4. Tensioner stud
6. Damper

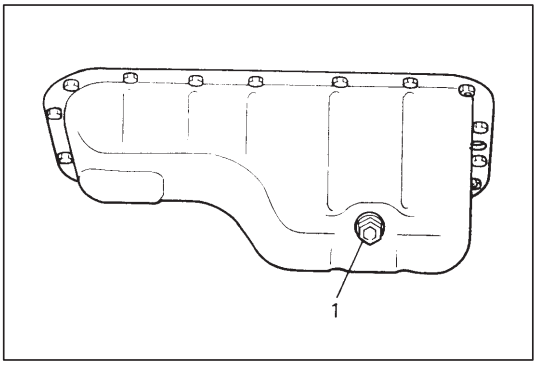
15) Remove timing belt tensioner (3), tensioner plate (2), tensioner spring (5) and timing belt (1).

OIL PAN AND OIL PUMP STRAINER



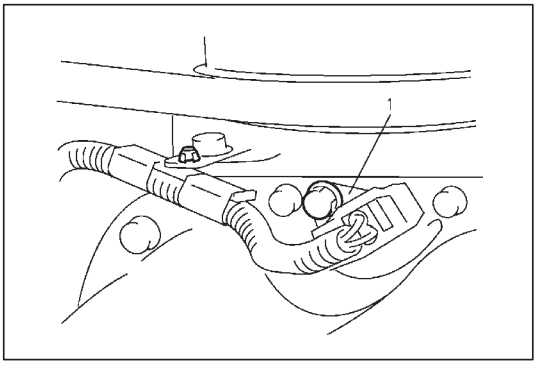
: Tightening Torque
: Do not reuse

1. Oil pan:
   Apply sealant 99000-31150 to oil pan mating surface.
2. Oil pump strainer
3. Seal
4. Drain plug gasket
5. Drain plug
6. CKP sensor

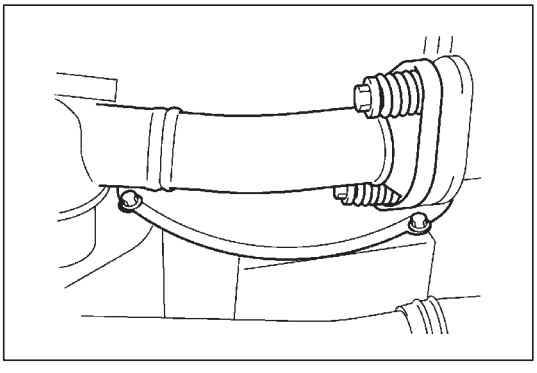


REMOVAL

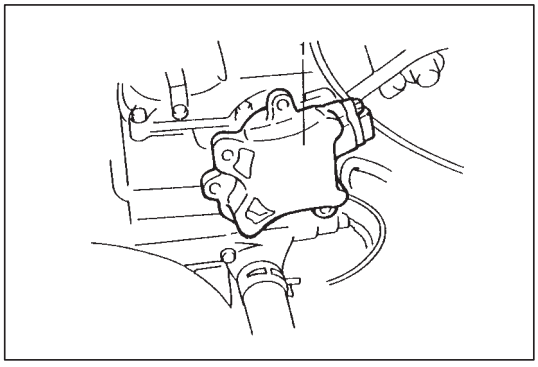
1) Raise vehicle.
2) Drain engine oil by removing drain plug (1).
3) Remove right side of engine under cover.



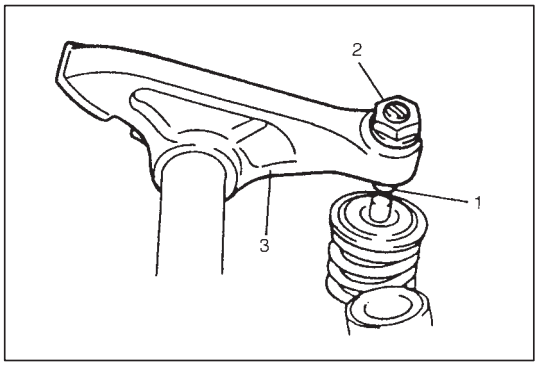
4) Disconnect CKP sensor coupler and remove CKP sensor (1) by removing its bolt. Then remove CKP sensor wire harness from clamp.



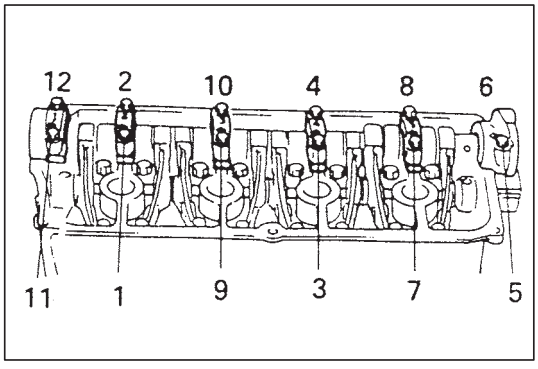
5) Remove clutch housing (torque converter housing for A/T) lower plate.



4) Disconnect CMP sensor coupler from CMP sensor.
5) Remove CMP sensor case (1) from cylinder head.
   Place a container or rag under CMP sensor case, for a small amount of oil flows out during removal of case.

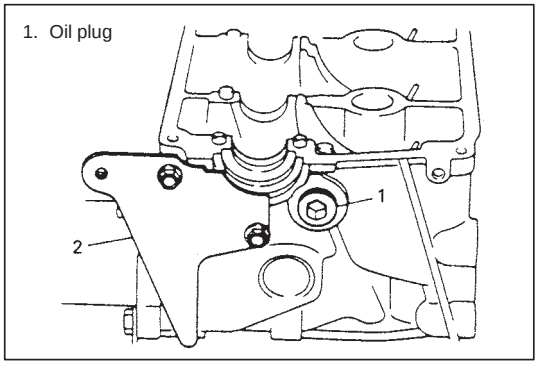


6) After loosening all valve adjusting screw lock nuts (2), turn adjusting screws (1) back all the way to allow all rocker arms (3) to move freely.

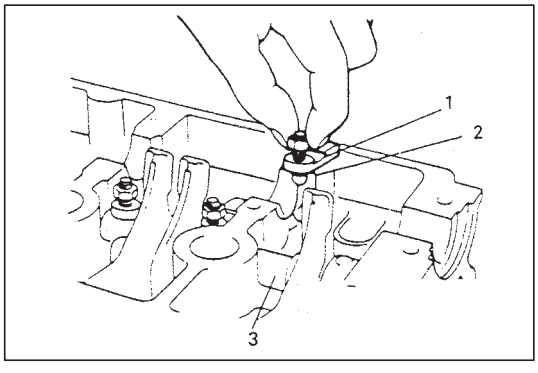


7) Remove camshaft housing and camshaft.

NOTE:
To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.

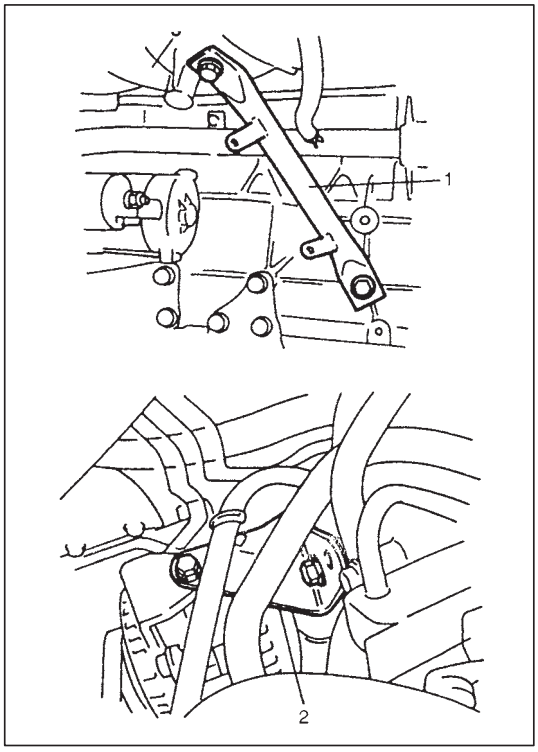


8) Remove timing belt inside cover (2).



9) Remove intake rocker arm (1) with clip (2) from rocker arm shaft (3).

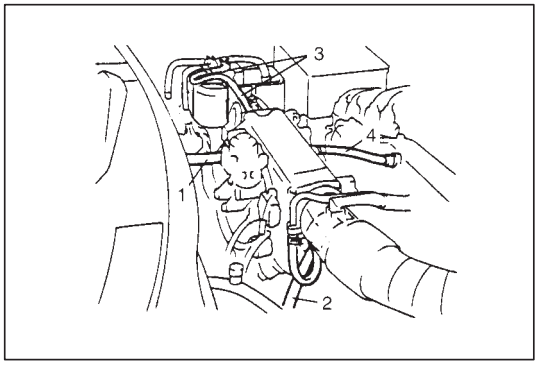
NOTE:
Do not bend clip when removing intake rocker arm.



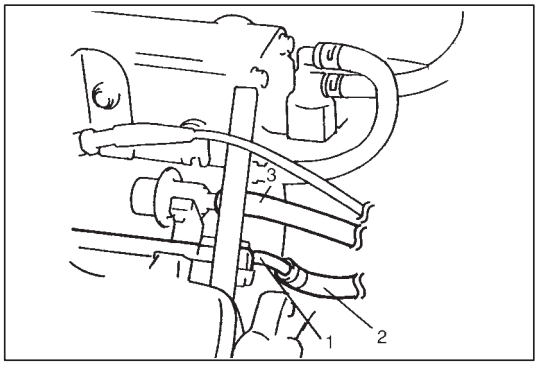
5) Remove intake manifold rear stiffener (1) and generator adjust arm reinforcement (2) from intake manifold.

6) Disconnect the following electric wires:
- Ignition coil assembly
- Ground wires from intake manifold
- EVAP canister purge valve
- ECT sensor
- Injectors, TP sensor and IAC valve wires at the coupler
- Heated oxygen sensor 1
- MAP sensor

and then release above wire harnesses from clamps.

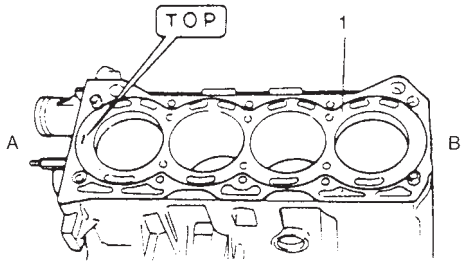


7) Disconnect the following hoses:
- Brake booster hose (1)
- EVAP canister purge hose (3) from purge valve
- Radiator inlet hose
- Heater inlet hose
- IAC valve outlet (2)



8) Disconnect fuel feed (2) and return hoses (3) from fuel delivery pipe (1).

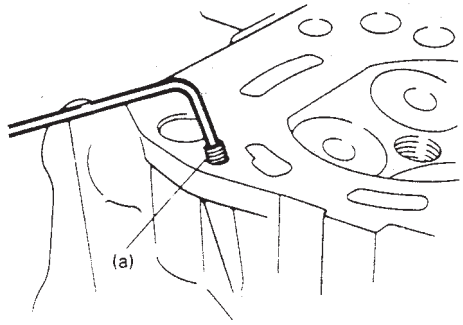
9) Install rocker arms, washers, rocker arm shaft and camshaft as previously outlined.
10) Install CMP sensor case, intake manifold and exhaust manifold.



A: Crankshaft pulley side
B: Flywheel side

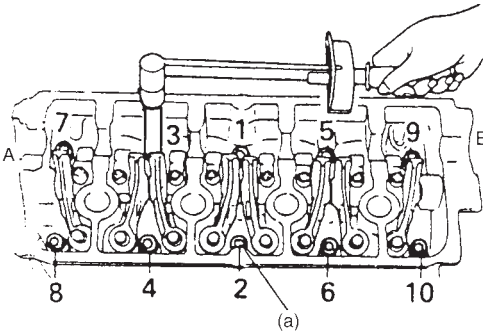
INSTALLATION

1) Remove oil gasket and oil on mating surfaces and install new head gasket (1) as shown in figure, that is, “TOP” mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



2) Check to make sure that oil jet (venturi plug) is installed and if it is, that it is not clogged.
When installing it, be sure to tighten to specified torque.

Tightening Torque
(a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)



A: Camshaft pulley side
B: CMP sensor case side

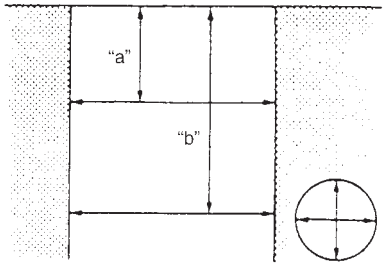
3) Apply engine oil to cylinder head bolts and tighten them gradually as follows.
   a) Tighten all bolts to 35 N·m (3.5 kg-m, 25.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in a), tighten them to 55 N·m (5.5 kg-m, 40.0 lb-ft).
   c) Loosen all bolts until tightening torque is reduced to 0 (zero) in reverse order of tightening.
   d) In the same manner as in a), tighten them to 35 N·m (3.5 kg-m, 25.0 lb-ft).
   e) In the same manner as in a) again, tighten them to specified torque.

Tightening Torque
(a): 68 N·m (6.8 kg-m, 49.5 lb-ft)

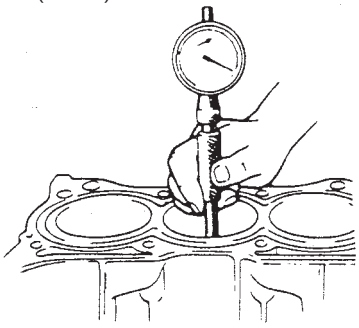
INSPECTION

Cylinders

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use oversize piston.



"a": 50 mm (1.96 in.)
"b": 95 mm (3.74 in.)

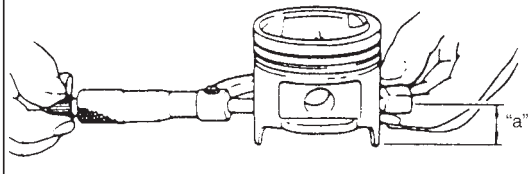


- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of the following conditions is noted, rebore cylinder.

1) Cylinder bore dia. exceeds limit.
2) Difference of measurements at two positions exceeds taper limit.
3) Difference between thrust and axial measurements exceeds out-of-round limit.

Cylinder bore dia. limit: 74.15 mm (2.9196 in.)
Tapper and out-of-round limit: 0.10 mm (0.0039 in.)

NOTE:
If any one of four cylinders has to be rebored, rebore all four to the same next oversize. This is necessary for the sake of uniformity and balance.

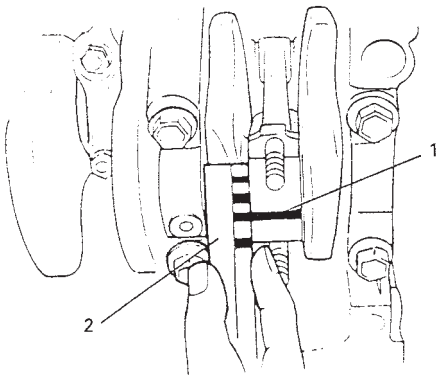


"a": 23 mm (0.91 in.)

Pistons

- Inspect piston for faults, cracks or other damaged.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 23 mm (0.91 in.) from piston skirt end in the direction perpendicular to piston pin.

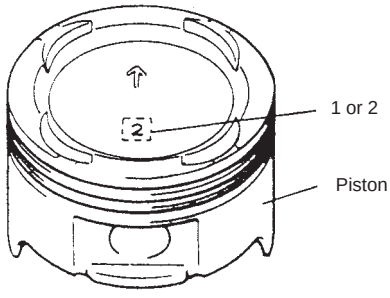
Piston diameter	Standard	73.970 – 73.990 mm (2.9122 – 2.9130 in.)
	Oversize: 0.25 mm (0.0098 in.)	74.220 – 74.230 mm (2.9220 – 2.9224 in.)
	0.50 mm (0.0196 in.)	74.470 –74.480 mm (2.9319 – 2.9323 in.)

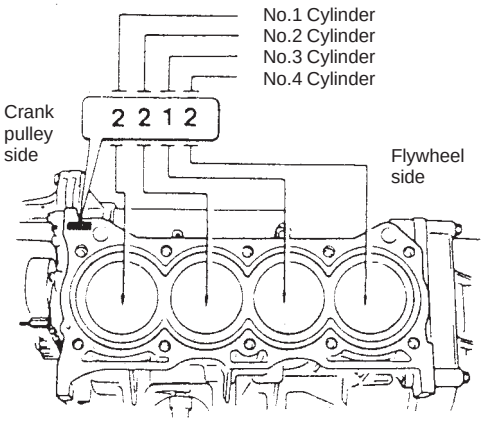


5) Remove cap and using a scale (2) on gaging plastic (1) envelope, measure gaging plastic width at the widest point (clearance).
   If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.020 – 0.050 mm (0.0008 – 0.0019 in.)	0.080 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crankpin to undersize and use 0.25 mm undersize bearing.





ASSEMBLY

NOTE:

Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.

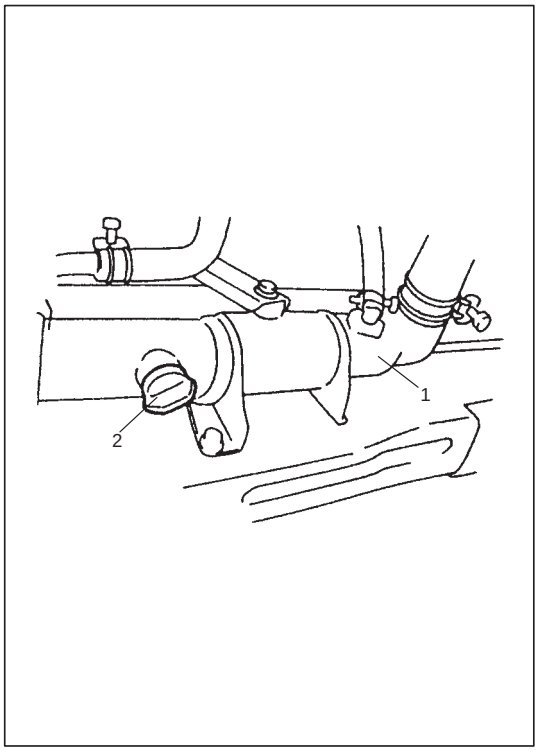
a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown. The first number represents inner diameter of No.1 cylinder, the second number of No.2 cylinder, the third number of No.3 cylinder and the fourth number of No.4 cylinder.

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

REMOVAL

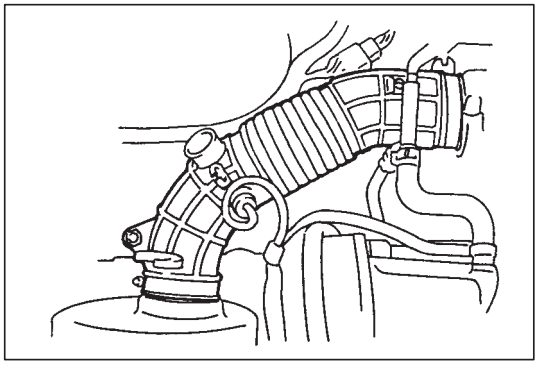
1) Release fuel pressure in fuel feed line by referring to Section 6.
2) Remove battery.
3) Remove engine hood after disconnecting windshield washer hose.



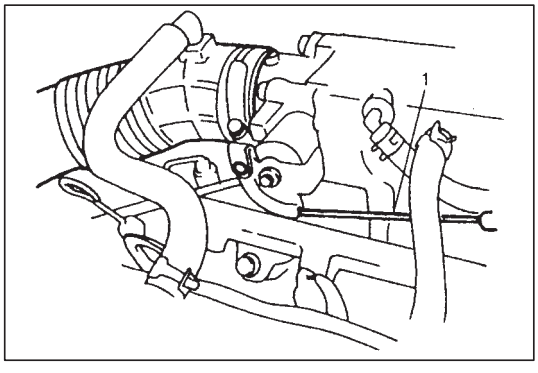
4) Drain cooling system.

WARNING:
To help avoid danger of being burned, do not remove drain plug (2) and radiator cap while engine and radiator (1) are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.

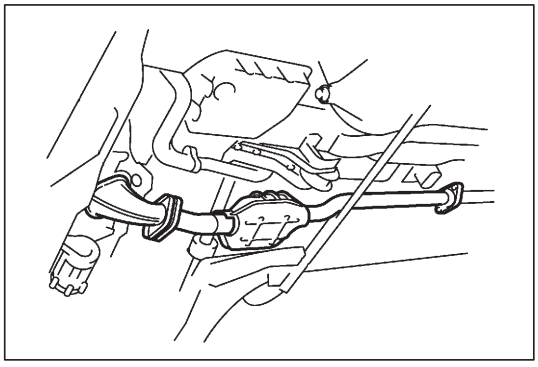
5) Disconnect coupler of cooling fan motor.
6) Disconnect radiator inlet hose from thermostat case.
7) Disconnect A/T fluid hoses from A/T fluid pipes (for A/T model)
8) Remove outlet hose from water inlet pipe and radiator.
9) Remove radiator referring to Section 6B.



10) Remove air cleaner case and air cleaner outlet hose as previously outlined.



11) Disconnect the following cables.
- Accelerator cable (1) from throttle body.
- A/T throttle pressure control cable from A/T.
- Clutch cable from transmission (M/T).
- Gear select cable from transmission (A/T).
- Speedometer cable



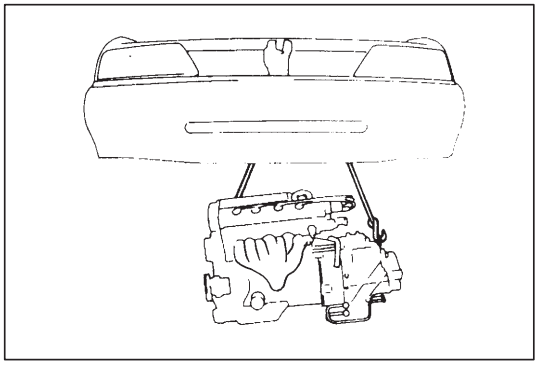
15) Remove exhaust No.1 pipe.
16) Remove right and left engine under covers.
17) Remove gear shift control shaft from transmission and remove extension rod (M/T).
18) Drain engine and transmission oil.
19) Disconnect drive shaft joints from differential gears of transmission or center bearing support referring to Section 4. In this case, it is not necessary to disconnect drive shafts from steering knuckle.
20) With hoses connected, detach A/C compressor and/or P/S pump with bracket from cylinder block, if equipped.

NOTE:
Suspend removed compressor and/or pump at a place where no damage will be caused during removal and installation of engine with transmission.

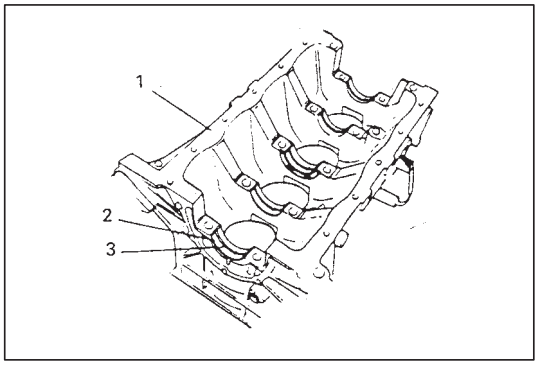
21) Disconnect P/S hose from P/S oil pump. (if equipped)

NOTE:
Plug pipe, hose and pump port.

22) Install support device.
23) Remove rear mounting from body. (For M/T model)
Remove rear torque rod (For A/T model).
24) Remove engine left mounting from body.
25) Remove engine right mounting from right mounting bracket and stiffener.



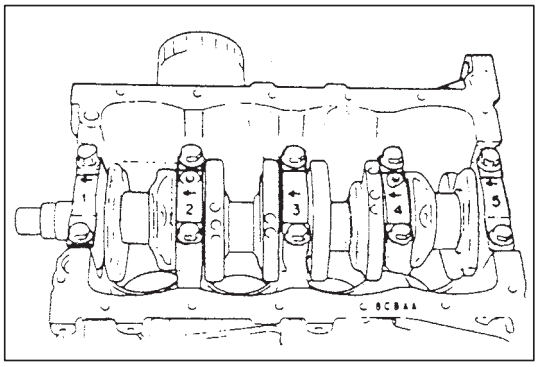
26) Before removing engine with transmission from body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transmission.
27) Lower engine with transmission from body.



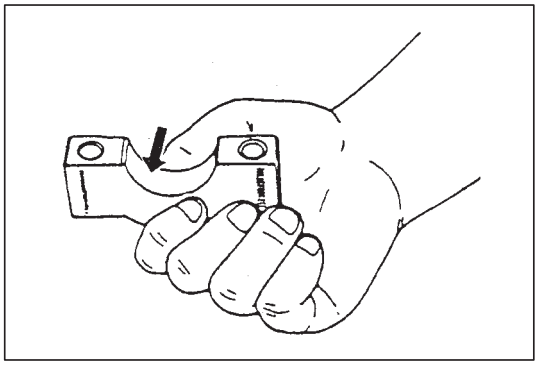
Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing (2) has oil groove (3) as shown in figure. Install this half with oil groove to cylinder block (1).

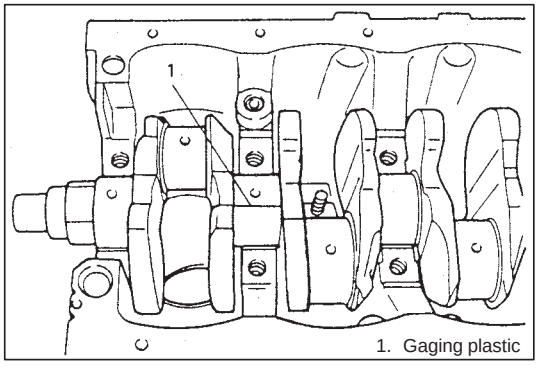


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers “1”, “2”, “3”, “4” and “5”. Tighten cap bolts to specified torque.



Inspection

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace one half without replacing the other half.

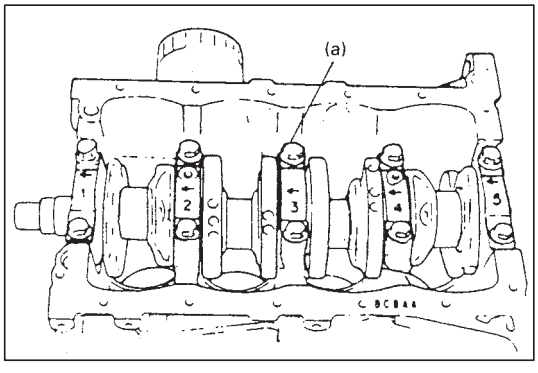


1. Gaging plastic

Main bearing clearance

Check clearance by using gaging plastic (1) according to the following procedure.

1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly toque cap bolts to specified torque.
   Bearing cap MUST be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 54 N·m (5.4 kg-m, 39.0 lb-ft)

   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.

TIGHTENING TORQUE SPECIFICATIONS

FASTENING PARTS	TIGHTENING TORQUE		
	N·m	kg-m	lb-ft
Oil pressure switch	13	1.3	9.5
Valve adjusting screw lock nuts	12	1.2	9.0
Cylinder head cover bolts	11	1.1	8.0
Intake manifold bolts and nuts	23	2.3	17.0
Timing belt tensioner stud	11	1.1	8.0
Timing belt tensioner bolt	25	2.5	18.0
Timing belt cover bolts and nut	11	1.1	8.0
Exhaust manifold bolts and nuts	32	3.2	23.5
Crankshaft pulley bolt	16	1.6	11.5
Crankshaft timing belt pulley bolt	130	13.0	94.0
Exhaust pipe nuts and bolts	50	5.0	36.5
Exhaust manifold stiffener nut			
Oil pump strainer bolt and stay bolt	11	1.1	8.0
Oil pan bolts and nuts			
CKP sensor bolt	10	1.0	7.5
Oil pan drain plug	50	5.0	36.0
Oil pump rotor plate screws	11	1.1	8.0
Oil pump case bolts			
Camshaft housing bolts	11	1.1	8.0
Rocker arm shaft bolts			
Camshaft timing belt pulley bolt	60	6.0	43.5
Cylinder head venturi plug	3.5	0.35	2.5
Cylinder head bolts	68	6.8	49.0
Connecting rod bearing cap nuts	35	3.5	25.5
Crankshaft main bearing cap bolts	54	5.4	39.0
Flywheel bolts	78	7.8	56.5
Drive plate bolts	95	9.5	69.0
Engine mounting & bracket bolts and nuts	Refer to INSTALLATION of ENGINE ASSEMBLY in this section.		