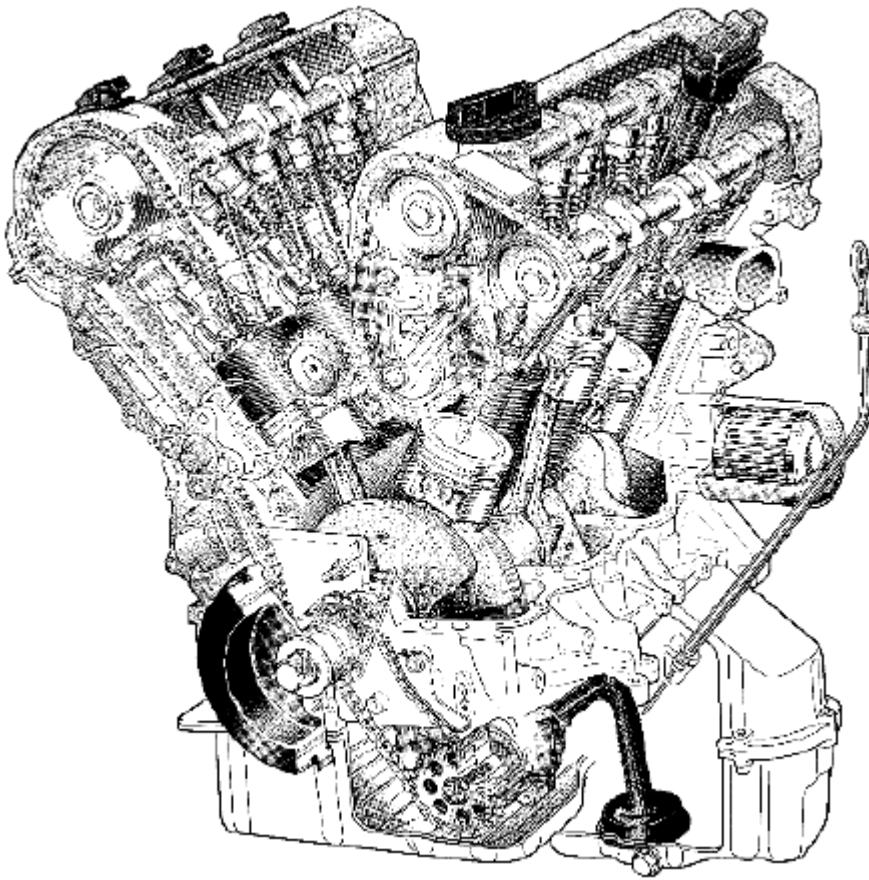


**2006-08 ENGINE****Engine Mechanical - Grand Vitara****GENERAL DESCRIPTION****ENGINE GENERAL INFORMATION**

The engine is a water-cooled, 60° V6 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for "V" type valve configuration. The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chains, and no push rods are provided in the valve train system.



**Fig. 1: Cutaway View Of Engine**  
Courtesy of SUZUKI OF AMERICA CORP.

**AIR CLEANER FILTER INTRODUCTION**

This air cleaner filter is of dry type. Note that it needs cleaning referring to **AIR CLEANER FILTER INSPECTION AND CLEANING**.

**IMT (INTAKE MANIFOLD TUNING) SYSTEM**

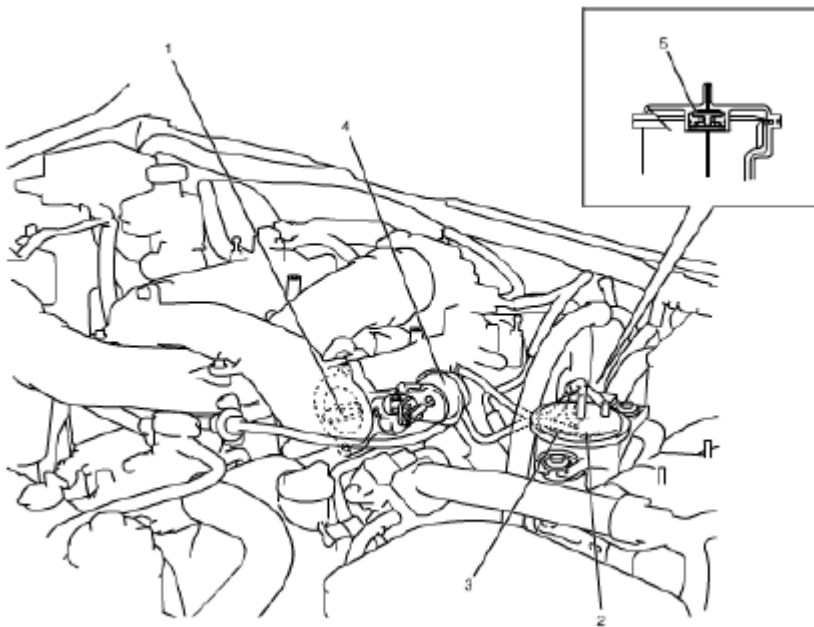
**Description**

IMT system consists of the following items:

- IMT valve (1) installed between intake manifold and surge tank pipe
- IMT valve actuator (4)
- IMT vacuum solenoid valve (2)
- Vacuum tank (3)

Vacuum tank contains the one way check valve (5) to maintain negative pressure constantly regardless of variation in the intake manifold pressure.

Vacuum tank, therefore, supplies IMT vacuum solenoid valve actuator with stable negative pressure in whole engine speed ranges.



**Fig. 2: Identifying IMT Valve Actuator & IMT Vacuum Solenoid Valve**  
**Courtesy of SUZUKI OF AMERICA CORP.**

IMT system varies the effective length of intake pipe by opening and closing IMT valve in order to improve an air volumetric efficiency.

When IMT valve is fully open [A]:

The effective length of intake pipe is short.

With this condition, the engine torque is large at low and middle-high engine speed ranges.

However, the engine torque is small at middle-low and high engine speed ranges.

When IMT valve is totally closed [B]:

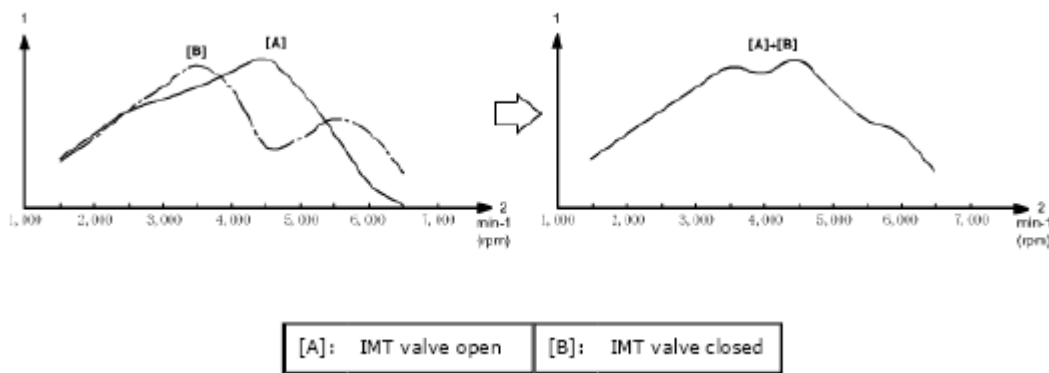
The effective length of intake pipe is long.

With this condition, the engine torque is large at middle-low and high engine speed ranges.

However, the engine torque is small at low and middle-high engine speed ranges.

IMT system utilizes this characteristic of engine. IMT valve is opened at low and middle-high engine speed ranges, and closed at middle-low and high engine speed ranges.

In this way, engine torque is improved in whole engine speed ranges.



**Fig. 3: IMT Valve Graph**

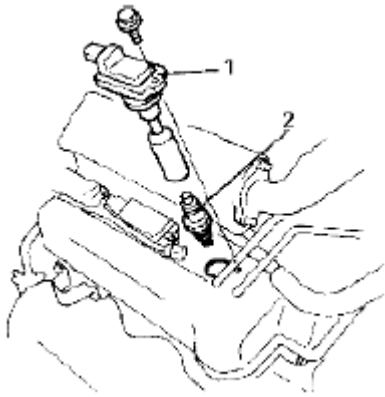
Courtesy of SUZUKI OF AMERICA CORP.

## DIAGNOSTIC INFORMATION AND PROCEDURE

### COMPRESSION CHECK

Check compression pressure on all 6 cylinders as follows:

1. Warm up engine.
2. Stop engine after warming up.
3. Remove surge tank cover and disconnect ignition coil harness couplers.
4. Remove all ignition coils (1) and spark plugs (2) referring to **SPARK PLUG REMOVAL AND INSTALLATION**.

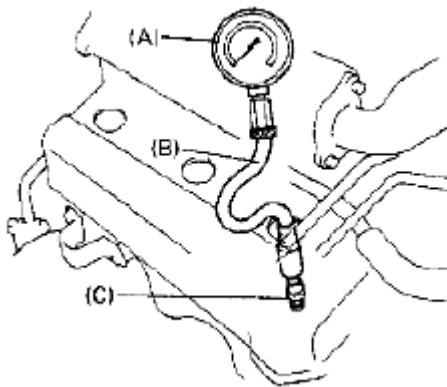


**Fig. 4: Identifying Ignition Coils & Spark Plugs**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Disconnect fuel injector wire harness at connector
6. Install special tool (Compression gauge) into spark plug hole.

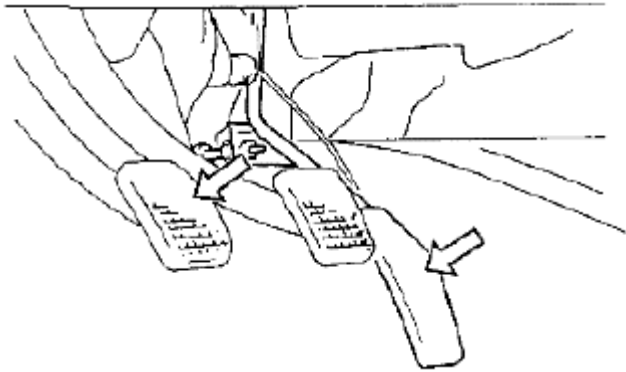
#### **Special Tool**

- A. **09915-64512**
- B. **09915-64530**
- C. **09915-67010**



**Fig. 5: Installing Special Tool (Compression Gauge) Into Spark Plug Hole**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Disengage clutch (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal all the way to make throttle fully open.



**Fig. 6: Locating Clutch & Accelerator Pedals**  
 Courtesy of SUZUKI OF AMERICA CORP.

8. Crank engine with fully charged battery, and read the highest pressure on compression gauge.

**NOTE:** For measuring compression pressure, crank engine at least 250 RPM by using fully charged battery.

#### Compression pressure

**Standard:** 1400 - 1600 kPa (14.0 - 16.0 kg/cm<sup>2</sup> , 199.0 - 227.5 psi)

**Limit:** 1100 kPa (11.0 kg/cm<sup>2</sup> , 156.0 psi)

**Max. difference between any two cylinders:** 100 kPa (1.0 kg/cm<sup>2</sup> , 14.2 psi)

9. Carry out steps 6, 7 and 8 on each cylinder to obtain 6 readings.

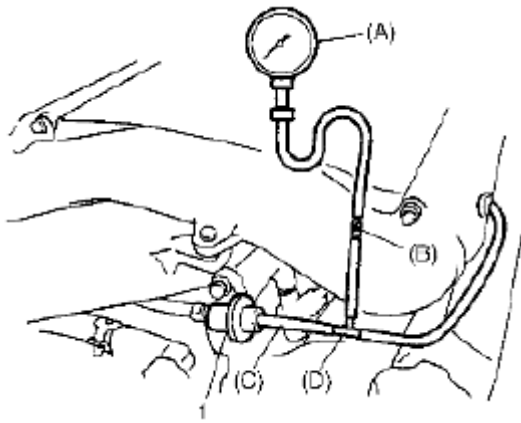
#### ENGINE VACUUM CHECK

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 and make sure that engine idle speed is within specification.
2. Stop engine and disconnect vacuum hoses from fuel pressure regulator valve (1).
3. Connect special tools (Vacuum gauge and hose joint) and 3-way joint between vacuum hose and valve.

#### Special Tool

- A. 09915-67311
- B. 09918-08210
- C. 09355-35754-600 Hose, SUZUKI genuine parts
- D. 09367-04002 3-way joint, SUZUKI genuine parts



**Fig. 7: Connecting Special Tools & 3-Way Joint Between Vacuum Hose & Valve**  
 Courtesy of SUZUKI OF AMERICA CORP.

4. Start engine and run engine at specified idle speed, and read vacuum gauge. Vacuum should be within specification.

**Vacuum specifications (sea level)**

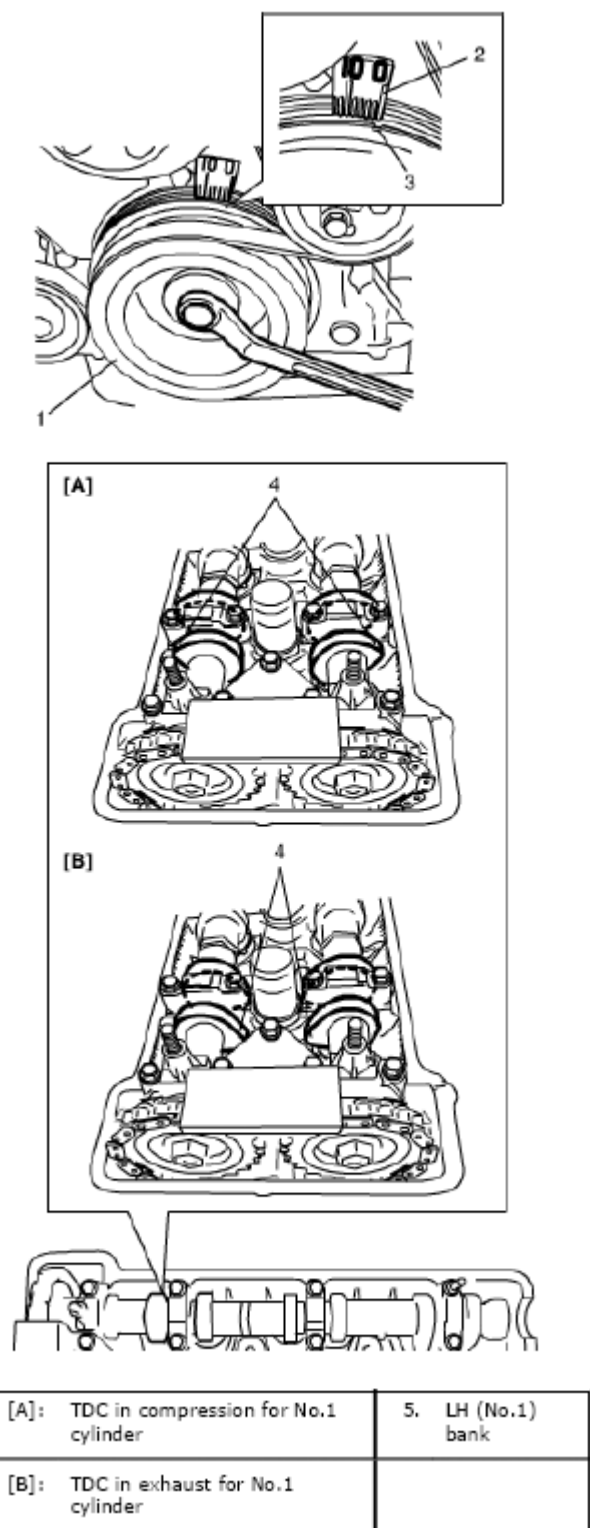
**59-79 kPa (450-600 mm Hg, 17.7-23.7 in. Hg) at specified idle speed**

5. After checking, remove, all special tools.
6. Connect vacuum hoses to fuel pressure regulator valve.

**VALVE LASH (CLEARANCE) INSPECTION**

1. Remove negative (-) cable at battery.
2. Remove cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
3. Using 19 mm wrench, turn crankshaft pulley (1) clockwise until timing mark "O" position (2) of cylinder block and index (3) of crankshaft pulley (1) are aligned.
4. Check whether cam position (4) of No. 1 cylinder is at the specified position [A] as shown in figure.

If cam position is [B], locate cam position to [A] by turning crankshaft one rotation.



**Fig. 8: Turning Crankshaft Pulley**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Check valve lashes with thickness gauge (1) according to the following procedure.

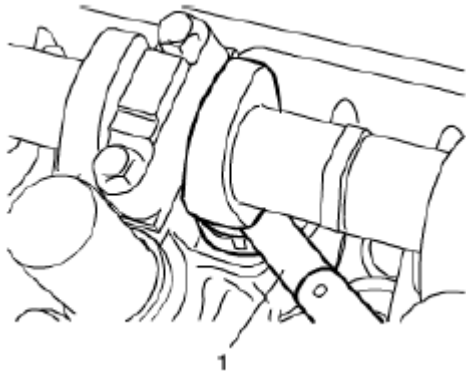
- a. Check valve lashes of cylinder No. 1.
- b. Turn crankshaft pulley by 120° clockwise.
- c. Check valve lashes of cylinder No.6.
- d. In the same manner as b) - c), check valve lashes of cylinder No. 5, cylinder No. 4, cylinder No. 3 then cylinder No. 2.

If valve lash is out of specification, record valve lash and adjust it to specification by replacing shim.

### Valve clearance specification

#### VALVE CLEARANCE SPECIFICATION

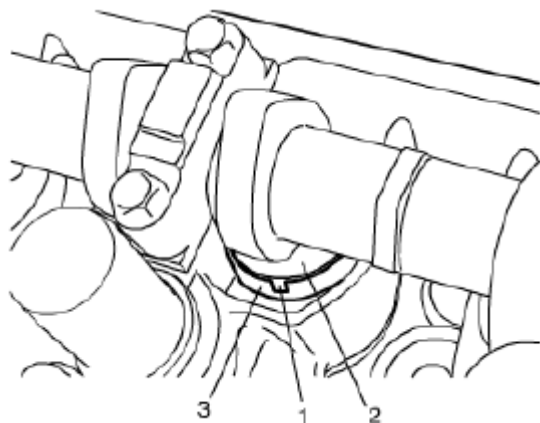
| Application | When cold (Coolant temperature is 15-25 °C (59-77 ° F)) | When hot (Coolant temperature is 60-68 °C (140-154 °F)) |
|-------------|---------------------------------------------------------|---------------------------------------------------------|
| Intake      | 0.18-0.22 mm (0.007-0.008 in.)                          | 0.21-0.27 mm (0.008-0.011 in.)                          |
| Exhaust     | 0.28-0.32 mm (0.011-0.012 in.)                          | 0.30-0.36 mm (0.012-0.014 in.)                          |



**Fig. 9: Checking Valve Lashes With Thickness Gauge**  
**Courtesy of SUZUKI OF AMERICA CORP.**

#### Replacement of Shim

1. Close the valve whose shim (2) is to be replaced by turning crankshaft, then turn tappet (3) till its cut section (1) faces inside as shown in figure.



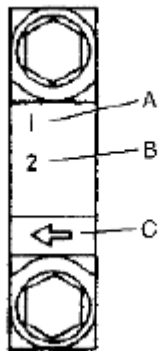
**Fig. 10: Identifying Valve Shim & Tappet**  
Courtesy of SUZUKI OF AMERICA CORP.

2. Lift down the valve by turning crankshaft to 360°.
3. Hold tappet at that position using special tool as follows.
  - a. Remove its housing bolts.
  - b. Check housing No. and select special tool corresponding to housing No. as below table.

**Special tool selection table**

**CAMSHAFT HOUSING REFERENCE**

| No. on camshaft housing | Embossed mark on special tool |
|-------------------------|-------------------------------|
| I2. I3. I4.             | IN                            |
| E2. E3. E4.             | EX                            |



|    |                                   |
|----|-----------------------------------|
| A: | I: Intake side or E: Exhaust side |
| B: | Position from timing chain side   |
| C: | Pointing to timing chain side     |

**Fig. 11: Identifying Intake & Exhaust Side Position From Timing Chain**  
Courtesy of SUZUKI OF AMERICA CORP.

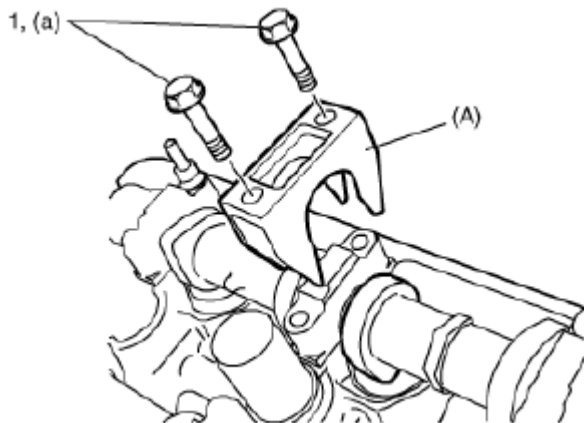
- c. Hold down the tappet so as not to contact the shim by installing special tool on camshaft housing with housing bolt (1) tighten housing bolts to specified torque.

### Special Tool

A. 09916-66510

### Tightening torque

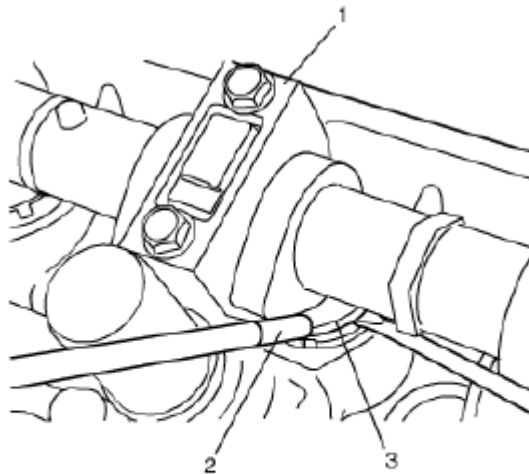
Camshaft housing bolts a: 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure



**Fig. 12: Identifying Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Turn camshaft by approximately 90° clockwise and remove shim (3).

**WARNING: Never put in the hand between camshaft and tappet.**



1. Special tool

2. Magnet

**Fig. 13: Identifying Shim & Magnet**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Using a micrometer (2), measure the thickness of the removed shim (1), and determine replacement shim by calculating the thickness of new shim with the following formula and table.

#### Shim thickness specification

##### Intake side:

$$A = B + C - 0.200 \text{ mm (0.008 in.)}$$

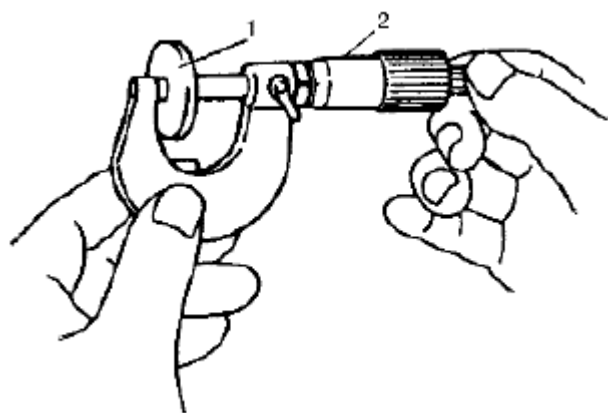
##### Exhaust side:

$$A = B + C - 0.300 \text{ mm (0.012 in.)}$$

**A: Thickness of new shim**

**B: Thickness of removed shim**

**C: Measured valve clearance**



**Fig. 14: Measuring Thickness Of Shim**  
**Courtesy of SUZUKI OF AMERICA CORP.**

For example of intake side:

When thickness of removed shim is 2.400 mm (0.094 in.), and measured valve clearance is 0.450 mm (0.018 in.).

$$A = 2.400 \text{ mm (0.094 in.)} + 0.450 \text{ mm (0.018 in.)} - 0.200 \text{ mm (0.008 in.)} = 2.650 \text{ mm (0.104 in.)}$$

Calculated thickness of new shim = 2.650 mm (0.104 in.)

6. Select new shim No. (1) with a thickness as close as possible to calculated value.

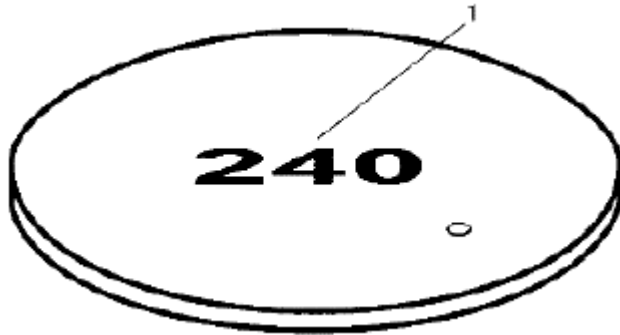
**Available new shim No .**

#### **SHIM THICKNESS SPECIFICATION**

| Thickness mm<br>(in.) | Shim No. | Thickness mm<br>(in.) | Shim No. |
|-----------------------|----------|-----------------------|----------|
| 2.175 (0.0856)        | 218      | 2.600 (0.1024)        | 260      |
| 2.200 (0.0866)        | 220      | 2.625 (0.1033)        | 263      |
| 2.225 (0.0876)        | 223      | 2.650 (0.1043)        | 265      |
| 2.250 (0.0886)        | 225      | 2.675 (0.1053)        | 268      |
| 2.275 (0.0896)        | 228      | 2.700 (0.1063)        | 270      |
| 2.300 (0.0906)        | 230      | 2.725 (0.1073)        | 273      |
| 2.325 (0.0915)        | 233      | 2.750 (0.1083)        | 275      |
| 2.350 (0.0925)        | 235      | 2.775 (0.1093)        | 278      |
| 2.375 (0.0935)        | 238      | 2.800 (0.1102)        | 280      |
| 2.400 (0.0945)        | 240      | 2.825 (0.1112)        | 283      |
| 2.425 (0.0955)        | 243      | 2.850 (0.1122)        | 285      |
| 2.450 (0.0965)        | 245      | 2.875 (0.1132)        | 288      |
| 2.475 (0.0974)        | 248      | 2.900 (0.1142)        | 290      |
| 2.500 (0.0984)        | 250      | 2.925 (0.1152)        | 293      |

|                |     |                |     |
|----------------|-----|----------------|-----|
| 2.525 (0.0994) | 253 | 2.950 (0.1161) | 295 |
| 2.550 (0.1004) | 255 | 2.975 (0.1171) | 298 |
| 2.575 (0.1014) | 258 | 3.000 (0.1181) | 300 |

7. Install new shim facing shim No. side (1) with tappet.

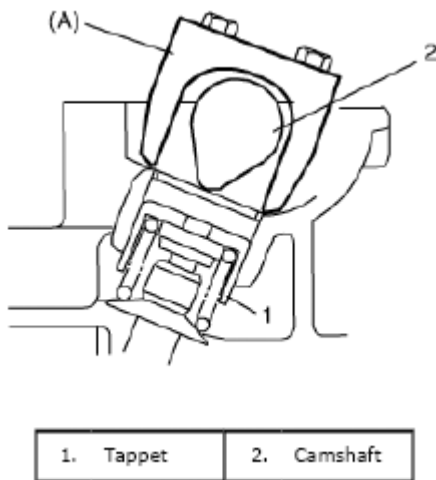


**Fig. 15: Identifying Shim Number**  
Courtesy of SUZUKI OF AMERICA CORP.

8. Lift valve by turning crankshaft counterclockwise (in opposite direction against above Step 4 and remove special tool.

**Special Tool**

- A. 09916-66510

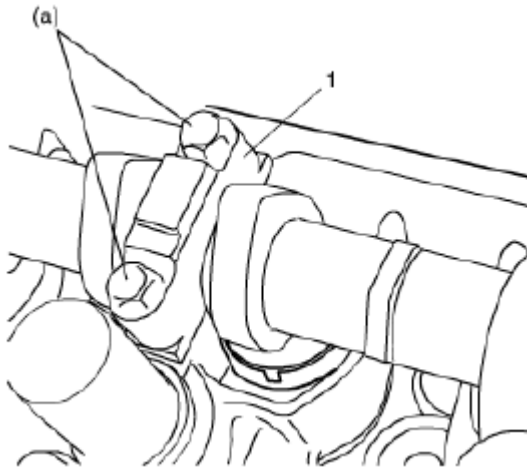


**Fig. 16: Identifying Tappet & Camshaft**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Install camshaft housing (1) and tighten bolts to specified torque.

**Tightening torque**

**Camshaft housing bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)**

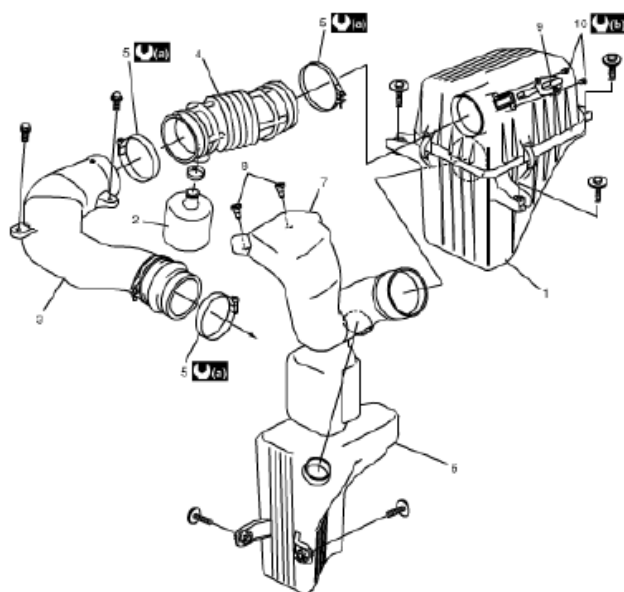


**Fig. 17: Identifying Camshaft Housing Bolts**  
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Turn crankshaft pulley more than 4 rotations.
11. Check valve clearance again after adjusting it.
12. After checking and adjusting all valves.
13. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.

## **REPAIR INSTRUCTIONS**

### **AIR INTAKE SYSTEM COMPONENTS**



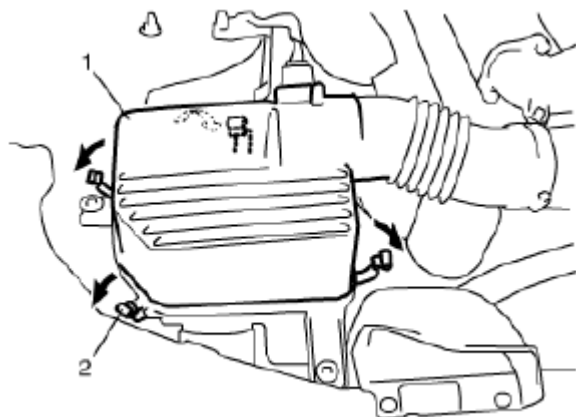
|                         |                            |                             |                                 |
|-------------------------|----------------------------|-----------------------------|---------------------------------|
| 1. Air cleaner assembly | 4. Air cleaner outlet hose | 7. Air cleaner suction pipe | 10. MAF and IAT sensor screw    |
| 2. Resonator No.2       | 5. Clamp                   | 8. Clip                     | 2.0 N·m (0.2 kgf-m, 1.5 lb-ft)  |
| 3. Air intake pipe      | 6. Resonator No.1          | 9. MAF and IAT sensor       | 1.6 N·m (0.16 kgf-m, 1.2 lb-ft) |

**Fig. 18: Identifying Air Intake System Components With Torque Specifications**  
 Courtesy of SUZUKI OF AMERICA CORP.

## AIR CLEANER FILTER REMOVAL AND INSTALLATION

### Removal

1. Disconnect connector from MAF and IAT sensor.
2. Open air cleaner upper case (1) after unhooking its clamps (2).



**Fig. 19: Identifying Cleaner Upper Case & Clamps**

Courtesy of SUZUKI OF AMERICA CORP.

3. Remove air cleaner filter.

#### Installation

**Reference:** AIR CLEANER FILTER INSPECTION AND CLEANING

Reverse removal procedure for installation.

#### AIR CLEANER FILTER INSPECTION AND CLEANING

**Reference:** AIR CLEANER FILTER REMOVAL AND INSTALLATION

#### Inspection

Check filter for dirt. Replace if filter is excessively dirty.

#### Cleaning

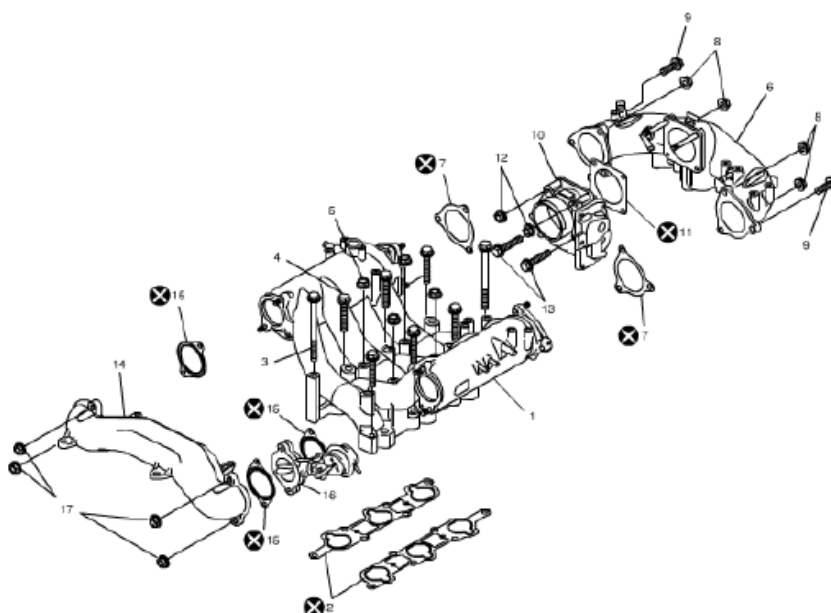
When cleaning filter, blow off dust by blowing compressed air from air outlet side of filter (i.e., the side facing up when installed in air cleaner case).



**Fig. 20: Cleaning Air Filter**

Courtesy of SUZUKI OF AMERICA CORP.

#### INTAKE COLLECTOR AND INTAKE MANIFOLD COMPONENTS



|                                 |                                     |                                            |                                        |
|---------------------------------|-------------------------------------|--------------------------------------------|----------------------------------------|
| 1. Intake manifold              | 6. Intake collector                 | 11. Electric throttle body assembly gasket | 16. IMT (Intake manifold tuning) valve |
| 2. Intake manifold gasket       | 7. Intake collector gasket          | 12. Electric throttle body assembly nut    | 17. Surge tank pipe nut                |
| 3. Intake manifold bolt (long)  | 8. Intake collector nut             | 13. Electric throttle body assembly bolt   | Do not reuse.                          |
| 4. Intake manifold bolt (short) | 9. Intake collector bolt            | 14. Surge tank pipe                        |                                        |
| 5. Intake manifold nut          | 10. Electric throttle body assembly | 15. Surge tank pipe gasket                 |                                        |

**Fig. 21: Identifying Intake Collector & Intake Manifold Components**

Courtesy of SUZUKI OF AMERICA CORP.

## ELECTRIC THROTTLE BODY ASSEMBLY ON-VEHICLE INSPECTION

Check electric throttle body assembly referring to **ELECTRIC THROTTLE BODY ASSEMBLY ON-VEHICLE INSPECTION**.

## ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION

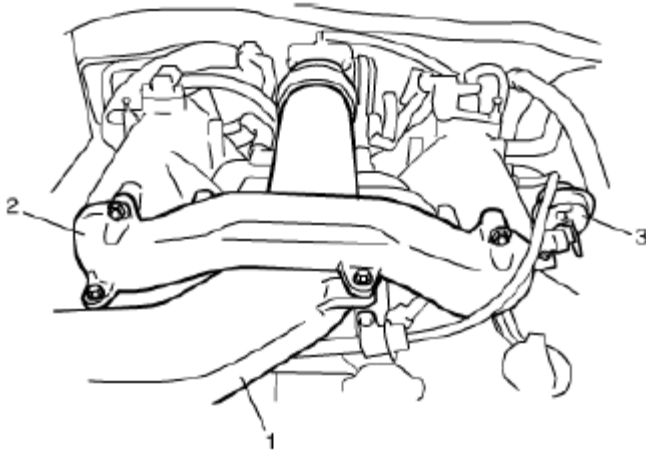
**Reference:** **INTAKE COLLECTOR AND INTAKE MANIFOLD COMPONENTS**

**Reference:** **ELECTRIC THROTTLE BODY ASSEMBLY ON-VEHICLE INSPECTION**

### Removal

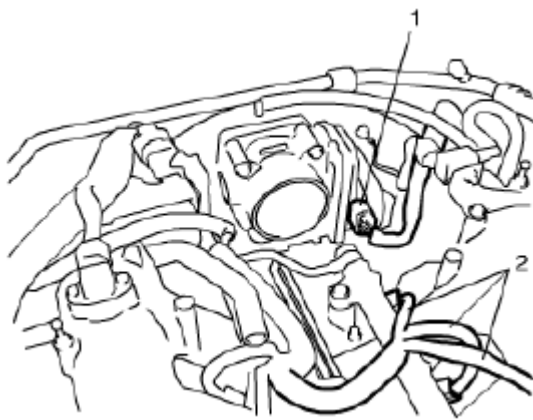
1. Release fuel pressure in fuel feed line by referring to **FUEL PRESSURE RELIEF PROCEDURE**.
2. Disconnect negative (-) cable at battery.
3. Drain engine coolant referring to **COOLING SYSTEM DRAINING**.

4. Remove surge tank cover.
5. Remove intake air pipe (1), surge tank pipe (2) and IMT valve (3).



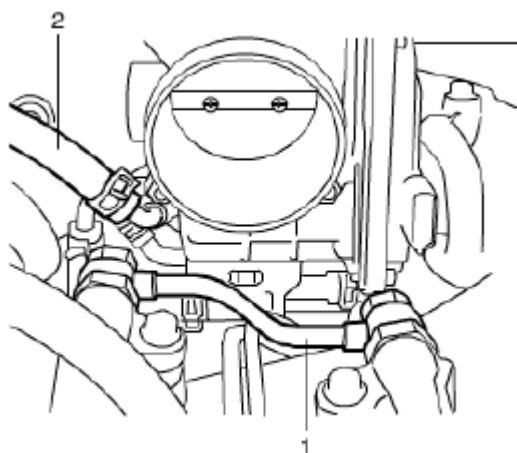
**Fig. 22: Identifying Intake Air Pipe Surge Tank Pipe & IMT Valve**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect connectors from electric throttle body assembly (1) and fuel injectors (2) of LH (No. 1) bank.



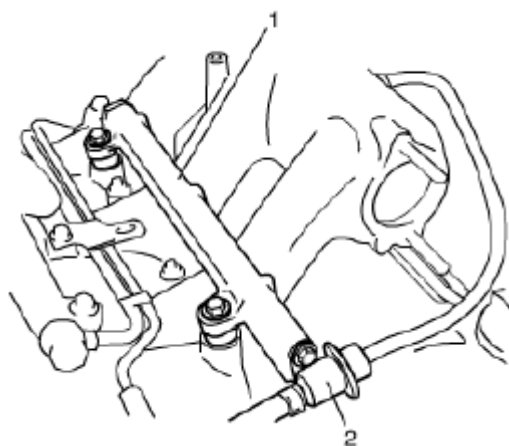
**Fig. 23: Identifying Electric Throttle Body Assembly & Fuel Injectors**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Disconnect fuel connect pipe (1) from delivery pipe.
8. Disconnect water hose (2) from electric throttle body assembly.



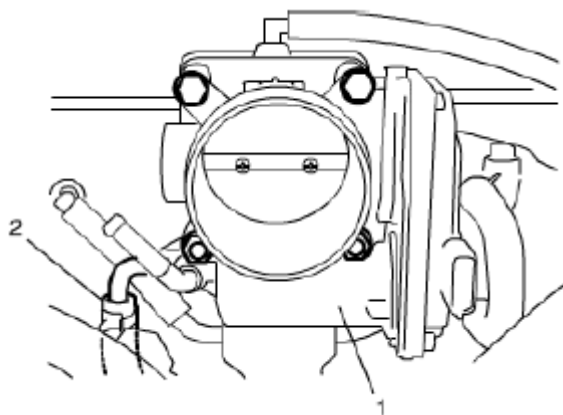
**Fig. 24: Identifying Connect Pipe From Delivery Pipe**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove LH (No. 1) bank delivery pipe (1) with fuel pressure regulator (2).



**Fig. 25: Identifying Bank Delivery Pipe & Fuel Pressure Regulator**  
Courtesy of SUZUKI OF AMERICA CORP.

10. Detach electric throttle body assembly (1) from intake collector.  
11. Disconnect water hose (2) from electric throttle body assembly.

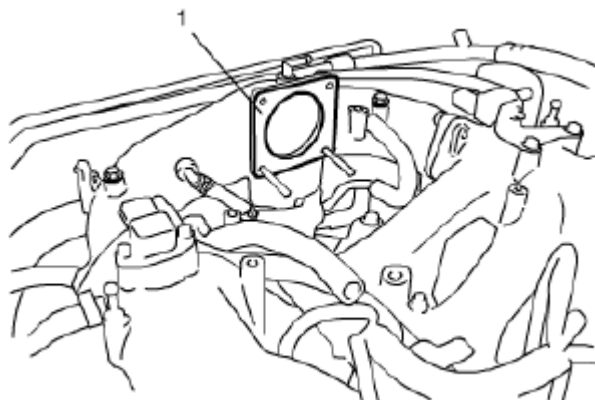


**Fig. 26: Identifying Water Hose & Electric Throttle Body Assembly**  
Courtesy of SUZUKI OF AMERICA CORP.

### Installation

Reverse removal procedure for installation noting the following.

- Clean mating surfaces and use new throttle body gasket (1).



**Fig. 27: Identifying Throttle Body Gasket**  
Courtesy of SUZUKI OF AMERICA CORP.

- Use new fuel connector pipe gaskets.
- Tighten fuel connector pipe union bolts and delivery pipe bolts to specified torque referring to **FUEL SYSTEM COMPONENTS**.
- Use new surge tank pipe gaskets.
- Check to ensure that all removed parts are back in place.

Reinstall any necessary parts which have not been reinstalled.

- Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL**.
- Upon completion of installation, verify that there is no fuel leakage at each connection according to

**FUEL LEAKAGE CHECK PROCEDURE .****IMT (INTAKE MANIFOLD TUNING) VALVE REMOVAL AND INSTALLATION**

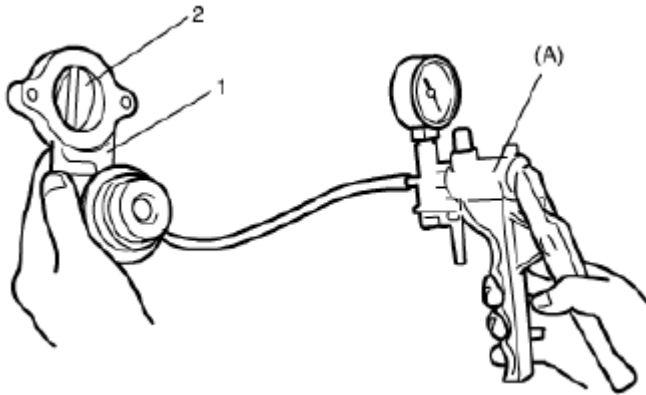
Refer to **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION.**

**IMT (INTAKE MANIFOLD TUNING) VALVE INSPECTION**

1. Connect special tool (A) to IMT valve (1).

***Special Tool***

- A. 09917-47011



**Fig. 28: Connecting Special Tool To IMT Valve**  
Courtesy of SUZUKI OF AMERICA CORP.

2. Apply vacuum to IMT valve (1) and verify that throttle (2) fully closes within the specified range. If IMT valve (1) fails this check, replace it.

**CAUTION:** Do not apply above 88 kPa (0.88 kg/cm<sup>2</sup> , 661 mm Hg, 880 mbar) of negative pressure. Damage may occur to IMT valve (1).

**IMT valve operation pressure**

1.3-34 kPa (0.01-0.34 kg/cm<sup>2</sup> , 9.8-255 mm Hg, 13-340 mbar)

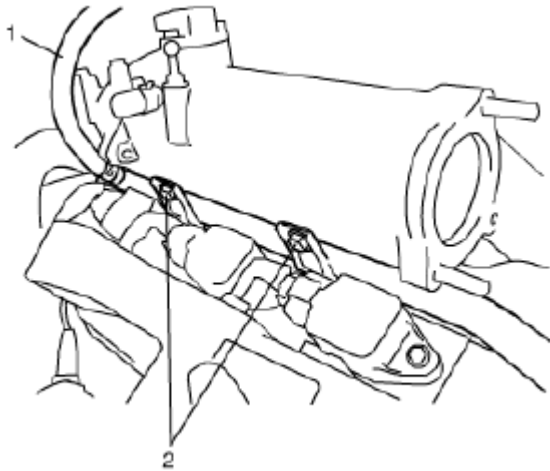
3. Let the throttle (2) close for 15 seconds with no vacuum application and inspect throttle travel. If throttle travel decreases, replace IMT valve (1).

**INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION**

***Reference:*** **INTAKE COLLECTOR AND INTAKE MANIFOLD COMPONENTS**

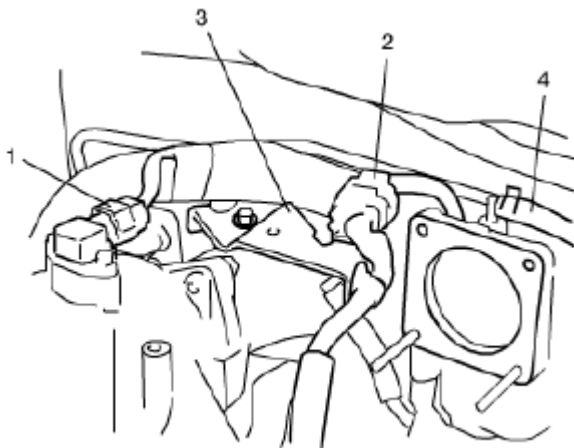
**Removal**

1. Remove electric throttle body assembly referring to **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
2. Disconnect water hose (1) from heater outlet pipe.
3. Remove heater outlet pipe bolts (2).



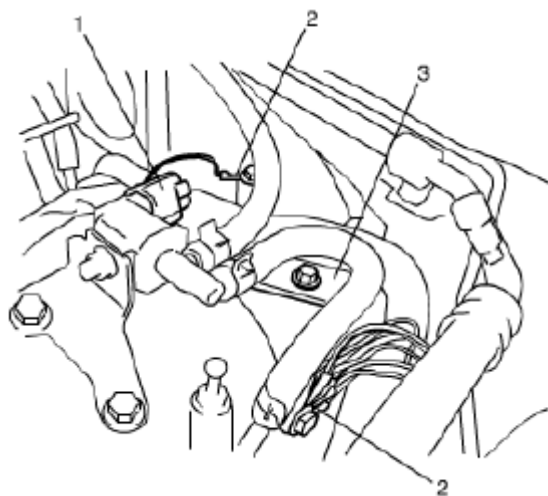
**Fig. 29: Identifying Heater Outlet Pipe Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Disconnect MAP sensor connector (1) and fuel injector harness connector (2).
5. Remove harness clamp bracket (right side) (3) from intake collector.
6. Disconnect vacuum hose (4) of EVAP canister purge valve from intake collector.



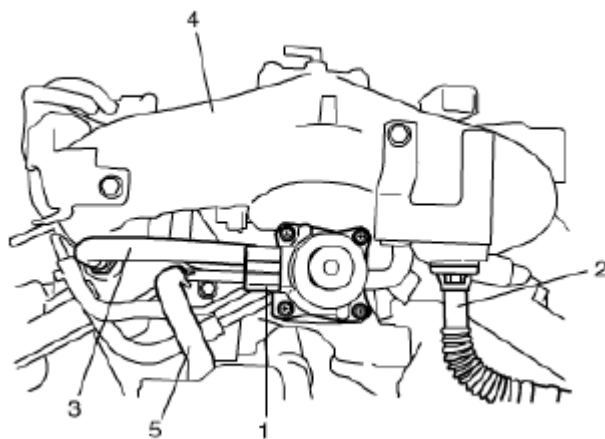
**Fig. 30: Identifying MAP Sensor Connector & Fuel Injector Harness Connector**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Disconnect EVAP canister purge valve connector (1) and ground terminals (2).
8. Remove harness clamp bracket (left side) (3) from intake collector.



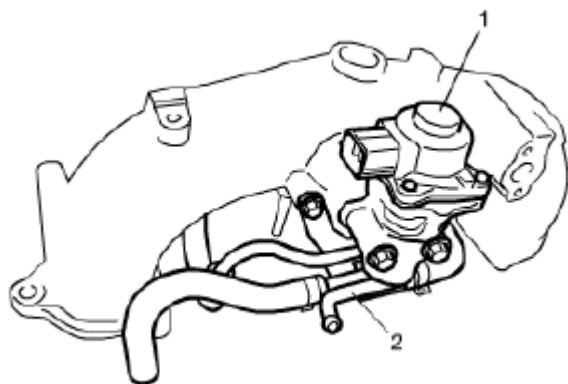
**Fig. 31: Identifying EVAP Canister Purge Valve Connector**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Disconnect EGR valve assembly connector (1), EGR pipe (2) and PCV hose (3).
10. Detach intake collector (4) from intake manifold, and then disconnect water hose (5).



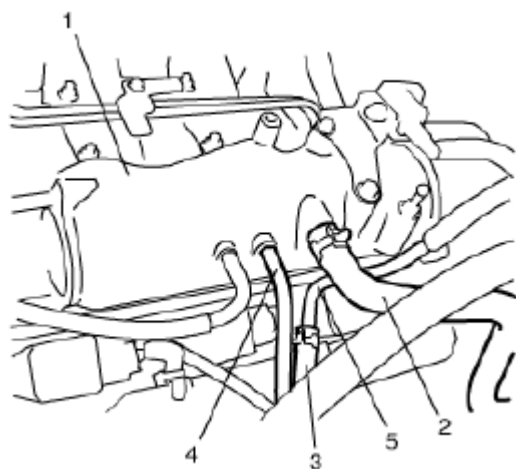
**Fig. 32: Identifying EGR Valve Assembly Connector**  
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove EGR valve assembly (1) and PCV pipe (2) from intake collector, if necessary.



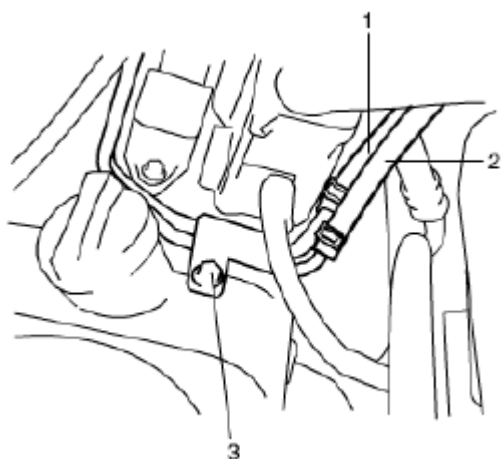
**Fig. 33: Identifying EGR Valve Assembly & PCV Pipe**  
 Courtesy of SUZUKI OF AMERICA CORP.

12. Disconnect brake booster hose (2) and vacuum tank hose (4) from intake manifold (1) then EVAP canister purge valve hose (3) from fuel No. 2 pipe (5).



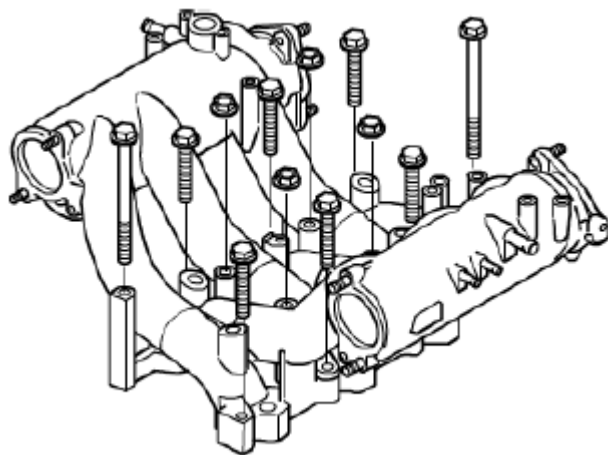
**Fig. 34: Identifying EVAP Canister Purge Valve Hose**  
 Courtesy of SUZUKI OF AMERICA CORP.

13. Disconnect fuel feed hose (1) and fuel return hose (2).
14. Remove fuel No. 2 pipe bolts (3).



**Fig. 35: Identifying Fuel Feed Hose & Fuel Return Hose**  
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove intake manifold bolts (8 pcs.) and nuts (4 pcs.).



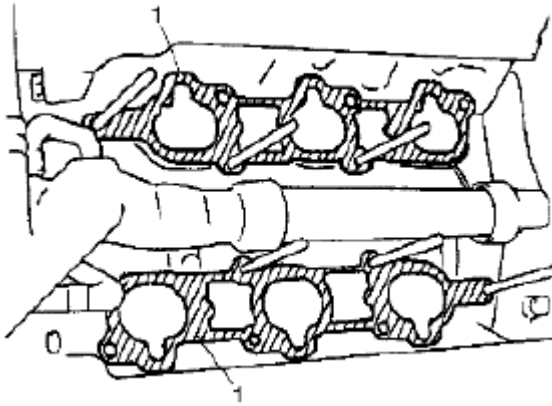
**Fig. 36: Identifying Intake Manifold Bolts & Nuts**  
Courtesy of SUZUKI OF AMERICA CORP.

16. Remove intake manifold.

#### Installation

Reverse removal procedure for installation noting the following.

- Use new intake manifold gaskets (1).



**Fig. 37: Identifying Intake Manifold Gaskets**  
Courtesy of SUZUKI OF AMERICA CORP.

- Use new intake collector gaskets, EGR valve gasket and EGR pipe gasket.
- Install electric throttle body assembly referring to **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
- Check to ensure that all removed parts are back in place.

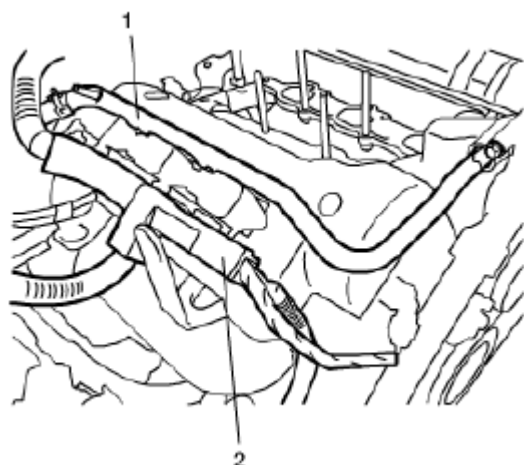
Reinstall any necessary parts which have not been reinstalled.

- Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
- Connect negative cable (-) at battery.
- Upon completion of installation, verify that there is no fuel leakage at each connection according to **FUEL LEAKAGE CHECK PROCEDURE** .

## CYLINDER HEAD COVERS REMOVAL AND INSTALLATION

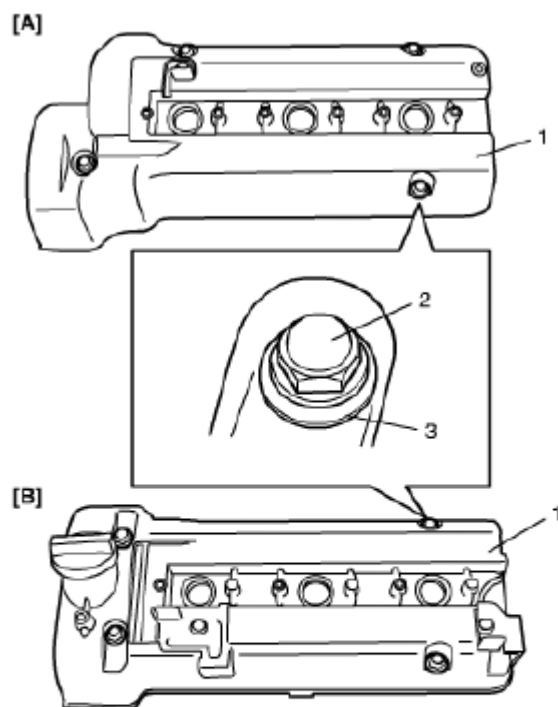
### Removal

1. Remove electric throttle body assembly, intake collector and intake manifold. Refer to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove heater outlet pipe (1).
3. Detach engine harness (2) from cylinder head covers.



**Fig. 38: Identifying Heater Outlet Pipe**  
 Courtesy of SUZUKI OF AMERICA CORP.

4. Disconnect ignition coil couplers and remove ignition coils referring to **IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL) REMOVAL AND INSTALLATION** .
5. Remove cylinder head covers (1).



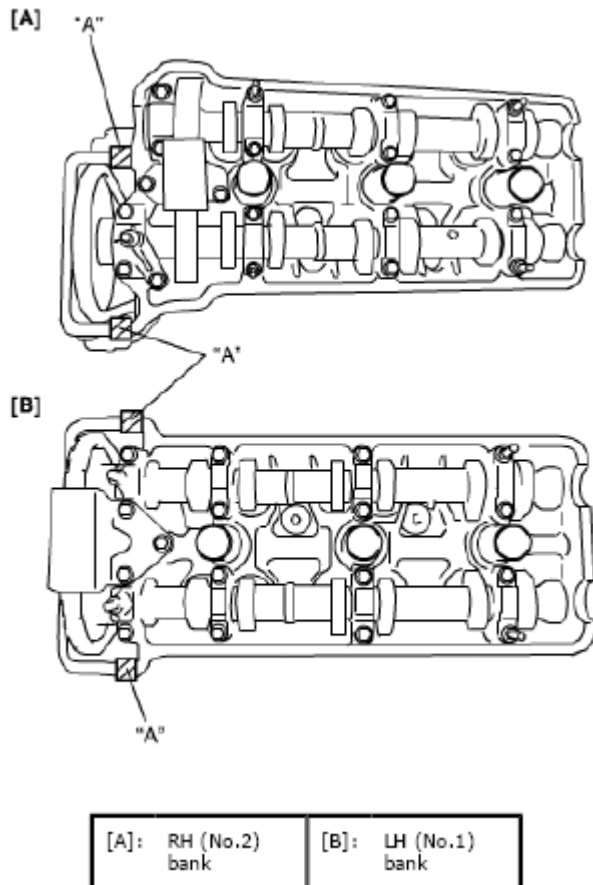
|                     |                |
|---------------------|----------------|
| [A]: RH (No.2) bank | 2. Nut         |
| [B]: LH (No.2) bank | 3. Seal washer |

**Fig. 39: Identifying Cylinder Head Covers**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### Installation

1. Clean sealing surfaces on cylinder heads and covers.
2. Remove oil, old sealant, and dust from sealing surfaces. After cleaning, apply sealant "A" to cylinder heads sealing surface area as shown in figure.

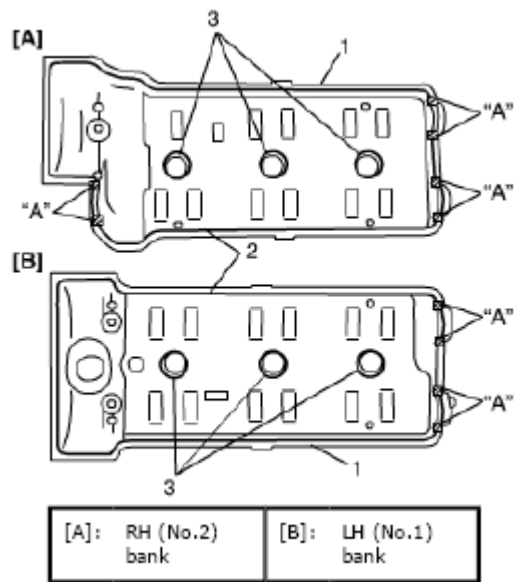
**"A": Water tight sealant 99000-31250SUZUKI Bond No. 1207F**



**Fig. 40: Identifying Area For Applying Sealant**  
 Courtesy of SUZUKI OF AMERICA CORP.

3. Install new spark plug hole gaskets (3) and new cylinder head cover gaskets (2) to head covers (1).
4. Apply sealant "A" to cylinder head gaskets searing surface area as shown in figure.

**"A": Water tight sealant 99000-31250SUZUKI Bond No. 1207F**

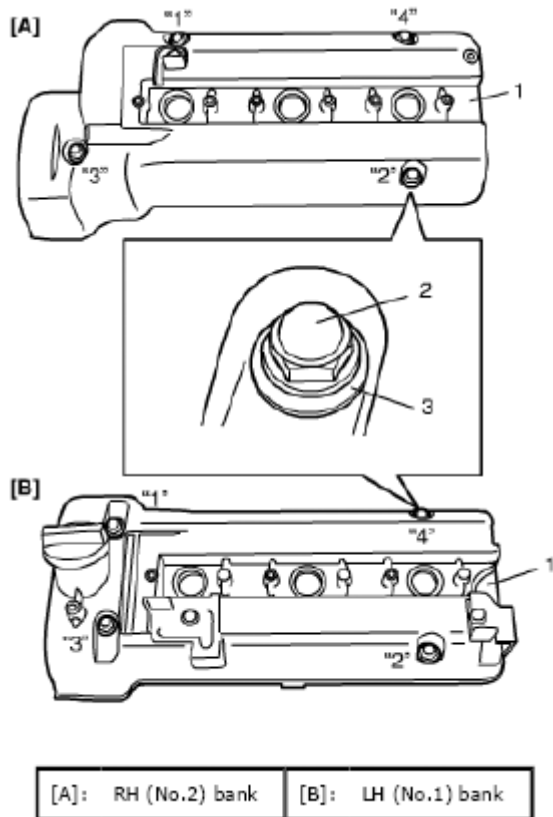


**Fig. 41: Identifying Spark Plug Hole Gaskets**  
 Courtesy of SUZUKI OF AMERICA CORP.

5. Install cylinder head covers (1) to cylinder heads.
6. Using new seal washers (3), tighten nuts (2) following sequence ("1"- "4") as indicated in figure. Tighten a little at a time and evenly among nuts and repeat tightening sequence 2 or 3 times before they are tightened to specified torque.

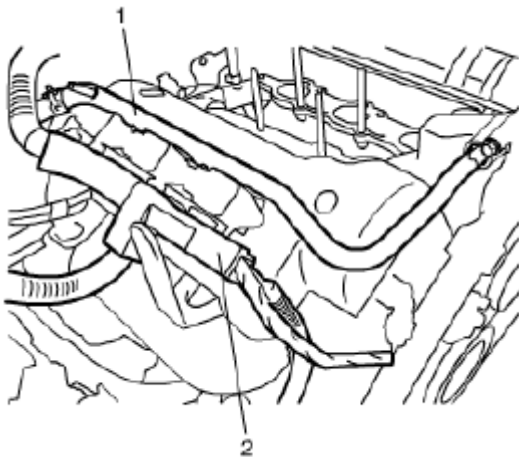
#### **Tightening torque**

**Cylinder head cover nut a: 10.5 N.m (1.1 kg-m, 7.5 lb-ft)**



**Fig. 42: Identifying Seal Washers & Tighten Nuts**  
Courtesy of SUZUKI OF AMERICA CORP.

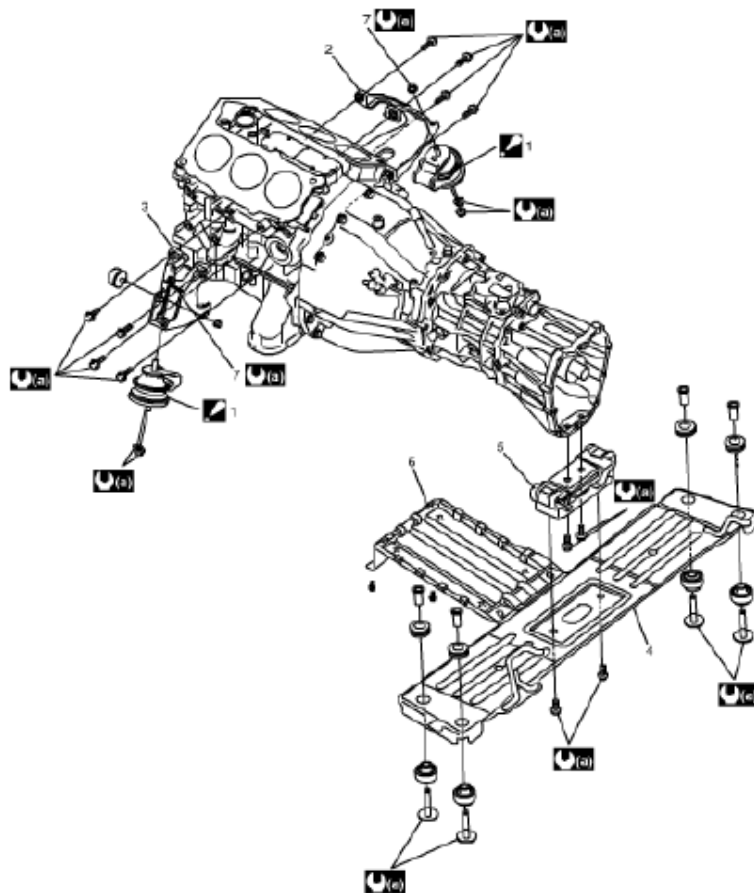
7. Install ignition coils and connect ignition coil couplers referring to **IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL) REMOVAL AND INSTALLATION** .
8. Clamp engine harness (2) to cylinder head cover.
9. Install heater outlet pipe (1).



**Fig. 43: Identifying Engine Harness**  
Courtesy of SUZUKI OF AMERICA CORP.

10. Install intake manifold and intake collector referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION**.
11. Install electric throttle body assembly referring to **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.

## ENGINE MOUNTING COMPONENTS



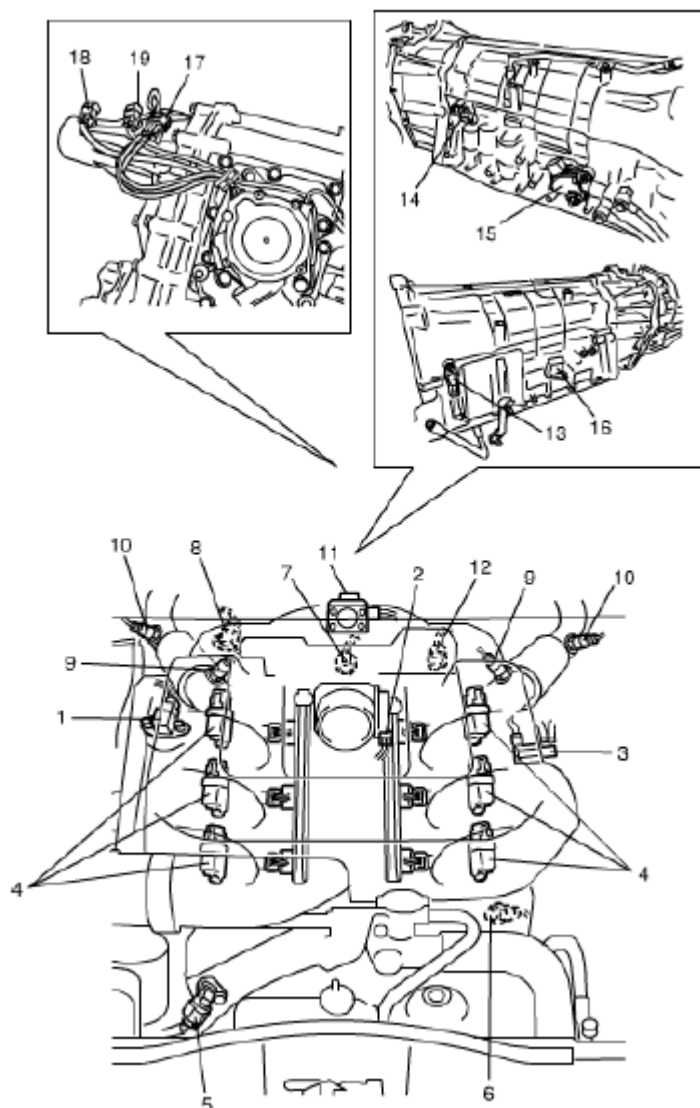
|                                                                                                                                                                                              |                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|  1. Engine front mounting<br>Be sure to align dowel pin with dowel hole of engine front mounting bracket. | 5. Engine rear mounting                                                                                            |
| 2. Engine front mounting right bracket                                                                                                                                                       | 6. Engine splash cover (if equipped)                                                                               |
| 3. Engine front mounting left bracket                                                                                                                                                        | 7. Engine front mounting nut                                                                                       |
| 4. Engine rear mounting member                                                                                                                                                               |  55 N·m (5.5 kgf-m, 40.0 lb-ft) |

**Fig. 44: Identifying Engine Mounting Components With Torque Specifications**  
 Courtesy of SUZUKI OF AMERICA CORP.

## ENGINE ASSEMBLY REMOVAL AND INSTALLATION

**Removal**

1. Release fuel pressure in fuel feed line referring to **FUEL PRESSURE RELIEF PROCEDURE** .
2. Remove battery and battery tray.
3. Remove surge tank cover.
4. Remove air cleaner assembly and air cleaner outlet hose referring to **AIR INTAKE SYSTEM COMPONENTS**.
5. Drain engine oil referring to **ENGINE OIL AND FILTER CHANGE** .
6. Drain coolant referring to **COOLING SYSTEM DRAINING** .
7. Drain transmission oil or A/T fluid referring to **MANUAL TRANSMISSION OIL CHANGE** or **A/T FLUID CHANGE** .
8. Disconnect the following electric wires.
  - MAP sensor (1)
  - Injector harness
  - Electric throttle body (2)
  - EVAP canister purge valve (3)
  - Ignition coil assemblies (4)
  - CMP sensor (5)
  - Generator
  - Starting motor
  - Pressure switch of P/S pump (6)
  - Magnet clutch switch of A/C compressor (if equipped)
  - Engine oil pressure switch
  - Ground terminals
  - Knock sensor (7)
  - CKP sensor (8)
  - A/F sensor (No. 1 and No. 2) (9)
  - HO2S (No. 1 and No. 2) (10)
  - EGR valve (11)
  - ECT sensor (12)
  - Back up light switch (for M/T model)
  - Input shaft speed sensor (for A/T model) (13)
  - Output shaft speed sensor (for A/T model) (14)
  - Transmission range sensor (for A/T model) (15)
  - Transmission wire connector (for A/T model) (16)
  - Transfer actuator (if equipped) (17)
  - Center differential switch (if equipped) (18)
  - 4 L/N switch (if equipped) (19)
  - Each wire harness clamps

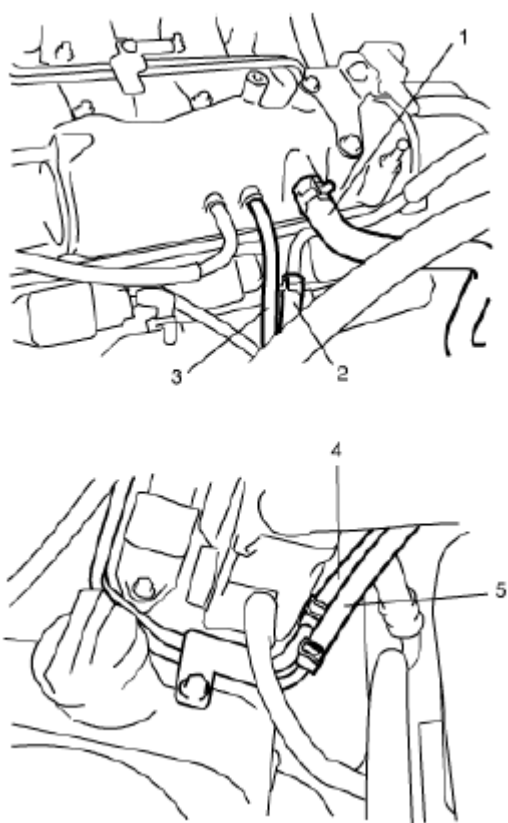


**Fig. 45: Identifying Engine Mounting Components**  
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Disconnect the following hoses.

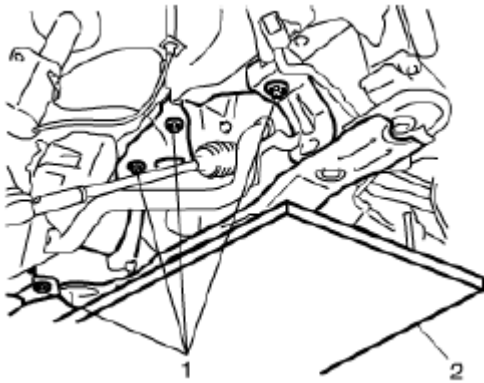
- Brake booster hose (1) from intake manifold
- EVAP canister purge hose (2) from fuel No. 2 pipe.
- Vacuum tank hose (3) from intake manifold
- IMT hose from IMT valve
- Radiator inlet hose and outlet hose from each pipe.
- Heater inlet hose and outlet hose from each pipe
- Fuel feed hose (4) and return hose (5) from each pipe
- Reservoir hose from water outlet cap
- Clutch oil pipe from transmission front case (for M/T model)

- A/T fluid cooler hose from radiator (for A/T model)



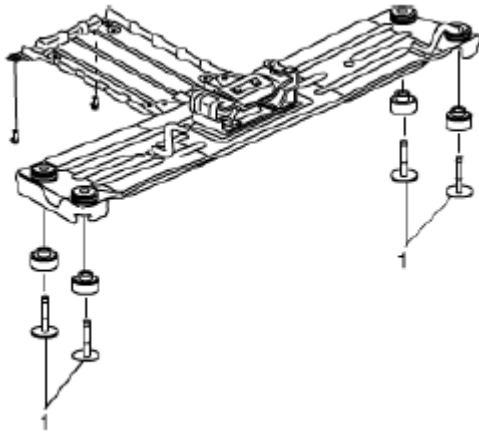
**Fig. 46: Identifying Brake Booster Hose & EVAP Canister Purge Hose**  
Courtesy of SUZUKI OF AMERICA CORP.

10. Disconnect high pressure pipe and suction hose from P/S pump referring to **P/S HOSE/PIPE COMPONENTS**.
11. Disconnect suction hose and discharge hose from A/C compressor referring to **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION**.
12. For M/T model, remove shift control lever referring to **TRANSMISSION SHIFT CONTROL LEVER REMOVAL AND INSTALLATION**.
13. For A/T model, disconnect A/T select cable from A/T referring to **SELECT CABLE COMPONENT**.
14. Remove exhaust No. 1 and No. 2 pipes referring to **EXHAUST SYSTEM COMPONENTS**.
15. Remove front and rear propeller shafts referring to **PROPELLER SHAFT REMOVAL AND INSTALLATION**.
16. Support front suspension frame and engine rear mounting member using jack (2).
17. Carry out Step 1) to 12) of "Removal" under **FRONT SUSPENSION FRAME, STABILIZER BAR AND/OR BUSHINGS REMOVAL AND INSTALLATION** in order to lower engine with front suspension frame.
18. Remove front suspension frame mounting bolts (1).



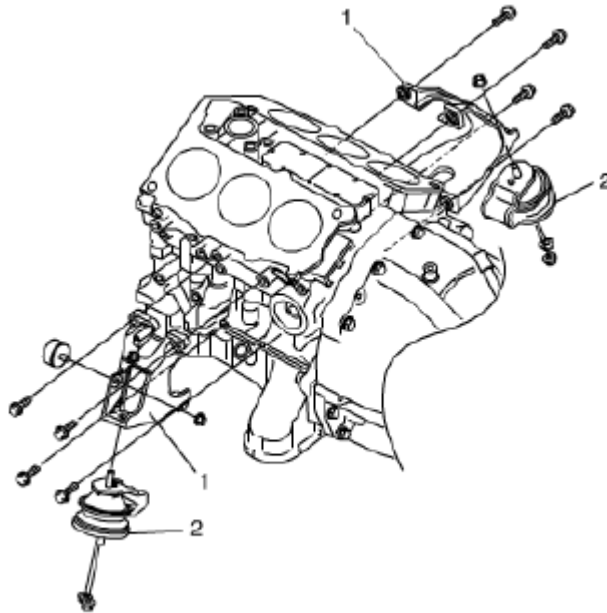
**Fig. 47: Identifying Front Suspension Frame Mounting Bolts**  
 Courtesy of SUZUKI OF AMERICA CORP.

19. Remove engine rear mounting member bolts (1).



**Fig. 48: Identifying Engine Rear Mounting Member Bolts**  
 Courtesy of SUZUKI OF AMERICA CORP.

20. Before lowering engine, recheck to make sure all hoses, electric wires and cables are disconnected from engine.
21. Lower engine with transmission, transfer, front suspension frame and engine rear mounting member from engine compartment.
22. Disconnect transmission from engine referring to **MANUAL TRANSMISSION ASSEMBLY DISMOUNTING AND REMOUNTING** or **AUTOMATIC TRANSMISSION UNIT COMPONENTS** , if necessary.
23. Remove engine with engine front mounting bracket (1) from engine front mounting (2), if necessary.



**Fig. 49: Identifying Engine Front Mounting Bracket**  
Courtesy of SUZUKI OF AMERICA CORP.

24. Remove clutch cover and clutch disk referring to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL AND INSTALLATION** , if necessary.

#### Installation

1. Install clutch cover and clutch disk referring to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL AND INSTALLATION** , if removed.
2. Install engine with engine front mounting bracket to engine front mounting. For tightening torque, referring to **ENGINE MOUNTING COMPONENTS**, if removed.

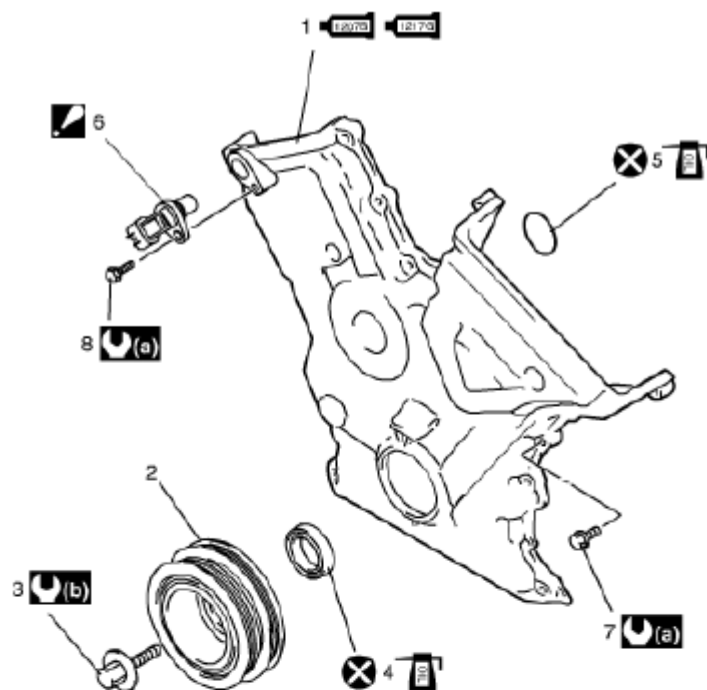
**NOTE:** Be sure to align dowel pin of engine front mounting with dowel hole of engine front mounting bracket.

3. Connect transmission to engine referring to **MANUAL TRANSMISSION ASSEMBLY DISMOUNTING AND REMOUNTING** or **AUTOMATIC TRANSMISSION UNIT COMPONENTS** , if removed.
4. Lift engine with transmission, front suspension frame and engine rear mounting member into engine compartment with jack.
5. Tighten engine rear mounting member bolt referring to **ENGINE MOUNTING COMPONENTS**.
6. Carry out Step 5) to 19) of "Installation" under **FRONT SUSPENSION FRAME, STABILIZER BAR AND/OR BUSHINGS REMOVAL AND INSTALLATION** in order to lift engine with front suspension frame.
7. Remove engine jack.
8. Install front and rear propeller shafts referring to **PROPELLER SHAFT REMOVAL AND**

**INSTALLATION** .

9. Install exhaust No. 1 and No. 2 referring to **EXHAUST SYSTEM COMPONENTS** .
10. Connect suction hose and discharge hose to A/C compressor referring to **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
11. Connect high pressure pipe and suction hose from P/S pump referring to **P/S HOSE/PIPE COMPONENTS** .
12. Return disconnected hoses, cables and electric wire.
13. Check all removed parts are back in place.
14. For A/T model, adjust select cable referring to **SELECT CABLE ADJUSTMENT** .
15. Refill cooling system with coolant referring to **COOLING SYSTEM FLUSH AND REFILL** .
16. Refill engine with engine oil referring to **ENGINE OIL AND FILTER CHANGE** .
17. Bleed air from clutch system referring to **AIR BLEEDING OF BRAKE SYSTEM** for air bleeding procedure.
18. Install battery tray and battery.
19. With engine OFF, turn ignition switch to ON position and check for fuel leakage.
20. Start engine and check coolant, oil and exhaust gas leakage at each connection.

**TIMING CHAIN COVER COMPONENTS**



|                                  |                                                                                                                                                                                                                                                         |                                   |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <b>1207B</b> :<br><b>1217G</b> : | 1. Timing chain cover<br>Apply sealant 99000-31140 referring to "Installation" in <i>Timing Chain Cover Removal and Installation</i> .<br>Apply sealant 99000-31260 referring to "Installation" in <i>Timing Chain Cover Removal and Installation</i> . | 7. Timing chain cover bolt        |
| 2. Crankshaft pulley             | 8. CMP sensor bolt                                                                                                                                                                                                                                      |                                   |
| 3. Crankshaft pulley bolt        | <b>(a)</b> :                                                                                                                                                                                                                                            | 11 N·m (1.1 kgf-m, 8.0 lb-ft)     |
| 4. Oil seal                      | <b>(b)</b> :                                                                                                                                                                                                                                            | 150 N·m (15.0 kgf-m, 108.5 lb-ft) |
| 5. O-ring                        |  :                                                                                                                                                                   | Do not reuse.                     |
| 6. CMP sensor                    |  :                                                                                                                                                                   | Apply engine oil.                 |

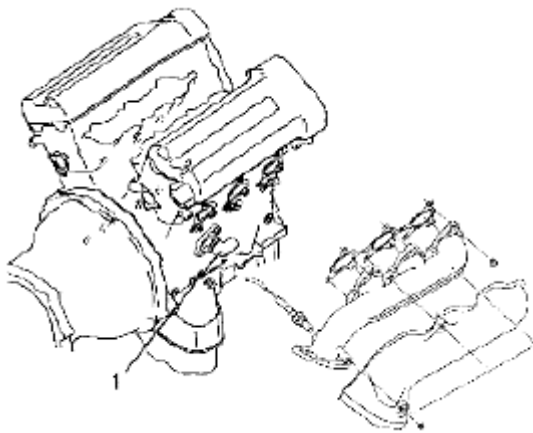
**Fig. 50: Identifying Timing Chain Cover Components With Torque Specifications**

Courtesy of SUZUKI OF AMERICA CORP.

## ENGINE BLOCK HEATER (IF EQUIPPED) REMOVAL AND INSTALLATION

### Removal

1. Disconnect negative (-) cable at battery.
2. Drain engine coolant referring to **COOLING SYSTEM DRAINING** .
3. Remove right side exhaust manifold. Refer to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION** .
4. Disconnect engine block heater and remove engine block heater (1).



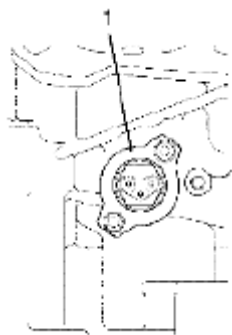
**Fig. 51: Identifying Engine Block Heater**  
Courtesy of SUZUKI OF AMERICA CORP.

### Installation

**Reference: ENGINE BLOCK HEATER (IF EQUIPPED) INSPECTION**

Reverse removal procedure for installation, noting the following.

- Install engine block heater (1) in the direction as shown in figure.



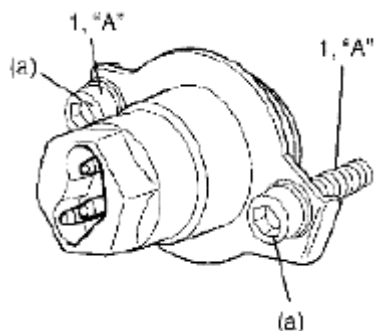
**Fig. 52: Identifying Engine Block Heater**

Courtesy of SUZUKI OF AMERICA CORP.

- Tighten engine block heater mounting bolt (1) to specified torque.

### Tightening torque

Engine block heater mounting bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)



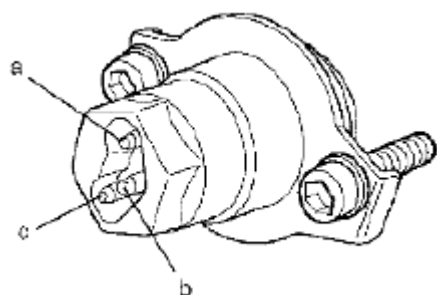
**Fig. 53: Identifying Engine Block Heater Mounting Bolt**  
Courtesy of SUZUKI OF AMERICA CORP.

- Use new exhaust manifold gasket.
- Tighten exhaust manifold mounting bolts and nuts to specified torque referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION**.
- Refill coolant referring to **COOLING SYSTEM FLUSH AND REFILL**.
- Finally, start engine and check for engine coolant leaks and exhaust gas leakage.

### ENGINE BLOCK HEATER (IF EQUIPPED) INSPECTION

**Reference:** **ENGINE BLOCK HEATER (IF EQUIPPED) REMOVAL AND INSTALLATION**

- Check continuity between terminal "a" and "c". If there is no continuity, replace it.
- Check that there is no continuity between terminal "a" or "b" and "c". If there is continuity, replace it.
- Check continuity between terminal "c" and engine block heater body. If there is no continuity, replace it.



**Fig. 54: Identifying Engine Block Heater Terminal**  
Courtesy of SUZUKI OF AMERICA CORP.

## TIMING CHAIN COVER REMOVAL AND INSTALLATION

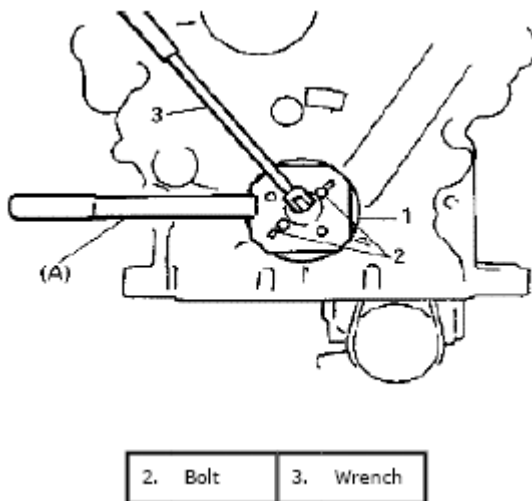
**Reference:** TIMING CHAIN COVER COMPONENTS

### Removal

1. Remove engine assembly from vehicle. Refer to ENGINE ASSEMBLY REMOVAL AND INSTALLATION.
2. Remove electric throttle body assembly with intake collector and intake manifold. Refer to INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION and ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION.
3. Remove cylinder head covers. Refer to CYLINDER HEAD COVERS REMOVAL AND INSTALLATION.
4. Remove P/S pump and A/C compressor (if equipped) drive belt referring to P/S PUMP AND A/C COMPRESSOR (IF EQUIPPED) DRIVE BELT REMOVAL AND INSTALLATION.
5. Remove water pump and generator drive belt. Refer to WATER PUMP AND GENERATOR DRIVE BELT REMOVAL AND INSTALLATION.
6. Remove water pump pulley.
7. Remove thermostat cap. Refer to THERMOSTAT REMOVAL AND INSTALLATION.
8. Remove P/S pump bracket. Refer to P/S HOSE/PIPE COMPONENTS.
9. Remove oil pans. Refer to OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.
10. Remove crankshaft pulley bolt (1). To lock crankshaft pulley, use special tool (camshaft pulley holder) as shown in figure.

### Special Tool

A. 09917-68221



**Fig. 55: Removing Crankshaft Pulley Bolt**

Courtesy of SUZUKI OF AMERICA CORP.

**NOTE:** Be sure to use the following bolt for fixing special tool to crankshaft pulley.  
Bolt size: M8, P1.25 L=45 mm  
Strength: 7T



**Fig. 56: Identifying Crankshaft Pulley Bolt Dimension**  
Courtesy of SUZUKI OF AMERICA CORP.

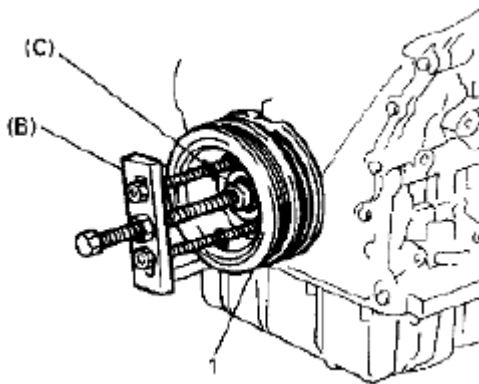
11. Remove crankshaft pulley (1).

If it is hard to remove, use special tools (Steering wheel remover, Bearing puller attachment) as shown in figure.

If bolts of steering wheel remover are too long, replace them with those of suitable length.

#### Special Tool

- A. 09944-36011
- B. 09926-58010



**Fig. 57: Removing Crankshaft Pulley**  
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove timing chain cover.

#### Installation

**Reference:** TIMING CHAIN COVER INSPECTION

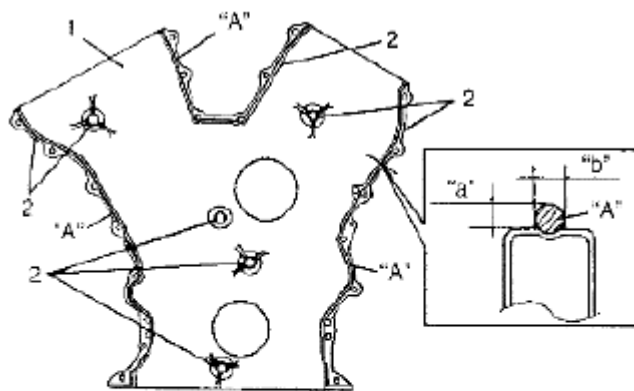
Reverse removal sequence to install timing chain cover noting the following points.

- Clean sealing surface on timing chain cover, crankcase, cylinder block and cylinder heads.

Remove oil, old sealant, and dust from sealing surface.

- Apply sealant "A" to timing chain cover sealing surface area as shown in figure.

**"A": Sealant 99000-31260SUZUKI Bond No. 1217G**

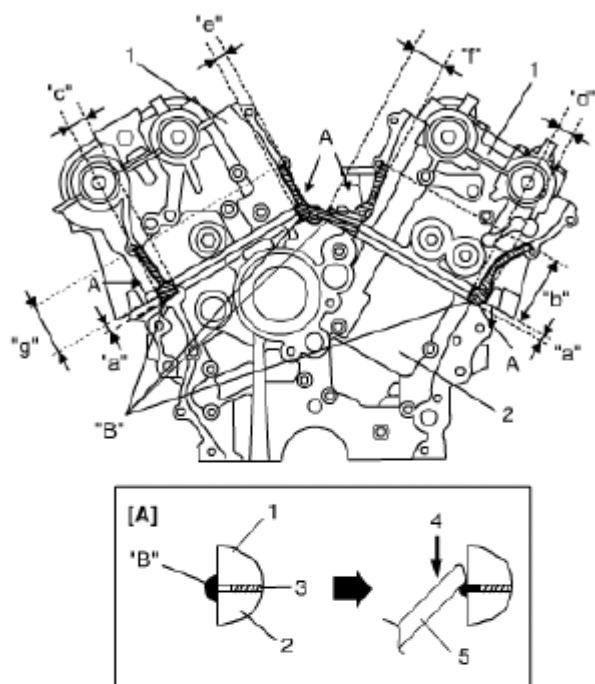


|                      |                       |
|----------------------|-----------------------|
| "a": 2 mm (0.08 in.) | 1. Timing chain cover |
| "b": 3 mm (0.11 in.) | 2. Sealant "A"        |

**Fig. 58: Identifying Area For Applying Sealant**  
Courtesy of SUZUKI OF AMERICA CORP.

- Apply sealant "B" to mating surfaces of cylinder head and cylinder block as shown in figure.

**"B": Water tight sealant 99000-31140SUZUKI Bond No. 1207B**



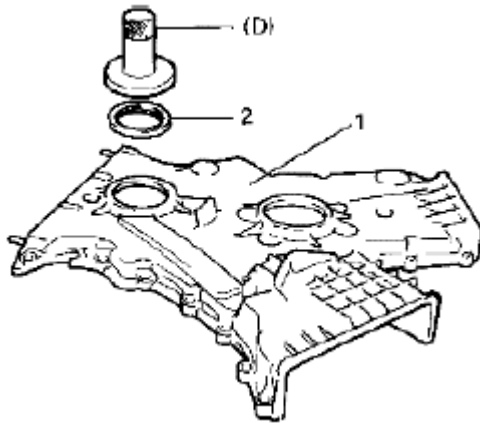
|                         |                       |
|-------------------------|-----------------------|
| [A]: View A             | "a": 7 mm (0.28 in.)  |
| 1. Cylinder head        | "b": 67 mm (2.64 in.) |
| 2. Cylinder block       | "c": 17 mm (0.67 in.) |
| 3. Cylinder head gasket | "d": 18 mm (0.71 in.) |
| 4. Rub into             | "e": 10 mm (0.39 in.) |
| 5. Jig                  | "f": 34 mm (1.34 in.) |
|                         | "g": 50 mm (1.97 in.) |

**Fig. 59: Identifying Area For Applying Sealant To Surfaces Of Cylinder Head**  
 Courtesy of SUZUKI OF AMERICA CORP.

- Apply engine oil to new oil seal lip and water pump O-ring. Using special tool (bearing installer), install new oil seal (2) with its surface is flush with edge of timing chain cover (1).

### Special Tool

(D): 09913-75510



**Fig. 60: Identifying Oil Seal & With Edge Of Timing Chain Cover**  
 Courtesy of SUZUKI OF AMERICA CORP.

- Install timing chain cover.

#### **Tightening torque**

**Timing chain cover bolt: 11 N.m (1.1 kg-m, 8.0 lb-ft)**

- Install CMP sensor to timing chain cover referring to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .
- Install crankshaft pulley (1).

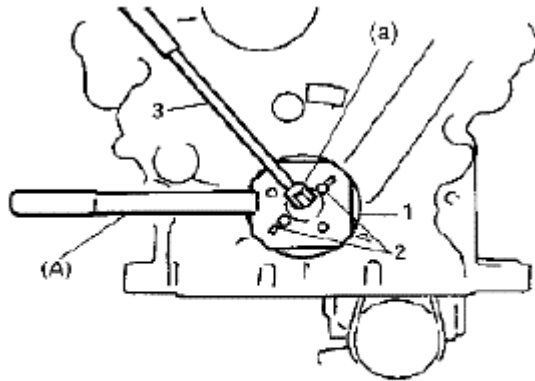
To lock crankshaft pulley, use special tool (camshaft pulley holder) with it at shown in figure.

#### **Special Tool**

A. 09917-68221

#### **Tightening torque**

**Crankshaft pulley bolt a: 150 N.m (15 kg-m, 108.5 lb-ft)**

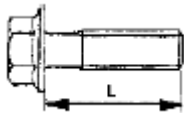


|         |           |
|---------|-----------|
| 2. Bolt | 3. Wrench |
|---------|-----------|

**Fig. 61: Locking Crankshaft Pulley**

Courtesy of SUZUKI OF AMERICA CORP.

**NOTE:** Be sure to use the following bolt for fixing special tool to crank pulley.  
**Bolt size: M8, P1.25 L=45 mm**  
**Strength: 7T**



**Fig. 62: Identifying Bolt Dimension**

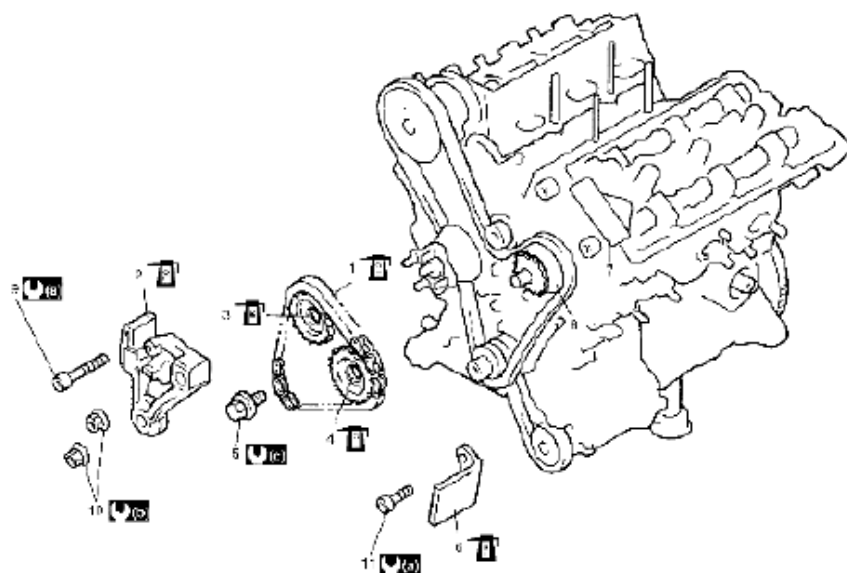
Courtesy of SUZUKI OF AMERICA CORP.

## TIMING CHAIN COVER INSPECTION

**Reference:** TIMING CHAIN COVER REMOVAL AND INSTALLATION

Check oil seal lip for damage or deterioration. Replace as necessary.

## LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS



|                                             |                                               |                                                                                                                                                        |
|---------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. LH (No.1) bank 2nd timing chain          | 6. Timing chain guide No.4                    | 11. Timing chain guide No. 4 bolt                                                                                                                      |
| 2. Timing chain tensioner adjuster No.3     | 7. Timing chain guide No.5                    |  Apply engine oil to sliding surface of each point.                  |
| 3. LH (No.1) bank intake camshaft sprocket  | 8. Idler sprocket No.2                        |  11 N·m (1.1 kgf-m, 8.0 lb-ft)                                      |
| 4. LH (No.1) bank exhaust camshaft sprocket | 9. Timing chain tensioner adjuster No. 3 bolt |  Tighten 45 N·m (4.5 kgf-m, 32.5 lb-ft) by the specified procedure. |
| 5. Camshaft sprocket bolt                   | 10. Timing chain tensioner adjuster No. 3 nut |  Tighten 80 N·m (8.0 kgf-m, 58.0 lb-ft) by the specified procedure. |

**Fig. 63: Identifying Bank 2nd Timing Chain & Chain Tensioner Components With Torque Specifications**  
 Courtesy of SUZUKI OF AMERICA CORP.

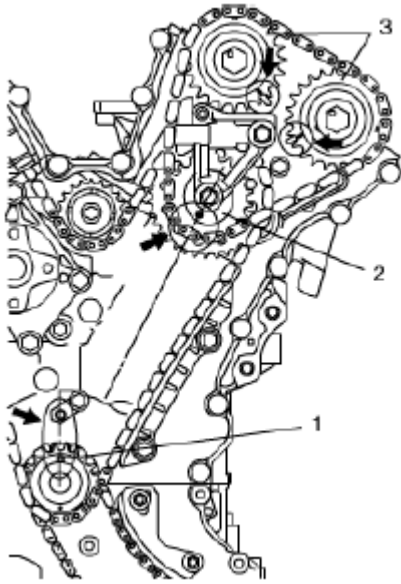
## LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION

**Reference: LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**

### Removal

1. Remove engine assembly from vehicle. Refer to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
3. Turn crankshaft to meet the following condition.
  - Key (1) on crankshaft positions as shown.
  - Mark on idler sprocket No. 2 (2) points the center of crankshaft.

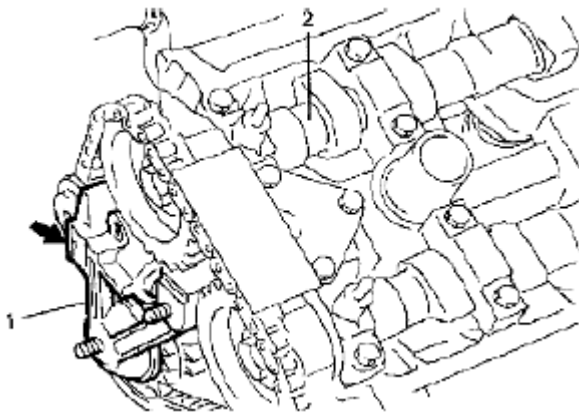
- The marks on sprockets (3) match with marks on cylinder head.



**Fig. 64: Identifying Matching Marks On Sprockets**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove timing chain tensioner adjuster No. 3 (1).

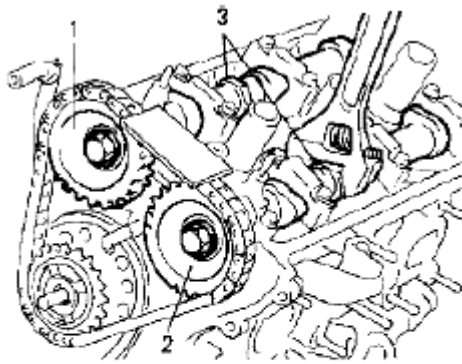
To remove it, slacken LH (No. 1) bank 2nd timing chain by turning intake camshaft (2) counterclockwise a little while pushing back pad.



**Fig. 65: Identifying Timing Chain Tensioner Adjuster No. 3**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove LH (No. 1) bank intake and exhaust camshaft sprocket bolts.

To remove it, fit a spanner to hexagonal part (3) at the center of camshaft to hold it stationary.

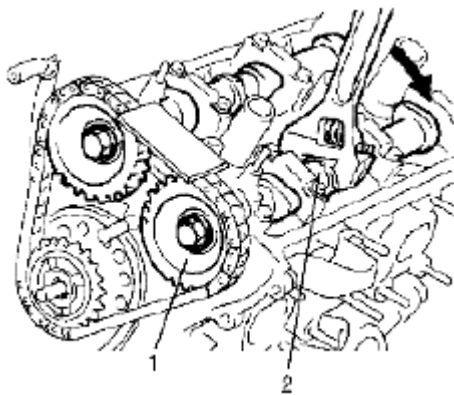


- |    |                                          |
|----|------------------------------------------|
| 1. | LH (No.1) bank intake camshaft sprocket  |
| 2. | LH (No.1) bank exhaust camshaft sprocket |

**Fig. 66: Identifying LH (No. 1) Bank Intake & Exhaust Camshaft Sprocket Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove LH (No. 1) bank exhaust camshaft sprocket (1).

**CAUTION:** Removing sprocket (1) from camshaft (2) may cause cam to turn, resulting in damage to valve and piston. To prevent this, when removing sprocket, hold camshaft stationary by using a spanner at its hexagonal part.



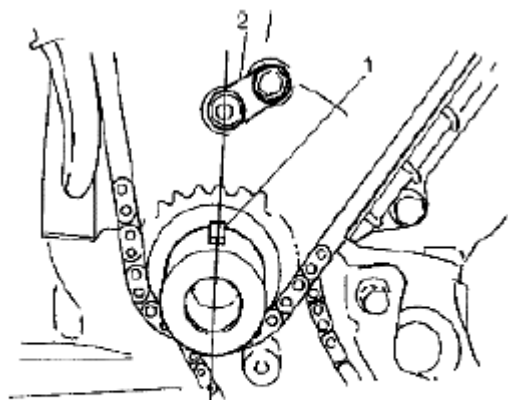
**Fig. 67: Identifying LH (No. 1) Bank Exhaust Camshaft Sprocket**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove LH (No. 1) bank intake camshaft sprocket.  
8. Remove LH (No. 1) bank 2nd timing chain.

#### Installation

**Reference: LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

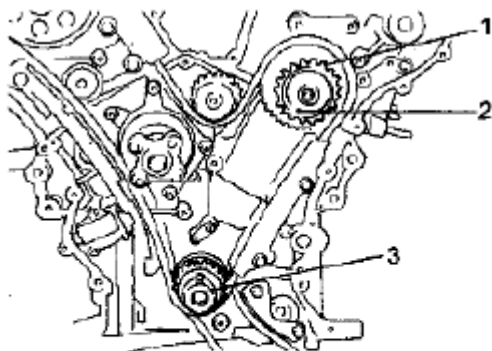
1. Check timing mark on crankshaft as shown in figure.



|                            |            |
|----------------------------|------------|
| 1. Crank timing pulley key | 2. Oil jet |
|----------------------------|------------|

**Fig. 68: Identifying Crank Timing Pulley Key**  
Courtesy of SUZUKI OF AMERICA CORP.

2. Check timing mark on idler sprocket No. 2 (1) as shown in figure.



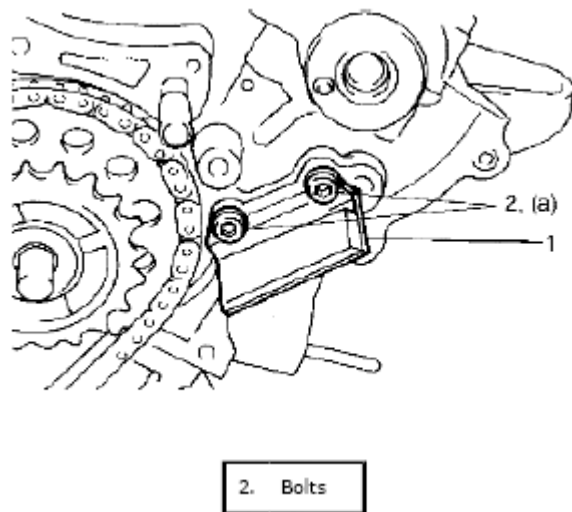
|                                      |               |
|--------------------------------------|---------------|
| 2. Match mark of idler sprocket No.2 | 3. Crankshaft |
|--------------------------------------|---------------|

**Fig. 69: Identifying Match Mark Of Idler Sprocket No. 2**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Install timing chain guide No. 4 (1).

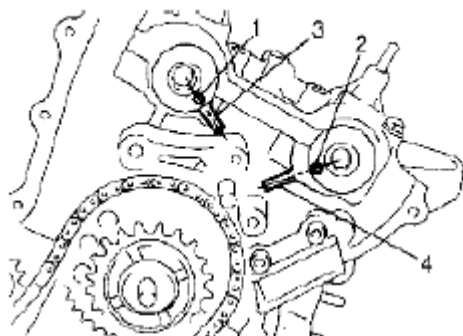
***Tightening torque***

Timing chain guide No. 4 bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)



**Fig. 70: Identifying Timing Chain Guide No. 4**  
Courtesy of SUZUKI OF AMERICA CORP.

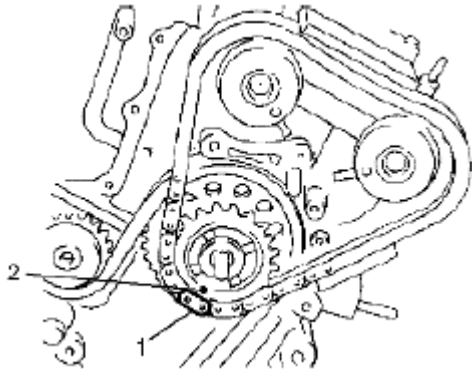
4. Check that knock-pins of intake and exhaust camshafts are aligned with match marks on cylinder head as shown in figure.



|                                                 |                               |
|-------------------------------------------------|-------------------------------|
| 1. Knock pin of LH (No.1) bank intake camshaft  | 3. Match mark of intake side  |
| 2. Knock pin of LH (No.1) bank exhaust camshaft | 4. Match mark of exhaust side |

**Fig. 71: Identifying Knock-Pins Of Intake & Exhaust Camshafts**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Install by aligning match marks (2) on yellow plate (1) of LH (No. 1) bank 2nd timing chain and idler sprocket No. 2.



**Fig. 72: Identifying Aligning Match Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Install sprockets to intake and exhaust camshafts by aligning silver plate (1) of LH (No. 1) bank 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

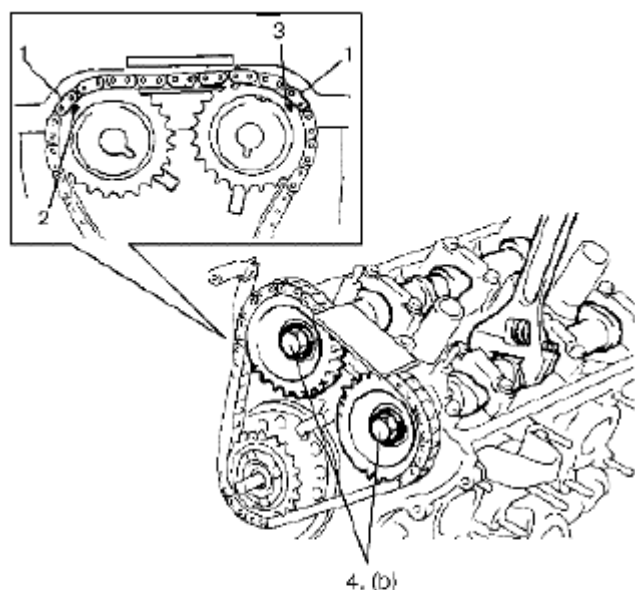
**CAUTION: Do not turn camshaft more than necessary. If turned excessively, valve and piston may get damaged.**

7. Install LH (No. 1) bank intake and exhaust camshaft timing sprockets.

To install it, fit a spanner to hexagonal part at the center of camshaft to hold stationary.

#### **Tightening torque**

**Camshaft timing sprocket bolt b: 80 N.m (8.0 kg-m, 58.0 lb-ft)**



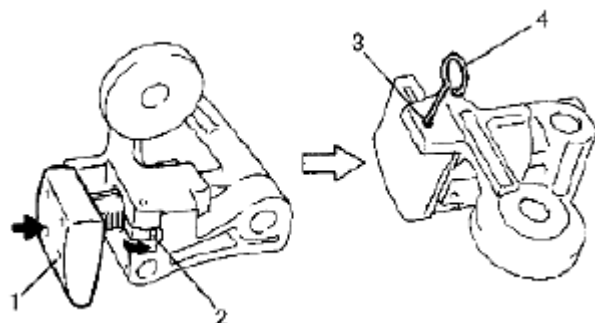
|    |                                                |
|----|------------------------------------------------|
| 2. | Arrow mark on intake camshaft timing sprocket  |
| 3. | Arrow mark on exhaust camshaft timing sprocket |
| 4. | Sprocket bolt                                  |

**Fig. 73: Identifying Sprocket Bolt**

Courtesy of SUZUKI OF AMERICA CORP.

8. With latch (2) of tensioner adjuster No. 3 returned and plunger (1) pushed back into body, insert stopper (pin) (4) into set hole (3).

After inserting it, check that plunger will not come out.



**Fig. 74: Inserting Stopper (Pin) Into Set Hole**

Courtesy of SUZUKI OF AMERICA CORP.

9. Install timing chain tensioner adjuster No. 3 (1) in tightening order below.

### Tightening torque

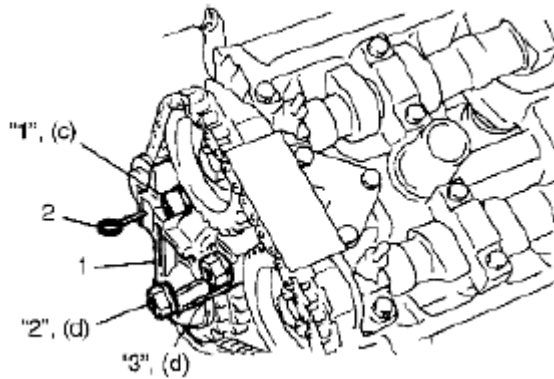
**Timing chain tensioner adjuster No. 3 bolt c: Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure**

**Timing chain tensioner adjuster No. 3 nut d: Tighten 45 N.m (4.5 kgf-m, 32.5 lb-ft) by the specified procedure**

### Tightening order for tensioner bolt and nuts

"1"-->"2"-->"3"

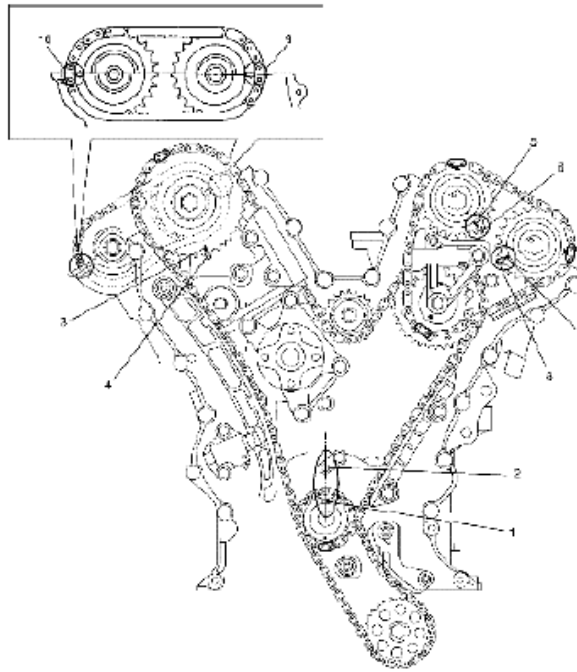
10. Pull out stopper (pin) (2) from set hole.



**Fig. 75: Identifying Stopper (Pin)**  
**Courtesy of SUZUKI OF AMERICA CORP.**

11. Turn crankshaft two rotations clockwise then align timing pulley key (1) on crankshaft and oil jet (2) on cylinder block as shown in figure.

Check each other timing marks that align them shown in figure.



|                                                                   |                                                                    |                                                                     |
|-------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------|
| 3. Timing mark of RH (No.2) bank 1st timing chain sprocket        | 6. Timing mark of LH (No.1) bank 2nd timing chain                  | 9. Timing mark of RH (No.2) bank 2nd timing chain intake sprocket   |
| 4. Timing mark of RH (No.2) bank 1st timing chain                 | 7. Timing mark of LH (No.1) bank 2nd timing chain exhaust sprocket | 10. Timing mark of RH (No.2) bank 2nd timing chain exhaust sprocket |
| 5. Timing mark of LH (No.1) bank 2nd timing chain intake sprocket | 8. Timing mark of LH (No.1) bank 2nd timing chain                  |                                                                     |

**Fig. 76: Aligning Timing Pulley Key On Crankshaft & Oil Jet**  
 Courtesy of SUZUKI OF AMERICA CORP.

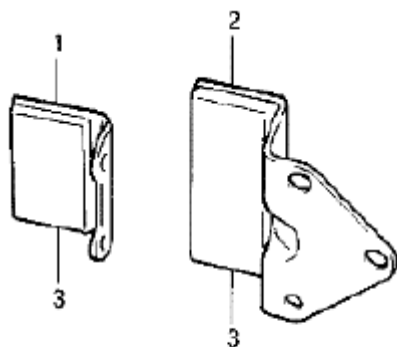
12. Apply oil to timing chains, tensioner adjusters sprockets and guides.
13. Install timing chain cover referring to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
14. Install oil pans referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
15. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
16. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
17. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

#### **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

**Reference: LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**

### Timing Chain Guide No. 4 and No. 5

Check shoe (3) for wear or damage.



1. Timing chain guide  
No.4

2. Timing chain guide  
No.5

### Fig. 77: Identifying Shoe

Courtesy of SUZUKI OF AMERICA CORP.

### Camshaft Sprocket

Check teeth of sprocket for wear or damage.



### Fig. 78: Identifying Teeth Of Sprocket

Courtesy of SUZUKI OF AMERICA CORP.

### Timing Chain

Check timing chain for wear or damage.

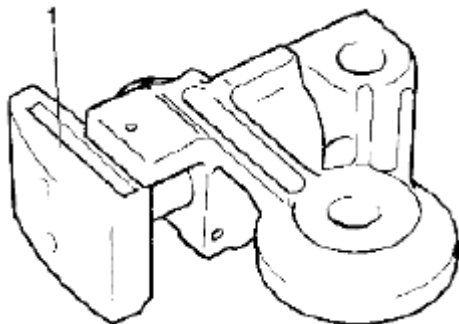


### Fig. 79: Identifying Timing Chain

Courtesy of SUZUKI OF AMERICA CORP.

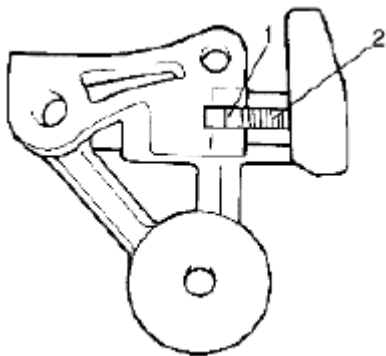
**Tensioner Adjuster No. 3**

- Check shoe (1) for wear or damage.

**Fig. 80: Identifying Shoe**

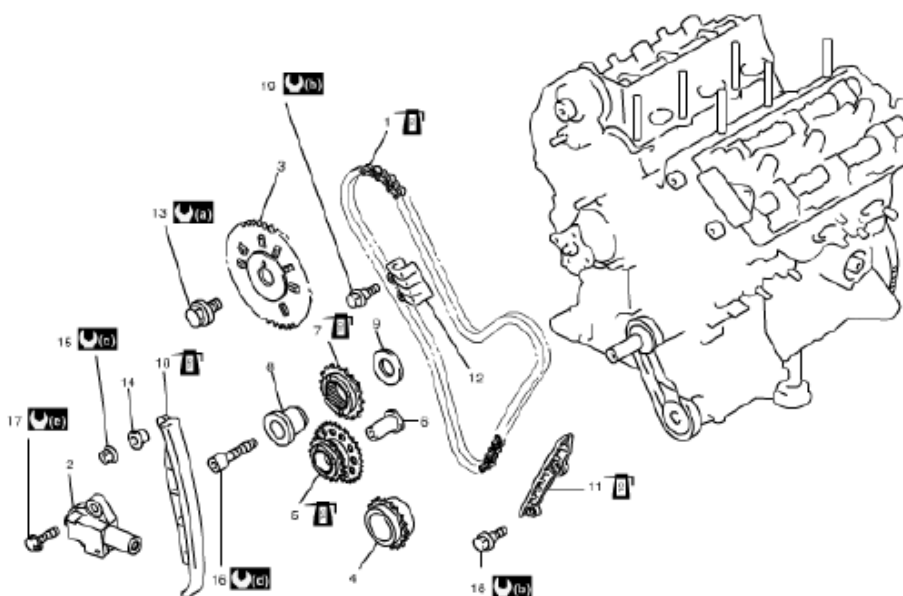
Courtesy of SUZUKI OF AMERICA CORP.

- Check that latch (1) and tooth surface (2) are free from damage and latch functions properly.

**Fig. 81: Identifying Latch & Tooth Surface**

Courtesy of SUZUKI OF AMERICA CORP.

**1ST TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**



|                                                             |                                         |                                      |
|-------------------------------------------------------------|-----------------------------------------|--------------------------------------|
| 1. 1st timing chain                                         | 10. Timing chain tensioner              | 19. Timing chain guide No.2 bolt     |
| 2. Timing chain tensioner adjuster No.1                     | 11. Timing chain guide No.1             | (a): 80 N·m (8.0 kgf-m, 58.0 lb-ft)  |
| 3. RH (No.2) bank 1st timing chain intake camshaft sprocket | 12. Timing chain guide No.2             | (b): 9 N·m (0.9 kgf-m, 6.5 lb-ft)    |
| 4. 1st timing chain crankshaft sprocket                     | 13. Camshaft sprocket bolt              | (c): 25 N·m (2.5 kgf-m, 18.0 lb-ft)  |
| 5. Idler sprocket No.2                                      | 14. Spacer                              | (d): 55 N·m (5.5 kgf-m, 40.0 lb-ft)  |
| 6. Shaft                                                    | 15. Timing chain tensioner nut          | (e): 11 N·m (1.1 kgf-m, 8.0 lb-ft)   |
| 7. Idler sprocket No.1                                      | 16. Idler sprocket No.1 bolt            | : Apply engine oil to sliding parts. |
| 8. Shaft                                                    | 17. Timing tensioner adjuster No.1 bolt |                                      |
| 9. Washer                                                   | 18. Timing chain guide No.1 bolt        |                                      |

**Fig. 82: Identifying 1st Timing Chain & Chain Tensioner Components With Torque Specifications**  
 Courtesy of SUZUKI OF AMERICA CORP.

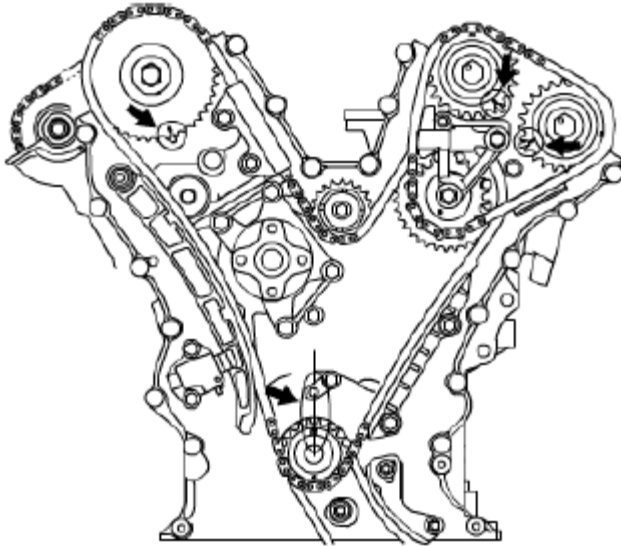
## 1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION

### Reference: 1ST TIMING CHAIN AND CHAIN TENSIONER COMPONENTS

#### Removal

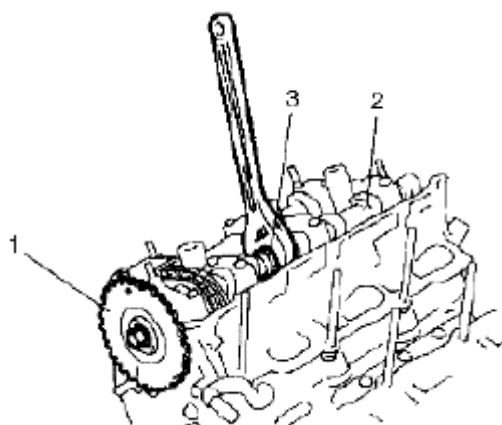
1. Remove engine assembly from vehicle. Refer to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

2. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
3. For reinstallation of timing chain, align 8 timing marks as shown in figure by turning crankshaft.



**Fig. 83: Aligning Timing Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
5. Remove the following parts referring to **1ST TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**.
  - Timing chain guide No. 1 and No. 2.
  - Timing chain tensioner.
  - Timing chain tensioner adjuster.
  - Idler sprocket No. 1 and 1st timing chain.
  - Idler sprocket No. 2 and sprocket shaft.
6. Remove RH (No. 2) bank 1st timing chain intake camshaft sprocket bolt. To remove it, fit a spanner to hexagonal part (3) at the center of camshaft (2) to hold it stationary.
7. Remove RH (No. 2) bank 1st timing chain intake camshaft sprocket (1).



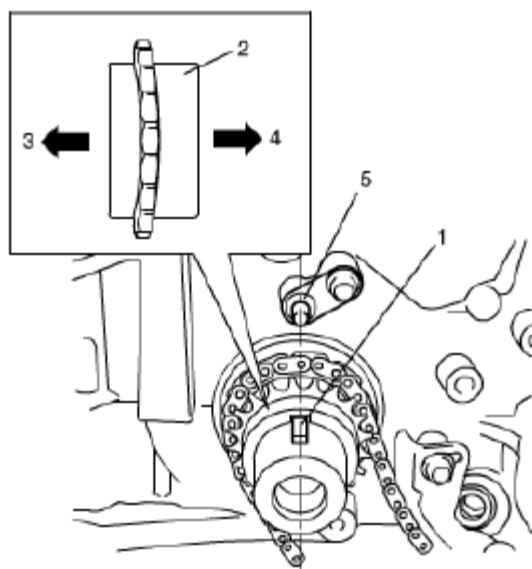
**Fig. 84: Removing RH (No. 2) Bank 1st Timing Chain Intake Camshaft Sprocket Bolt**  
 Courtesy of SUZUKI OF AMERICA CORP.

8. Remove 1st timing chain crankshaft sprocket.

#### Installation

#### **Reference: 1ST TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

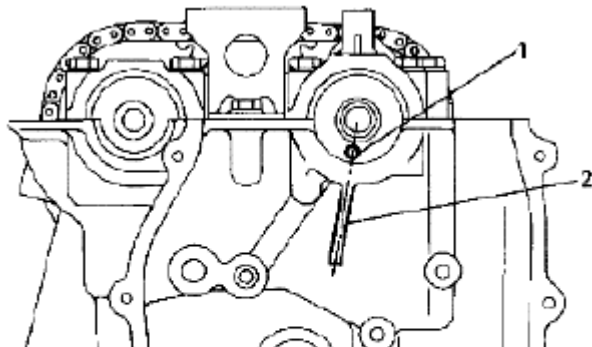
1. Check timing pulley key (1) of crankshaft is on specified position as shown in figure.
2. Install 1st timing chain crankshaft sprocket (2) to crankshaft as shown in figure.



|                           |                           |            |
|---------------------------|---------------------------|------------|
| 3. Crankshaft pulley side | 4. Oil pump sprocket side | 5. Oil jet |
|---------------------------|---------------------------|------------|

**Fig. 85: Identifying Timing Pulley Key Of Crankshaft**  
 Courtesy of SUZUKI OF AMERICA CORP.

3. Check timing mark on RH (No. 2) bank intake camshaft as shown in figure.



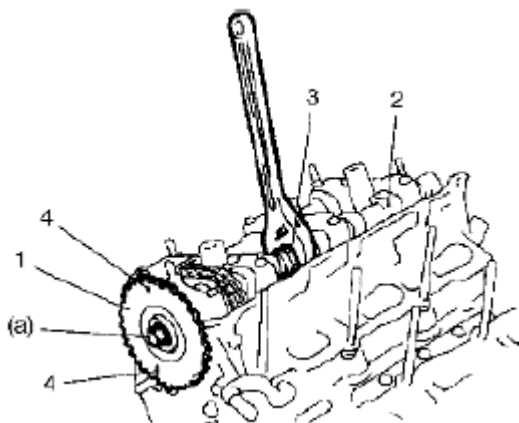
|                                 |               |
|---------------------------------|---------------|
| 1. Knock pin of intake camshaft | 2. Match mark |
|---------------------------------|---------------|

**Fig. 86: Identifying Knock Pin Of Intake Camshaft**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Install RH (No. 2) bank 1st timing chain intake camshaft sprocket (1) noting the following points.
  - The sprocket should be set in such way that its timing marks (4) can be seen.
  - Camshaft (2) should be held stationary by using a spanner at its hexagonal parts (3) as shown in figure.

#### Tightening torque

**RH (No. 2) bank 1st timing chain intake camshaft sprocket bolt a: 80 N.m (8.0 kg-m, 58.0 lb-ft)**

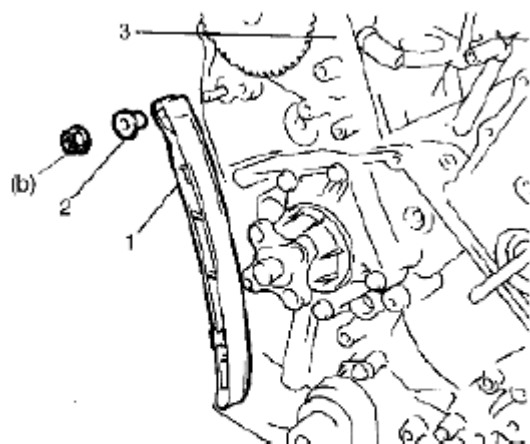


**Fig. 87: Installing RH (No. 2) Bank 1st Timing Chain Intake Camshaft Sprocket**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Install timing chain tensioner (1) as shown in figure.

**Tightening torque**

**Timing chain tensioner nut b: 25 N.m (2.5 kg-m, 18.0 lb-ft)**

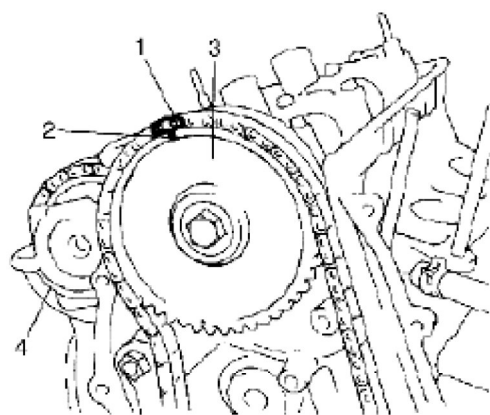


2. Spacer

3. RH (No.2) bank cylinder head

**Fig. 88: Identifying Timing Chain Tensioner Nut & Spacer**  
 Courtesy of SUZUKI OF AMERICA CORP.

6. Install 1st timing chain by aligning match marks (2) on RH silver plate (1) of 1st timing chain and RH (No. 2) bank 1st timing chain intake camshaft sprocket (3).

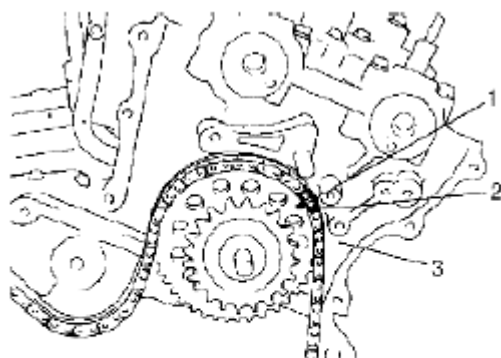


4. RH (No.2) bank cylinder head

**Fig. 89: Aligning Match Marks**  
 Courtesy of SUZUKI OF AMERICA CORP.

7. Apply oil to bush of idler sprocket No. 2.

8. Install idler sprocket No. 2 and sprocket shaft.
9. Install idler sprocket No. 2 by aligning match marks (2) on LH silver plate (1) of 1st timing chain.



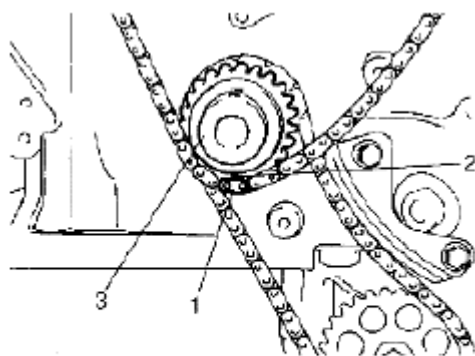
3. LH (No.1) bank cylinder head

**Fig. 90: Identifying Idler Sprocket No. 2 & Sprocket Shaft**  
Courtesy of SUZUKI OF AMERICA CORP.

10. Install crankshaft sprocket by aligning match marks (2) on yellow plate (1) of 1st timing chain and crankshaft timing sprocket.

To install it, fit a spanner to hexagonal part at the center of RH (No. 2) bank intake camshaft to turn a little.

**CAUTION: Do not turn camshaft more than necessary. If turned excessively, valve and piston may get damaged.**



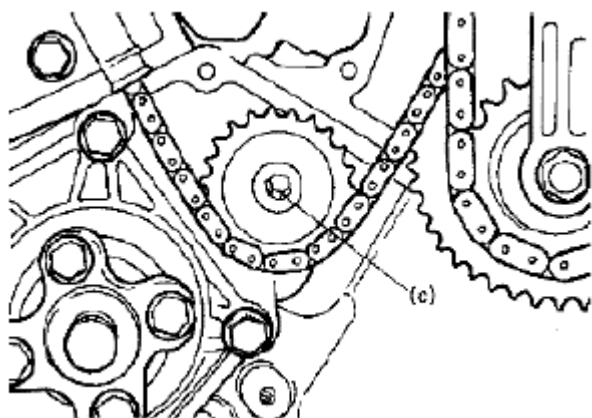
3. Crankshaft

**Fig. 91: Identifying Crankshaft & Aligning Match Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

11. Apply oil to bearing of idler sprocket No. 1.
12. Install idler sprocket No. 1.

### Tightening torque

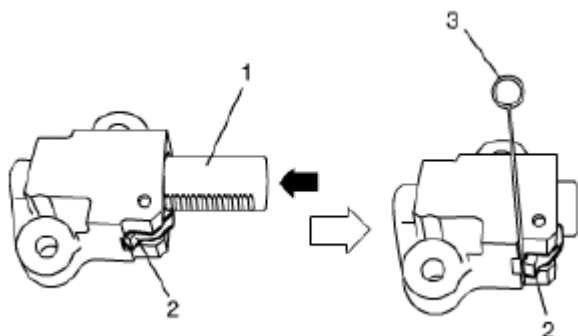
**Idler sprocket No. 1 bolt c: 55 N.m (5.5 kg-m, 40.0 lb-ft)**



**Fig. 92: Identifying Idler Sprocket No. 1**  
Courtesy of SUZUKI OF AMERICA CORP.

13. With latch of tensioner adjuster No. 1 returned and plunger (1) pushed back into body, insert stopper (3) into latch (2) and body.

After inserting it, check to make sure that plunger (1) will not come out.



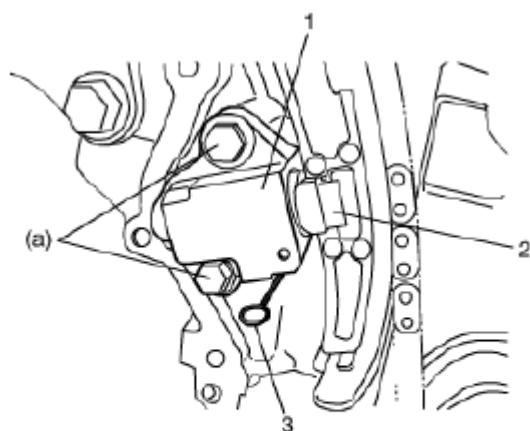
**Fig. 93: Inserting Stopper Into Latch & Body**  
Courtesy of SUZUKI OF AMERICA CORP.

14. Install timing chain tensioner adjuster No. 1 (1).

### Tightening torque

**Timing chain tensioner adjuster No. 1 bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)**

15. Pull out stopper (3) from adjuster No. 1 (1).



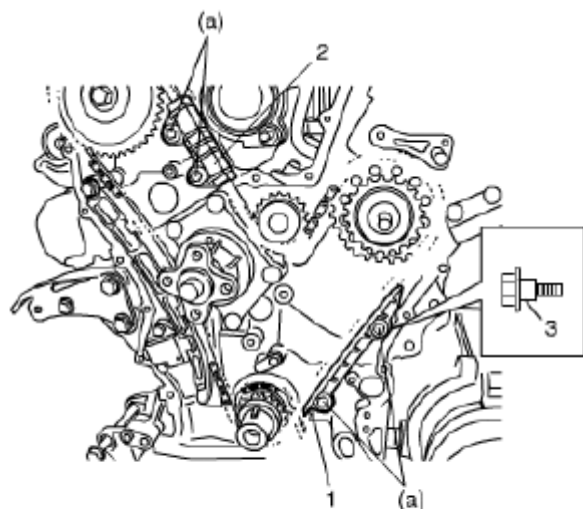
2. Timing chain tensioner

**Fig. 94: Identifying Timing Chain Tensioner**  
Courtesy of SUZUKI OF AMERICA CORP.

16. Install timing chain guide No. 1 (2) and No. 2 (1).

#### **Tightening torque**

**Timing chain guide No. 1 and No. 2 bolt a: 9 N.m (0.9 kg-m, 6.5 lb-ft)**

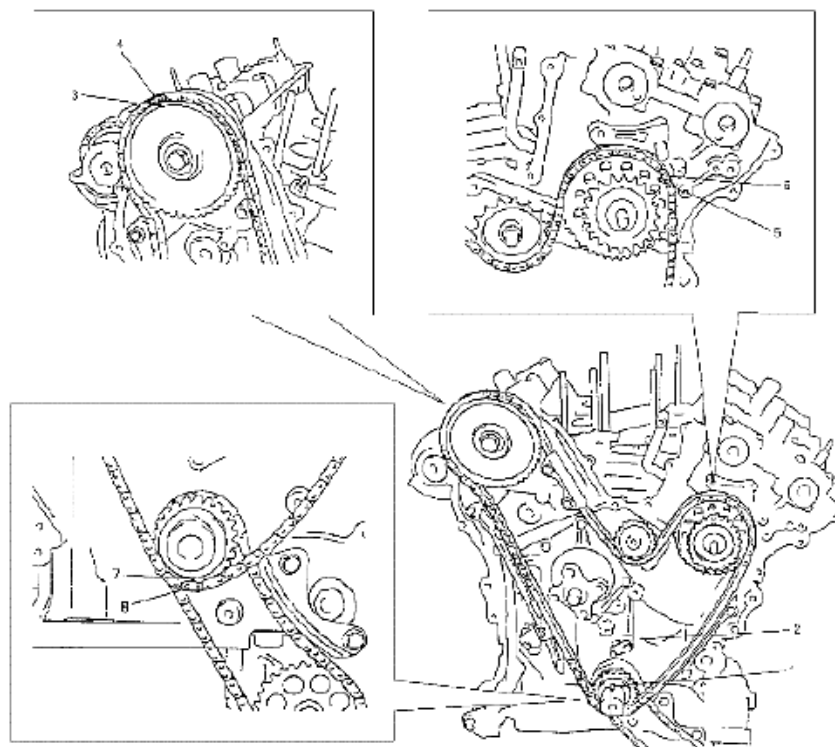


3. Guide bolt

**Fig. 95: Identifying Guide Bolt**

Courtesy of SUZUKI OF AMERICA CORP.

17. Check each aligned timing marks as shown in figure.



|                                                           |                                          |                                             |
|-----------------------------------------------------------|------------------------------------------|---------------------------------------------|
| 1. Crank timing pulley key                                | 4. Silver plate (LH) of 1st timing chain | 7. Match mark of crankshaft timing sprocket |
| 2. Oil jet                                                | 5. Match mark of idler sprocket No.2     | 8. Yellow plate of 1st timing chain         |
| 3. Match mark of RH (No.2) bank 1st timing chain sprocket | 6. Silver plate (LH) of 1st timing chain |                                             |

**Fig. 96: View Of Aligned Timing Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

18. Install LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
19. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
20. Install oil pans referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
21. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
22. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.

23. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

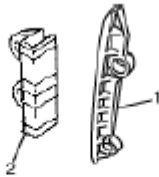
## 1ST TIMING CHAIN AND CHAIN TENSIONER INSPECTION

**Reference: 1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**

### Timing Chain Guides No. 1 and No. 2

Check shoe for excessive wear or damage.

If any malfunction is found, replace it.



1. Timing chain guide  
No.1

2. Timing chain guide  
No.2

**Fig. 97: Identifying Timing Chain Guides No. 1 & No. 2**  
Courtesy of SUZUKI OF AMERICA CORP.

### Timing Chain Tensioner

Check shoe (1) for wear or damage.

If any malfunction is found, replace it.

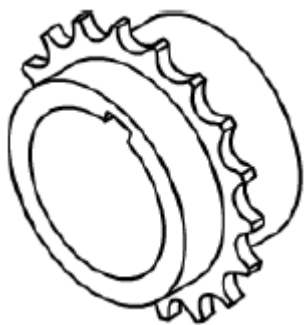


**Fig. 98: Identifying Timing Chain Tensioner**  
Courtesy of SUZUKI OF AMERICA CORP.

### 1st Timing Chain Crankshaft Sprocket

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.

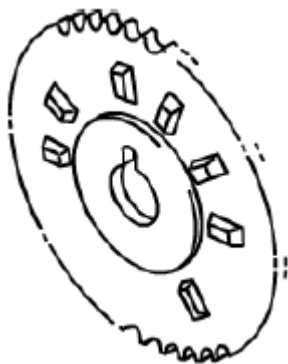


**Fig. 99: Identifying 1st Timing Chain Crankshaft Sprocket**  
**Courtesy of SUZUKI OF AMERICA CORP.**

**RH (No. 2) Bank 1st Timing Chain Intake Camshaft Sprocket**

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.

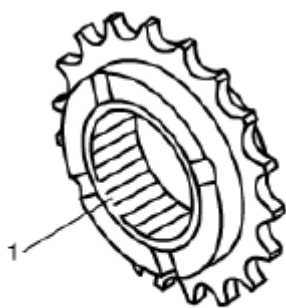


**Fig. 100: Identifying RH (No. 2) Bank 1st Timing Chain Intake Camshaft Sprocket**  
**Courtesy of SUZUKI OF AMERICA CORP.**

**Idle Sprocket No. 1**

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.



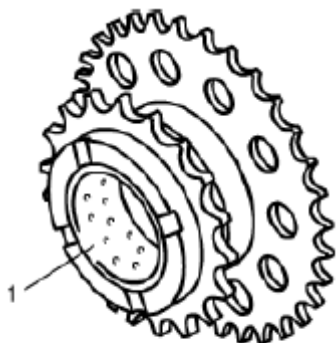
1. Bearing

**Fig. 101: Identifying Idler Sprocket No. 1 Bearing**  
Courtesy of SUZUKI OF AMERICA CORP.

### Idler Sprocket No. 2

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.



1. Bush

**Fig. 102: Identifying Idler Sprocket No. 2 Bush**  
Courtesy of SUZUKI OF AMERICA CORP.

### 1st Timing Chain

Check timing chain for wear or damage.

If any malfunction is found, replace it.



**Fig. 103: Identifying 1st Timing Chain**

Courtesy of SUZUKI OF AMERICA CORP.

### Timing Chain Tensioner Adjuster No. 1

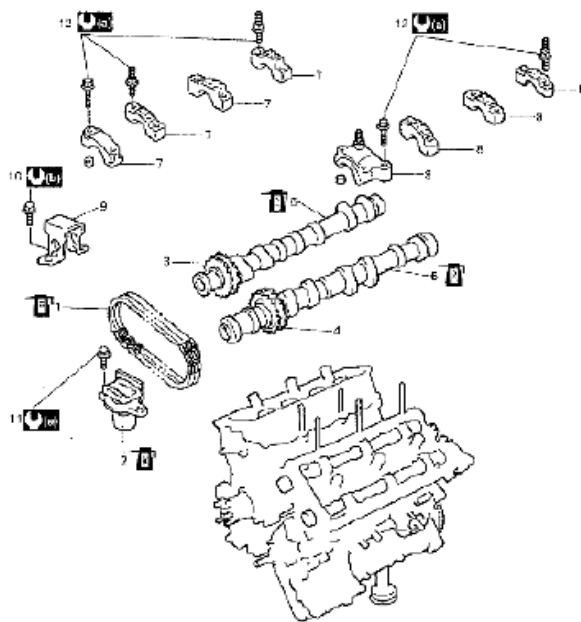
Check that latch (1) and tooth surface (2) are free from damage and latch functions properly.

If any malfunction is found, replace it.



**Fig. 104: Identifying Latch & Tooth Surface**  
Courtesy of SUZUKI OF AMERICA CORP.

### RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS



|                                             |                                            |                                                                                                                                                       |
|---------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. RH (No.2) bank 2nd timing chain          | 6. RH (No.2) bank intake camshaft          | 11. Timing chain tensioner adjuster No.2 bolt                                                                                                         |
| 2. Timing chain tensioner adjuster No.2     | 7. RH (No.2) bank exhaust camshaft housing | 12. Camshaft housing bolt                                                                                                                             |
| 3. RH (No.2) bank exhaust camshaft sprocket | 8. RH (No.2) bank intake camshaft housing  |  Apply engine oil to sliding surface of each part.                 |
| 4. RH (No.2) bank intake camshaft sprocket  | 9. Timing chain guide No.3                 |  Tighten 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure. |
| 5. RH (No.2) bank exhaust camshaft          | 10. Timing chain guide No.3 bolt           |                                                                                                                                                       |

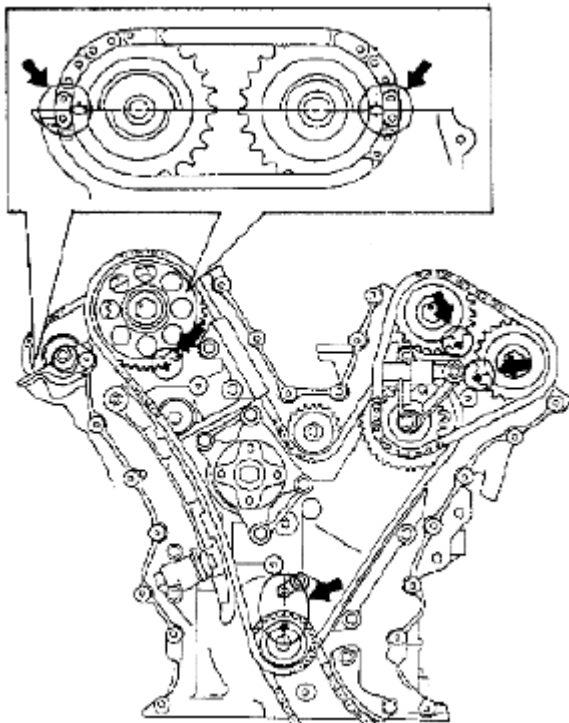
**Fig. 105: Identifying RH (No. 2) Bank 2nd Timing Chain & Chain Tensioner Components With Torque Specifications**

Courtesy of SUZUKI OF AMERICA CORP.

**RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**

**Reference: RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**

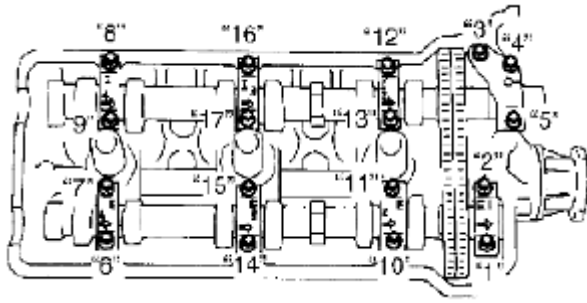
1. Remove engine assembly from vehicle. Refer to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
3. For reinstallation of timing chain, align 12 timing marks as shown in figure by turning crankshaft.



**Fig. 106: Identifying Timing Marks**

Courtesy of SUZUKI OF AMERICA CORP.

4. Remove LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
5. Remove 1st timing chain. Refer to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
6. Remove timing chain guide No. 3 referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**.
7. Loosen camshaft housing bolts in such order ("1"-"17") as indicated in figure and remove them.
8. Remove camshaft housings.



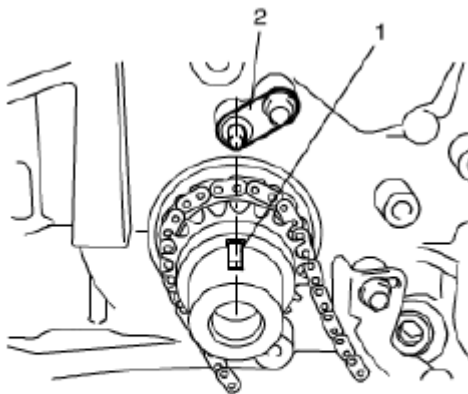
**Fig. 107: Identifying Tightening Sequence Of Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove RH (No. 2) bank intake camshaft, RH (No. 2) bank exhaust camshaft, and RH (No. 2) bank 2nd timing chain as a set referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS.**
10. Remove timing chain tensioner adjuster No. 2 referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER COMPONENTS.**

#### Installation

#### **Reference: RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

1. Check timing mark on crankshaft as shown in figure.



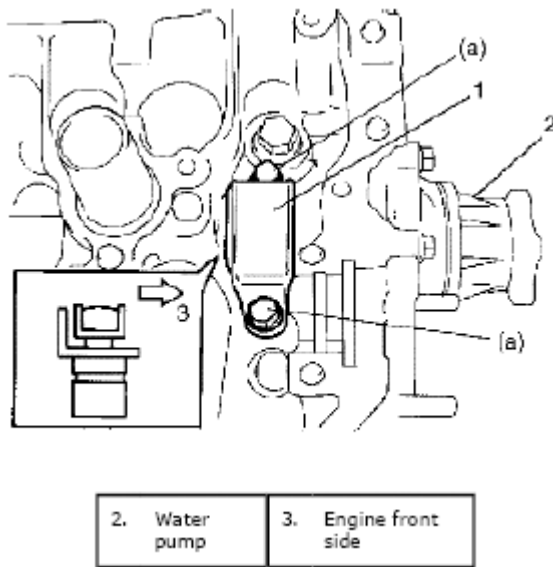
|                            |            |
|----------------------------|------------|
| 1. Crank timing pulley key | 2. Oil jet |
|----------------------------|------------|

**Fig. 108: Identifying Crankshaft Pulley Key & Oil Set**  
Courtesy of SUZUKI OF AMERICA CORP.

2. Apply oil to timing chain tensioner adjuster No. 2 (1).
3. Install timing chain tensioner adjuster No. 2 (1).

#### **Tightening torque**

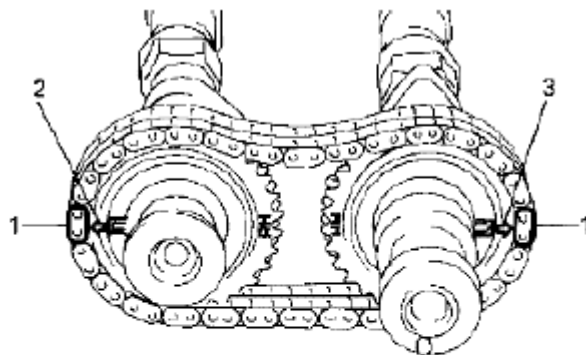
**Timing chain tensioner adjuster No. 2 bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)**



**Fig. 109: Identifying Water Pump & Engine Front Side**

Courtesy of SUZUKI OF AMERICA CORP.

4. Apply oil to sliding surface of each camshafts and camshaft journals.
5. Install RH (No. 2) bank 2nd timing chain by aligning match marks on yellow plates (1) of RH (No. 2) bank 2nd timing chain, RH (No. 2) bank 2nd timing chain intake camshaft sprocket and RH (No. 2) bank 2nd timing chain exhaust camshaft sprocket as shown in figure.

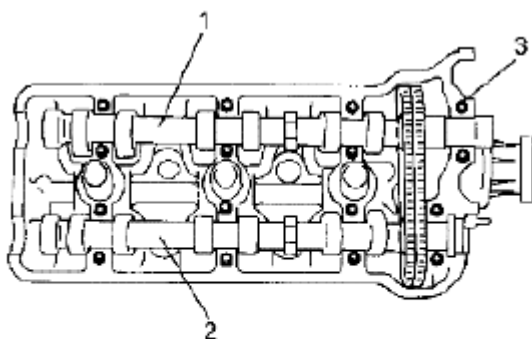


- |                                                                            |
|----------------------------------------------------------------------------|
| 2. Match mark of RH (No.2) bank 2nd timing chain exhaust camshaft sprocket |
| 3. Match mark of RH (No.2) bank 2nd timing chain intake camshaft sprocket  |

**Fig. 110: Identifying Match Mark Of RH (No. 2) Bank 2nd Timing Chain Exhaust Camshaft Sprocket**

Courtesy of SUZUKI OF AMERICA CORP.

6. Install camshaft housing pins (3) as shown in figure.



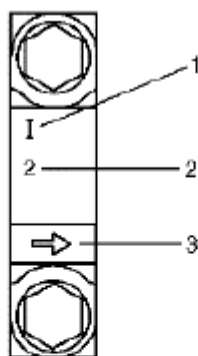
1. RH (No.2) bank intake camshaft

2. RH (No.2) bank exhaust camshaft

**Fig. 111: Identifying Camshaft Housing Pins**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Check position of camshaft housings.

Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.



1. I: Intake side, E: Exhaust side

3. Timing chain side

2. Position from timing chain side

**Fig. 112: Identifying Connecting Rod Bearing Cap Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

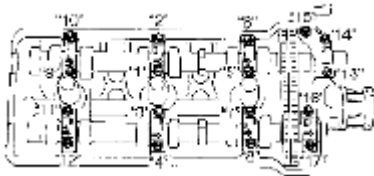
8. After applying oil to housing bolts, tighten them temporarily first.

Then tighten them by following sequence ("1"- "17") as indicated in figure. Tighten a little at a time and

evenly among bolts and repeat tightening sequence 2 or 3 times before they are tightened to specified torque below.

### Tightening torque

**Camshaft housing bolt: 11 N.m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure**

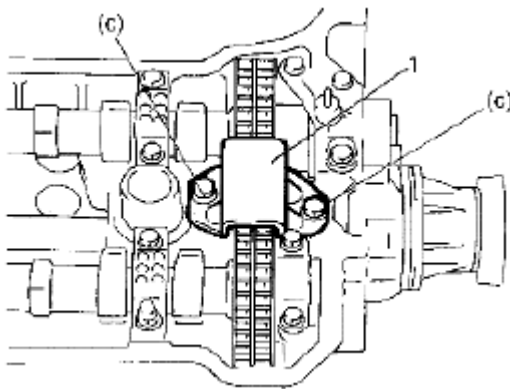


**Fig. 113: Identifying Tightening Sequence Of Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Install timing chain guide No. 3 (1).

### Tightening torque

**Timing chain guide No. 3 bolt c: 11 N.m (1.1 kg-m, 8.0 lb-ft)**



**Fig. 114: Identifying Timing Chain Guide No. 3 Bolt**  
Courtesy of SUZUKI OF AMERICA CORP.

10. Install 1st timing chain. Refer to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
11. Install LH (No. 1) bank 2nd timing chain. Refer to **LH (No. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
12. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
13. Install oil pans referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
14. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.

15. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
16. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

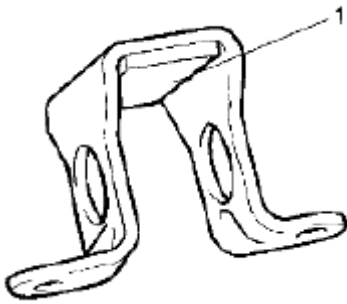
## **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

**Reference: RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**

### **Timing Chain Guide No. 3**

Check shoe (1) for excessive wear or damage.

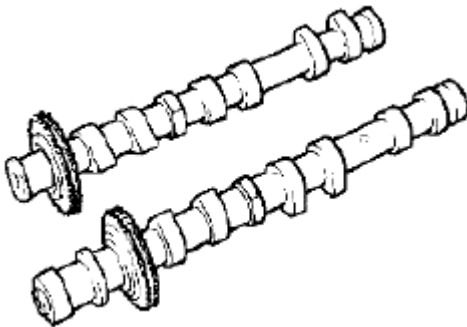
If any malfunction is found, replace it.



**Fig. 115: Identifying Timing Chain Guide No. 3 Shoe**  
Courtesy of SUZUKI OF AMERICA CORP.

### **RH (No. 2) Bank 2nd Timing Chain Sprockets**

Check teeth of sprocket for wear or damage.



**Fig. 116: Identifying RH (No. 2) Bank 2nd Timing Chain Sprockets Teeth**  
Courtesy of SUZUKI OF AMERICA CORP.

### **RH (No. 2) Bank 2nd Timing Chain**

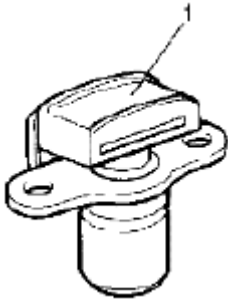
Check timing chain for wear or damage.



**Fig. 117: Identifying Timing Chain**  
Courtesy of SUZUKI OF AMERICA CORP.

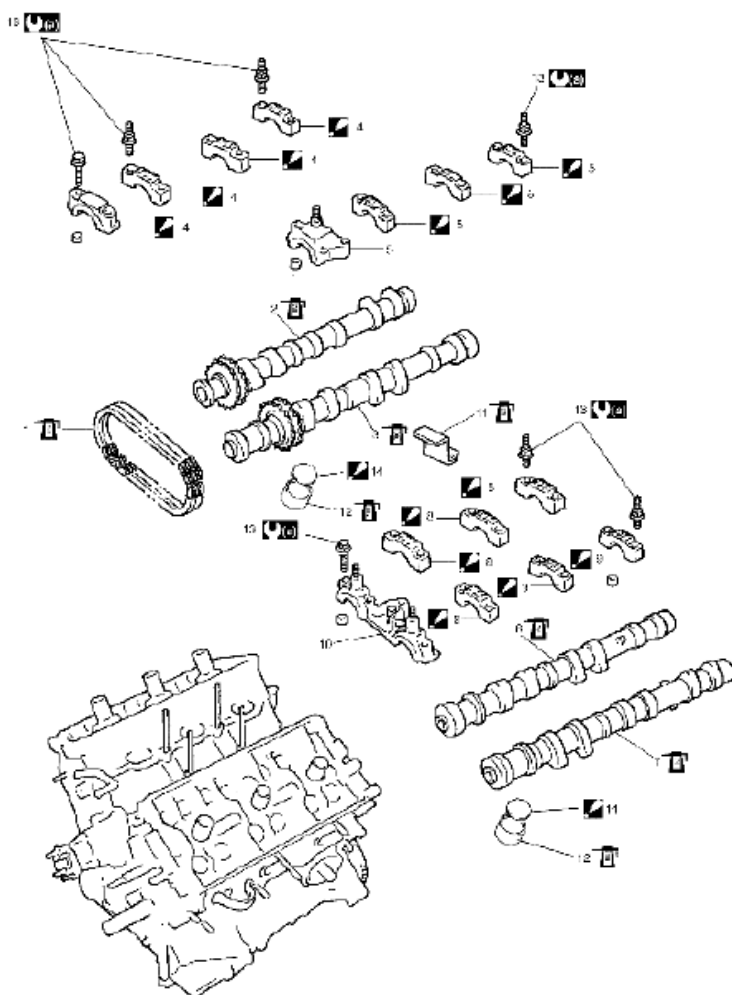
**Timing Chain Tensioner Adjuster No. 2**

- Check shoe (1) for wear or damage.
- Check that plunger slides smoothly.



**Fig. 118: Identifying Timing Chain Tensioner Adjuster No. 2 Shoe**  
Courtesy of SUZUKI OF AMERICA CORP.

**CAMSHAFTS, TAPPETS AND SHIMS COMPONENTS**



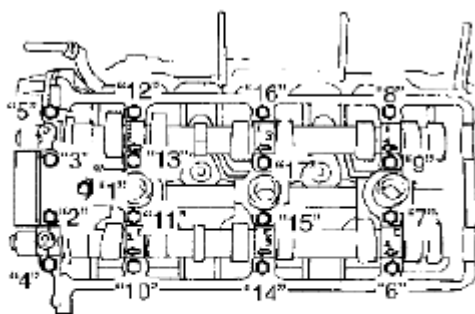
|                                                                                                                                                                                        |                                                                                                                                                                                        |                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. RH (No.2) bank 2nd timing chain                                                                                                                                                     | 7. LH (No.1) bank exhaust camshaft                                                                                                                                                     | 13. Camshaft housing bolt                                                                                                                                 |
| 2. RH (No.2) bank exhaust camshaft                                                                                                                                                     |  8. LH (No.1) bank intake camshaft housing<br>: Point arrow mark on cap to camshaft sprocket side.  |  14. Shim<br>: Direct shim No. side toward tappet.                     |
| 3. RH (No.2) bank intake camshaft                                                                                                                                                      |  9. LH (No.1) bank exhaust camshaft housing<br>: Point arrow mark on cap to camshaft sprocket side. |  (a): Tighten 11 Nm (1.1 kgf-m, 8.0 lb-ft) by the specified procedure. |
|  4. RH (No.2) bank exhaust camshaft housing<br>: Point arrow mark on cap to camshaft sprocket side. | 10. LH (No.1) bank camshaft housing                                                                                                                                                    |  : Apply engine oil to sliding surface of each part.                   |
| RH (No.2) bank intake camshaft housing<br>: Point arrow mark on cap to camshaft sprocket side.                                                                                         | 11. Timing chain guide No.5                                                                                                                                                            |                                                                                                                                                           |
|  5. LH (No.1) bank intake camshaft                                                                  | 12. Tappet                                                                                                                                                                             |                                                                                                                                                           |

**Fig. 119: Identifying Camshafts, Tappets & Shims Components With Torque Specifications**  
 Courtesy of SUZUKI OF AMERICA CORP.

**CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION****Reference: CAMSHAFTS, TAPPETS AND SHIMS COMPONENTS****Removal**

1. Remove engine assembly from vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
3. Remove LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
4. Remove 1st timing chain. Refer to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
5. Remove RH (No. 2) bank camshafts. Refer to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
6. Loosen LH (No. 1) bank camshaft housing bolts in such order ("1"- "17") as indicated in figure and remove them.

[A]



[A]: LH (No.1)  
bank

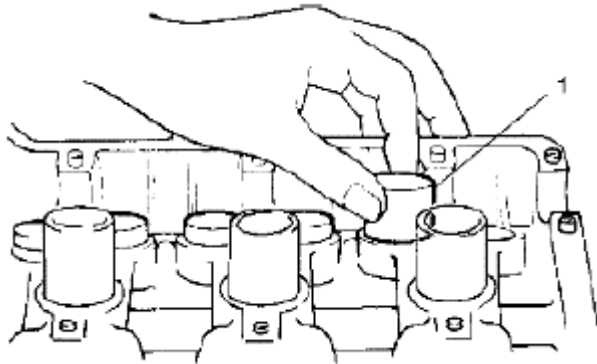
**Fig. 120: Identifying Tightening Sequence Of Camshaft Housing Bolts**  
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Remove LH (No. 1) bank camshaft housings.
8. Remove LH (No. 1) bank camshafts.
9. Remove tappets with shims.

**Installation****Reference: CAMSHAFTS AND CAMSHAFT HOUSINGS INSPECTION****Reference: TAPPETS AND SHIMS INSPECTION**

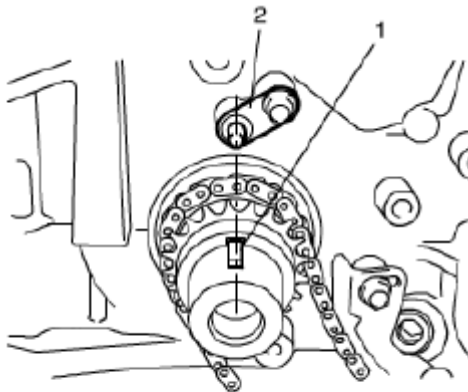
1. Apply engine oil around tappet (1), and then install tappets with shims to cylinder head.

**NOTE:** When installing shim, make sure to direct shim No. side toward tappet.



**Fig. 121: Installing Tappets With Shims**  
Courtesy of SUZUKI OF AMERICA CORP.

2. Check timing pulley key (1) on crankshaft as shown in figure.

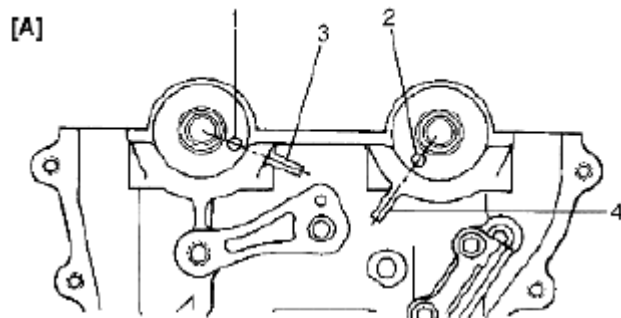


2. Oil jet

**Fig. 122: Checking Timing Pulley Key On Crankshaft**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Install RH (No. 2) bank camshafts referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION.**
4. Install LH (No. 1) bank camshafts.

Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks (4) on cylinder head (3) and LH (No. 1) bank camshafts as shown in figure.

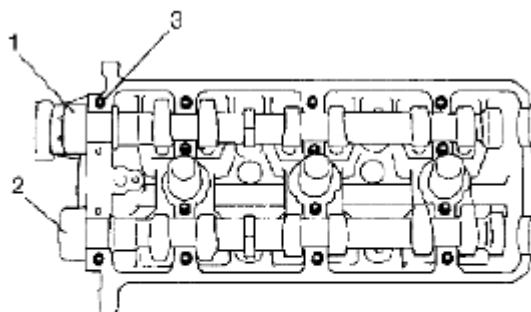


|                                   |                                    |
|-----------------------------------|------------------------------------|
| [A]: LH (No.1) bank               | 2. LH (No.1) bank exhaust camshaft |
| 1. LH (No.1) bank intake camshaft |                                    |

**Fig. 123: Identifying Oil Jet**

Courtesy of SUZUKI OF AMERICA CORP.

5. Install LH (No. 1) bank camshaft housing pins (3) as shown in figure.



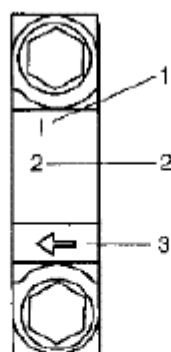
|                                   |                                    |
|-----------------------------------|------------------------------------|
| 1. LH (No.1) bank intake camshaft | 2. LH (No.1) bank exhaust camshaft |
|-----------------------------------|------------------------------------|

**Fig. 124: Identifying Camshaft Housing Pins**

Courtesy of SUZUKI OF AMERICA CORP.

6. Check position of LH (No. 1) bank camshaft housings.

Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.



|                                    |                      |
|------------------------------------|----------------------|
| 1. I: Intake side, E: Exhaust side | 3. Timing chain side |
| 2. Position from timing chain side |                      |

**Fig. 125: Identifying Connecting Rod Bearing Cap Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

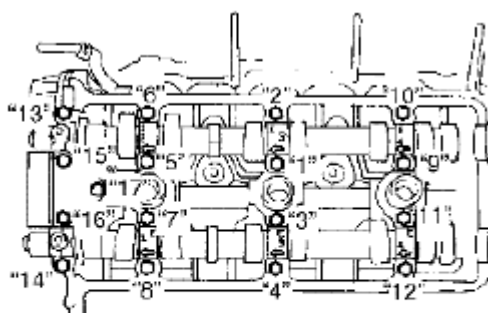
7. Tighten housing bolts temporarily first.

Then tighten them by following sequence ("1"- "17") as indicated in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence 2 or 3 times before they are tightened to specified torque below.

### Tightening torque

**Camshaft housing bolts: Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure**

[A]



[A]: LH (No.1)  
bank

**Fig. 126: Identifying Tightening Sequence Of Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

8. Install 1st timing chain. Refer to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL**

**AND INSTALLATION.**

9. Install LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION.**
10. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION.**
11. Install oil pans referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
12. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION.**
13. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION.**
14. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION.**

**CAMSHAFTS AND CAMSHAFT HOUSINGS INSPECTION**

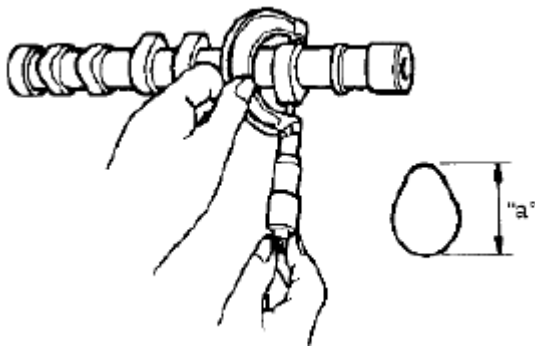
**Reference: CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION**

**Cam Wear**

Using a micrometer, measure cam height. If measured height is below its limit, replace camshaft.

**Cam height "a"****CAM HEIGHT SPECIFICATION**

| Cam height | Intake cam                           | Exhaust cam                            |
|------------|--------------------------------------|----------------------------------------|
| Standard   | 45.005-45.165 mm (1.7719-1.7781 in.) | 45.550-45.710 mm (1.7933 - 1.7996 in.) |
| Limit      | 44.89 mm (1.7673 in.)                | 45.43 mm (1.7886 in.)                  |



**Fig. 127: Measuring Cam Height**  
**Courtesy of SUZUKI OF AMERICA CORP.**

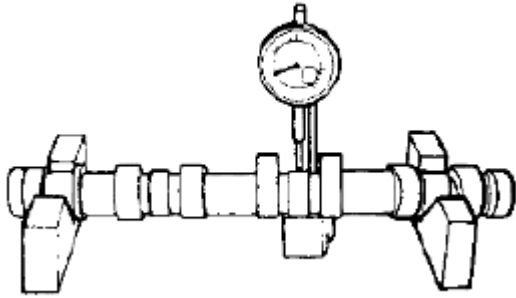
**Camshaft Runout**

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.

If measured runout exceeds specified limit, replace camshaft.

#### Camshaft runout limit

**0.04 mm (0.002 in.)**

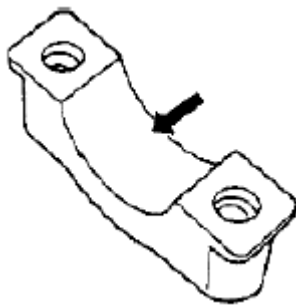


**Fig. 128: Measuring Camshaft Runout**  
Courtesy of SUZUKI OF AMERICA CORP.

#### Camshaft Journal Wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.

Always replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housings.



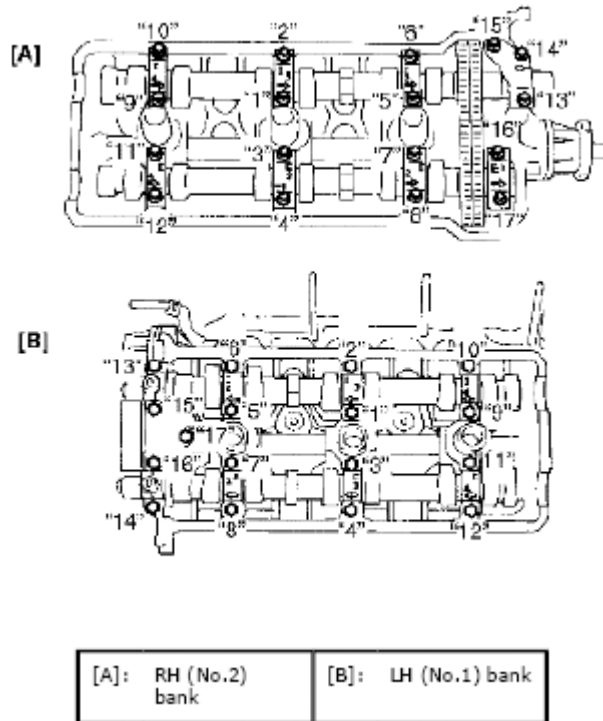
**Fig. 129: Locating Connecting Rod Bearing Cap**  
Courtesy of SUZUKI OF AMERICA CORP.

Check clearance by using gauging plastic. The procedure is as follows.

1. Clean housings and camshaft journals.
2. Make sure that all tappets and shims are removed and install camshafts to cylinder head.
3. Place a piece of gauging plastic the full width of journal of camshaft (parallel to camshaft).
4. Install camshaft housing.
5. Tighten camshaft housing bolts in such order ("1"- "17") as shown in figure a little at a time till they are

tightened to specified torque.

**NOTE:** Do not rotate camshaft while gauging plastic is installed.



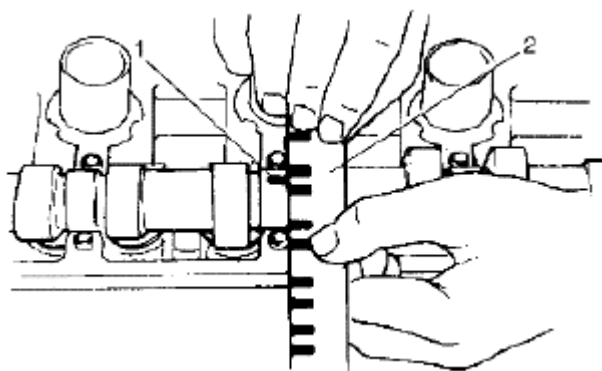
**Fig. 130: Identifying Tightening Sequence Of Camshaft Housing Bolts**  
 Courtesy of SUZUKI OF AMERICA CORP.

6. Remove housing, and using scale (2) on gauging plastic (1) envelop, measure gauging plastic (1) width at its widest point.

#### Camshaft journal clearance

**Standard:** 0.020-0.074 mm (0.0008-0.0029 in.)

**Limit:** 0.10 mm (0.0039 in.)



**Fig. 131: Measuring Gauging Plastic Width**  
Courtesy of SUZUKI OF AMERICA CORP.

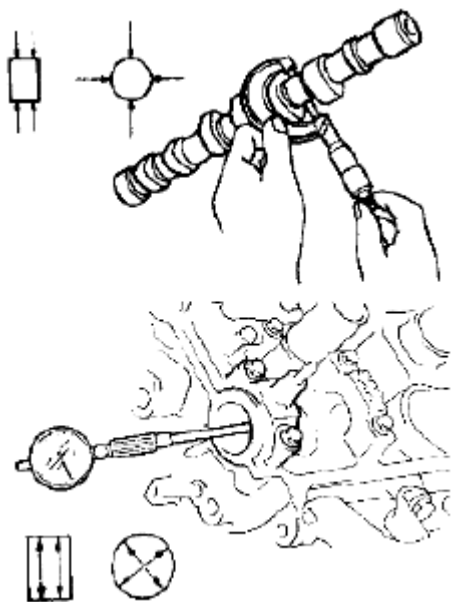
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

**Camshaft journal bore (IN and EX)**

**Standard: 26.000-26.033 mm (1.0236-1.0249 in.)**

**Camshaft journal outside diameter (IN and EX)**

**Standard: 25.959-25.980 mm (1.0220-1.0228 in.)**

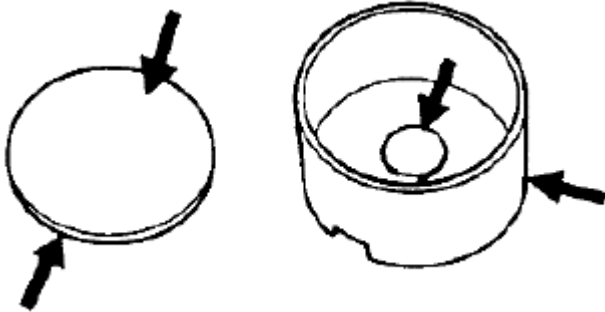


**Fig. 132: Measuring Journal (Housing) Bore & Outside Diameter Of Camshaft Journal**  
Courtesy of SUZUKI OF AMERICA CORP.

**TAPPETS AND SHIMS INSPECTION****Reference: CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION**

Check tappet and shim for pitting, scratches, or damage.

If any malcondition is found, replace.



**Fig. 133: Checking Tappet & Shim For Pitting Or Scratches**  
**Courtesy of SUZUKI OF AMERICA CORP.**

Measure cylinder head bore and tappet outside diameter to determine cylinder head-to-tappet clearance. If clearance exceeds limit, replace tappet or cylinder head.

**Tappet outside diameter**

**Standard: 32.456-32.472 mm (1.2778-1.2784 in.)**

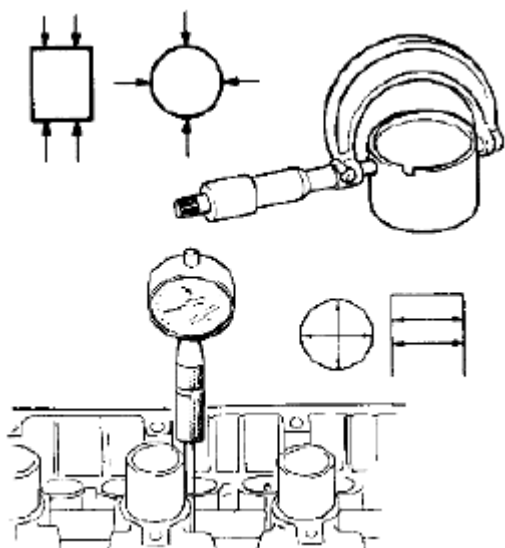
**Cylinder head bore**

**Standard: 32.500-32.525 mm (1.2795-1.2805 in.)**

**Cylinder head to tappet clearance**

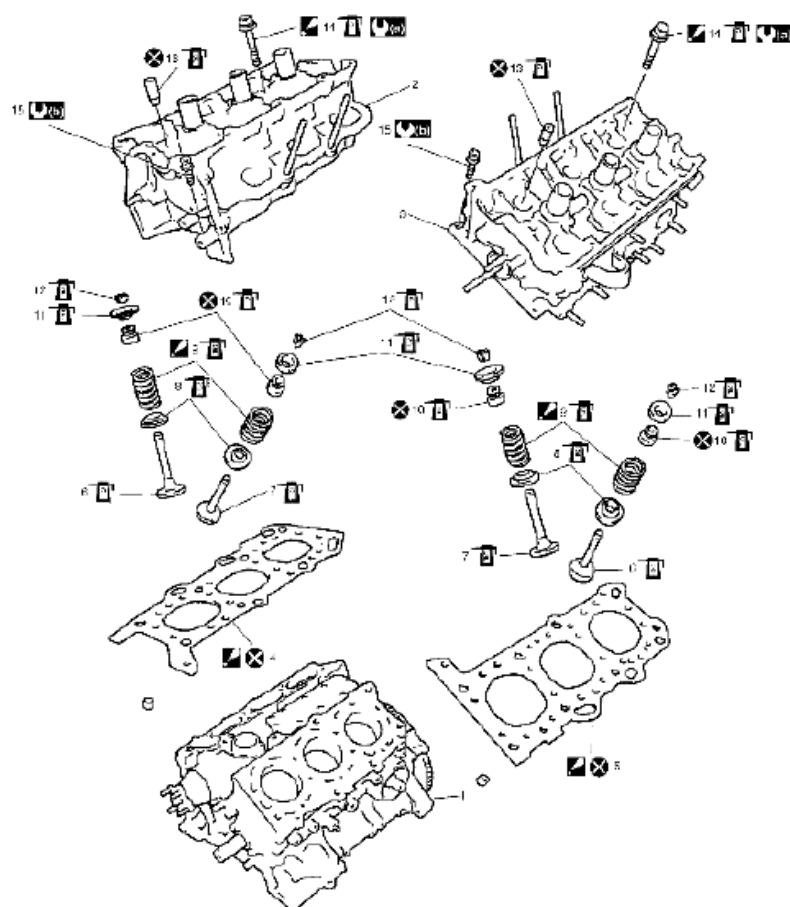
**Standard: 0.028-0.069 mm (0.0011-0.0027 in.)**

**Limit: 0.10 mm (0.0039 in.)**



**Fig. 134: Measuring Cylinder Head Bore & Tappet Outside Diameter**  
**Courtesy of SUZUKI OF AMERICA CORP.**

#### **VALVES AND CYLINDER HEADS COMPONENTS**



Expand image

|                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Cylinder block                                                                                                                                                                                                    | 8. Valve spring seat                                                                                                                                                                                                                                        | 15. Cylinder head bolt (hex hole bolt)                                                                                                                                                                                                                                                     |
| 2. RH (No.2) bank cylinder head                                                                                                                                                                                      |  9. Valve spring:<br>Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).                               |  (a): Tighten 53 N·m (5.3 kgf-m, 38.5 lb-ft), 84 N·m (8.4 kgf-m, 61.0 lb-ft), 0 N·m (0 kgf-m, 0 lb-ft), 53 N·m (5.3 kgf-m, 38.5 lb-ft) and 105 N·m (10.5 kgf-m, 76.0 lb-ft) by the specified procedure. |
| 3. LH (No.1) bank cylinder head                                                                                                                                                                                      | 10. Valve stem oil seal                                                                                                                                                                                                                                     |  (b): 11 N·m (1.1 kgf-m, 8.0 lb-ft)                                                                                                                                                                     |
|  4. RH (No.2) bank cylinder head gasket:<br>Carved lot number on cylinder head gasket should face up (toward cylinder head side). | 11. Valve spring retainer                                                                                                                                                                                                                                   |  : Do not reuse.                                                                                                                                                                                        |
|  5. LH (No.1) bank cylinder head gasket:<br>Carved lot number on cylinder head gasket should face up (toward cylinder head side). | 12. Valve cotter                                                                                                                                                                                                                                            |  : Apply engine oil to sliding surface of each part.                                                                                                                                                    |
| 6. Exhaust valve                                                                                                                                                                                                     | 13. Valve guide                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                            |
| 7. Intake valve                                                                                                                                                                                                      |  14. Cylinder head bolt<br>: Check cylinder head bolt (M10) for deformation referring to "Cylinder Head Bolt" under Valves and Valve Guides Inspection, if it is reused. |                                                                                                                                                                                                                                                                                            |

**Fig. 135: Identifying Valves & Cylinder Heads Components With Torque Specifications**

Courtesy of SUZUKI OF AMERICA CORP.

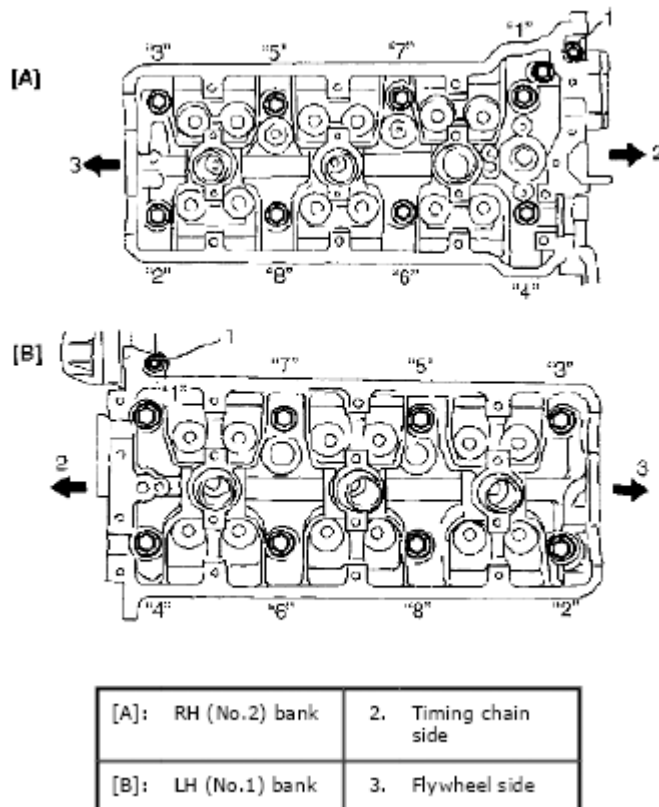
## VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION

**Reference:** VALVES AND CYLINDER HEADS COMPONENTS

### Removal

1. Remove engine assembly from vehicle referring to ENGINE ASSEMBLY REMOVAL AND INSTALLATION.
2. Remove camshafts, tappets and shims referring to CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION.
3. Remove exhaust manifold referring to EXHAUST MANIFOLD REMOVAL AND INSTALLATION.
4. Remove water outlet cap.
5. Loosen cylinder head bolts in such order ("1"-->"8") as shown in figure and remove them.

**NOTE:** Be sure to remove 2 hex bolts (1) shown in figure.

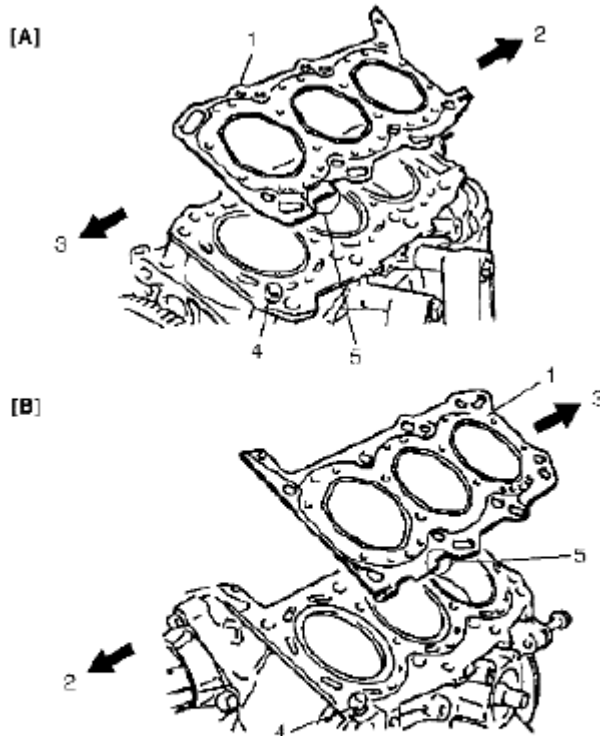


**Fig. 136: Identifying Loosening Sequence Of Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove cylinder heads.

## Installation

1. Clean mating surface on cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.
2. Install knock pin (4) to cylinder block.
3. Install new cylinder head gasket (1) to cylinder block as shown in figure. Carved lot number (5) on cylinder head gasket (1) should face up (toward cylinder head side).



|                     |                           |
|---------------------|---------------------------|
| [A]: RH (No.2) bank | 2. Crankshaft pulley side |
| [B]: LH (No.1) bank | 3. Flywheel side          |

**Fig. 137: Identifying Head Gasket Matching Marks To Crank Shaft Pulley Side**  
 Courtesy of SUZUKI OF AMERICA CORP.

4. Install cylinder head to block.

After applying oil to cylinder head bolts, tighten them gradually as follows.

- a. Tighten cylinder head bolts (except hex hole bolt) to 53 N.m (5.3 kgf-m, 38.5 lb-ft) according to numerical order in figure.
- b. In the same manner as Step a), tighten them to 84 N.m (8.4 kgf-m, 61.0 lb-ft).
- c. Loosen all bolts until tightening torque is reduced to 0 in reverse order of tightening.

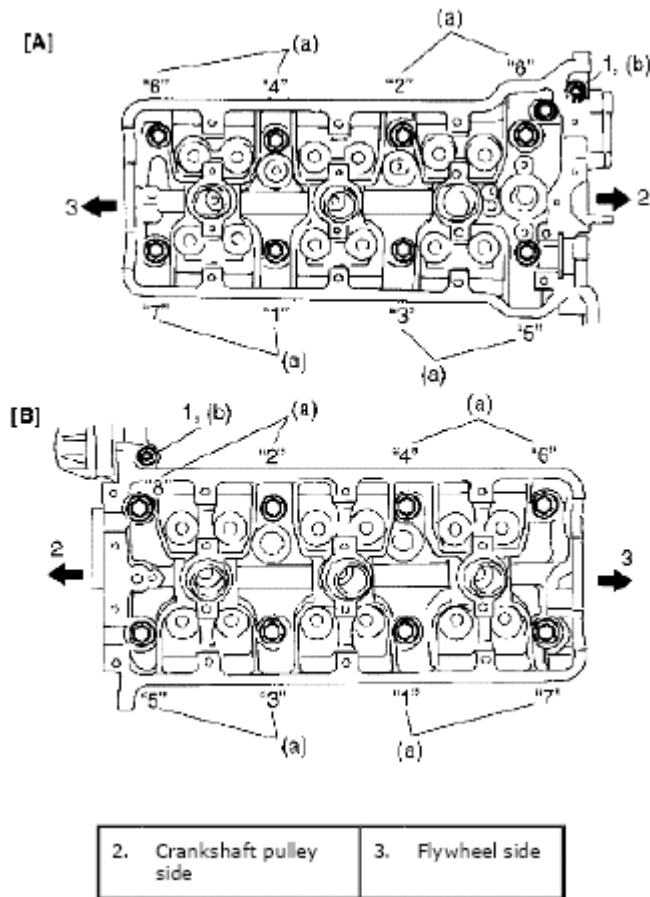
- d. In the same manner as Step a), tighten them to 53 N.m (5.3 kgf-m, 38.5 lb-ft).
- e. In the same manner as Step a) again, tighten them to 105 N.m (10.5 kgf-m, 76.0 lb-ft).
- f. Tighten cylinder head bolts (hex hole bolt) to specified torque.

### Tightening torque

**Cylinder head bolt a:** Tighten 53 N.m (5.3 kgf-m, 38.5 lb-ft), 84 N.m (8.4 kgf-m, 61.0 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 53 N.m (5.3 kgf-m, 38.5 lb-ft) and 105 N.m (10.5 kgf-m, 76.0 lb-ft) by the specified procedure

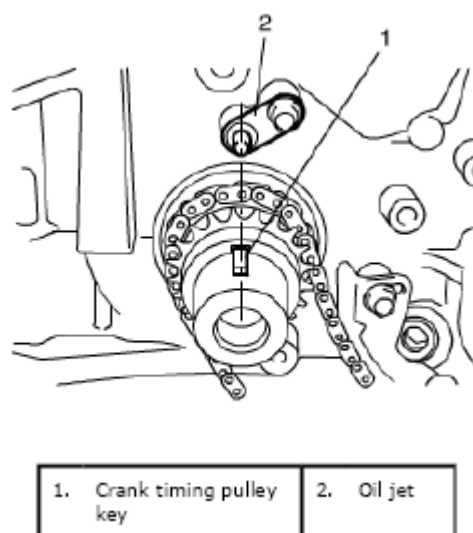
**Cylinder head bolt (hex hole bolt) b:** Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure

**NOTE:** Be sure to install hex hole bolts (1) as shown in figure.



**Fig. 138: Identifying Loosening Sequence Of Camshaft Housing Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Install water outlet cap.
6. Check timing mark on crankshaft as shown in figure.



**Fig. 139: Identifying Tightening Sequence Of Cylinder Head Bolts**  
 Courtesy of SUZUKI OF AMERICA CORP.

7. Install tappets, shims, camshafts, and RH (No. 2) bank 2nd timing chain.

Refer to **CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION AND RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.

8. Install 1st timing chain referring to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
9. Install LH (No. 1) bank 2nd timing chain referring to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
10. Install timing chain cover referring to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
11. Install oil pans and oil pump strainer referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
12. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
13. Install exhaust manifold referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION**.
14. Install radiator outlet pipe referring to **COOLING WATER PIPES OR HOSES REMOVAL AND INSTALLATION**.
15. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
16. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

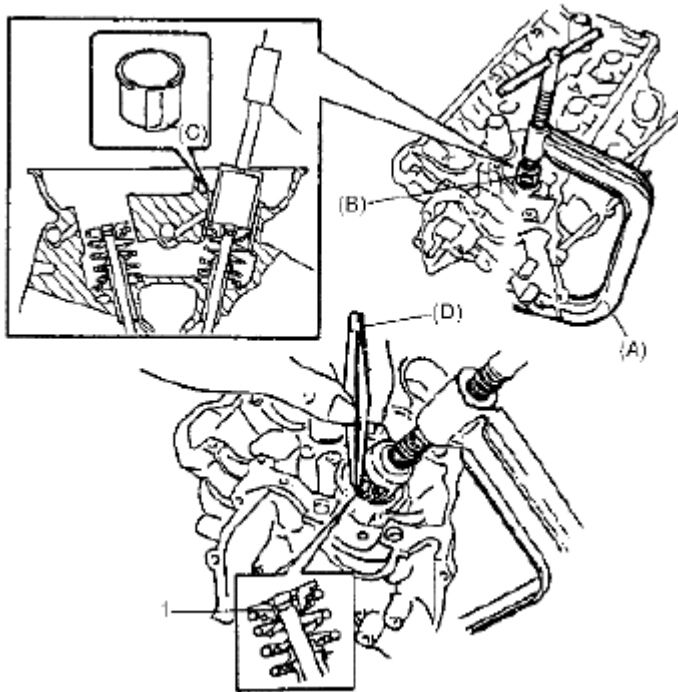
## VALVES AND CYLINDER HEADS DISASSEMBLY AND REASSEMBLY

**Reference: VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION****Disassembly**

1. Using special tools (A), (B) and (C), compress valve springs and then remove valve cotters (1) by using special tool (D).
2. Release special tool, and remove spring retainer and valve spring.

**Special Tool**

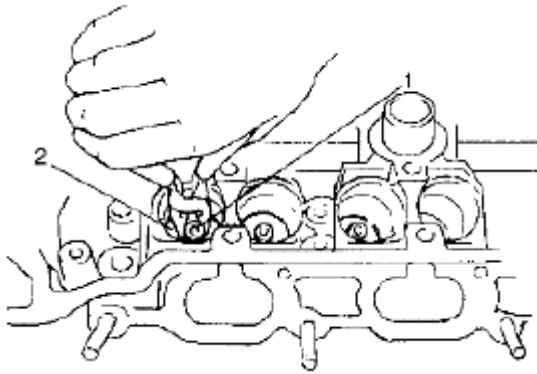
- A. 09916-14510
- B. 09916-14910
- C. 09919-28610
- D. 09916-84511



**Fig. 140: Compressing Valve Springs**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove valve from combustion chamber side.
4. Remove valve stem seal (1) from valve guide, and then valve spring seat (2).

**NOTE:** Do not reuse seal once disassembled. Be sure to use new seal when assembling.



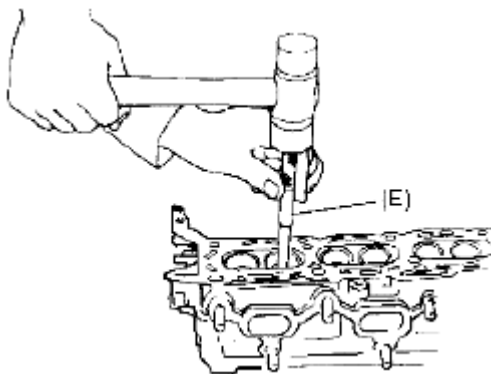
**Fig. 141: Removing Valve Stem Seal From Valve Guide**  
Courtesy of SUZUKI OF AMERICA CORP.

5. Using special tool (E) (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

#### Special Tool

(E): 09916-44910

**NOTE:** Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.



**Fig. 142: Driving Valve Guide Out From Combustion Chamber**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original positions.

#### Reassembly

**Reference:** VALVES AND VALVE GUIDES INSPECTION

**Reference:** CYLINDER HEAD INSPECTION

**Reference: VALVE SPRINGS INSPECTION**

1. Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so as to remove burrs and make it truly round.

**Special Tool****(E): 09916-34542****(F): 09916-38210**

2. Install valve guide to cylinder head.

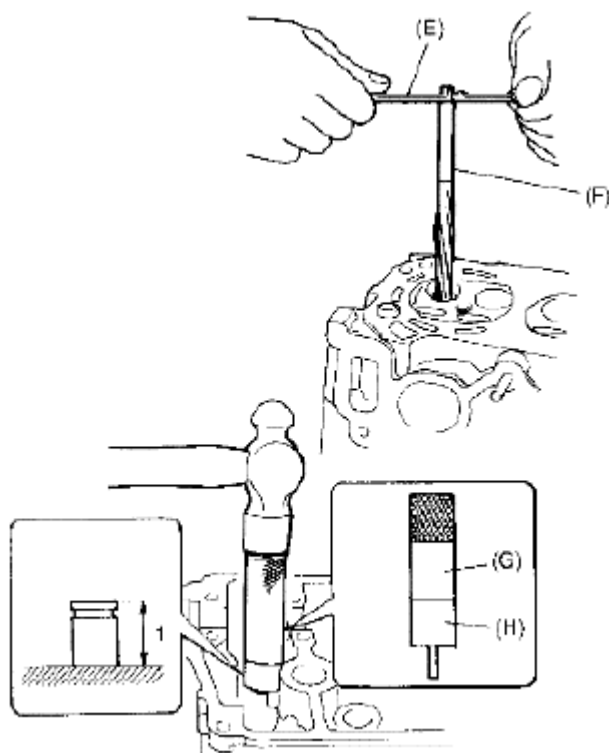
Heat cylinder head uniformly at a temperature of 80 to 100 °C (176 to 212 °F) so that head will not be distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.

After installing, make sure that valve guide protrusions (1) by specified height from cylinder head.

**Special Tool****(G): 09916-58210****(H): 09917-87810****NOTE:**

- Do not reuse valve guide once disassembled. Install new valve guide (Oversize).
- Intake and exhaust valve guides are identical.

**Outer diameter of oversized valve guide****11.088-11.103 mm (0.4365-0.4371 in.)****Valve guide protrusion (In and Ex)****13.5 mm (0.53 in.)**



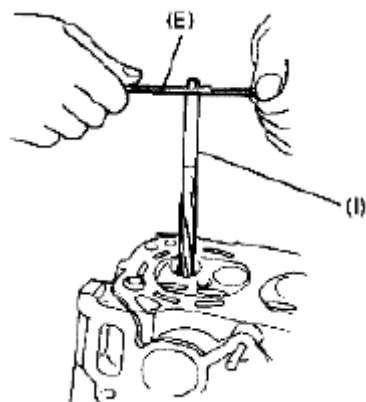
**Fig. 143: Reaming Guide Hole With Special Tool**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Ream valve guide bore with special tool (6.0 mm reamer). After reaming, clean bore.

#### Special Tool

(E): 09916-34542

(I): 09916-37810



**Fig. 144: Reaming Valve Guide Bore With Special Tool**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Install valve spring seat to cylinder head.
5. Install new valve stem seal (1) to valve guide.

After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.

After installing, check to be sure that seal is properly fixed to valve guide.

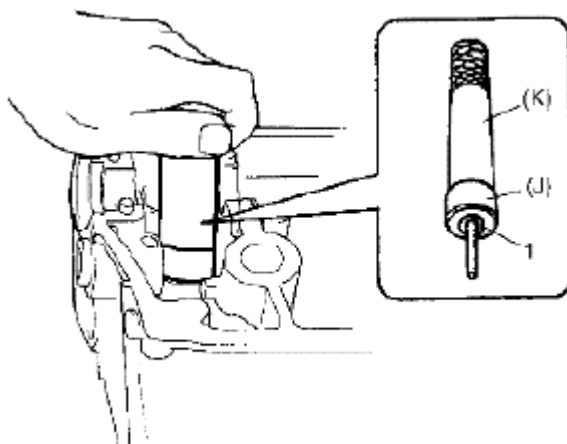
### Special Tool

(J): 09917-98221

(K): 09916-58210

### NOTE:

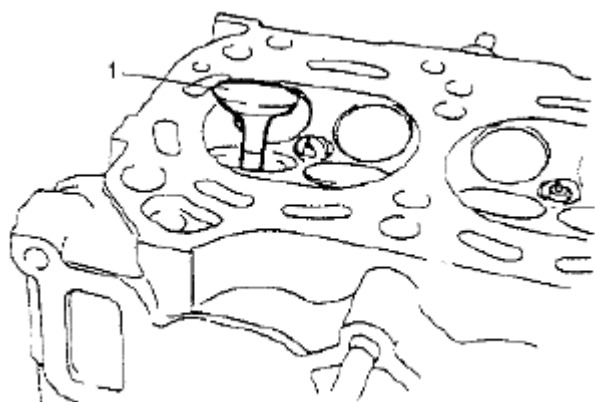
- Do not reuse seal once disassembled. Be sure to install new seal.
- When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.



**Fig. 145: Installing Valve Spring Seat To Cylinder Head**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Install valve (1) to valve guide.

Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.

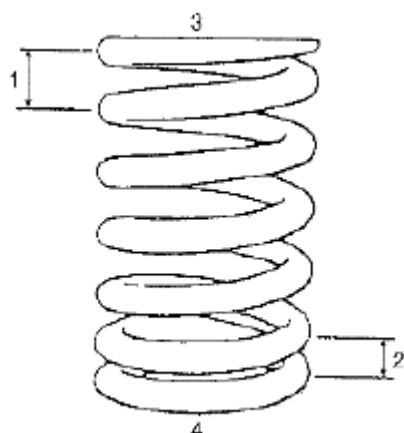


**Fig. 146: Identifying Valve**

Courtesy of SUZUKI OF AMERICA CORP.

7. Install valve spring and spring retainer.

Each valve spring has top end (large-pitch end (1)) and bottom end (small-pitch end (2)). Be sure to position spring in place with its bottom end (valve spring retainer side (3)) facing the bottom (valve spring seat side (4)).



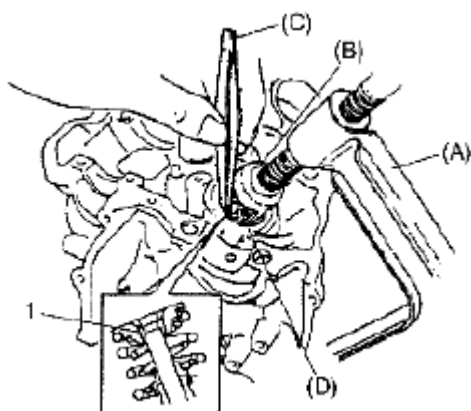
**Fig. 147: Identifying Valve Spring & Spring Retainer**

Courtesy of SUZUKI OF AMERICA CORP.

8. Using special tool (Valve lifter), compress valve spring and fit 2 valve cotters (1) into groove in valve stem.

#### Special Tool

- A. 09916-14510
- B. 09916-14910
- C. 09916-84511
- D. 09919-28610



**Fig. 148: Compressing Valve Spring**  
 Courtesy of SUZUKI OF AMERICA CORP.

## VALVES AND VALVE GUIDES INSPECTION

**Reference:** VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION

**Reference:** VALVES AND CYLINDER HEADS DISASSEMBLY AND REASSEMBLY

### Valve Guides

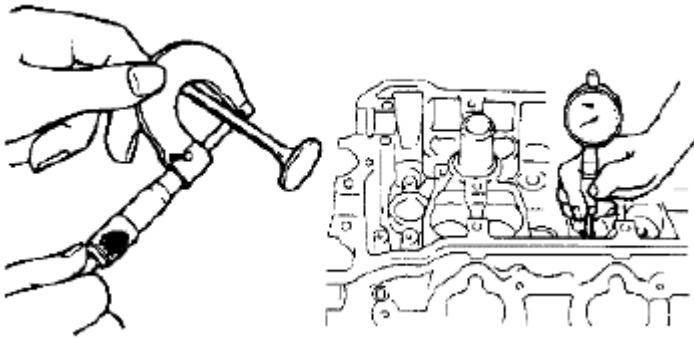
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide.

If clearance exceeds limit, replace valve and valve guide.

### Valve stem-to-guide clearance

#### VALVE STEM-TO-GUIDE CLEARANCE SPECIFICATION

| Item                    |           | Standard                           | Limit                |
|-------------------------|-----------|------------------------------------|----------------------|
| Valve stem diameter     | Intake    | 5.965-5.980 mm (0.2348-0.2354 in.) | -                    |
|                         | Exhaust   | 5.940-5.955 mm (0.2339-0.2344 in.) | -                    |
| Valve guide bore        | In and Ex | 6.000-6.012 mm (0.2362-0.2367 in.) | -                    |
| Stem-to-guide clearance | Intake    | 0.020-0.047 mm (0.0008-0.0019 in.) | 0.07 mm (0.0028 in.) |
|                         | Exhaust   | 0.045-0.072 mm (0.0018-0.0028 in.) | 0.09 mm (0.0035 in.) |



**Fig. 149: Checking Check Stem-To-Guide Clearance**  
 Courtesy of SUZUKI OF AMERICA CORP.

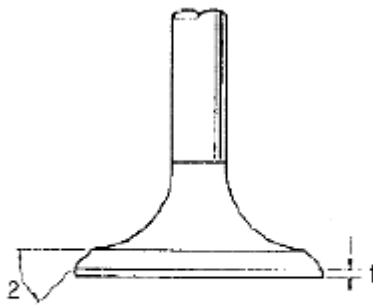
### Valves

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem and, as necessary, replace it.
- Measure thickness of valve head. If measured thickness exceeds limit, replace valve.

### Valve specifications

#### VALVE SPECIFICATIONS

| Item    | Standard           | Limit              |
|---------|--------------------|--------------------|
| Intake  | 1.0 mm (0.039 in.) | 0.6 mm (0.024 in.) |
| Exhaust | 1.2 mm (0.047 in.) | 0.7 mm (0.028 in.) |



|                         |        |
|-------------------------|--------|
| 1. Valve head thickness | 2. 45° |
|-------------------------|--------|

**Fig. 150: Identifying Valve Head Thickness**  
 Courtesy of SUZUKI OF AMERICA CORP.

- Inspect valve stem end face for pitting and wear. If pitting or wear is found, valve stem end may be resurfaced. But do not grind its taper excessively. When valve is excessively worn out too much or its taper is gone, replace it.



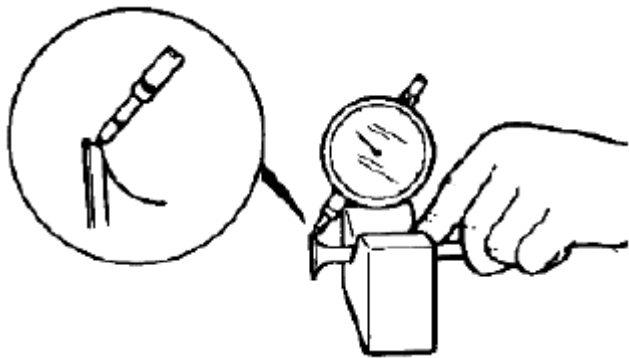
**Fig. 151: Locating Valve Stem End Face**  
 Courtesy of SUZUKI OF AMERICA CORP.

- Check each valve for radial runout with a dial gauge and "V" block.

To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

#### Valve head radial runout

**Limit: 0.08 mm (0.003 in.)**



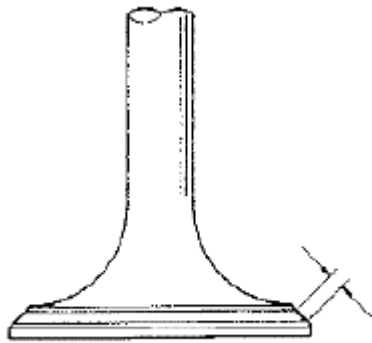
**Fig. 152: Checking Radial Runout Of Valve**  
 Courtesy of SUZUKI OF AMERICA CORP.

- Seating contact width

Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used. Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

#### Standard seating width revealed by contact pattern on valve face

**Intake and Exhaust: 1.1-1.3 mm (0.0433-0.0512 in.)**



**Fig. 153: Identifying Valve Seat Face**  
Courtesy of SUZUKI OF AMERICA CORP.

- Valve seat repair

A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.

- a. **Exhaust valve seat**

Use valve seat cutters (1) to make two cuts as illustrated in figure. Two cutters must be used: the 1st for making 15° angle, and the 2nd for making 45° angle. The 2nd cut must be made to produce desired seat width.

**Seat width for exhaust valve seat**

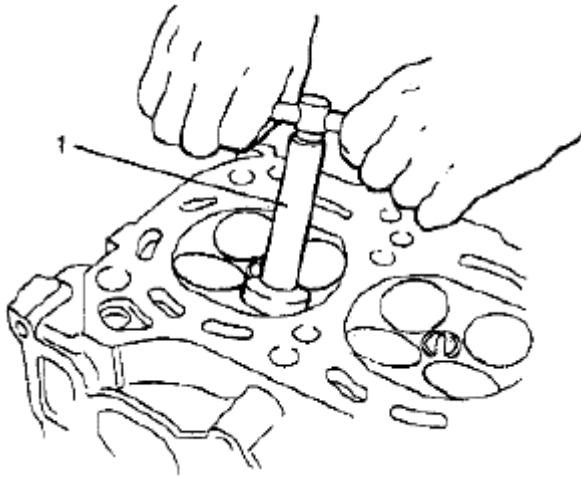
**1.1-1.3 mm (0.0433-0.0512 in.)**

- b. **Intake valve seat**

Use valve seat cutters (1) to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 15° angle, the 2nd for making 60° angle, and the 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

**Seat width for intake valve seat**

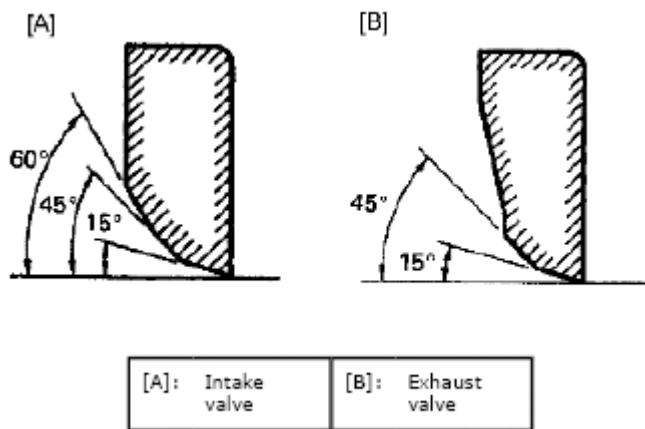
**1.1-1.3 mm (0.0433-0.0512 in.)**



**Fig. 154: Identifying Valve Seat Cutters**  
Courtesy of SUZUKI OF AMERICA CORP.

**c. Valve lapping**

Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.



**Fig. 155: Identifying Valve Lapping Dimension**  
Courtesy of SUZUKI OF AMERICA CORP.

**CYLINDER HEAD INSPECTION**

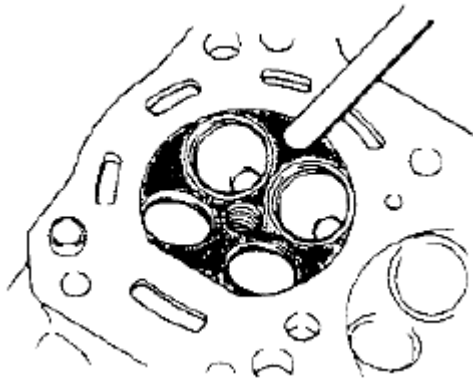
**Reference:** VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION

**Reference:** VALVES AND CYLINDER HEADS DISASSEMBLY AND REASSEMBLY

- Remove all carbon from combustion chambers.

**NOTE:** Do not use any sharp-edged tool to scrape off carbon. Be careful not to

**scuff or nick metal surfaces when de-carboning. The same applies to valves and valve seats, too.**



**Fig. 156: Removing Carbon From Combustion Chambers**  
**Courtesy of SUZUKI OF AMERICA CORP.**

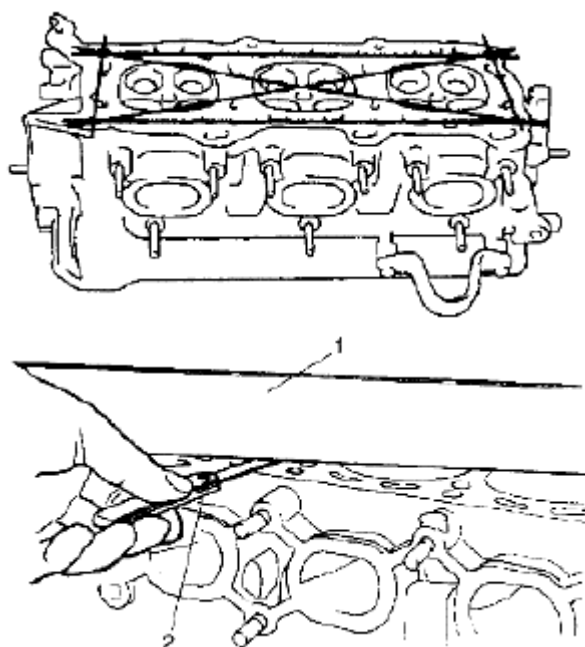
- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface.

Using straightedge (1) and thickness gauge (2), check flatness of gasketed surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): Place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.

Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

#### **Cylinder head gasketed surface distortion**

**Limit: 0.05 mm (0.002 in.)**



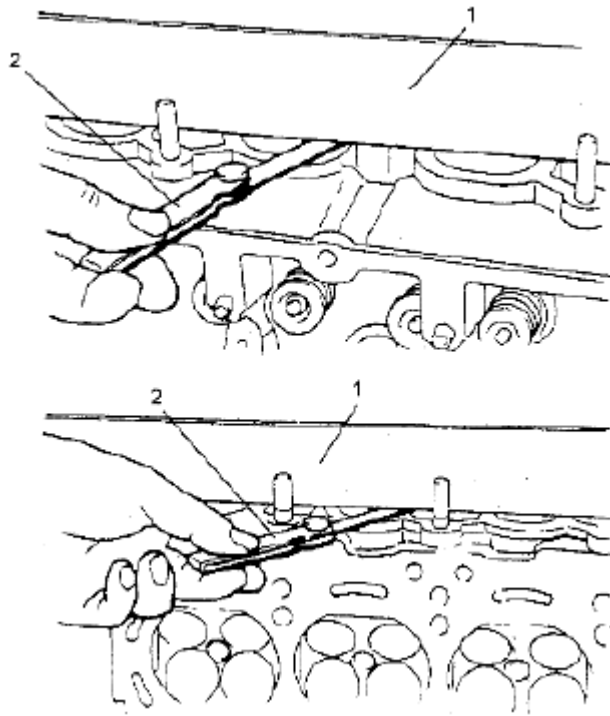
**Fig. 157: Checking Cylinder Head Gasket Surface Distortion**  
Courtesy of SUZUKI OF AMERICA CORP.

- Distortion of manifold seating faces

Check seating faces of cylinder head for manifolds, using a straightedge (1) and thickness gauge (2), in order to determine whether these faces should be corrected or cylinder head replaced.

#### **Manifold seating surface distortion**

**Limit: 0.10 mm (0.004 in.)**



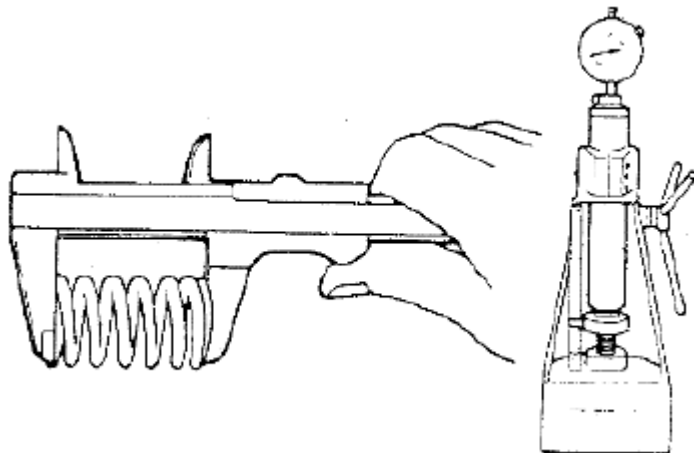
**Fig. 158: Checking Distortion Of Manifold Seating Faces**  
Courtesy of SUZUKI OF AMERICA CORP.

## VALVE SPRINGS INSPECTION

**Reference:** VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION

**Reference:** VALVES AND CYLINDER HEADS DISASSEMBLY AND REASSEMBLY

- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.



**Fig. 159: Inspecting Valve Springs Tension**  
Courtesy of SUZUKI OF AMERICA CORP.

**Valve spring free length**

**Standard: 51.13 mm (2.0130 in.)**

**Valve spring preload**

**Standard: 209-241 N (20.9-24.1 kg, 46.1-53.1 lb) for 37.60 mm (1.480 in.)**

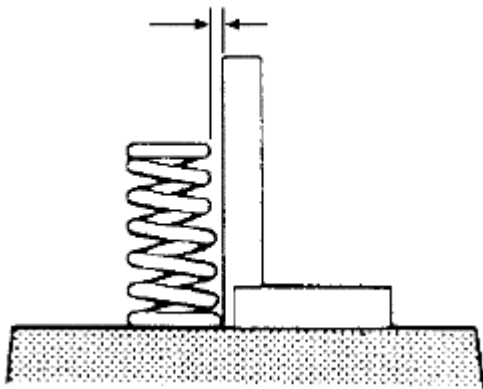
**Limit: 192 N (19.2 kg, 42.24 lb) for 37.60 mm (1.480 in.)**

- **Spring squareness**

Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

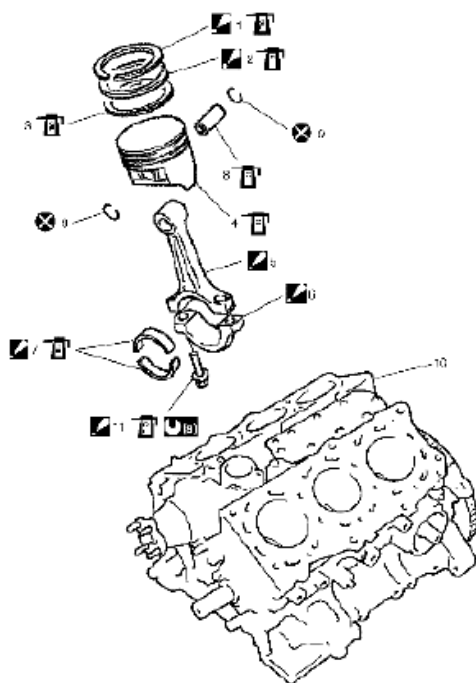
**Valve spring squareness limit**

**2.2 mm (0.087 in.)**



**Fig. 160: Checking Spring Squareness**  
Courtesy of SUZUKI OF AMERICA CORP.

**PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS COMPONENTS**



|                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  1. Top ring<br>: "RN" mark provided on piston ring comes to facing up.                                                                          | 8. Piston pin                                                                                                                                                                                                                                                                                                   |
|  2. 2nd ring<br>: "R" mark provided on piston ring comes to facing up.                                                                          | 9. Piston pin circlip                                                                                                                                                                                                                                                                                           |
| 3. Oil ring                                                                                                                                                                                                                        | 10. Cylinder block                                                                                                                                                                                                                                                                                              |
| 4. Piston                                                                                                                                                                                                                          |  11. Connecting rod bolt<br>: Check connecting rod bolt referring to "Connecting Rod Bolt Deformation (Plastic Deformation Tightening Bolt)" under <i>Crank Pins and Connecting Rod Bearings Inspection</i> if it is reused. |
|  5. Connecting rod<br>: Do not apply engine oil to inner surface of big end.                                                                    |  (a) : Tighten 15 N·m (1.5 kgf-m, 11.0 lb-ft), 45° and 45° by the specified procedure.                                                                                                                                       |
|  6. Connecting rod bearing cap<br>: Point arrow mark on cap to crankshaft pulley side. Do not apply engine oil to inner surface of bearing cap. |  : Apply engine oil to sliding surface of each part.                                                                                                                                                                         |
|  7. Connecting rod bearing<br>: Do not apply engine oil between connecting rod big end and bearing, between cap and bearing.                    |  : Do not reuse.                                                                                                                                                                                                             |

**Fig. 161: Identifying Pistons, Piston Rings, Connecting Rods & Cylinders Components With Torque Specifications**

Courtesy of SUZUKI OF AMERICA CORP.

## PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION

**Reference:** PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS COMPONENTS

### Removal

1. Remove engine assembly from vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove cylinder heads. Refer to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
3. Remove oil pump. Refer to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION**.
4. Mark cylinder number on all pistons, connecting rods and connecting rod bearing caps.
5. Remove connecting rod bearing caps.
6. Clean carbon from top of cylinder bore before removing piston from cylinder.
7. Push piston and connecting rod assembly out through the top of cylinder bore.

#### Installation

**Reference:** **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND REASSEMBLY**

**Reference:** **CYLINDERS, PISTONS AND PISTON RINGS INSPECTION**

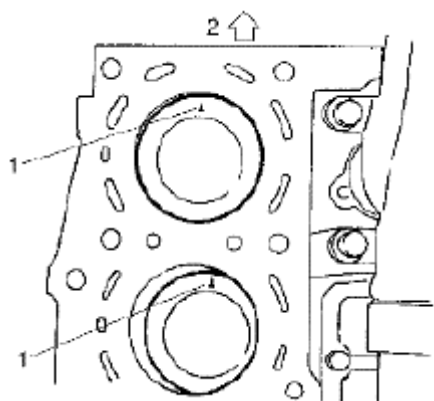
**Reference:** **PISTON PINS AND CONNECTING RODS INSPECTION**

**Reference:** **CRANK PINS AND CONNECTING ROD BEARINGS INSPECTION**

1. Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crank pins.

**NOTE:** Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

2. When installing piston and connecting rod assembly into cylinder bore, point mark (1) on piston head to crankshaft pulley side (2).



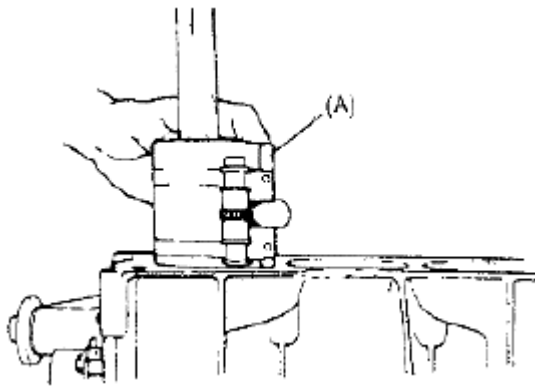
**Fig. 162: Locating Mark On Piston Head To Crankshaft Pulley Side**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.

Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

### Special Tool

- A. 09916-77310



**Fig. 163: Installing Piston & Connecting Rod Assembly Into Cylinder Bore**  
Courtesy of SUZUKI OF AMERICA CORP.

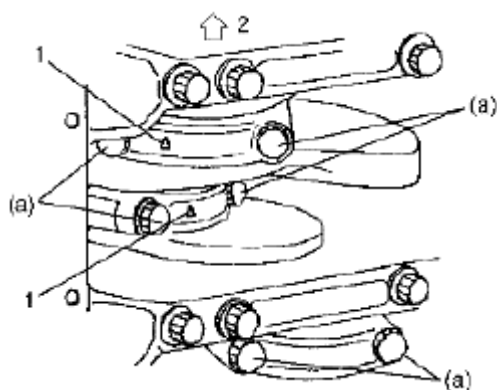
4. Install connecting rod bearing cap (1) as follows.

**NOTE:** If connecting rod bolt is reused, mark sure to check connecting rod bolt for deformation referring to "Connecting Rod Bolt Deformation (Plastic Deformation Tightening Bolt)" under CRANK PINS AND CONNECTING ROD BEARINGS INSPECTION.

- a. Point arrow mark (2) on cap to crankshaft pulley side.
- b. Apply engine oil to new connecting rod bolts (3).
- c. Tighten all connecting rod bolts to 15 N.m (1.5 kgf-m, 11.0 lb-ft).
- d. Retighten them by turning through 45°
- e. Repeat step d) once again.

### Tightening torque

**Connecting rod bolt a:** Tighten 15 N.m (1.5 kgf-m, 11.0 lb-ft), 45° and 45° by the specified procedure .



**Fig. 164: Locating Arrow Mark Point On Cap To Crankshaft Pulley Side**  
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Install cylinder heads to cylinder block referring to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
6. Install oil pump to cylinder block referring to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION**.
7. Install tappets, shims and camshafts referring to **CAMSHAFTS, TAPPETS AND SHIMS REMOVAL AND INSTALLATION**.
8. Install RH (No. 2) bank 2nd timing chain referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
9. Install 1st timing chain. Refer to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
10. Install LH (No. 1) bank 2nd timing chain. Refer to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
11. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
12. Install oil pans and pump strainer. Refer to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
13. Install cylinder head covers. Refer to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
14. Install exhaust manifold. Refer to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION**.
15. Install radiator outlet pipe.

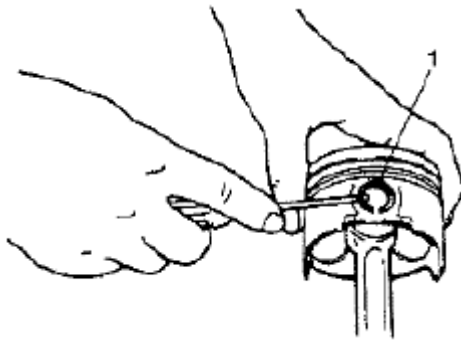
Refer to **COOLING WATER PIPES OR HOSES REMOVAL AND INSTALLATION**.

16. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
17. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND REASSEMBLY**

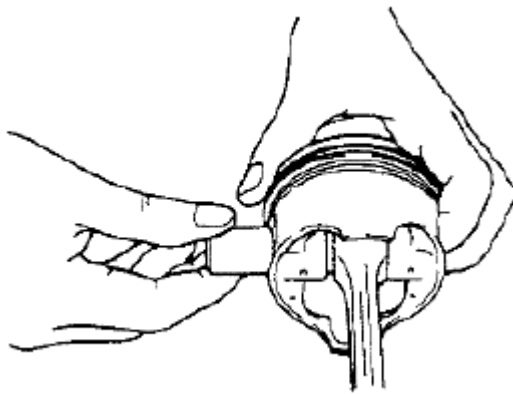
**Reference: PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION****Disassembly**

1. Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
2. Remove piston pin from connecting rod.
  - a. Ease out piston pin circlips (1) as shown in figure.



**Fig. 165: Removing Piston Pin Circlips**  
Courtesy of SUZUKI OF AMERICA CORP.

- b. Force piston pin out.



**Fig. 166: Forcing Piston Pin Out**  
Courtesy of SUZUKI OF AMERICA CORP.

**Reassembly**

**Reference: CYLINDERS, PISTONS AND PISTON RINGS INSPECTION**

**Reference: PISTON PINS AND CONNECTING RODS INSPECTION**

**Reference: CRANK PINS AND CONNECTING ROD BEARINGS INSPECTION**

1. 2 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 (8) has stamped number (9) on its piston head. It represents outer diameter of piston.
- b. There are also stamped numbers (10) or painted color (10) on cylinder block as shown in figure.
- c. Stamped number on piston and painted color (stamped number) on cylinder block must correspond. That is, install number "2" stamped piston to cylinder which is identified with blue painted (or "2" stamped) and a number "1" piston to cylinder with red painted (or "1" stamped).

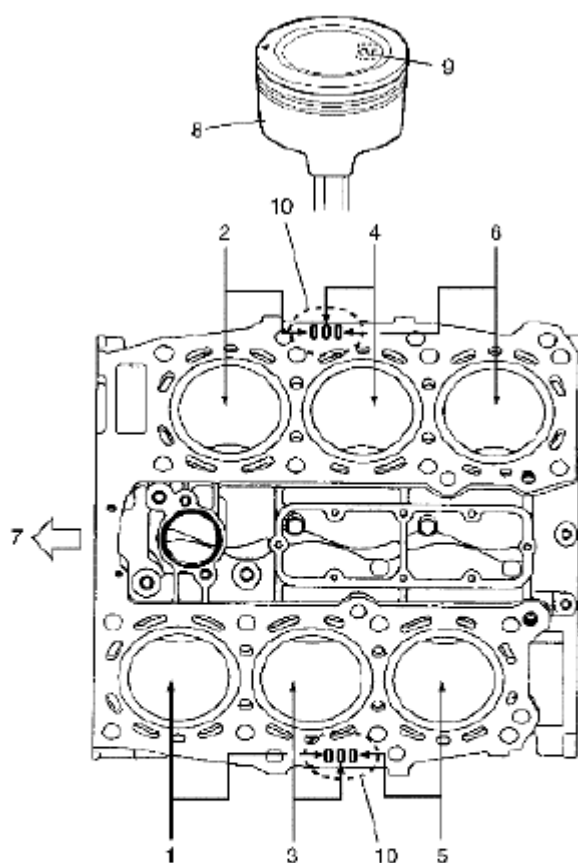
### **Piston outer diameter and cylinder bore diameter**

#### **PISTON OUTER DIAMETER AND CYLINDER BORE DIAMETER SPECIFICATION**

| <b>Piston</b> |                                              | <b>Cylinder</b>       |                                              |
|---------------|----------------------------------------------|-----------------------|----------------------------------------------|
| <b>Number</b> | <b>Outer diameter</b>                        | <b>Number (Paint)</b> | <b>Bore diameter</b>                         |
| 1             | 87.9800-87.9900<br>mm<br>(3.4638-3.4641 in.) | 1 (Red)               | 88.0101-88.0200<br>mm<br>(3.4650-3.4653 in.) |
| 2             | 87.9700-87.9799<br>mm<br>(3.4633-3.4637 in.) | 2 (Blue)              | 88.0000-88.0100<br>mm<br>(3.4646-3.4649 in.) |

### **Piston-to-cylinder clearance**

**0.02-0.04 mm (0.0008-0.0015 in.)**



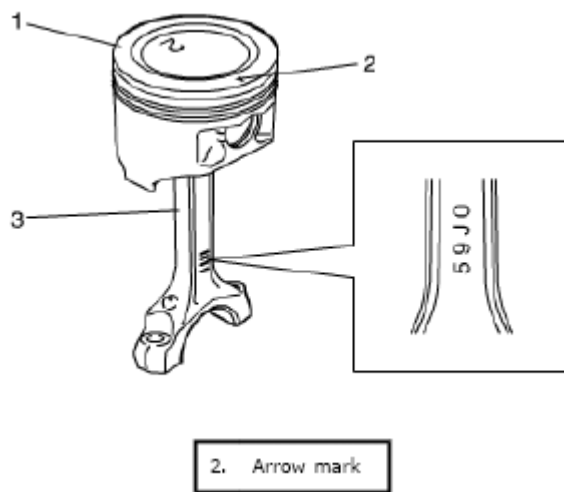
|                  |                  |                           |
|------------------|------------------|---------------------------|
| 1. No.1 cylinder | 4. No.4 cylinder | 7. Crankshaft pulley side |
| 2. No.2 cylinder | 5. No.5 cylinder |                           |
| 3. No.3 cylinder | 6. No.6 cylinder |                           |

**Fig. 167: Identifying Piston-To-Cylinder Clearance**  
**Courtesy of SUZUKI OF AMERICA CORP.**

2. Install piston pin to piston and connecting rod:

After applying engine oil to piston pin and piston pin holes in piston (1) and connecting rod (3), fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

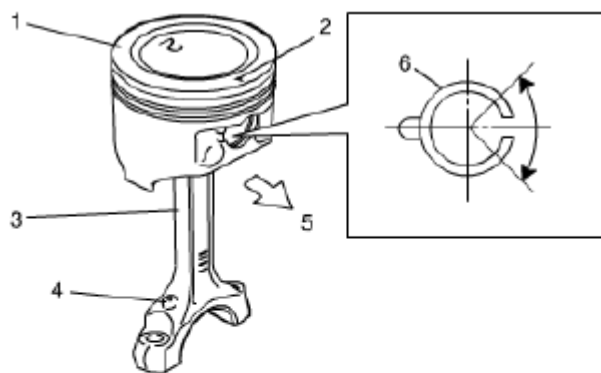
**NOTE:** "59J0" mark on connecting rod must face toward crankshaft pulley side.



**Fig. 168: Locating Mark On Connecting Rod**  
Courtesy of SUZUKI OF AMERICA CORP.

**NOTE:**

- Install circlip (6) with its cut part facing as shown in figure.
- Install so that circlip end gap comes within such range as indicated by arrow.



|                   |                           |
|-------------------|---------------------------|
| 1. Piston         | 4. Oil hole               |
| 2. Arrow mark     | 5. Crankshaft pulley side |
| 3. Connecting rod |                           |

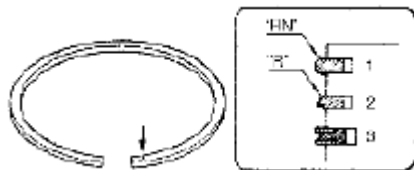
**Fig. 169: Identifying Circlip End Gap**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Install piston rings to piston:

- As shown in figure, 1st (1) and 2nd rings (2) have "RN" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st rings differs from 2nd ring in thickness, shape of surface contacting cylinder wall.

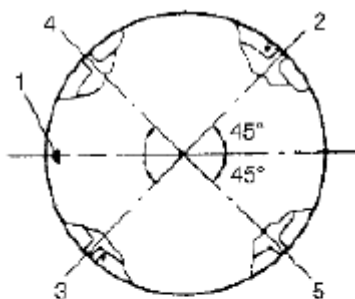
Distinguish 1st ring from 2nd ring by referring to figure.

- When installing oil ring (3), install spacer first and then 2 rails.



**Fig. 170: Identifying Piston Rings Marks**  
Courtesy of SUZUKI OF AMERICA CORP.

4. After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.



|                                             |
|---------------------------------------------|
| 1. Mark                                     |
| 2. 1st ring end gap                         |
| 3. 2nd ring end gap and oil ring spacer gap |
| 4. Oil ring upper rail gap                  |
| 5. Oil ring lower rail gap                  |

**Fig. 171: Identifying Piston Rings End Gaps**  
Courtesy of SUZUKI OF AMERICA CORP.

## CYLINDERS, PISTONS AND PISTON RINGS INSPECTION

**Reference:** PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION

**Reference:** PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND REASSEMBLY

**NOTE:** Before the following inspection, clean carbon from piston head and ring

grooves, using a suitable tool.

### 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 over size piston.
- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at 2 positions (1, 2) as shown in figure. If any of the following condition is noted, rebore cylinder.
  - Cylinder bore diameter exceeds limit.
  - Difference of measurements at 2 positions exceeds taper limit.
  - Difference between thrust and axial measurements exceeds out-of-round limit.

### Cylinder bore

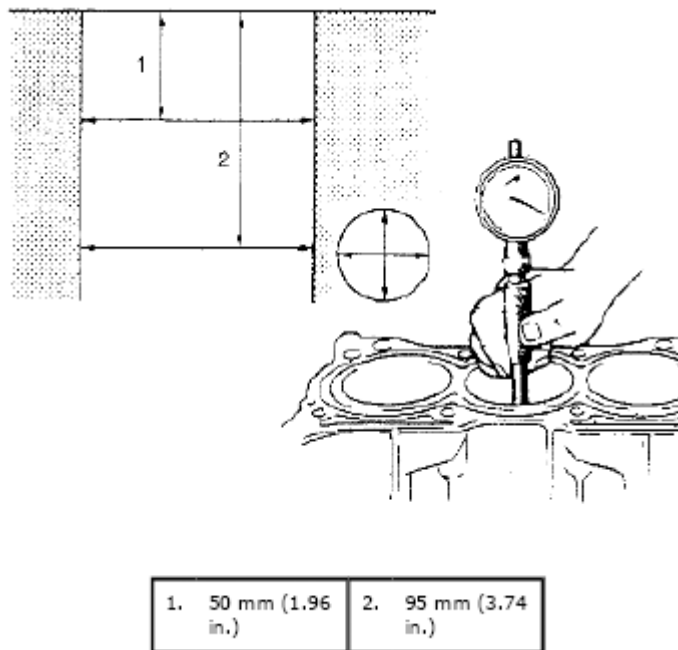
**Standard:** 88.000-88.020 mm (3.4646-3.4653 in.)

**Limit:** 88.050 mm (3.4665 in.)

### Taper and out-of-round

**Limit:** 0.10 mm (0.004 in.)

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



**Fig. 172: Measuring Cylinder Bore In Thrust & Axial Directions**

**Courtesy of SUZUKI OF AMERICA CORP.**

### **Pistons**

- Inspect piston for faults, cracks or other damages.

Damaged or faulty piston should be replaced.

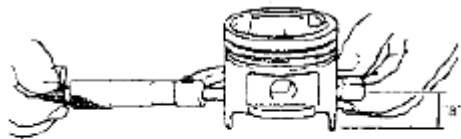
- Piston diameter:

As shown in figure, piston diameter should be measured at a position 26.5 mm (1.04 in.) ("a") from piston skirt end in the direction perpendicular to piston pin.

#### **Piston diameter**

**Standard: 87.970-87.990 mm (3.4634-3.4641 in.)**

**Oversize (0.50 mm): 88.470-88.490 mm (3.4831-3.4838 in.)**



"a": 26.5 mm  
(1.04 in.)

**Fig. 173: Measuring Piston Diameter**  
**Courtesy of SUZUKI OF AMERICA CORP.**

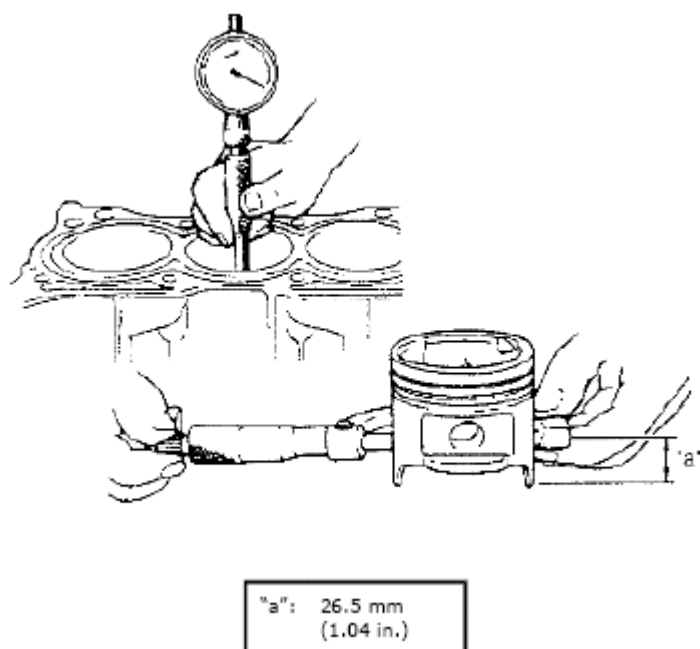
- Piston clearance:

Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, rebore cylinder and use oversize piston.

#### **Piston-to-cylinder clearance**

**0.02-0.04 mm (0.0008-0.0015 in.)**

**NOTE:**        **Cylinder bore diameter should be measured in 2 places 90 degrees apart.**



**Fig. 174: Measuring Cylinder Bore Diameter**  
Courtesy of SUZUKI OF AMERICA CORP.

- Ring groove clearance:

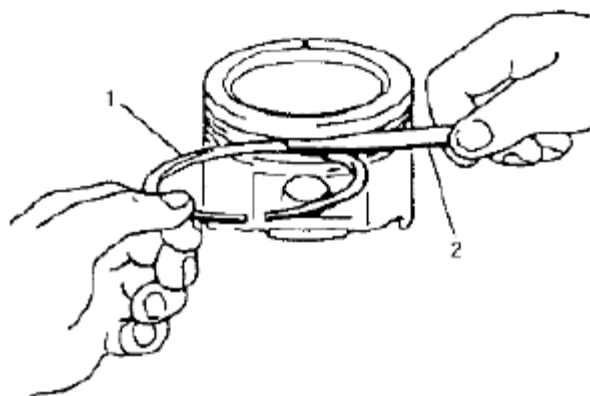
Before checking, piston grooves must be clean, dry and free of carbon.

Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2). If clearance is out of specification, replace piston.

**Ring groove clearance**

**Top: 0.03-0.07 mm (0.0012-0.0027 in.)**

**2nd: 0.02-0.06 mm (0.0008-0.0023 in.)**



**Fig. 175: Measuring Clearance Between Ring & Ring Land**  
 Courtesy of SUZUKI OF AMERICA CORP.

### Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.

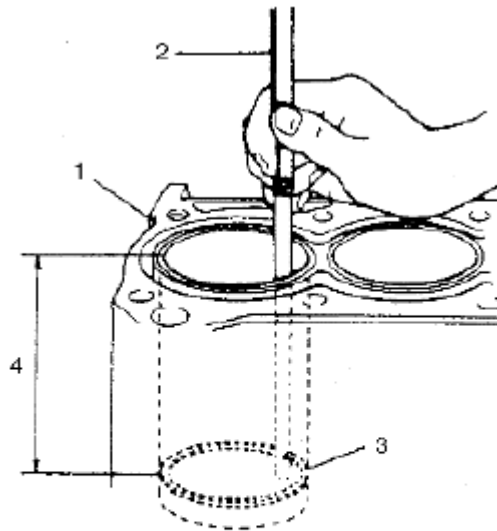
If measure gap is out of specification, replace ring.

**NOTE:** Clean carbon and any other dirt from top of cylinder bore before inserting piston ring.

### Piston ring end gap

#### PISTON RING END GAP SPECIFICATION

| Item     | Standard                         | Limit               |
|----------|----------------------------------|---------------------|
| Top ring | 0.20-0.35 mm (0.0079-0.0137 in.) | 0.7 mm (0.0276 in.) |
| 2nd ring | 0.35-0.47 mm (0.0138-0.0185 in.) | 0.7 mm (0.0276 in.) |
| Oil ring | 0.20-0.70 mm (0.0079-0.0275 in.) | 1.8 mm (0.0709 in.) |



|                   |                      |
|-------------------|----------------------|
| 1. Cylinder block | 3. Piston ring       |
| 2. Feeler gauge   | 4. 120 mm (4.72 in.) |

**Fig. 176: Measuring End Gap Of Piston Rings**  
 Courtesy of SUZUKI OF AMERICA CORP.

### PISTON PINS AND CONNECTING RODS INSPECTION

**Reference: PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION****Reference: PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND REASSEMBLY****Piston Pins**

- Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod or piston.
- Piston pin clearance:

Check piston pin clearance in small end. Replace connecting rod if its small end is badly worn or damaged or if measured clearance exceeds limit.

**Piston pin clearance in small end**

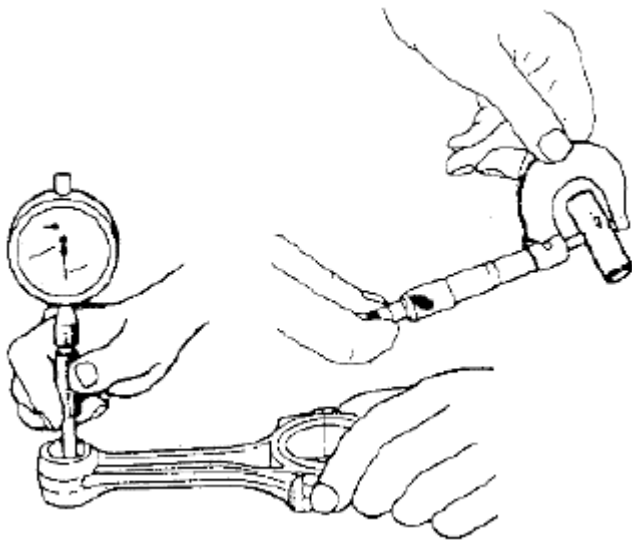
**0.003-0.014 mm (0.0001-0.0005 in.)**

**Small-end bore**

**21.003-21.011 mm (0.8269-0.8272 in.)**

**Piston pin diameter**

**20.997-21.000 mm (0.82665-0.82677 in.)**



**Fig. 177: Checking Piston Pin Clearance In Small End**  
Courtesy of SUZUKI OF AMERICA CORP.

## Connecting Rods

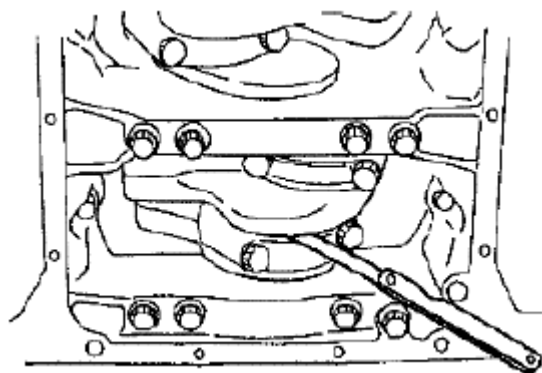
- Big-end side clearance:

Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

### Big-end side clearance

**Standard: 0.25-0.35 mm (0.0099-0.0137 in.)**

**Limit: 0.45 mm (0.0177 in.)**



**Fig. 178: Checking Big-End Side Clearance**  
Courtesy of SUZUKI OF AMERICA CORP.

- Connecting rod alignment:

Mount connecting rod on aligner to check it for bow and twist. If limit is exceeded, replace it.

### Connecting rod alignment

**Limit on bow: 0.05 mm (0.0020 in.)**

**Limit on twist: 0.10 mm (0.0039 in.)**

## CRANK PINS AND CONNECTING ROD BEARINGS INSPECTION

**Reference: PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION**

**Reference: PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND REASSEMBLY**

- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind

crank pin then inspect rod bearing clearance.

### Crank pin diameter

#### CRANK PIN DIAMETER SPECIFICATION

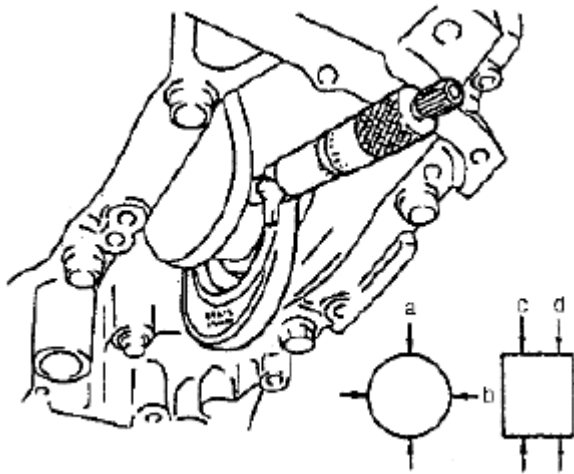
| Connecting rod bearing size    | Crank pin diameter                   |
|--------------------------------|--------------------------------------|
| Standard                       | 49.982-50.000 mm (1.9678-1.9685 in.) |
| 0.25 mm (0.0098 in.) undersize | 49.732-49.750 mm (1.9580-1.9586 in.) |

### Crank pin out-of-round (a - b)

**Limit: 0.01 mm (0.0004 in.)**

### Crank pin taper (c - d)

**Limit: 0.01 mm (0.0004 in.)**



**Fig. 179: Measuring Crank Pin For Out-Of-Round Or Taper**  
Courtesy of SUZUKI OF AMERICA CORP.

#### • Connecting rod bearing general information:

Service connecting rod bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and standard size bearing has 5 kinds of bearings differing in tolerance. For identification of undersize bearing, it is painted red at the position as indicated in figure, undersize bearing thickness is 1.605-1.615 mm (0.0632-0.0635 in.) at the center of it.



1. Painting

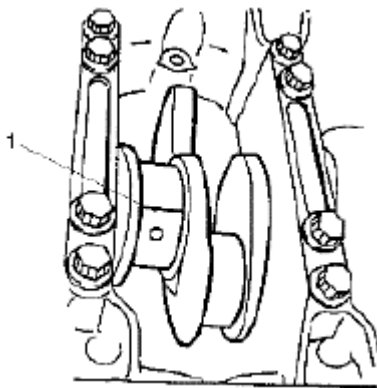
**Fig. 180: Identifying Paint Mark For Bearing Size Identification**  
Courtesy of SUZUKI OF AMERICA CORP.

• **Connecting rod bearing visual inspection:**

Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.

• **Connecting rod bearing clearance:**

- Before checking bearing clearance, clean bearing and crank pin.
- Install bearing in connecting rod and bearing cap.
- Place a piece of gaging plastic (1) to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



**Fig. 181: Identifying Plastic Gaging Piece**  
Courtesy of SUZUKI OF AMERICA CORP.

- Install rod bearing cap to connecting rod referring to **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION**.

**NOTE:** Do not turn crankshaft with gaging plastic installed.

- e. Remove cap and using a scale (2) on gaging plastic (1) envelope, measure gaging plastic (1) width at the widest point (clearance).

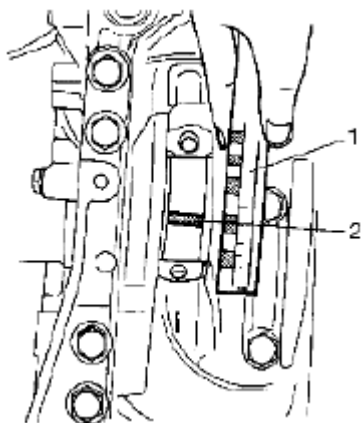
If clearance exceed its limit, use a new standard size bearing.

After selecting new bearing, recheck clearance.

### Bearing clearance

**Standard: 0.045-0.063 mm (0.0018-0.0024 in.)**

**Limit: 0.08 mm (0.0031 in.)**



**Fig. 182: Removing Cap**  
Courtesy of SUZUKI OF AMERICA CORP.

- f. 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 as follows.
  - i. Install 0.25 mm undersize bearing to connecting rod big end.
  - ii. Measure bore diameter of connecting rod big end.
  - iii. Regrind crank pin to the following finished diameter.

Measured big end bore

Finished crank 0.054 mm

pin diameter = diameter (including undersize bearing) - (0.0021 in.)

- iv. Confirm that bearing clearance is within standard value described at step e).

### • Selection of connecting rod bearings:

#### NOTE:

- If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the

following procedure and install it.

- When replacing crankshaft or connecting rod and its bearing due to any reason, select new standard bearings to be installed by referring to numbers stamped on connecting rod and its cap and/or alphabets stamped on crank web No. 3.

- a. Check stamped numbers on connecting rod and its cap as shown.

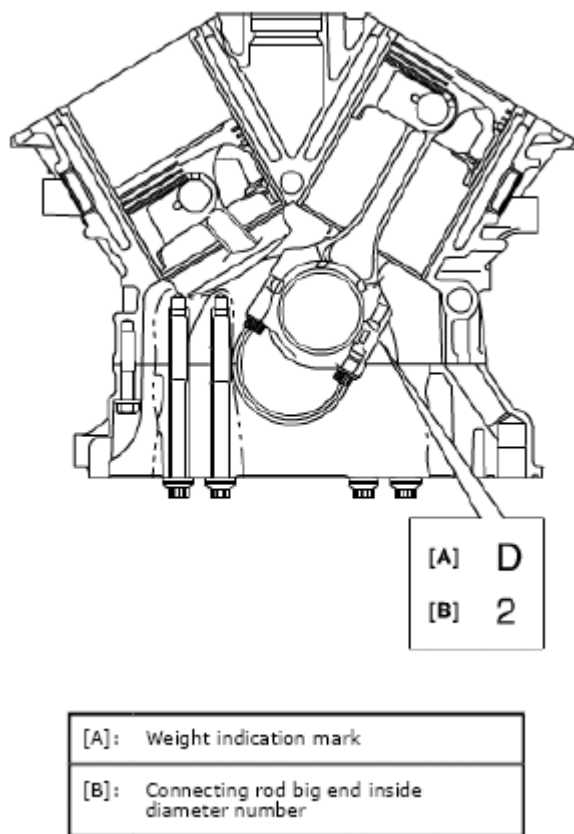
Three kinds of numbers ("1", "2" and "3") represent the following connecting rod big end inside diameters.

For example, stamped number "1" indicates that corresponding connecting rod big end inside diameter is 53.0000-53.0060 mm (2.0867-2.0868 in.).

#### Connecting rod big end inside diameter

#### CRANK PIN DIAMETER SPECIFICATION

| Stamped numbers | Connecting rod big end inside diameter |
|-----------------|----------------------------------------|
| 1               | 53.0000-53.0060 mm (2.0867-2.0868 in.) |
| 2               | 53.0061-53.0120 mm (2.0869-2.0870 in.) |
| 3               | 53.0121-53.0180 mm (2.0871-2.0873 in.) |



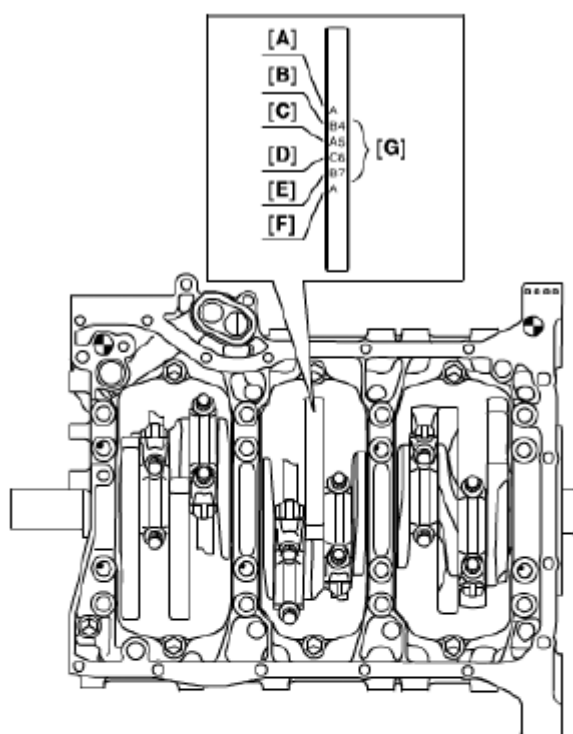
**Fig. 183: Identifying Weight Identification Mark**  
 Courtesy of SUZUKI OF AMERICA CORP.

- b. Next, check crankshaft pin diameter. On crank web No. 3, six alphabets are stamped as shown in figure. Three kinds of alphabet ("A", "B" and "C") represent the following crankshaft pin diameter respectively. For example, stamped "A" indicates that corresponding crankshaft pin diameter is 49.9940-50.0000 mm (1.9683-1.9685 in.).

#### Crankshaft pin diameter

##### CRANK PIN DIAMETER SPECIFICATION

| Stamped alphabet | Crankshaft pin diameter                |
|------------------|----------------------------------------|
| A                | 49.9940-50.0000 mm (1.9683-1.9685 in.) |
| B                | 49.9880-49.9939 mm (1.9681-1.9682 in.) |
| C                | 49.9820-49.9879 mm (1.9678-1.9680 in.) |



|      |                                                    |
|------|----------------------------------------------------|
| [A]: | Crankshaft pin diameter for No.1 cylinder          |
| [B]: | Crankshaft pin diameter for No.2 cylinder          |
| [C]: | Crankshaft pin diameter for No.3 cylinder          |
| [D]: | Crankshaft pin diameter for No.4 cylinder          |
| [E]: | Crankshaft pin diameter for No.5 cylinder          |
| [F]: | Crankshaft pin diameter for No.6 cylinder          |
| [G]: | Crankshaft journal outside diameter tolerance mark |

**Fig. 184: Identifying Stamped Mark On Crankshaft Pin**  
 Courtesy of SUZUKI OF AMERICA CORP.

- c. There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.

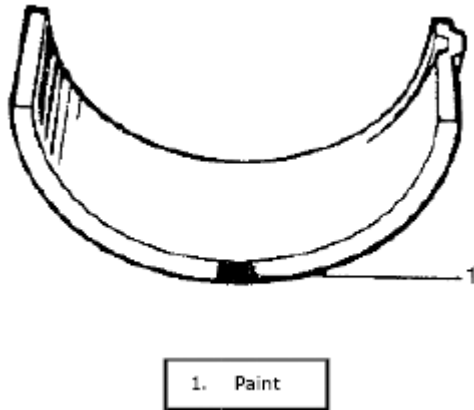
Each color indicated the following thickness at the center of bearing.

#### Standard size of connecting rod bearing thickness

#### STANDARD SIZE OF CONNECTING ROD BEARING THICKNESS

| Color painted | Bearing thickness                    |
|---------------|--------------------------------------|
| Blue          | 1.494-1.497 mm (0.05882-0.05893 in.) |

|         |                                      |
|---------|--------------------------------------|
| Yellow  | 1.491-1.494 mm (0.05871-0.05881 in.) |
| Nothing | 1.488-1.491 mm (0.05859-0.05870 in.) |
| Black   | 1.485-1.488 mm (0.05847-0.05858 in.) |
| Green   | 1.482-1.485 mm (0.05835-0.05846 in.) |



**Fig. 185: Identifying Paint Mark For Bearing Size Identification**  
**Courtesy of SUZUKI OF AMERICA CORP.**

- d. From number stamped on connecting rod and its cap and alphabets stamped on crank web No. 3, determine new standard bearing to be installed to connecting rod big end inside, by referring to table.

For example, if number stamped on connecting rod and its cap is "1" and alphabet stamped on crank web No. 3 is "B", install a new standard bearing painted in "Black" to its connecting rod big end inside.

#### Specification of new standard connecting rod bearing size

##### CONNECTING ROD BEARING SIZE SPECIFICATION

| Application                                                        |   | Number stamped on connecting rod and its cap (connecting rod big end inside diameter) |         |         |
|--------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---------|---------|
|                                                                    |   | 1                                                                                     | 2       | 3       |
| Alphabet stamped on crank web No.3 (Crankshaft pin outer diameter) | A | Green                                                                                 | Black   | Nothing |
|                                                                    | B | Black                                                                                 | Nothing | Yellow  |
|                                                                    | C | Nothing                                                                               | Yellow  | Blue    |
|                                                                    |   | New standard bearing to be installed.                                                 |         |         |

- e. Check bearing clearance with newly selected standard bearing.

If clearance still exceeds its limit, use next thicker bearing and recheck clearance.

- Selection of connecting rod bearings:

Measured each thread diameter of connecting rod bolts (1) at specified measurement points "A" and "B" by using a micrometer (2).

Calculate difference in diameters ("A"- "B"). If it exceeds limit, replace connecting rod.

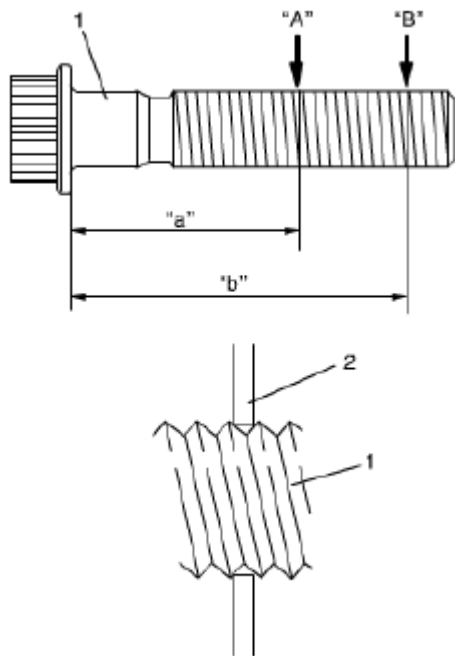
#### Connecting rod bolt measurement points

"a": 28.5 mm (1.12 in.)

"b": 42.0 mm (1.65 in.)

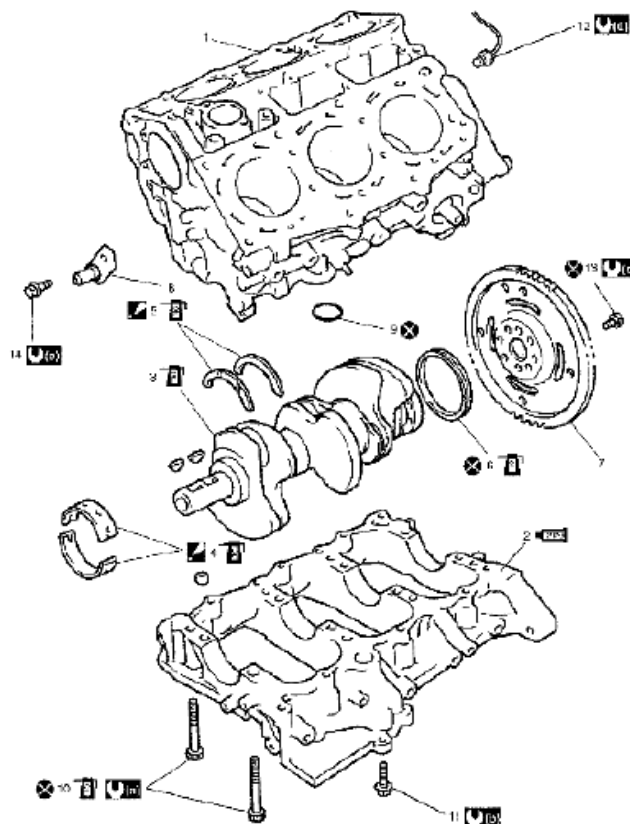
#### Connecting rod bolt diameter difference

Limit: ("A"- "B"): 0.1 mm (0.004 in.)



**Fig. 186: Identifying Connecting Rod Bolt Dimension**  
Courtesy of SUZUKI OF AMERICA CORP.

#### MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS



Expand image

|                                                                                                                                                                 |                                                       |                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1. Cylinder block                                                                                                                                               | 8. Timing chain oil jet                               | (a): Tighten 30 N·m (3.0 kgf-m, 22.0 lb-ft), 42 N·m (4.2 kgf-m, 30.5 lb-ft) and 40° by the specified procedure. |
| 1217G 2. Lower crankcase:<br>Apply sealant 99000-31260 referring to "Installation" under Main Bearings, Crankshaft and Cylinder Block Removal and Installation. | 9. O-ring                                             | (b): Tighten 27 N·m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure.                                         |
| 3. Crankshaft:<br>Apply engine oil to crankshaft journals.                                                                                                      | 10. Crankcase bolt (10 mm (0.39 in.) thread diameter) | (c): 70 N·m (7.0 kgf-m, 51.0 lb-ft)                                                                             |
| 4. Main bearing:<br>Apply engine oil to bearing inside surfaces only.                                                                                           | 11. Crankcase bolt (8 mm (0.31 in.) thread diameter)  | (d): 23 N·m (2.3 kgf-m, 17.0 lb-ft)                                                                             |
| 5. Thrust bearing:<br>Set bearing facing grooved side to crank weds.                                                                                            | 12. Knock sensor                                      | (e): 11 N·m (1.1 kgf-m, 8.0 lb-ft)                                                                              |
| 6. Rear oil seal:<br>Apply engine oil to contact part of crankshaft with oil seal lip.                                                                          | 13. Flywheel (or drive plate) bolt                    | : Do not reuse.                                                                                                 |
| 7. Flywheel (M/T) / Drive plate (A/T)                                                                                                                           | 14. Timing chain oil jet bolt                         | : Apply engine oil.                                                                                             |

**Fig. 187: Identifying Main Bearings, Crankshaft & Cylinder Block Components With Torque Specifications**

Courtesy of SUZUKI OF AMERICA CORP.

## MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION

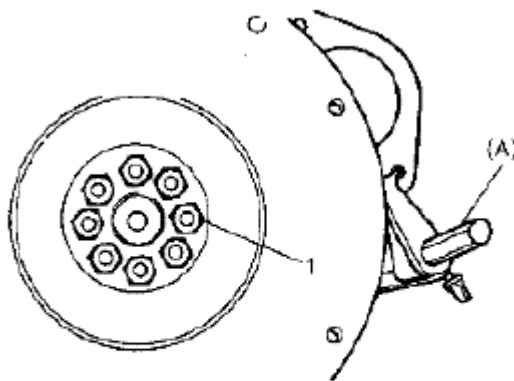
**Reference: MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS****Removal**

1. Remove engine assembly from vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove clutch and flywheel (for M/T vehicle) or drive plate (for A/T vehicle). For clutch removal, refer to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL AND INSTALLATION**.

Using special tool (flywheel holder), remove flywheel (M/T vehicle) or drive plate (A/T vehicle).

**Special Tool**

A. 09924-17811



1. Flywheel bolt

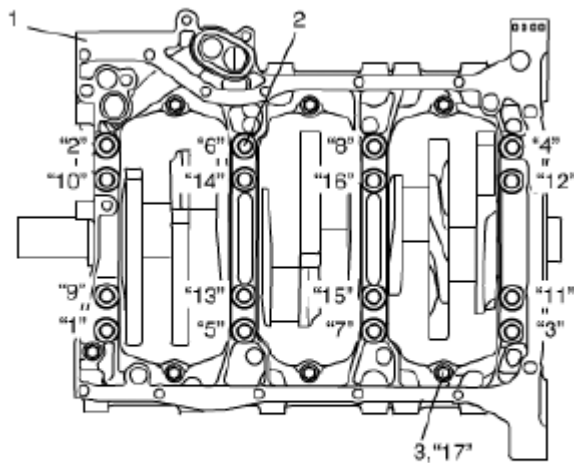
**Fig. 188: Identifying Flywheel Bolts**  
 Courtesy of SUZUKI OF AMERICA CORP.

3. Remove electric throttle body assembly with intake collector and intake manifold.
4. Remove oil pans (lower and upper) and oil pump strainer. Refer to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
5. Remove cylinder head cover referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
6. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
7. Remove LH (No. 1) bank 2nd timing chain and tensioner referring to **LH (No. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
8. Remove 1st timing chain and tensioner referring to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
9. Remove RH (No. 2) bank 2nd timing chain and tensioner referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
10. Remove cylinder heads referring to **VALVES AND CYLINDER HEADS REMOVAL AND**

**INSTALLATION.**

11. Remove pistons and connecting rods referring to **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION.**
12. Remove oil pump referring to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION.**
13. Remove oil pump chain referring to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION.**
14. Loosen crankcase bolts by numerical order ("1" through "17") in figure and remove them.

**NOTE:** Loosen 8 mm (0.31 in.) thread diameter bolts (2) first, then loosen 10 mm (0.39 in.) thread diameter bolts (3).



1. Lower crankcase

**Fig. 189: Loosening Sequence Of Crankcase Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove crankshaft from cylinder block.

**Installation**

**Reference:** **CRANKSHAFT INSPECTION**

**Reference:** **MAIN BEARINGS INSPECTION**

**Reference:** **REAR OIL SEAL AND FLYWHEEL INSPECTION**

**Reference:** **CYLINDER BLOCK INSPECTION**

**NOTE:**

- All parts to be installed must be perfectly clean.

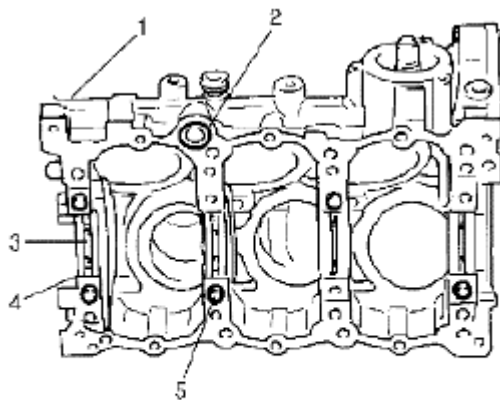
- Be sure to apply oil crankshaft journals, main bearings, thrust bearings, crank pins, connecting rod bearings, pistons, piston rings and cylinder bores.
- Main bearings, crankcase (bearings caps), connecting rods, connecting rod bearings, connecting rod bearing caps, pistons and piston rings are in combination sets. Do not disturb combination and try to see that each part goes back to where it came from, when installing.
- Clean mating surface of cylinder block and crankcase, remove oil, old sealant and dust from mating surface.

1. Fit main bearings (4) to cylinder block (1).

One of two halves of main bearing, has oil groove (3). Install this half with oil groove to cylinder block, and another half without oil groove to crankcase.

Make sure that two halves are painted in the same color.

2. Install O-ring (2) to cylinder block.

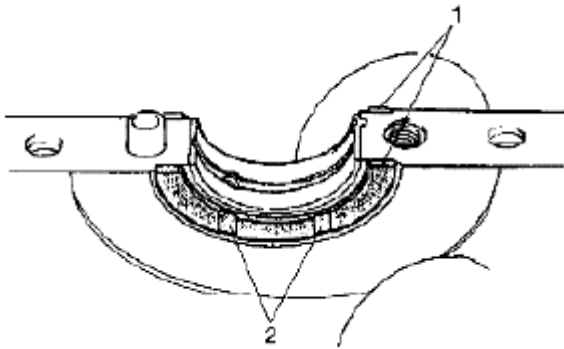


5. Knock pin

**Fig. 190: Identifying Oil Groove, Knock Pin & O-Ring**  
Courtesy of SUZUKI OF AMERICA CORP.

3. Fit thrust bearings (1) to cylinder block between No. 4 and No. 5 cylinders.

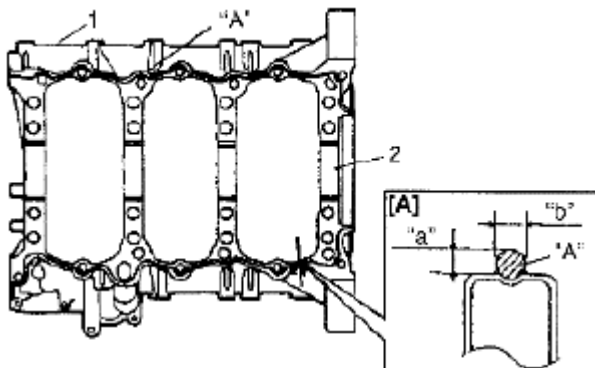
Face oil groove (2) sides to crank webs.



**Fig. 191: Identifying Thrust Bearing & Face Of Oil Groove**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Put crankshaft to cylinder block.
5. Apply sealant "A" to lower crankcase mating surface area as shown in figure.

"A": Sealant 99000-31260SUZUKI Bond No. 1217G



|                                 |                    |
|---------------------------------|--------------------|
| [A]: Sealant application amount | 1. Lower crankcase |
| "a": 2 mm (0.08 in.)            | 2. Bearing         |
| "b": 3 mm (0.11 in.)            |                    |

**Fig. 192: Identifying Area For Applying Sealant**  
Courtesy of SUZUKI OF AMERICA CORP.

6. Install lower crankcase (1) to cylinder block. Apply oil to crankcase bolts before installing them. Tighten crankcase bolts gradually as follows.
  - a. Tighten crankcase bolts (10 mm (0.39 in.) thread diameter) (2) to 30 N.m (3.0 kgf-m, 22.0 lb-ft) according to numerical order in figure.
  - b. In the same manner as Step a, tighten them to 42 N.m (4.2 kgf-m, 30.5 lb-ft).
  - c. In the same manner as Step a, retighten by turning through 40°.

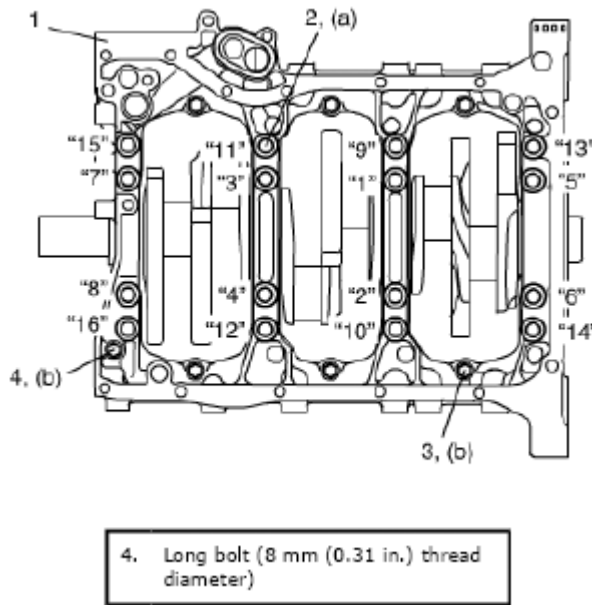
- d. Tighten crankcase bolts (8 mm (0.31 in.) thread diameter) (3) to specified torque.

**NOTE:** Tighten 10 mm (0.39 in.) thread diameter bolts first (the following the order shown in figure), then tighten 8 mm (0.31 in.) thread diameter bolts.

#### Tightening torque

Lower crankcase bolt (10 mm (0.39 in.) thread diameter) a: Tighten 30 N.m (3.0 kgf-m, 22.0 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 42 N.m (4.2 kgf-m, 30.5 lb-ft) and 40° by the specified procedure Lower crankcase bolt (8 mm (0.31 in.) thread diameter) b: 27 N.m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure

**NOTE:** After tightening crankcase bolts, check to be sure that crankshaft rotates smoothly when turned by hand.

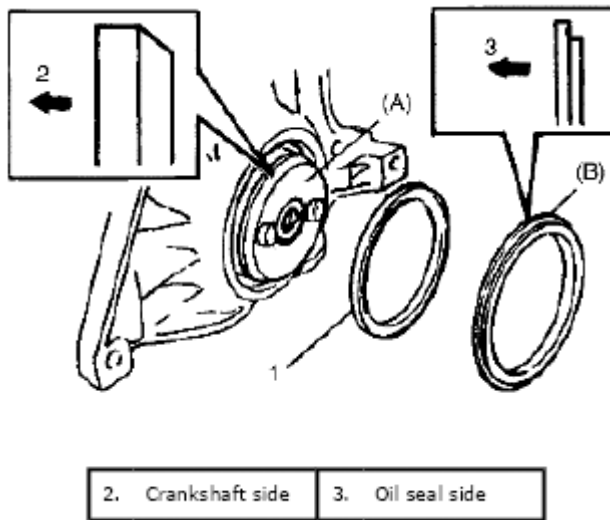


**Fig. 193: Identifying Tightening Sequence Of Crankcase Bolts**  
Courtesy of SUZUKI OF AMERICA CORP.

7. Using special tools (Oil seal installer and oil seal guide), install rear oil seal (1).

#### Special Tool

- A. 09911-97710  
B. 09911-97811



**Fig. 194: Installing Rear Oil Seal**  
Courtesy of SUZUKI OF AMERICA CORP.

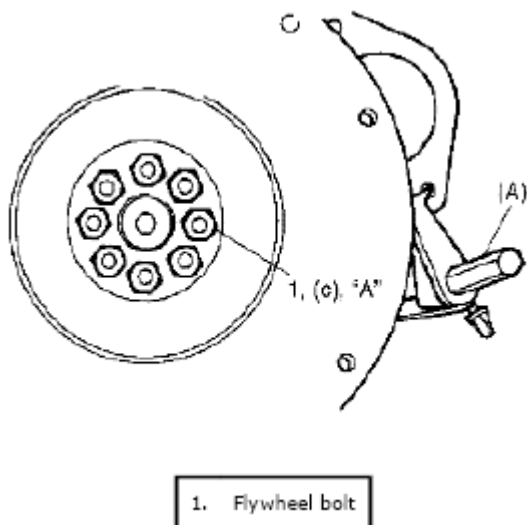
8. Install flywheel (M/T vehicle) or drive plate (A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten new flywheel bolts or new drive plate bolts to specification.

#### Special Tool

A. 09924-17811

#### Tightening torque

Flywheel (or drive plate) bolt c: 70 N.m (7.0 kg-m, 51.0 lb-ft)



**Fig. 195: Locking Flywheel Or Drive Plate**  
Courtesy of SUZUKI OF AMERICA CORP.

9. Install oil pump referring to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION**.
10. Install pistons and connecting rods referring to **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION**.
11. Install oil pump strainer and oil pans referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION**.
12. Install cylinder heads assembly to cylinder block referring to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
13. Install oil pump chain referring to **OIL PUMP AND OIL PUMP CHAIN REMOVAL AND INSTALLATION**.
14. Install RH (No. 2) bank 2nd timing chain and tensioner referring to **RH (NO. 2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
15. Install 1st timing chain and tensioner referring to **1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
16. Install LH (No. 1) bank 2nd timing chain and tensioner referring to **LH (NO. 1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION**.
17. Install timing chain cover and crankshaft pulley referring to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
18. Install cylinder head covers referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
19. Install intake manifold, intake collector and electric throttle body assembly referring to **INTAKE COLLECTOR AND INTAKE MANIFOLD REMOVAL AND INSTALLATION** and **ELECTRIC THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION**.
20. Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL AND INSTALLATION**.
21. Install engine assembly to vehicle referring to **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## **CRANKSHAFT INSPECTION**

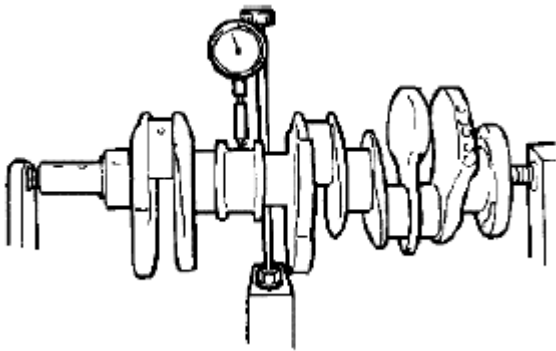
**Reference:** **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**

### **Crankshaft Runout**

Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

### **Crankshaft runout**

**Limit: 0.06 mm (0.0023 in.)**



**Fig. 196: Measuring Runout At Center Journal**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### **Crankshaft Thrust Play**

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing, lower crankcase, main bearings and main bearing caps installed. Refer to **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**.

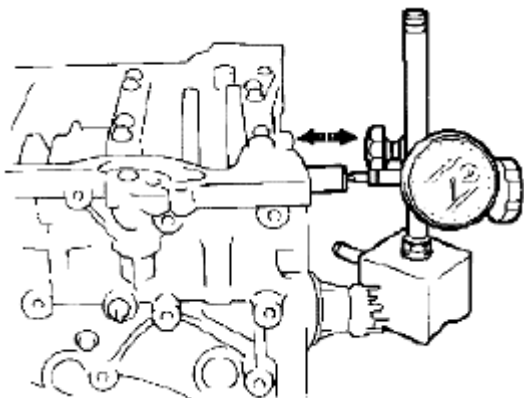
Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.

If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

#### **Crankshaft thrust play**

**Standard: 0.10-0.35 mm (0.0040-0.0137 in.)**

**Limit: 0.38 mm (0.0150 in.)**

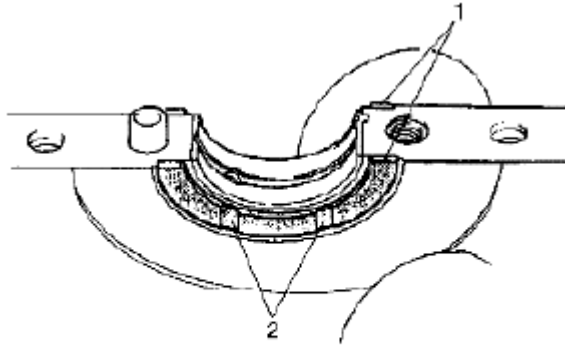


**Fig. 197: Measuring Crankshaft Thrust Play**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### **Thickness of crankshaft thrust bearing**

**Standard: 2.425-2.475 mm (0.0955-0.0974 in.)**

**Oversize (0.125 mm): 2.488-2.538 mm (0.0980-0.0999 in.)**



|                   |               |
|-------------------|---------------|
| 1. Thrust bearing | 2. Oil groove |
|-------------------|---------------|

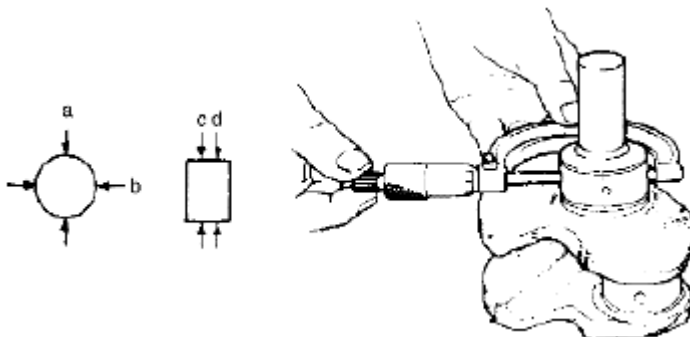
**Fig. 198: Identifying Thrust Bearing & Face Of Oil Groove**  
Courtesy of SUZUKI OF AMERICA CORP.

#### Out-of-Round and Taper (Uneven Wear) of Journals

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

#### Crank journal out-of-round (a - b) and taper (c - d)

**Limit: 0.01 mm (0.0004 in.)**



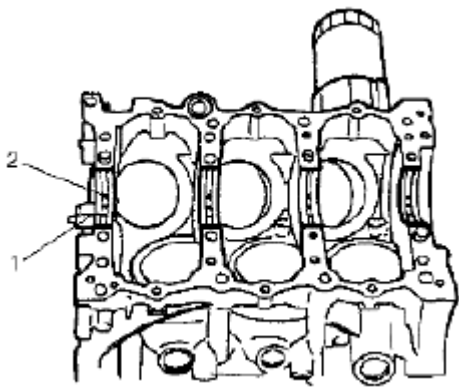
**Fig. 199: Measuring Crank Journal Out-Of-Round & Taper**  
Courtesy of SUZUKI OF AMERICA CORP.

#### MAIN BEARINGS INSPECTION

**Reference: MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION****Main Bearing General Information**

**NOTE:** Before inspecting main bearings, note the following points.

- 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 (1) has oil groove (2) as shown in figure. Install this half with oil groove toward cylinder block.



**Fig. 200: Identifying Bearing & Oil Groove**  
Courtesy of SUZUKI OF AMERICA CORP.

- Lower half of bearing does not have oil groove.

**Visual Inspection**

Check bearings for pitting, scratches, wear or damage.

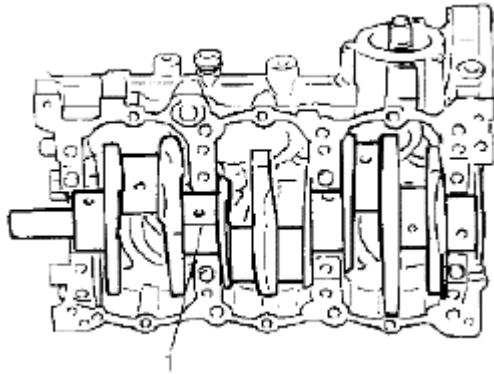
If any malcondition is found, replace both upper and lower halves. Never replace either half without replacing the other half.

**Main Bearing Clearance**

**NOTE:** Do not rotate crankshaft while gauging plastic is installed.

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

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



**Fig. 201: Identifying Plastic Gauging Piece**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Install lower crankcase to cylinder block without applying sealant referring to **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**.
5. Remove lower crankcase, and using scale (2) on gauging plastic (1) envelop, measure gauging plastic (1) width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.

A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.

After selecting new bearing, recheck clearance.

**Main bearing clearance for standard size bearing**

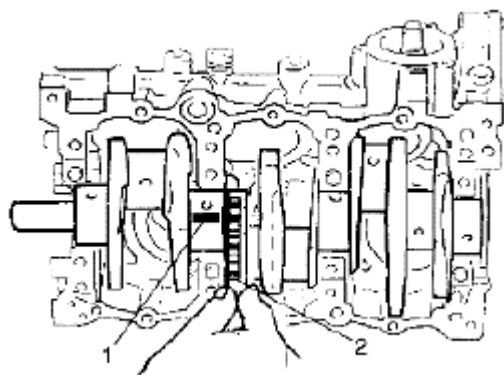
**Standard: 0.0210-0.0390 mm (0.0009-0.0015 in.)**

**Limit: 0.0520 mm (0.0020 in.)**

**Main bearing clearance for undersize bearing**

**Standard: 0.0240-0.0420 mm (0.0010-0.0016 in.)**

**Limit: 0.0550 mm (0.0021 in.)**



**Fig. 202: Removing Lower Crankcase & Using Scale**  
 Courtesy of SUZUKI OF AMERICA CORP.

## Selection of Main Bearings

### Standard bearing

**NOTE:** The meaning of "Upper" and "Lower" described in this procedure are the following.

- **Upper:** It is meaning of main bearing installed in cylinder block side journal.
- **Lower:** It is meaning of main bearing installed in lower crankcase side journal.

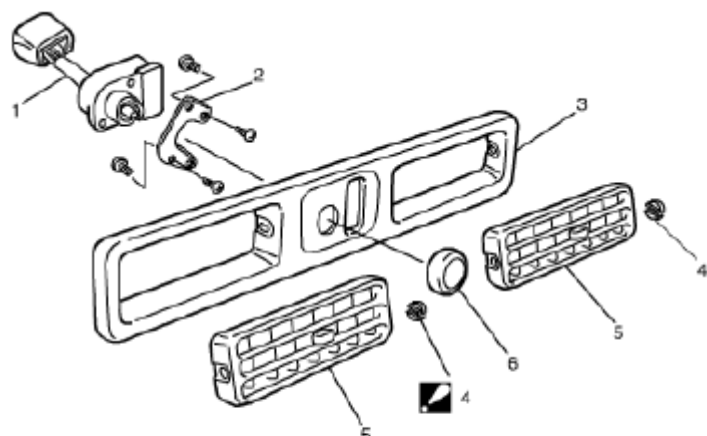
If engine is under one of the following conditions, select a new standard bearing as follow, and install it.

- Bearing is in malcondition.
  - Bearing clearance is out of specification.
  - Crankshaft or cylinder block is replaced.
1. First check journal diameter. As shown in figure, crank web has stamped numbers and alphabet at the center. Six kinds of numbers ("4" through "9") represent the following journal diameters.

### Journal diameter

#### JOURNAL DIAMETER SPECIFICATION

| Stamped numbers | Journal diameter                         |
|-----------------|------------------------------------------|
| 4               | 65.0030-65.0060 mm (2.55917-2.55928 in.) |
| 5               | 65.0000-65.0029 mm (2.55905-2.55916 in.) |
| 6               | 64.9970-64.9999 mm (2.55893-2.55904 in.) |
| 7               | 64.9940-64.9969 mm (2.55882-2.55892 in.) |
| 8               | 64.9910-64.9939 mm (2.55870-2.55881 in.) |
| 9               | 64.9880-64.9909 mm (2.55858-2.55869 in.) |



1. Crankshaft

2. Crank web

**Fig. 203: Identifying Crank Web**  
 Courtesy of SUZUKI OF AMERICA CORP.

2. Next, check journal bore diameter.

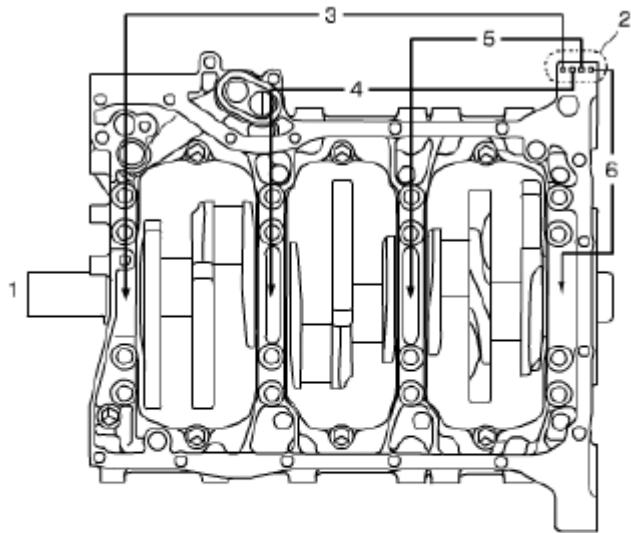
On lower crankcase, 4 alphabets (1) are stamped as shown in figure.

Three kinds of alphabets (A, B and C) represent the following journal bore diameters.

#### Journal bore diameter

#### JOURNAL BORE DIAMETER SPECIFICATION

| Stamped alphabet | Bearing cap bore diameter (without bearing) |
|------------------|---------------------------------------------|
| A                | 70.0000-70.0060 mm (2.75590-2.75613 in.)    |
| B                | 70.0061-70.0120 mm (2.75614-2.75637 in.)    |
| C                | 70.0121-70.0180 mm (2.75638-2.75660 in.)    |



*Expand image*

|                           |                 |
|---------------------------|-----------------|
| 1. Crankshaft pulley side | 4. No.2 bearing |
| 2. Stamped alphabets      | 5. No.3 bearing |
| 3. No.1 bearing           | 6. No.4 bearing |

**Fig. 204: Identifying Stamped Alphabet On Lower Crankcase**  
 Courtesy of SUZUKI OF AMERICA CORP.

3. There are 5 kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.

Each color indicates the following thickness at the center of bearing.

**NOTE:** The following bearing are not supplied because they are unnecessary in this selection procedure.

- Upper main bearing: Brown
- Lower main bearing: Black

Standard size main bearing thickness

#### MAIN BEARING THICKNESS SPECIFICATION

| Color painted        | Bearing thickness                      |
|----------------------|----------------------------------------|
| Black                | 2.4970-2.5000 mm (0.09831-0.09842 in.) |
| Colorless (no paint) | 2.5000-2.5030 mm (0.09843-0.09854 in.) |
| Yellow               | 2.5030-2.5060 mm (0.09855-0.09866 in.) |
| Blue                 | 2.5060-2.5090 mm (0.09867-0.09877 in.) |
| Pink                 | 2.5090-2.5120 mm (0.09878-0.09889 in.) |
| Brown                | 2.5120-2.5150 mm (0.09890-0.09901 in.) |



1. Paint

**Fig. 205: Identifying Paint Mark For Bearing Size Identification**  
 Courtesy of SUZUKI OF AMERICA CORP.

4. From number stamped on crank webs at its center and alphabets stamped on cylinder block lower side, determine new standard bearing to be installed to journal referring to cross-reference table below.

For example, if number stamped on crank web is "4" and alphabet stamped on cylinder block is "A", install new standard bearing painted in "Black" to cylinder block side journal and "Colorless" to lower crankcase side journal.

#### Main bearing cross-reference table (standard bearing)

#### MAIN BEARING CROSS-REFERENCE CHART

| Application                         |   | Stamped number on crank web       |           |                                   |        |                              |                             |
|-------------------------------------|---|-----------------------------------|-----------|-----------------------------------|--------|------------------------------|-----------------------------|
|                                     |   | 4                                 | 5         | 6                                 | 7      | 8                            | 9                           |
| Stamped alphabet on lower crankcase | A | Upper: Black<br>Lower: Colorless  | Colorless | Upper: Colorless<br>Lower: Yellow | Yellow | Upper: Yellow<br>Lower: Blue | Blue                        |
|                                     | B | Upper: Colorless<br>Lower: Yellow | Yellow    | Upper: Yellow<br>Lower: Blue      | Blue   | Upper: Blue<br>Lower: Pink   | Pink                        |
|                                     | C | Upper: Yellow<br>Lower: Blue      | Blue      | Upper: Blue<br>Lower: Pink        | Pink   | Upper: Pink<br>Lower: Brown  | Upper: Pink<br>Lower: Brown |

5. Using gauging plastic, check bearing clearance with newly selected standard bearing referring to **MAIN BEARING CLEARANCE**.

If clearance still exceeds its limit, use next thicker bearing and recheck clearance.

#### Undersize bearing (0.25 mm)

0.25 mm (0.0098 in.) undersize bearing is available, in five kinds varying in thickness.

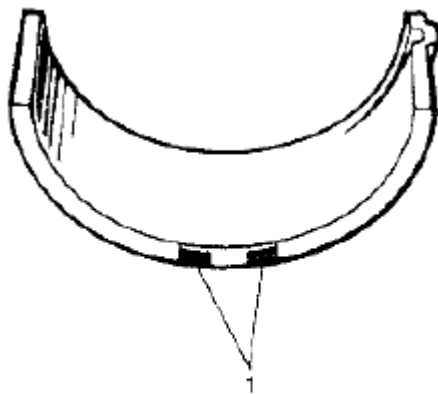
To distinguish them, each bearing is painted in the following colors at such position as indicated in figure.

Each color represents the following thickness at the center of bearing.

### Undersize main bearing thickness

#### UNDERSIZE MAIN BEARING THICKNESS SPECIFICATION

| Color painted | Bearing thickness                      |
|---------------|----------------------------------------|
| Black & Red   | 2.6220-2.6250 mm (0.10322-0.10334 in.) |
| Red only      | 2.6250-2.6280 mm (0.10335-0.10346 in.) |
| Yellow & Red  | 2.6280-2.6310 mm (0.10347-0.10358 in.) |
| Blue & Red    | 2.6310-2.6340 mm (0.10359-0.10370 in.) |
| Pink & Red    | 2.6340-2.6370 mm (0.10371-0.10382 in.) |



1. Paint

**Fig. 206: Identifying Paint Mark For Bearing Size Identification**  
Courtesy of SUZUKI OF AMERICA CORP.

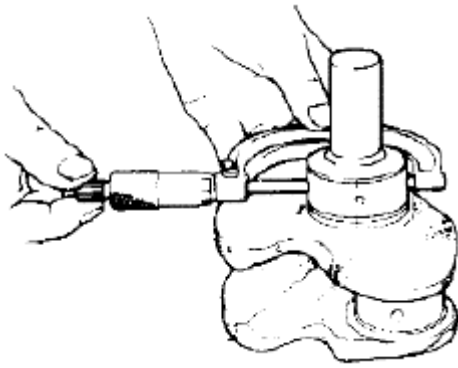
- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.
  - a. Regrind journal to the following finished diameter.

#### Finished journal diameter

**64.7380-64.7560 mm (2.54874-2.54944 in.)**

- b. Using micrometer, measure reground journal diameter.

Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.



**Fig. 207: Measuring Reground Journal Diameter**  
 Courtesy of SUZUKI OF AMERICA CORP.

- c. Using journal diameter measured and alphabets stamped on cylinder block, select undersize bearing referring to cross-reference table below.

Check bearing clearance with newly selected undersize bearing referring to **MAIN BEARING CLEARANCE**.

**Main bearing cross-reference table (undersize bearing)**

**MAIN BEARING CROSS-REFERENCE CHART**

|                                               |   | Measured journal diameter                           |                                                     |                                                     |
|-----------------------------------------------|---|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
|                                               |   | 64.7500-<br>64.7560 mm<br>(2.54921-<br>2.54944 in.) | 64.7440-<br>64.7499 mm<br>(2.54897-<br>2.54920 in.) | 64.7380-<br>64.7439 mm<br>(2.54873-<br>2.54896 in.) |
| Alphabets<br>stamped on<br>lower<br>crankcase | A | Black & Red                                         | Red only                                            | Yellow & Red                                        |
|                                               | B | Red only                                            | Yellow & Red                                        | Blue & Red                                          |
|                                               | C | Yellow & Red                                        | Blue & Red                                          | Pink & Red                                          |

**REAR OIL SEAL AND FLYWHEEL INSPECTION**

**Reference: MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**

**Rear Oil Seal**

Carefully inspect oil seal for wear or damage. If lip portion is worn or damaged, replace oil seal.



**Fig. 208: Identifying Oil Seal**

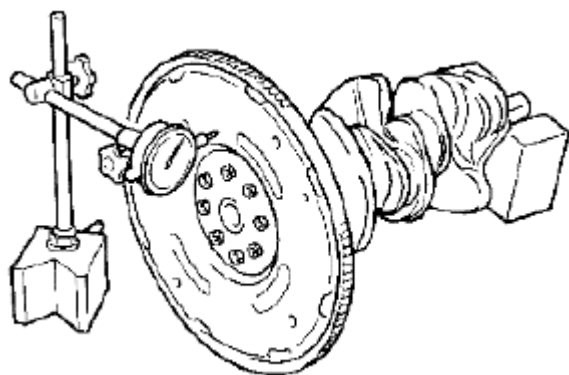
Courtesy of SUZUKI OF AMERICA CORP.

#### Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged or excessively worn, replace flywheel.
- Check flywheel for face runout with a dial gauge. If runout exceeds its limit, replace flywheel.

#### Flywheel runout

**Limit: 0.2 mm (0.0078 in.)**



**Fig. 209: Measuring Flywheel Runout**

Courtesy of SUZUKI OF AMERICA CORP.

#### CYLINDER BLOCK INSPECTION

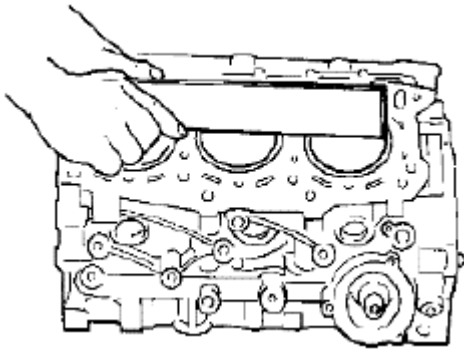
**Reference: MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**

#### Distortion of Gasketed Surface

Using straightedge and thickness gauge, check gasketed surface for distortion. If flatness exceeds its limit, correct or replace it.

#### Gasketed surface flatness

**Limit: 0.06 mm (0.0024 in.)**



**Fig. 210: Checking Gasketed Surface For Distortion**  
Courtesy of SUZUKI OF AMERICA CORP.

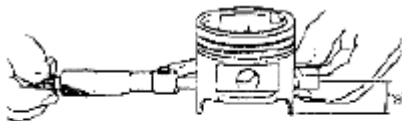
#### Honing or reboring cylinders

1. When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2. Select oversized piston according to amount of cylinder wear.

#### Oversize piston diameter

**88.470-88.490 mm (3.4831-3.4838 in.)**

3. Using micrometer, measure piston diameter.



"a": 26.5 mm  
(1.04 in.)

**Fig. 211: Measuring Piston Diameter**  
Courtesy of SUZUKI OF AMERICA CORP.

4. Calculate cylinder bore diameter to be rebored as follows.

$$D = A + B - C$$

D: Cylinder bore diameter to be rebored

A: Piston diameter as measured

B: Piston clearance = 0.02 - 0.04 mm (0.0008 - 0.0015 in.)

C: Allowance for honing = 0.02 mm (0.0008 in.)

5. Rebore and hone cylinder to calculated dimension.

**NOTE:** Before reboring, install lower crankcase in place and tighten to specification to avoid distortion of bearing bores.

6. Measure piston clearance after honing.

## SPECIFICATIONS

**NOTE:** For the tightening torque of fastener not specified in this TIGHTENING TORQUE SPECIFICATIONS service information, refer to FASTENER INFORMATION.

### TIGHTENING TORQUE SPECIFICATIONS

### TIGHTENING TORQUE SPECIFICATIONS

| Fastening part                                                | Tightening torque                                                 |       |       |
|---------------------------------------------------------------|-------------------------------------------------------------------|-------|-------|
|                                                               | N.m                                                               | kgf-m | lb-ft |
| Camshaft housing bolts                                        | 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure          |       |       |
| Camshaft housing bolt                                         | 11                                                                | 1.1   | 8.0   |
| Cylinder head cover nut                                       | 10.5                                                              | 1.1   | 7.5   |
| Engine block heater mounting bolt                             | 11                                                                | 1.1   | 8.0   |
| Timing chain cover bolt                                       | 11                                                                | 1.1   | 8.0   |
| Crankshaft pulley bolt                                        | 150                                                               | 15    | 108.5 |
| Timing chain guide No.4 bolt                                  | 11                                                                | 1.1   | 8.0   |
| Camshaft timing sprocket bolt                                 | 80                                                                | 8.0   | 58.0  |
| Timing chain tensioner adjuster No.3 bolt                     | Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure  |       |       |
| Timing chain tensioner adjuster No.3 nut                      | Tighten 45 N.m (4.5 kgf-m, 32.5 lb-ft) by the specified procedure |       |       |
| RH (No.2) bank 1st timing chain intake camshaft sprocket bolt | 80                                                                | 8.0   | 58.0  |
| Timing chain tensioner nut                                    | 25                                                                | 2.5   | 18.0  |
| Idler sprocket No.1 bolt                                      | 55                                                                | 5.5   | 40.0  |
| Timing chain tensioner adjuster No.1 bolt                     | 11                                                                | 1.1   | 8.0   |
| Timing chain guide No.1 and No.2 bolt                         | 9                                                                 | 0.9   | 6.5   |

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|                                                         |                                                                                                                                                                                                  |     |      |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| Timing chain tensioner adjuster No.2 bolt               | 11                                                                                                                                                                                               | 1.1 | 8.0  |
| Camshaft housing bolt                                   | 11 N.m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure                                                                                                                                         |     |      |
| Timing chain guide No.3 bolt                            | 11                                                                                                                                                                                               | 1.1 | 8.0  |
| Cylinder head bolt                                      | Tighten 53 N.m (5.3 kgf-m, 38.5 lb-ft), 84 N.m (8.4 kgf-m, 61.0 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 53 N.m (5.3 kgf-m, 38.5 lb-ft) and 105 N.m (10.5 kgf-m, 76.0 lb-ft) by the specified procedure |     |      |
| Cylinder head bolt (hex hole bolt)                      | Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure                                                                                                                                 |     |      |
| Connecting rod bolt                                     | Tighten 15 N.m (1.5 kgf-m, 11.0 lb-ft), 45° and 45° by the specified procedure.                                                                                                                  |     |      |
| Lower crankcase bolt (10 mm (0.39 in.) thread diameter) | Tighten 30 N.m (3.0 kgf-m, 22.0 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 42 N.m (4.2 kgf-m, 30.5 lb-ft) and 40° by the specified procedure                                                              |     |      |
| Lower crankcase bolt (8 mm (0.31 in.) thread diameter)  | 27 N.m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure                                                                                                                                        |     |      |
| Flywheel (or drive plate) bolt                          | 70                                                                                                                                                                                               | 7.0 | 51.0 |

**NOTE:** Specified tightening torque can also be found in [Fig. 18](#), [Fig. 44](#), [Fig. 50](#), [Fig. 63](#), [Fig. 82](#), [Fig. 105](#), [Fig. 119](#), [Fig. 135](#), [Fig. 161](#) & [Fig. 187](#) .

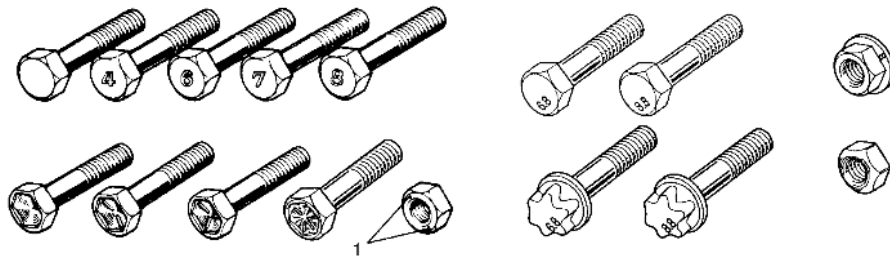
**FASTENER INFORMATION****Metric Fasteners**

Most of the fasteners used for this vehicle are metric. When replacing any fasteners, it is most important that replacement fasteners be the correct diameter, thread pitch and strength.

**Fastener Strength Identification**

Most commonly used metric fastener strength property classes are 4T, 6.8, 7T, 8.8 and radial line with the class identification embossed on the head of each bolt. Some metric nuts will be marked with punch, 6 or 8 mark strength identification on the nut face. Figure shows the different strength markings.

When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct diameter and thread pitch. Correct replacement bolts and nuts are available through the parts division. Metric bolts: Identification class numbers or marks correspond to bolt strength (increasing numbers represent increasing strength).



1. Nut strength identification

**Fig. 212: Fastener Strength Identification**  
 Courtesy of SUZUKI OF AMERICA CORP.

### Standard Tightening Torque

Each fastener should be tightened to the torque specified in each section of this service information . If no description or specification is provided, refer to the following tightening torque charts for the applicable torque for each fastener. When a fastener of greater strength than the original one is used, however, use the torque specified for the original fastener.

#### NOTE:

- For the flanged bolt, flanged nut and self-lock nut of 4T and 7T strength, add 10 percent to the tightening torque given in the following charts.
- The following charts are applicable only where the fastened parts are made of steel light alloy.

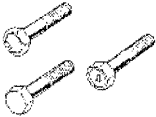
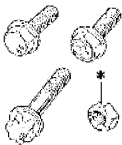
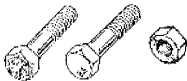
### Tightening Torque Charts

| Strength | Unit | Thread Diameter (Nominal Diameter) (mm) |   |   |   |    |    |    |    |
|----------|------|-----------------------------------------|---|---|---|----|----|----|----|
|          |      | 4                                       | 5 | 6 | 8 | 10 | 12 | 14 | 16 |

**Fig. 213: Tightening Torque Chart (1 Of 3)**  
 Courtesy of SUZUKI OF AMERICA CORP.

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|                                                                                     |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |
|-------------------------------------------------------------------------------------|------------------------|--------------------|--------------------|--------------------|-------------------|-------------------|---------------------|----------------------|----------------------|----------------------|
| A equivalent of 4T strength fastener                                                | N·m<br>kgf-m<br>lbf-ft | 1.5<br>0.15<br>1.0 | 3.0<br>0.30<br>2.5 | 5.5<br>0.55<br>4.0 | 13<br>1.3<br>9.5  | 29<br>2.9<br>21.0 | 45<br>4.5<br>32.5   | 65<br>6.5<br>47.0    | 105<br>10.5<br>76.0  | 160<br>16.0<br>116.0 |
|    |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |
| A equivalent of 6.8 strength fastener without flange                                | N·m<br>kgf-m<br>lbf-ft | 2.4<br>0.24<br>2.0 | 4.7<br>0.47<br>3.5 | 8.4<br>0.84<br>6.0 | 20<br>2.0<br>14.5 | 42<br>4.2<br>30.5 | 80<br>8.0<br>58.0   | 125<br>12.5<br>90.5  | 193<br>19.3<br>139.5 | 280<br>28.0<br>202.5 |
|    |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |
| A equivalent of 6.8 strength fastener with flange<br>*: Self-lock nut (6 strength)  | N·m<br>kgf-m<br>lbf-ft | 2.4<br>0.24<br>2.0 | 4.9<br>0.49<br>3.5 | 8.8<br>0.88<br>6.5 | 21<br>2.1<br>15.5 | 44<br>4.4<br>32.0 | 84<br>8.4<br>61.0   | 133<br>13.3<br>96.5  | 203<br>20.3<br>147.0 | 298<br>29.8<br>215.5 |
|    |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |
| A equivalent of 7T strength fastener                                                | N·m<br>kgf-m<br>lbf-ft | 2.3<br>0.23<br>2.0 | 4.5<br>0.45<br>3.5 | 10<br>1.0<br>7.5   | 23<br>2.3<br>17.0 | 50<br>5.0<br>36.5 | 85<br>8.5<br>61.5   | 135<br>13.5<br>98.0  | 210<br>21<br>152.0   | 240<br>24<br>174.0   |
|  |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |
| A equivalent of 8.8 strength bolt (8 strength nut) without flange                   | N·m<br>kgf-m<br>lbf-ft | 3.1<br>0.31<br>2.5 | 6.3<br>0.63<br>4.5 | 11<br>1.1<br>8.0   | 27<br>2.7<br>19.5 | 56<br>5.6<br>40.5 | 105<br>10.5<br>76.0 | 168<br>16.8<br>121.5 | 258<br>25.8<br>187.0 | 373<br>37.3<br>270.0 |
|  |                        |                    |                    |                    |                   |                   |                     |                      |                      |                      |

**Fig. 214: Tightening Torque Chart (2 Of 3)**  
Courtesy of SUZUKI OF AMERICA CORP.

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| A equivalent of 8.8 strength bolt (8 strength nut) with flange                    | N·m<br>kgf-m<br>lbf-ft | 3.2  | 6.5  | 12  | 29   | 59   | 113  | 175   | 270   | 395   |
|-----------------------------------------------------------------------------------|------------------------|------|------|-----|------|------|------|-------|-------|-------|
|                                                                                   |                        | 0.32 | 0.65 | 1.2 | 2.9  | 5.9  | 11.3 | 17.5  | 27    | 39.5  |
|  |                        | 2.5  | 5.0  | 9.0 | 21.0 | 43.0 | 82.0 | 126.5 | 195.5 | 286.0 |
|                                                                                   |                        |      |      |     |      |      |      |       |       |       |

**Fig. 215: Tightening Torque Chart (3 Of 3)**  
Courtesy of SUZUKI OF AMERICA CORP.

## SPECIAL TOOLS AND EQUIPMENT

### RECOMMENDED SERVICE MATERIAL

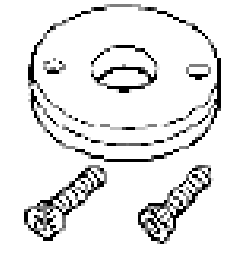
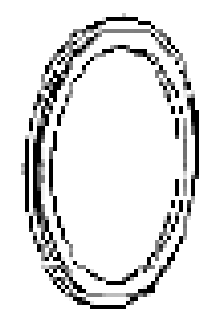
### RECOMMENDED SERVICE MATERIAL

| Material            | SUZUKI recommended product or Specification |                  |
|---------------------|---------------------------------------------|------------------|
| Sealant             | SUZUKI Bond No.1217G                        | P/N: 99000-31260 |
| Water tight sealant | SUZUKI Bond No.1207B                        | P/N: 99000-31140 |
|                     | SUZUKI Bond No.1207F                        | P/N: 99000-31250 |

**NOTE:** Specified tightening torque can also be found in [Fig. 18](#), [Fig. 44](#), [Fig. 50](#), [Fig. 63](#), [Fig. 82](#), [Fig. 105](#), [Fig. 119](#), [Fig. 135](#), [Fig. 161](#) & [Fig. 187](#) .

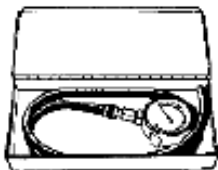
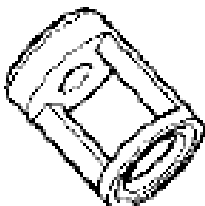
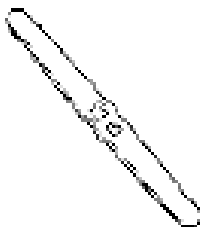
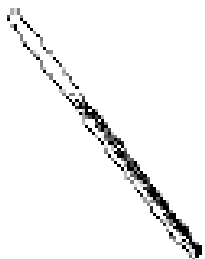
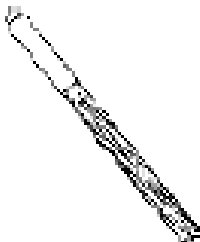
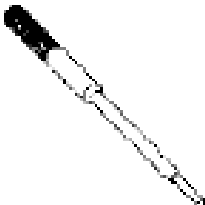
### SPECIAL TOOL

### SPECIAL TOOL SPECIFICATION

|                 |                                                                                     |                    |                                                                                       |
|-----------------|-------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| 09355-35754-600 |  | 09367-04002        |  |
| Hose            |                                                                                     | 3-way joint        |                                                                                       |
| 09911-97710     |  | 09911-97811        |  |
| Oil seal guide  |                                                                                     | Oil seal installer |                                                                                       |

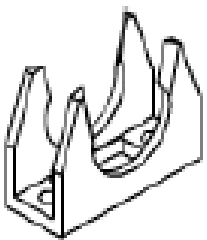
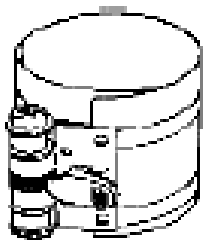
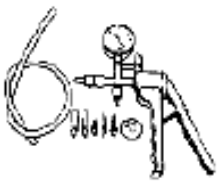
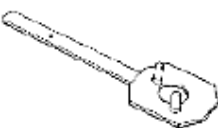
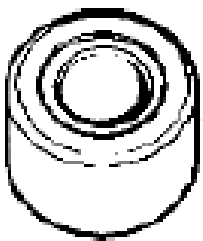
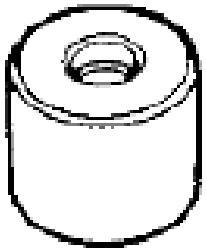
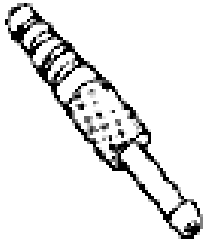
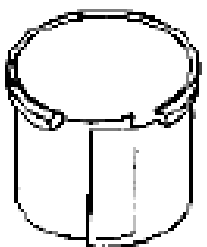
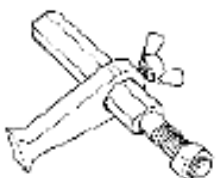
# 2008 Suzuki Grand Vitara

2006-08 ENGINE Engine Mechanical - Grand Vitara

|                                    |                                                                                     |                                    |                                                                                       |
|------------------------------------|-------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------|
| 09913-75510                        |    | 09915-64512                        |    |
| Bearing installer                  |                                                                                     | Compression gauge                  |                                                                                       |
| 09915-64530                        |    | 09915-67010                        |    |
| Compression gauge hose             |                                                                                     | Compression gauge attachment (C)   |                                                                                       |
| 09915-67311                        |    | 09916-14510                        |    |
| Vacuum gauge                       |                                                                                     | Valve lifter                       |                                                                                       |
| 09916-14910                        |   | 09916-34542                        |   |
| Valve spring compressor attachment |                                                                                     | Reamer handle                      |                                                                                       |
| 09916-37810                        |  | 09916-38210                        |  |
| Valve guide reamer (6 mm)          |                                                                                     | Valve guide reamer (11 mm)         |                                                                                       |
| 09916-44910                        |  | 09916-58210                        |  |
| Valve guide installer & remover    |                                                                                     | Valve guide installer handle       |                                                                                       |
| 09916-66510                        |                                                                                     | 09916-77310                        |                                                                                       |
| Tappet holder                      |                                                                                     | Piston ring compressor (50-125 mm) |                                                                                       |

# 2008 Suzuki Grand Vitara

2006-08 ENGINE Engine Mechanical - Grand Vitara

|                             |                                                                                     |                                                        |                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------|
|                             |    |                                                        |    |
| 09916-84511                 |    | 09917-47011                                            |    |
| Forceps                     |                                                                                     | Vacuum pump gauge                                      |                                                                                       |
| 09917-68221                 |    | 09917-87810                                            |   |
| Camshaft pulley holder      |                                                                                     | Valve guide installer attachment (protrusion: 13.5 mm) |                                                                                       |
| 09917-98221                 |  | 09918-08210                                            |  |
| Valve guide stem attachment |                                                                                     | Vacuum gauge hose joint                                |                                                                                       |
| 09919-28610                 |  | 09924-17811                                            |  |
| Protector sleeve            |                                                                                     | Flywheel holder                                        |                                                                                       |
| 09926-58010                 |  | 09944-36011                                            |  |
| Bearing remover attachment  |                                                                                     | Steering wheel remover                                 |                                                                                       |