# 2009 ENGINE

# Engine Mechanical (N32A) - Grand Vitara

## GENERAL DESCRIPTION

### ENGINE CONSTRUCTION DESCRIPTION

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 camshafts are mounted over the cylinder head. They are driven from crankshaft through timing chains, and no push rod is provided in the valve train system.

## DIAGNOSTIC INFORMATION AND PROCEDURES

### COMPRESSION CHECK

1. Warm up engine to normal operating temperature.
2. Stop engine after warming up.
3. After warming up, place shift select lever to "P" range, and set parking brake and block drive wheels.
4. Remove engine cover and air cleaner outlet hose.

**CAUTION: When removing engine cover, be sure to lift up its front side to prevent breakage of engine cover claws.**

5. Remove spark plug. See **SPARK PLUG REMOVAL AND INSTALLATION** .
6. Disconnect fuel injector connectors.
7. Install special tools (Compression gauge) into spark plug hole.

**Special Tool**

**(A): 09915-64512**

**(B): 09915-64530**

**(C): 09915-67010**

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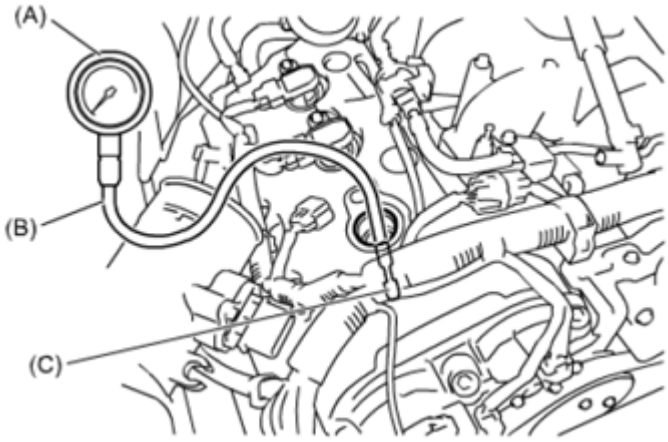



**Fig. 1: Identifying Special Tools (Compression Gauge) Into Spark Plug Hole**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Depress accelerator pedal all the way to make throttle fully open.
9. Crank engine with fully charged battery, and read the highest pressure on compression gauge.

**NOTE:**

- **For measuring compression pressure, crank engine at least 200 RPM using fully charged battery.**
- **If measured compression pressure is lower than limit value, check installation condition of special tool. If it is properly installed, it way be leakage from piston ring and valve seat.**

**Compression pressure**

**Standard: 1200 kPa (12.2 kgf/cm$^2$ , 174 psi)**

**Limit: 1000 kPa (10.2 kgf/cm$^2$ , 145 psi)**

**Max. difference between any two cylinders: 150 kPa (1.5 kgf/cm$^2$ , 21.8 psi)**

10. Carry out Steps 6) through 8) on all cylinders to obtain 6 readings.
11. Install spark plugs and ignition coil assemblies. See **SPARK PLUG REMOVAL AND INSTALLATION** .
12. Connect ignition coil connectors.
13. Connect fuel injector wires to their connectors.
14. Install engine cover and air cleaner outlet hose.

## ENGINE VACUUM CHECK

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine.

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**Using SUZUKI Scan Tool**

1. Warm up engine to normal operating temperature.
2. After warming up, place select lever to "P" range, and set parking brake and block drive wheels.
3. Stop engine and turn off all electric switches.
4. Connect SUZUKI scan tool to DLC (1) with ignition switch turned off.

   **Special Tool**

   **(A): SUZUKI scan tool (SUZUKI-SDT)**

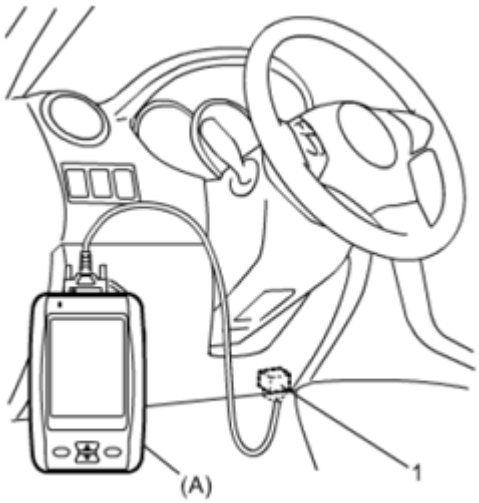



**Fig. 2: Connecting SUZUKI Scan Tool To DLC**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Run engine at specified idle speed, and then select "Manifold Absolute Pressure" under "Data List" mode on scan tool.

   Manifold absolute pressure should be lower than specification.

**Manifold absolute pressure specification (at sea level)**

**42 kPa (0.42 kgf/cm$^2$ , 6.09 psi, 0.42 bar) or less at specified idle speed**

**Not using SUZUKI scan tool**

1. Warm up engine to normal operating temperature.
2. After warming up, place select lever to "P" range, and set parking brake and block drive wheels.
3. Stop engine and turn off all electric switches.
4. Remove PCV hose (1) from breather pipe (2).
5. Connect special tool (Vacuum gauge) to PCV hose.

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**Special Tool**

**(A): 09915-67311**

6. Close breather pipe using tape (3) or the like.

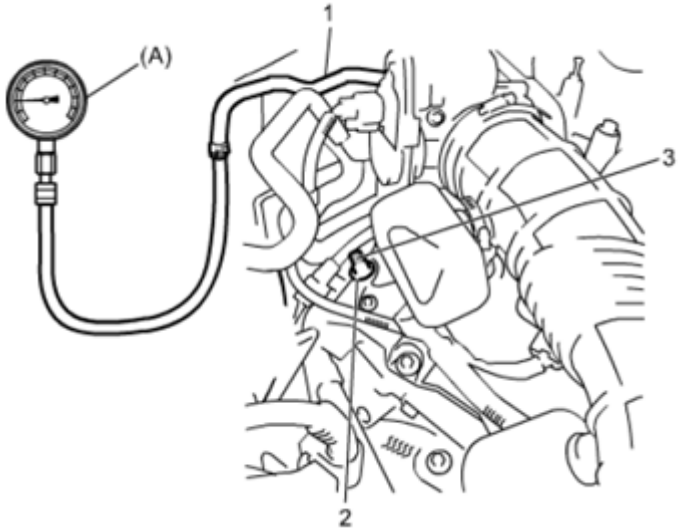



**Fig. 3: Connecting Special Tool (Vacuum Gauge) To PCV Hose**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Run engine at specified idle speed and read vacuum gauge. Vacuum should be higher than specification.

   **Vacuum specification (at sea level)**

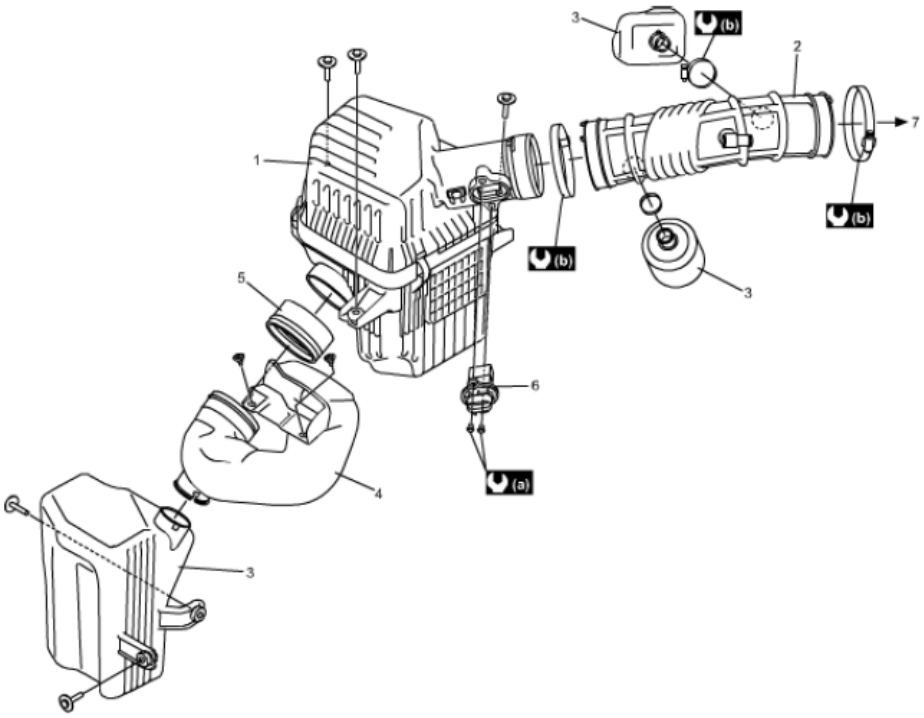
   **-59 kPa (-0.60 kgf/cm$^2$ , -8.56 psi, -0.59 bar) or more at specified idle speed**

8. Disconnect special tool (Vacuum gauge) from breather pipe.
9. Open breather pipe and connect PCV hose to breather pipe.

# REPAIR INSTRUCTIONS

## AIR CLEANER COMPONENTS

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| | | |
|---|---|---|
| 1. Air cleaner assembly | 4. Air cleaner suction pipe | 7. To throttle body |
| 2. Air cleaner outlet hose | 5. Suction pipe joint | (a): 3.0 N·m (0.31 kgf-m, 2.5 lbf-ft) |
| 3. Resonator | 6. MAF sensor & IAT sensor | (b): 2.0 N·m (0.20 kgf-m, 1.5 lbf-ft) |

**Fig. 4: Identifying Air Cleaner Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

## AIR CLEANER FILTER REMOVAL AND INSTALLATION

### Removal

1. Open air cleaner case (1) by unhooking its clamps (2).

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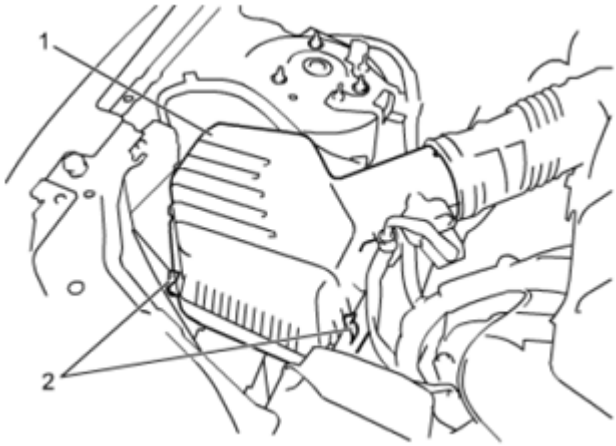



**Fig. 5: Identifying Air Cleaner Case With Clamps**
**Courtesy of SUZUKI OF AMERICA CORP.**

2. Remove air cleaner filter from case.

**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 air cleaner filter for dirt. Replace excessively dirty filter.

**Cleaning**

Blow off dust by compressed air from air outlet side of filter.



**Fig. 6: Checking Air Cleaner Filter For Dirt**

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**Courtesy of SUZUKI OF AMERICA CORP.**

## AIR CLEANER ASSEMBLY REMOVAL AND INSTALLATION

### Removal

1. Disconnect negative cable from battery.
2. Disconnect MAF sensor connector (1) and remove MAF sensor (2).
3. Disconnect air cleaner outlet hose (3) from air cleaner assembly (4).
4. Remove air cleaner assembly.




**Fig. 7: Identifying MAF Sensor Connector And Air Cleaner Outlet Hose**
**Courtesy of SUZUKI OF AMERICA CORP.**

### Installation

Reverse removal procedure for installation noting the following.

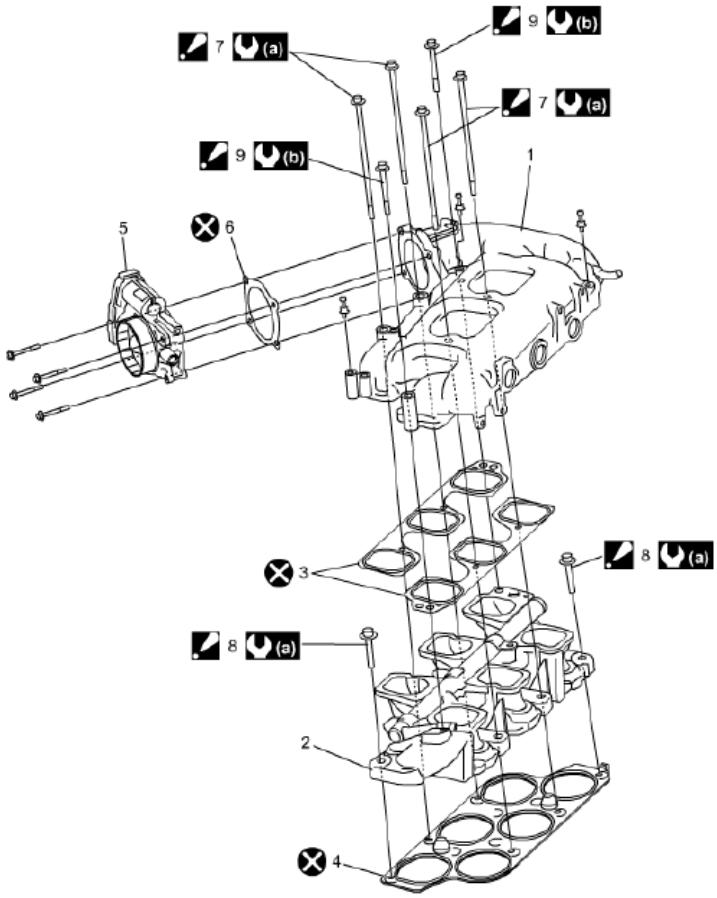
- Tighten MAF sensor bolt to specified torque.

**Tightening torque**

**MAF sensor bolt: 3 N.m (0.3 kg-m, 2.5 lbf-ft)**

## INTAKE MANIFOLD AND THROTTLE BODY COMPONENTS

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| | | |
|---|---|---|
| 1. Intake upper manifold | 5. Throttle body | 9. Intake manifold bolt No.3 :For tightening order, refer to *Intake Manifold Removal and Installation:N32A*. |
| 2. Intake lower manifold | 6. Throttle body gasket | (a): 10 N·m → 25 N·m (1.0 kgf-m → 2.5 kgf-m, 7.5 lbf-ft → 18.5 lbf-ft) |
| 3. Intake manifold upper gasket | 7. Intake manifold bolt No.1 :For tightening order, refer to *Intake Manifold Removal and Installation:N32A*. | (b): 25 N·m (2.5 kgf-m, 18.5 lbf-ft) |
| 4. Intake manifold lower gasket | 8. Intake manifold bolt No.2 :For tightening order, refer to *Intake Manifold Removal and Installation:N32A*. | : Do not reuse. |

**Fig. 8: Exploded View Of Intake Manifold And Throttle Body With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Tightening Order figure callout references:**

7), 8), 9): **INTAKE MANIFOLD REMOVAL AND INSTALLATION**

**THROTTLE BODY REMOVAL AND INSTALLATION**

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*Reference:* **INTAKE MANIFOLD AND THROTTLE BODY COMPONENTS**

**CAUTION: Never disassemble throttle body. Disassembly will spoil its original performance. If faulty condition is found, replace it with new one as an assembly.**

**Removal**

1. Disconnect negative cable from battery.
2. Disconnect air cleaner outlet hose (1) and throttle body connector (2) from throttle body (3).

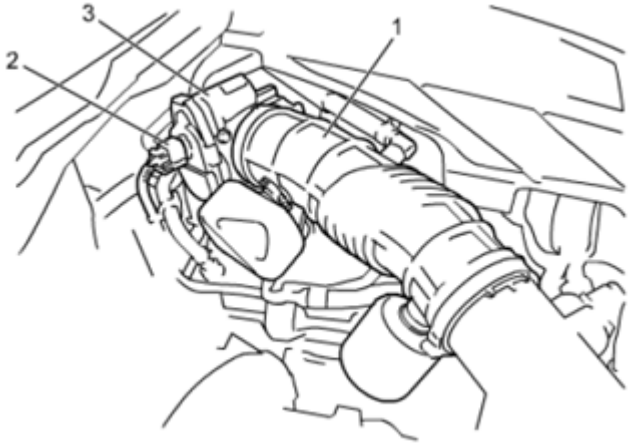



**Fig. 9: Identifying Air Cleaner Outlet Hose And Throttle Body Connector With Throttle Body**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Remove throttle body from intake manifold.

**Installation**

1. Clean mating surfaces of intake manifold and throttle body.
2. Install new gasket and throttle body (3) to intake manifold.
3. Connect air cleaner outlet hose (1) and throttle body connector (2) to throttle body (3) securely.

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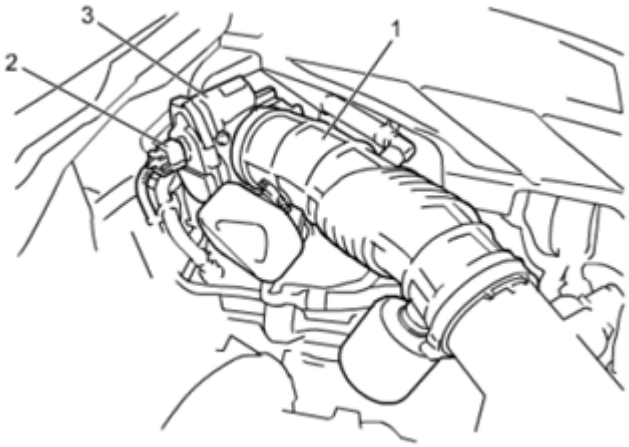



**Fig. 10: Identifying Air Cleaner Outlet Hose And Throttle Body Connector With Throttle Body**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Connect negative cable to battery.

**THROTTLE BODY CLEANING**

***Reference:*** **THROTTLE BODY REMOVAL AND INSTALLATION**

Clean throttle body assembly. See **ELECTRIC THROTTLE SYSTEM ON-VEHICLE INSPECTION** .

**INTAKE MANIFOLD REMOVAL AND INSTALLATION**

***Reference:*** **INTAKE MANIFOLD AND THROTTLE BODY COMPONENTS**

**Removal**

1. Relieve fuel pressure. See **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative cable at battery.
3. Remove engine cover.

**CAUTION: When removing engine cover, be sure to lift up its front side to prevent breakage of engine cover claws.**

4. Drain coolant. See **COOLING SYSTEM DRAINING** .
5. Remove throttle body assembly. See **THROTTLE BODY REMOVAL AND INSTALLATION**.
6. Remove the following parts.
   - Purge pipe bolt (1)
   - Purge valve bracket bolt (2)
   - Electric wire bracket bolt (3)
   - Water bypass hose (4)

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- PCV hose (5)
- Brake booster hose (6)
- Purge hose (7)

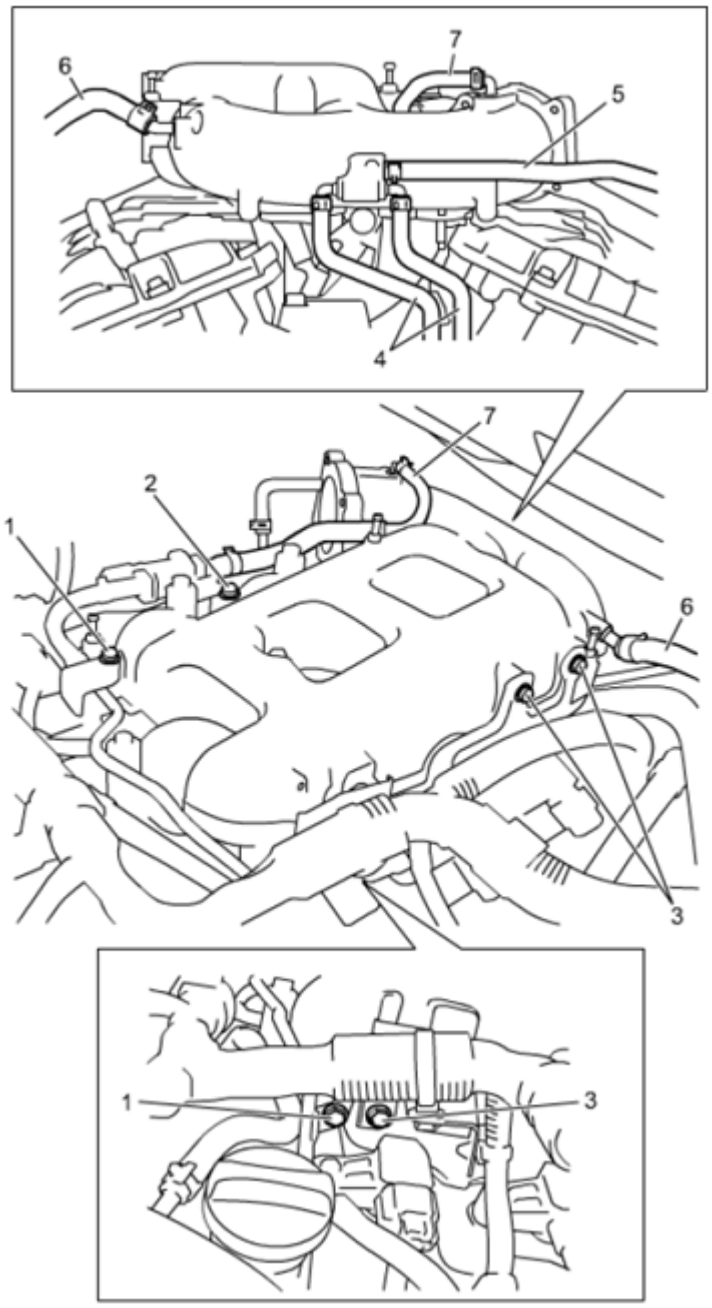



**Fig. 11: Identifying Purge Pipe Bolt And Purge Valve Bracket Bolt With Water Bypass Hose**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Remove intake upper manifold and intake manifold upper gasket.
8. Remove fuel injectors. See **FUEL INJECTOR REMOVAL AND INSTALLATION** .

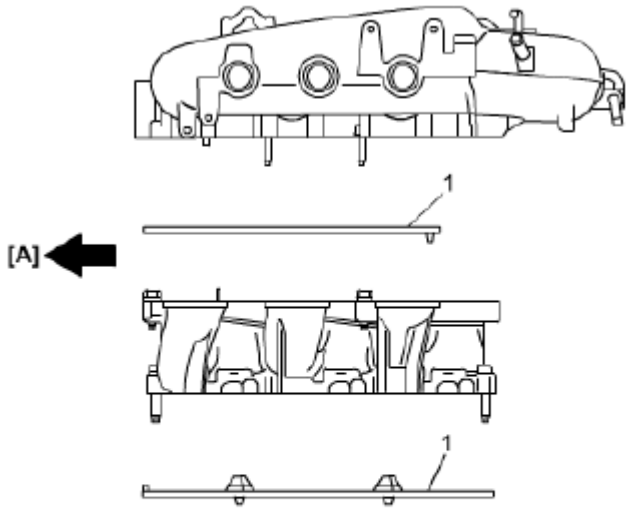
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9. Remove intake lower manifold and intake manifold lower gasket.

**Installation**

Reverse removal procedure for installation noting the following.

- Install new gaskets (1) as shown in figure.




| | |
|---|---|
| [A]: | Vehicle front side |

**Fig. 12: Identifying Gaskets**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Tighten intake manifold bolt as follows.
  a. Tighten intake manifold bolts (No. 1 and No. 2) to 10 N.m (1.0 kgf-m, 7.5 lbf-ft) in numerical order ("1" - "6") shown in figure evenly and gradually.

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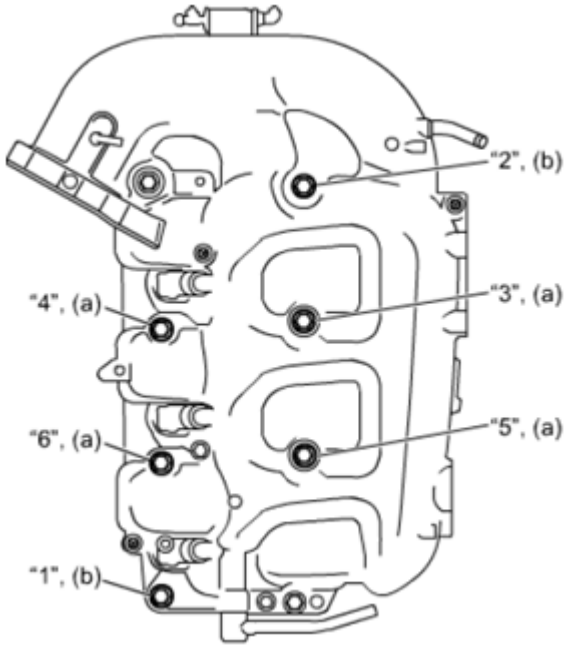



**Fig. 13: Identifying Intake Manifold Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Tighten intake manifold bolts (No. 1, No. 2 and No. 3) to 25 N.m (2.5 kgf-m, 18.5 lbf-ft) in numerical order ("1" - "8") shown in figure evenly and gradually.

**Tightening torque**

**Intake manifold bolt No. 1* (a): 10 N.m --> 25 N.m (1.0 kgf-m --> 2.5 kgf-m, 7.5 lbf-ft --> 18.5 lbf-ft)**

**Intake manifold bolt No. 2* (b): 10 N.m --> 25 N.m (1.0 kgf-m --> 2.5 kgf-m, 7.5 lbf-ft --> 18.5 lbf-ft)**

**Intake manifold bolt No. 3* (c): 25 N.m (2.5 kg-m, 18.5 lbf-ft)**

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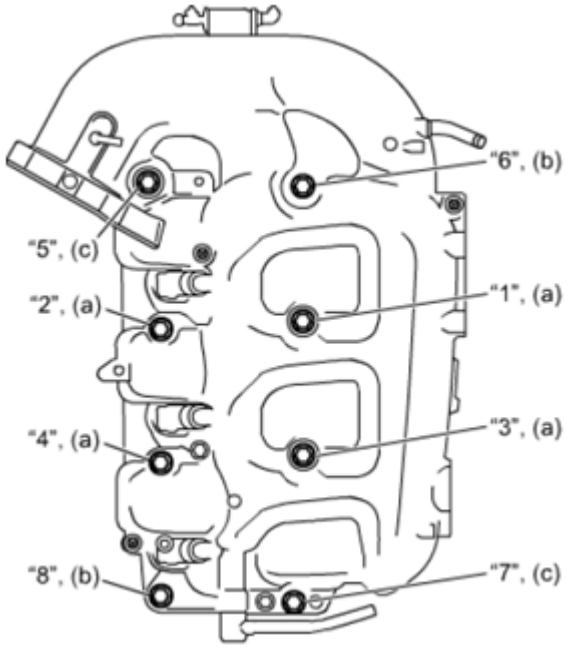



**Fig. 14: Identifying Intake Manifold Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Tighten purge pipe bolt (1) and purge valve bracket bolt (2) to specified torque.

  **Tightening torque**

  **Purge pipe bolt (a): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**

  **Purge valve bracket bolt (b): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**

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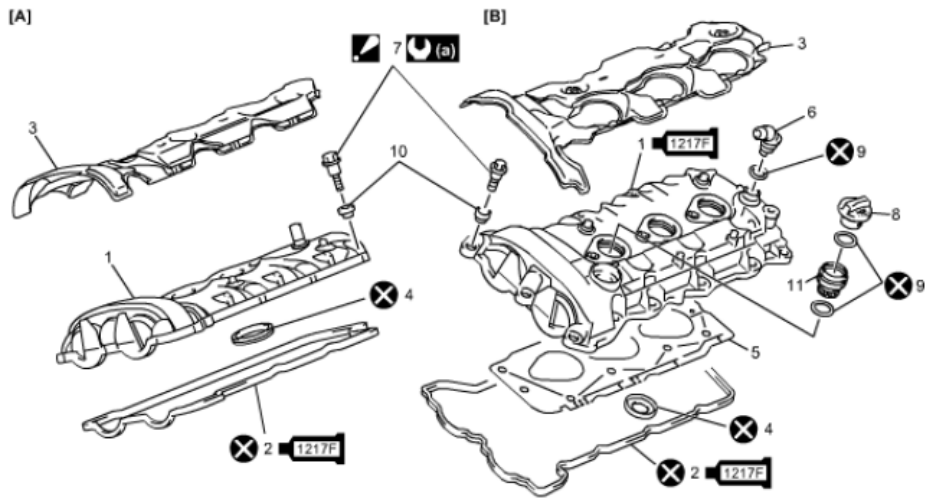

**Fig. 15: Identifying Purge Pipe Bolt And Purge Valve Bracket Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Check to ensure that all removed parts are back in place.
- Upon completion of installation, turn ignition switch ON position without starting engine and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

## CYLINDER HEAD COVER COMPONENTS

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

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| | | |
|---|---|---|
| [A]: Bank 1 | 4. Spark plug hole gasket | 9. O-ring |
| [B]: Bank 2 | 5. Plate | 10. Insulator |
| 1217F 1. Cylinder head cover | 6. Breather pipe | 11. Oil filler tube |
| 1217F 2. Cylinder head cover gasket | 7. Cylinder head cover bolt :For tightening order, refer to *Cylinder Head Cover Removal and Installation:N32A*. | (a): 10 N·m (1.0 kgf-m, 7.5 lbf-ft) |
| 3. Cylinder head cover damper | 8. Oil filler cap | : Do not reuse. |

**Fig. 16: Exploded View Of Cylinder Head Cover With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Tightening Order figure callout references:**

7): **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**

## CYLINDER HEAD COVER REMOVAL AND INSTALLATION

### Removal

**NOTE: For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

1. Relieve fuel pressure. See **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative cable from battery.
3. Remove engine cover.

**CAUTION: When removing engine cover, be sure to lift up its front side to prevent breakage of engine cover claws.**


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4. Drain coolant. See **COOLING SYSTEM DRAINING** .
5. Remove intake upper manifold. See **INTAKE MANIFOLD REMOVAL AND INSTALLATION**.
6. Remove ignition coil. See **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .
7. Remove delivery pipe. See **FUEL INJECTOR REMOVAL AND INSTALLATION** .
8. Disconnect the following electric wires.
    - CMP sensor (1)
    - OCV (2)
    - Ground terminals (3)
    - Engine wire harness clamps
9. Remove the following parts.
    - Fuel pipe bracket (4)
    - Engine wire harness bracket (5)
    - Harness protector (6)
    - Oil filler cap (7)


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**Fig. 17: Identifying Fuel Pipe Bracket, Engine Wire Harness Bracket And Oil Filler Cap**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Remove cylinder head cover.
11. Install special tool to spark plug tube.

**Special Tool**

**(A): Spark plug tube seal guide (EN-46101)**

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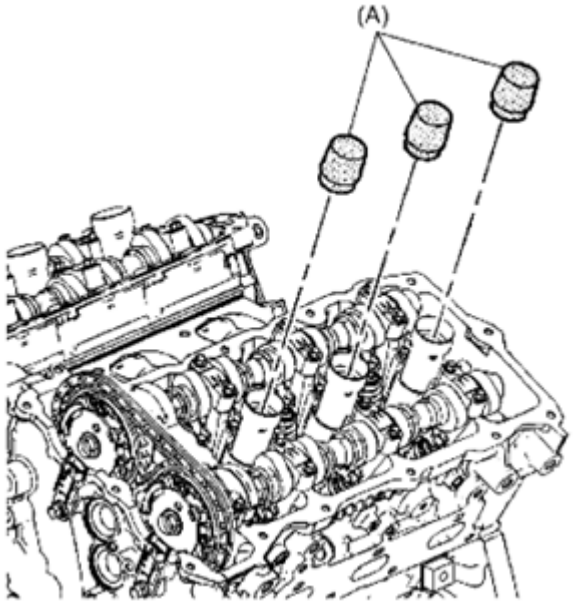



**Fig. 18: Identifying Spark Plug Tube Seal Guide**
**Courtesy of SUZUKI OF AMERICA CORP.**

12. Disassemble cylinder head cover, if necessary. See **CYLINDER HEAD COVER COMPONENTS**

**Installation**

Reverse removal procedure for installation noting the following.

- Install new O-ring.
- Install new spark plug hole gasket (1) using special tool as shown in figure [A] or [B].

**Special Tool**

**(A): 09913-75510**

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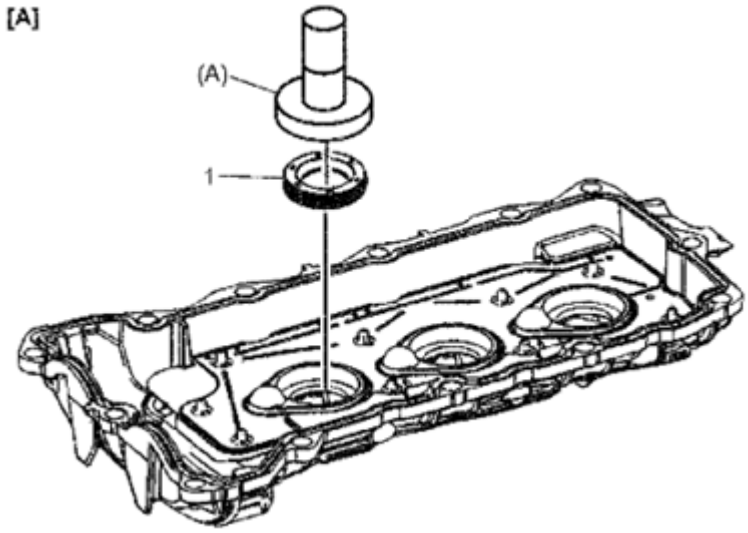



**Fig. 19: Identifying Spark Plug Hole Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Special Tool**

**(B): Oil seal installer (J-25254-A)**

**(C): Bearing and seal driver (J-5590)**

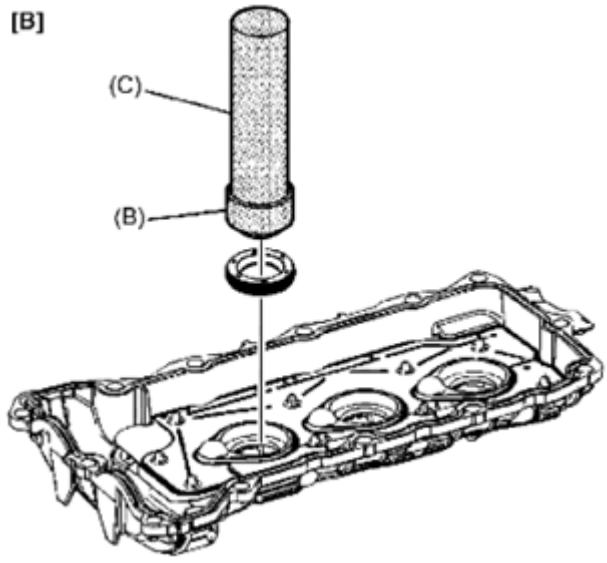



**Fig. 20: Identifying Bearing And Seal Driver**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Clean mating surface of cylinder head cover (bank 2) and plate. Apply sealant to plate mating surface as shown in figure.

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**"A": Sealant 99000-31290 (SUZUKI Bond No. 1217F)**

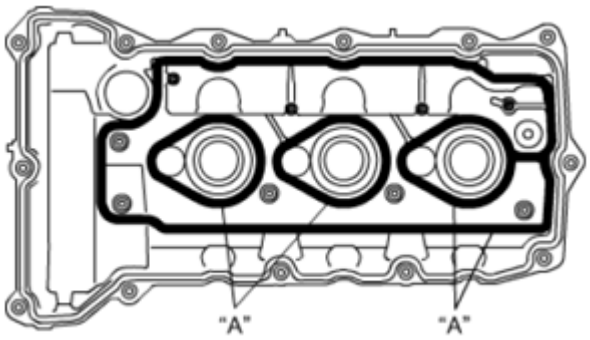
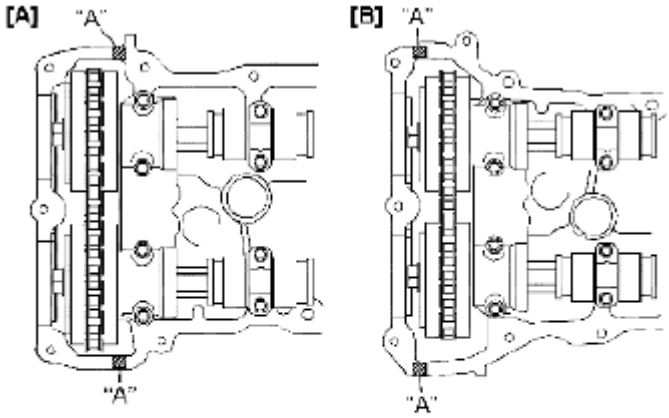



**Fig. 21: Applying Sealant To Plate Mating Surface**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Clean mating surface of cylinder head and cylinder head cover. Apply sealant to cylinder head and cylinder head cover mating surface as shown in figure.

**"A": Sealant 99000-31290 (SUZUKI Bond No. 1217F)**

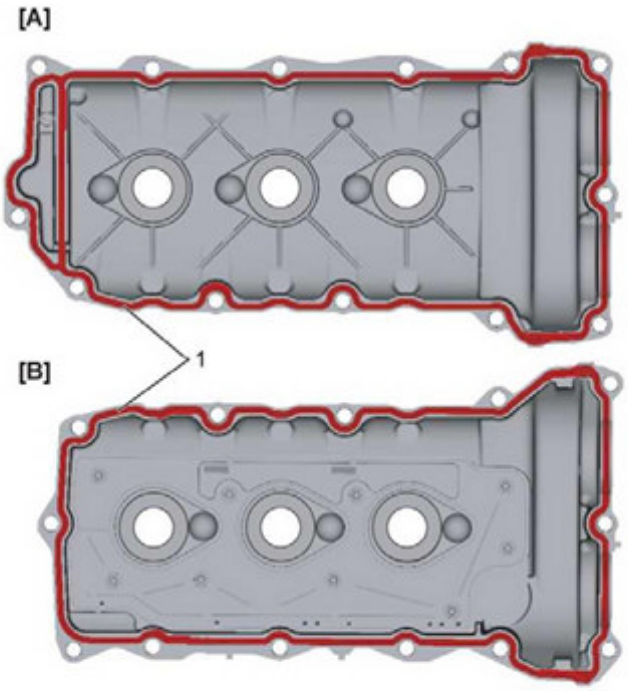



| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 22: Applying Sealant To Cylinder Head And Cylinder Head Cover Mating Surface**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Install new cylinder head cover gasket (1) as shown in figure.

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 23: Identifying Cylinder Head Cover Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

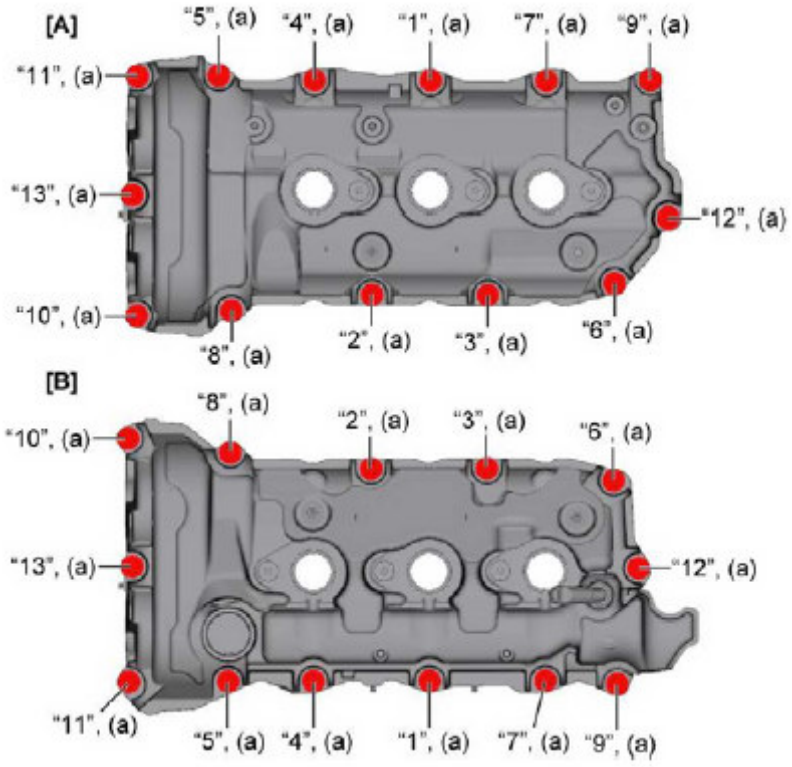
- Tighten cylinder head cover bolt to 10 N.m (1.0 kgf-m, 7.5 lbf-ft) in numerical order ("1" - "13") shown in figure evenly and gradually.

**NOTE:** **When installing cylinder head cover, use care so that cylinder head cover gasket or spark plug hole gaskets will not get out of place or fall off.**

**Tightening torque**

**Cylinder head cover bolt* (a): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 24: Identifying Cylinder Head Cover Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Remove special tool from spark plug tube.

  **Special Tool**

  **(A): Spark plug tube seal guide (EN-46101)**

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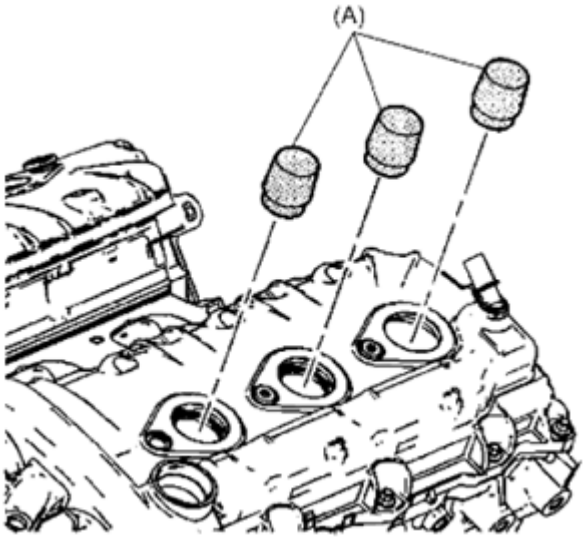


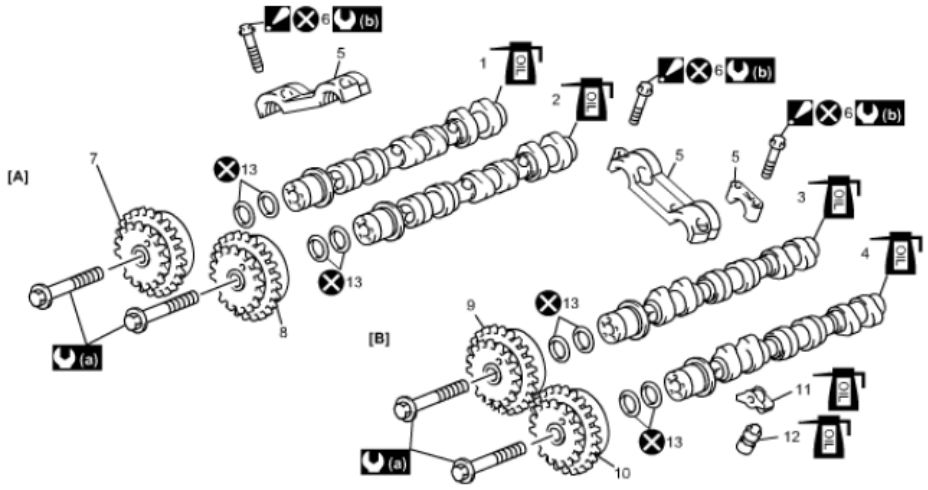

**Fig. 25: Identifying Spark Plug Tube Seal Guide**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Check to ensure that all removed parts are back in place.
- Upon completion of installation, turn ignition switch to ON position without starting engine and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

## CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM COMPONENTS

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

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| | | |
|---|---|---|
| [A]: Bank 1 | 5. Camshaft housing | 11. Valve rocker arm |
| [B]: Bank 2 | 6. Camshaft housing bolt :For tightening order, refer to *Camshaft, CMP Actuator, Valve Lash Adjuster and Valve Rocker Arm Removal and Installation:N32A*. | 12. Valve lash adjuster |
| 1. Exhaust camshaft (bank 1) | 7. Exhaust CMP actuator (bank 1) | 13. Seal ring |
| 2. Intake camshaft (bank 1) | 8. Intake CMP actuator (bank 1) | (a): 58 N·m (5.9 kgf-m, 43.0 lbf-ft) |
| 3. Intake camshaft (bank 2) | 9. Intake CMP actuator (bank 2) | (b): 10 N·m (1.0 kgf-m, 7.5 lbf-ft) |
| 4. Exhaust camshaft (bank 2) | 10. Exhaust CMP actuator (bank 2) | : Do not reuse. |

**Fig. 26: Identifying Camshaft, CMP Actuator, Valve Lash Adjuster And Valve Rocker Arm Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Tightening Order figure callout references:**

**CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM REMOVAL AND INSTALLATION**

**CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM REMOVAL AND INSTALLATION**

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*Reference:* **CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM COMPONENTS**

**Removal**

**NOTE: For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

1. Remove cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
2. Remove CMP sensor. See **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .
3. Make sure that the flat sections (1) of camshafts are parallel to cylinder head (2).

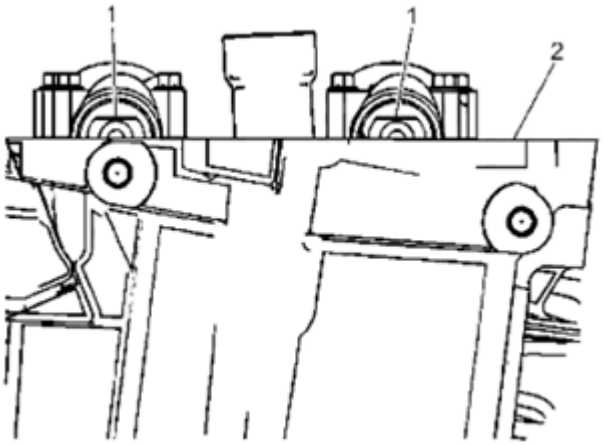



**Fig. 27: Identifying Flat Sections And Cylinder Head**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Hold timing chain using special tool as follows.

**CAUTION: Do not remove special tool until camshaft and timing chain are installed. If special tool is removed before operations are completed, timing chain may not be installed correctly.**

**Special Tool**

**(A): 09918-57800**

a. Insert special tool, align groove (1) of special tool and top surface (2) of cylinder head as shown in figure.

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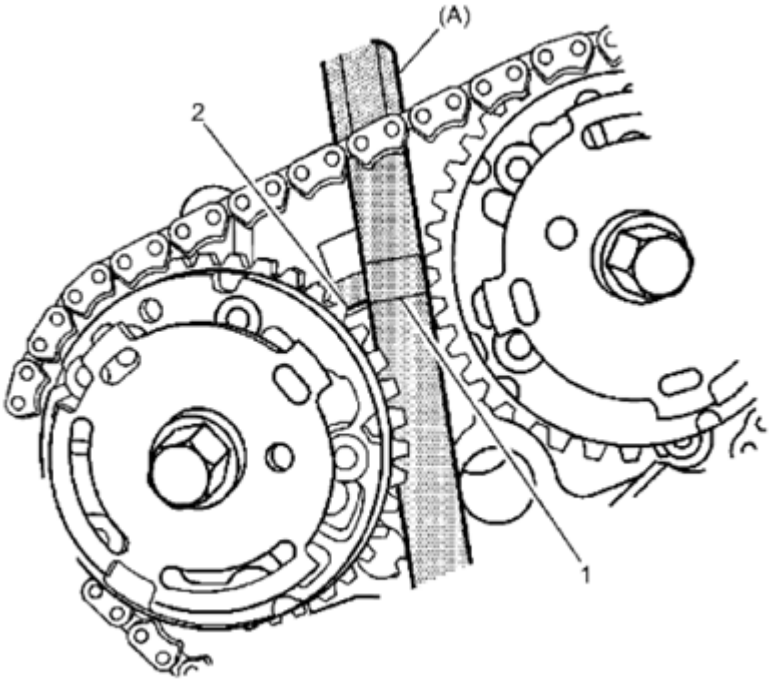



**Fig. 28: Aligning Groove Of Special Tool And Top Surface Of Cylinder Head**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Tighten special tool by hand until special tool hangs in timing chain (1) as shown in figure.

**NOTE: When tightening special tool, insert feet (3) of special tool into pocket (2) of timing chain to avoid misalignment of timing chain.**

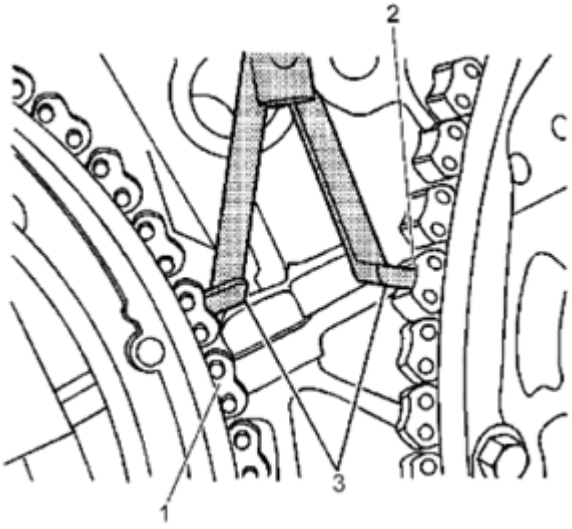



**Fig. 29: Identifying Timing Chain**
**Courtesy of SUZUKI OF AMERICA CORP.**

c. Rotating hexagonal section of intake and exhaust camshafts inward with wrench or the like, tighten

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special tool by hand and fix timing chain.

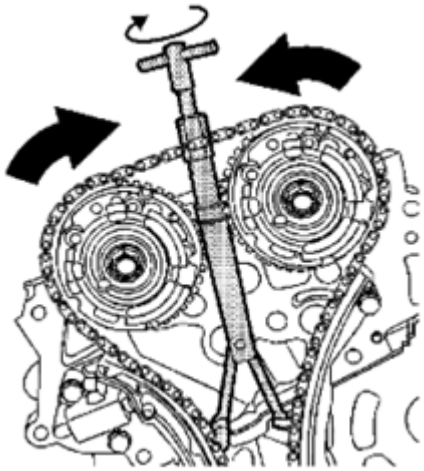


**Fig. 30: Rotating Hexagonal Section Of Intake And Exhaust Camshafts**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Give match marks (1) on CMP actuator and timing chain as shown in figure.

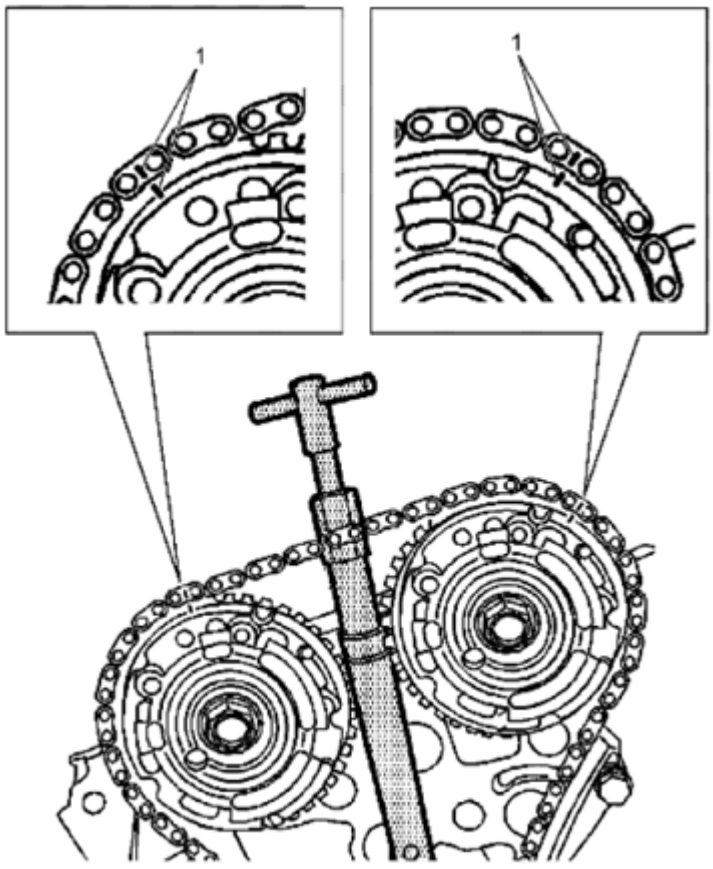



**Fig. 31: Identifying Match Marks On CMP Actuator**

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**Courtesy of SUZUKI OF AMERICA CORP.**

6. With hexagonal section of camshaft held stationary with wrench or the like, remove CMP actuator bolt (1).

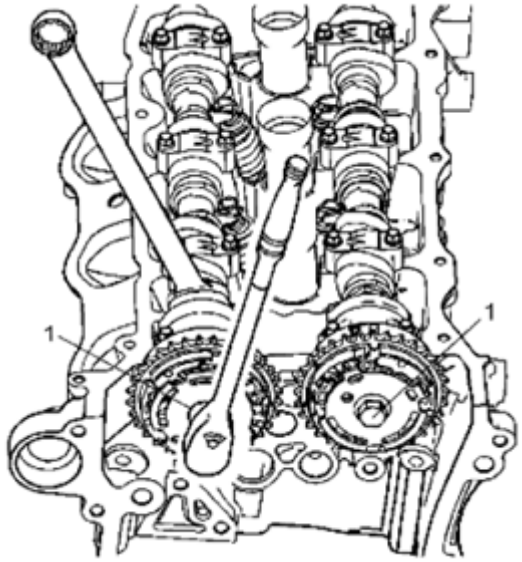
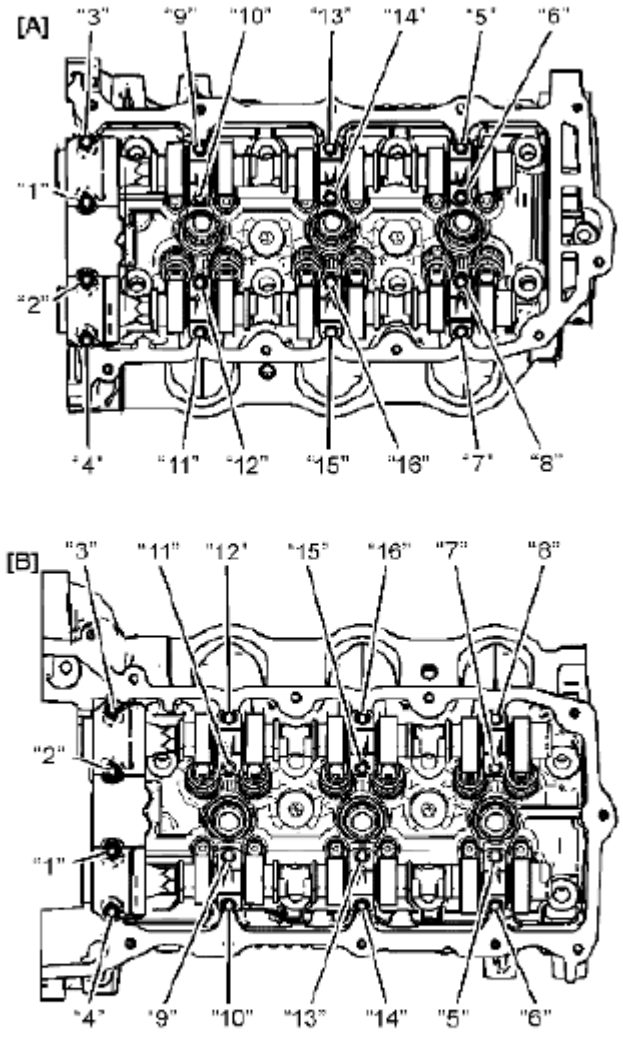



**Fig. 32: Removing CMP Actuator Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Loosen camshaft housing bolts in numerical order ("1" - "16") shown in figure, and remove intake and exhaust camshafts.

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 33: Identifying Camshaft Housing Bolts**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Remove intake and exhaust CMP actuators.
9. Remove valve lash adjusters (1) and valve rocker arms (2).

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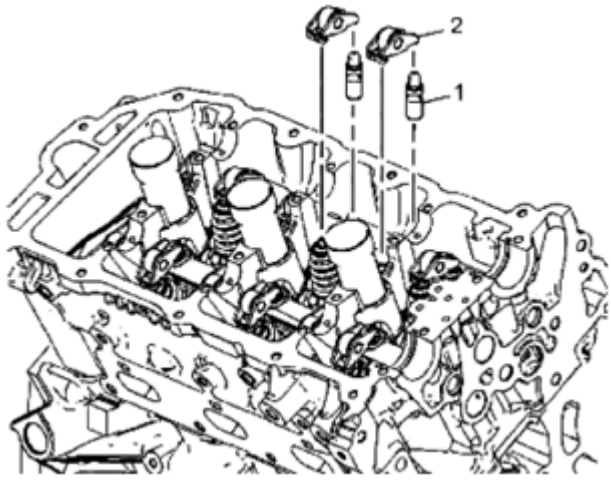



**Fig. 34: Identifying Valve Lash Adjusters And Valve Rocker Arms**
**Courtesy of SUZUKI OF AMERICA CORP.**

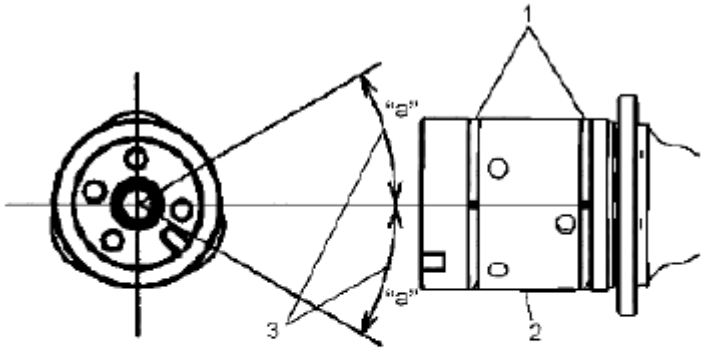
**Installation**

1. Apply engine oil to sliding part of valve lash adjusters and valve rocker arms, and install them to cylinder head.

**NOTE: Do not expose valve lash adjuster to excessive shock so as to prevent oil leakage.**

2. Install new seal rings (1) to camshafts (2) as shown in figure.

**NOTE: Position end gap of seal ring in a specified range.**

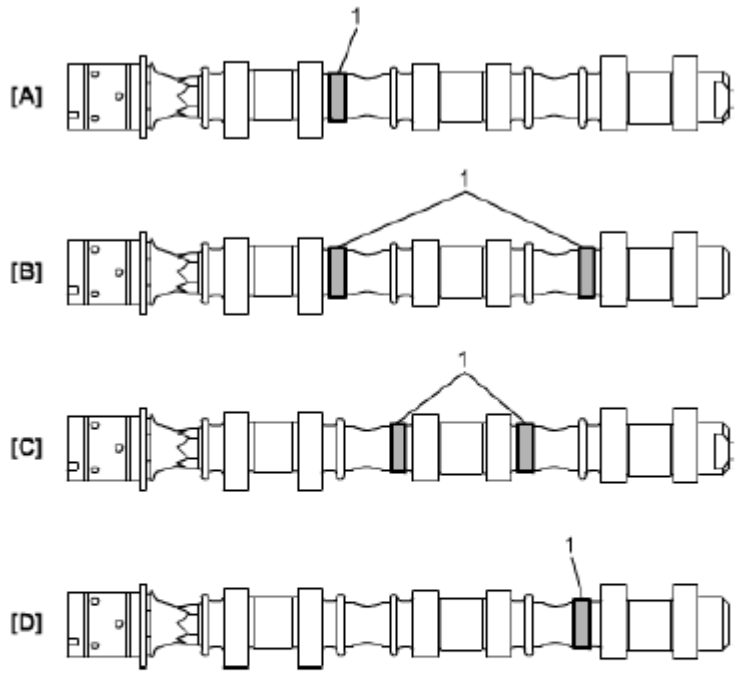



| | |
|---|---|
| "a": 30° | 3. End gap of seal ring installation position |

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**Fig. 35: Identifying Seal Ring Installation Position**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Confirm identification mark (1) of camshafts, to install them to the correct positions in cylinder heads.




| | | | |
|---|---|---|---|
| [A]: | Exhaust camshaft (bank 1) | [C]: | Intake camshaft (bank 2) |
| [B]: | Intake camshaft (bank 1) | [D]: | Exhaust camshaft (bank 2) |

**Fig. 36: Identifying Identification Mark Of Camshafts**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Apply engine oil to sliding part of camshafts, install camshafts to cylinder head as follows.
   a. Align match marks (1) on CMP actuators and timing chain, install intake and exhaust CMP actuators.

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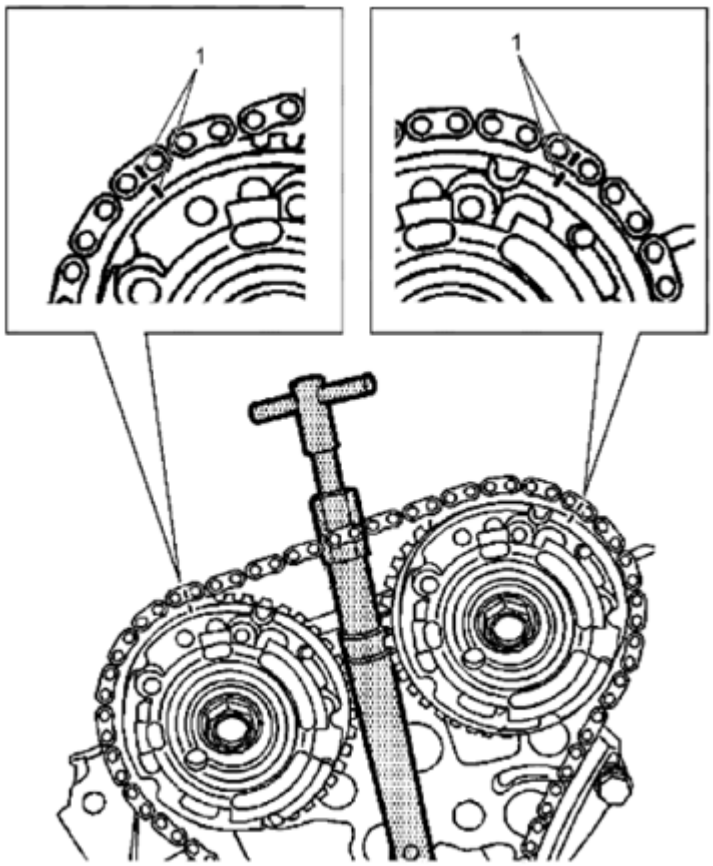



**Fig. 37: Aligning Match Marks On CMP Actuators**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Align lock pin (1) of CMP actuator with groove (2) of camshaft, install CMP actuator bolt by hand.

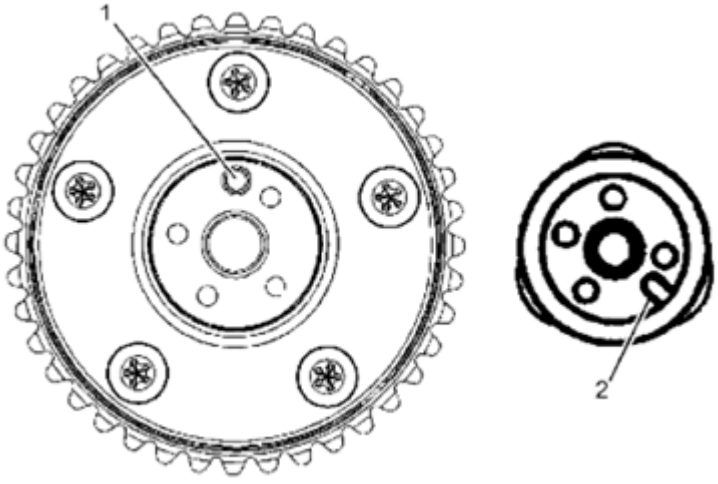



**Fig. 38: Aligning Lock Pin Of CMP Actuator With Groove Of Camshaft**
**Courtesy of SUZUKI OF AMERICA CORP.**

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c. That the flat sections (1) of camshafts are parallel to cylinder head (2).

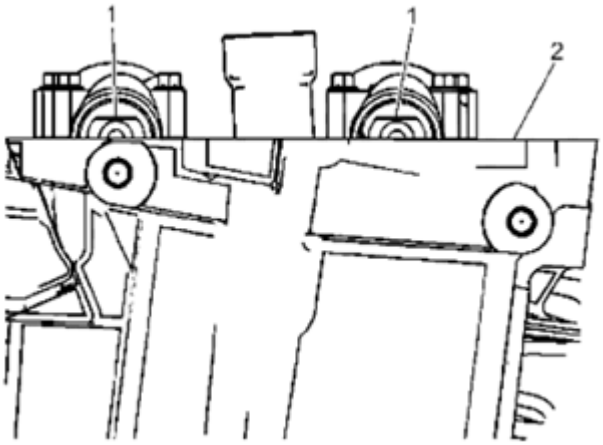
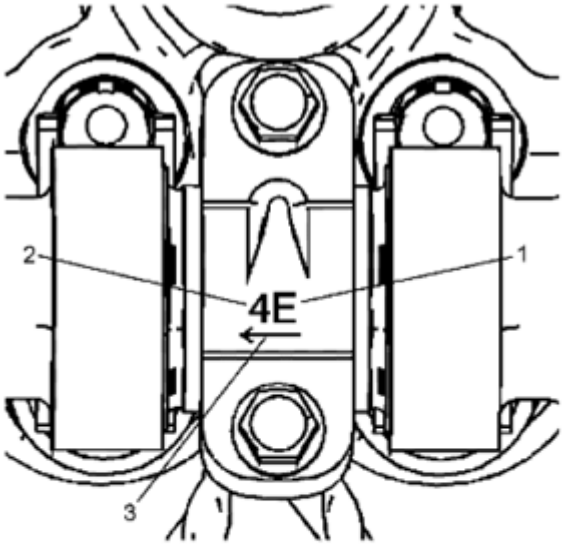



**Fig. 39: Identifying Flat Sections Of Camshafts**
**Courtesy of SUZUKI OF AMERICA CORP.**

d. Install camshaft housings as indicated by embossed mark.




| | |
|---|---|
| 1. | I: Intake side, E: Exhaust side |
| 2. | 1, 3, 5: Position from timing chain side of bank 1<br>2, 4, 6: Position from timing chain side of bank 2 |
| 3. | Timing chain side |

**Fig. 40: Identifying Mark On Camshaft Housings**
**Courtesy of SUZUKI OF AMERICA CORP.**

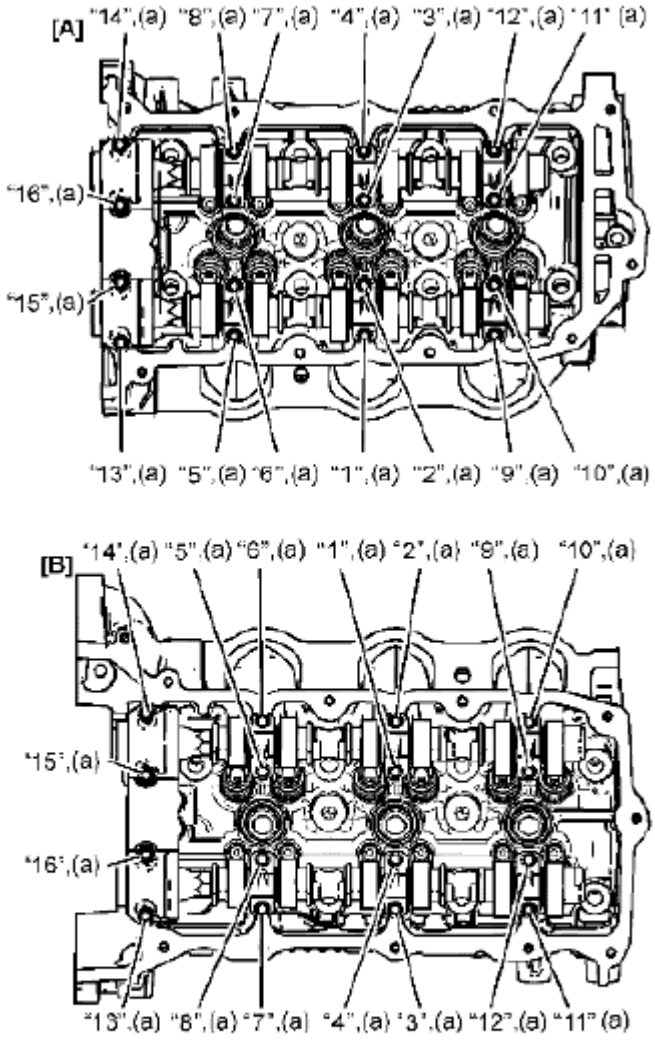
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e. Tighten new camshaft housing bolt to specified torque in numerical order ("1" - "16") shown in figure evenly and gradually.

**NOTE: Do not apply engine oil to camshaft housing bolt.**

**Tightening torque**

**Camshaft housing bolt* (a): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**




| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 41: Identifying Camshaft Housing Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

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f. With hexagonal section of camshaft held with wrench or the like, install CMP actuator bolt to specified torque.

**Tightening torque**

**CMP actuator bolt (a): 58 N.m (5.9 kg-m, 43.0 lbf-ft)**

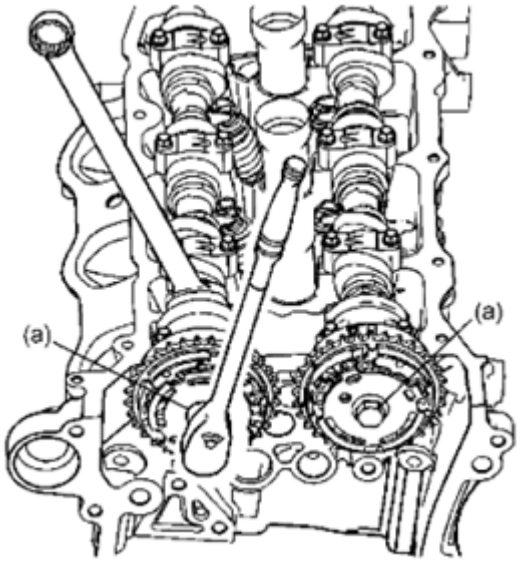



**Fig. 42: Tightening CMP Actuator Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Remove special tool.

**Special Tool**

**(A): 09918-57800**

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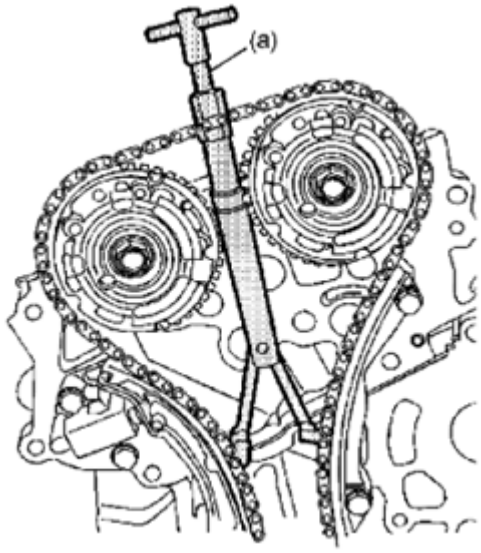



**Fig. 43: Identifying Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Install CMP sensors. See **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .
7. Install cylinder head covers. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
8. Install delivery pipe. See **FUEL INJECTOR REMOVAL AND INSTALLATION** .
9. Install ignition coils. See **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .
10. Install intake upper manifold. See **INTAKE MANIFOLD REMOVAL AND INSTALLATION**.
11. Refill cooling system with coolant. See **COOLING SYSTEM REFILLING** .
12. Install engine cover.
13. Connect negative cable to battery.
14. Upon completion of installation, turn ignition switch to ON position without starting engine and check for fuel leaks.
15. Finally, start engine and check for engine coolant leaks.

## CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM INSPECTION

*Reference:* **CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM REMOVAL AND INSTALLATION**

**Cam Wear**

Using micrometer, measure cam height "a". If measured height is lower than its limit, replace camshaft.

**Cam height "a" of camshaft**

**CAM HEIGHT SPECIFICATION**

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| Camshaft | Standard | Limit |
|---|---|---|
| Intake | 42.385 - 42.685 mm (1.6687 - 1.6805 in.) | 42.25 mm (1.6634 in.) |
| Exhaust | 42.425 - 42.725 mm (1.6703 - 1.6821 in.) | 42.25 mm (1.6634 in.) |

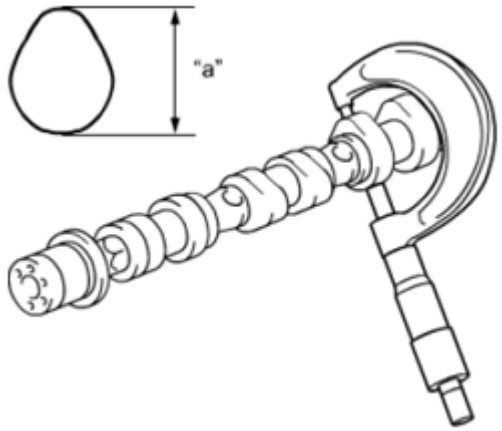



**Fig. 44: Measuring Cam Height**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Camshaft Runout**

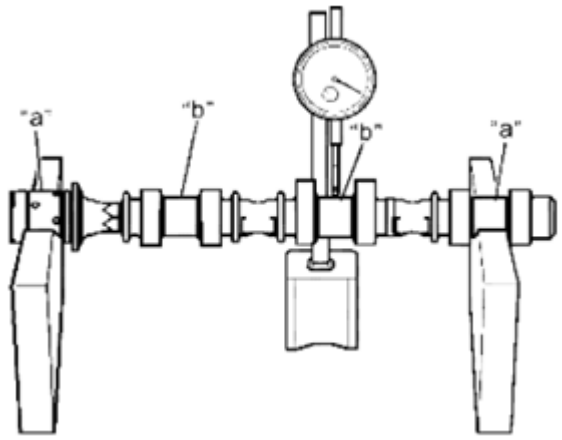
Set camshaft between two "V" blocks, and measure its runout using dial gauge.

If measured runout exceeds limit, replace camshaft.

**Camshaft runout limit**

**CAMSHAFT RUNOUT SPECIFICATION**

| Measurement position | Limit |
|---|---|
| "a" | 0.025 mm (0.0010 in.) |
| "b" | 0.050 mm (0.0020 in.) |




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**Fig. 45: Measuring Camshaft Runout**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Camshaft Journal Wear**

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

  If any defective condition is found, replace camshaft or cylinder head with housings. Never replace cylinder head without replacing housings.

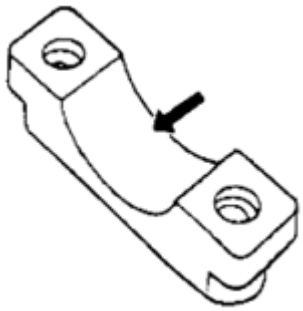


**Fig. 46: Identifying Camshaft Journals Pitting Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Check clearance using gauging plastic as follows.

1. Clean housings and camshaft journals.
2. Remove all valve lash adjusters and valve rocker arms.
3. Install camshafts to cylinder head.
4. Place a piece of gauging plastic to full width of journal of camshaft (parallel to camshaft).
5. Install camshaft housing referring to steps 2) to 4) of "Installation" under **CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM REMOVAL AND INSTALLATION**.
6. Remove housing, and using scale (2) on gauging plastic envelop, measure gauging plastic (1) width at its widest point.

   **Camshaft journal clearance**

   **CAMSHAFT JOURNAL CLEARANCE SPECIFICATION**

| Standard | Limit |
|---|---|
| 0.040 - 0.084 mm (0.0016 - 0.0033 in.) | 0.10 mm (0.0039 in.) |


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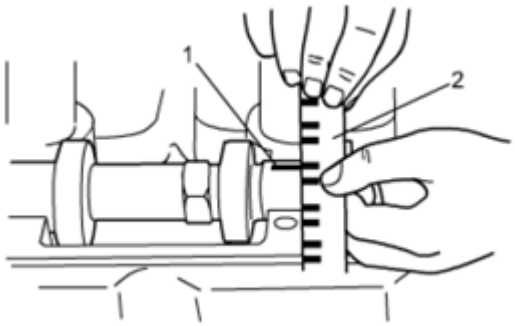



**Fig. 47: Measuring Gauging Plastic Width Widest Point**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. 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 diameter [A]**

**CAMSHAFT JOURNAL DIAMETER SPECIFICATION**

| Item | Standard |
|---|---|
| Intake and Exhaust side No. 1 housing | 34.936 - 34.960 mm (1.3754 - 1.3764 in.) |
| Others | 26.936 - 26.960 mm (1.0605 - 1.0614 in.) |

**Camshaft journal housing bore [B]**

**CAMSHAFT JOURNAL HOUSING BORE SPECIFICATION**

| Item | Standard |
|---|---|
| Intake and Exhaust side No. 1 housing | 35.000 - 35.020 mm (1.3780 - 1.3787 in.) |
| Others | 27.000 - 27.020 mm (1.0630 - 1.0638 in.) |

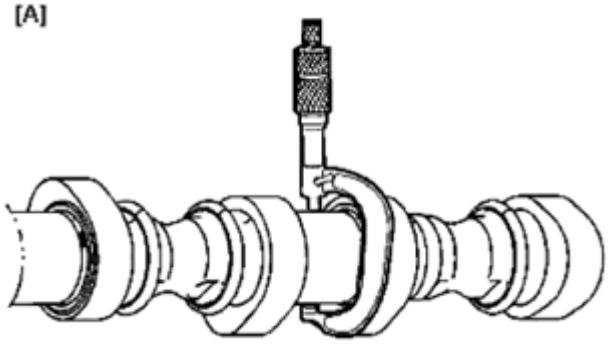



**Fig. 48: Measuring Camshaft Journal Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

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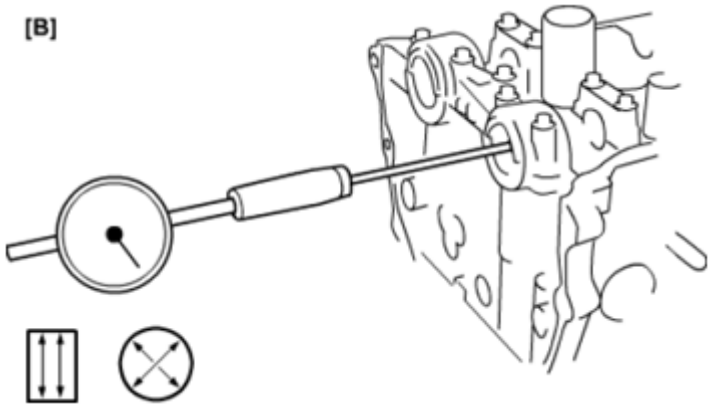



**Fig. 49: Measuring Camshaft Journal Housing Bore**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Camshaft Thrust Clearance**

1. Install intake and exhaust camshaft without valve lash adjuster and valve rocker arm, measure intake and exhaust camshaft housing thrust clearance using dial gauge.

   If measured clearance exceed limit, replace camshaft or cylinder head.

   **Camshaft housing thrust clearance**

**CAMSHAFT HOUSING THRUST CLEARANCE SPECIFICATION**

| | Camshaft housing thrust clearance |
|---|---|
| Standard | 0.045 - 0.215 mm (0.0018 - 0.0085 in.) |
| Limit | 0.50 mm (0.0020 in.) |

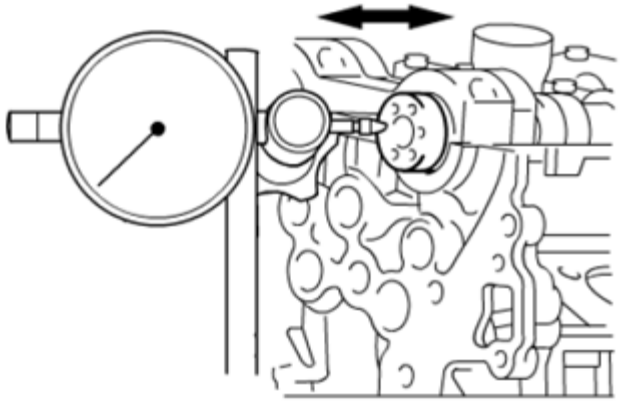


**Fig. 50: Measure Intake And Exhaust Camshaft Housing Thrust Clearance**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Valve Lash Adjuster and Valve Rocker Arm**

Check valve rocker arm (1) and valve lash adjuster (2) for pitting, scratches, wear or damage.

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If any defective condition is found, replace.

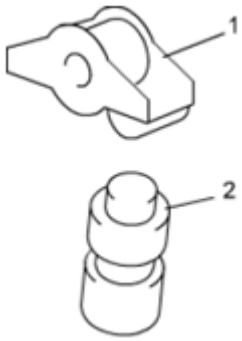



**Fig. 51: Identifying Valve Lash Adjuster And Valve Rocker Arm**
**Courtesy of SUZUKI OF AMERICA CORP.**

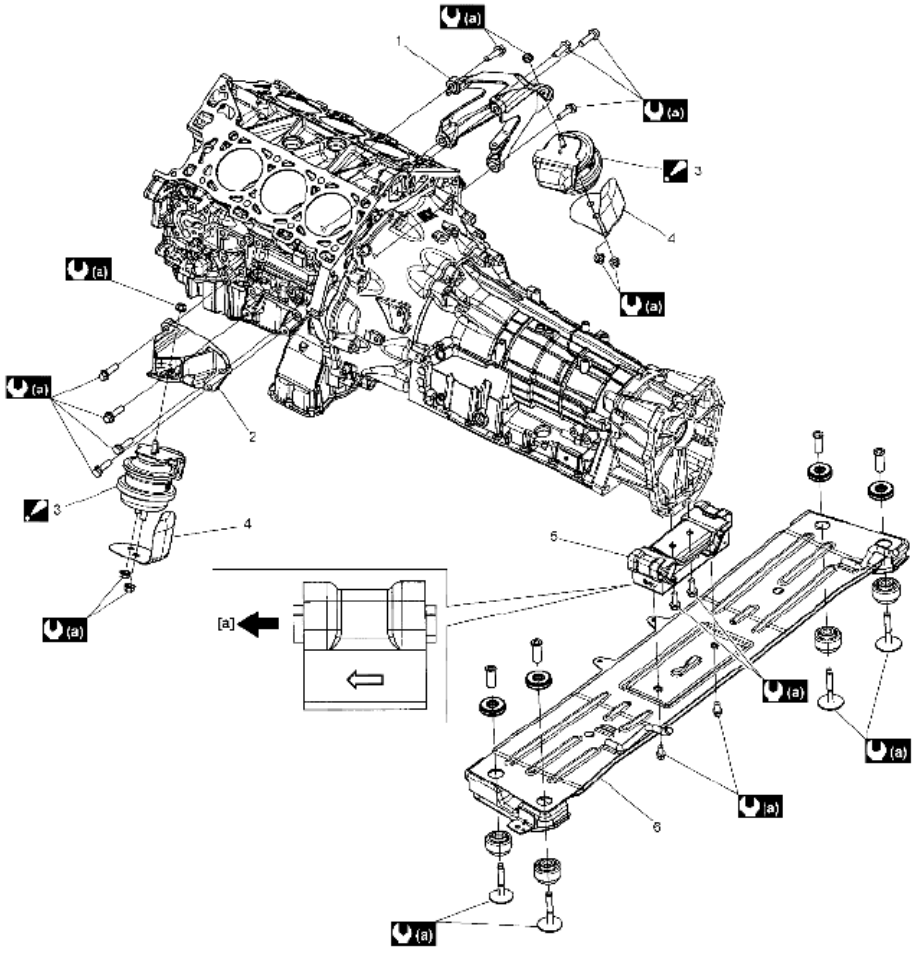
**CMP Actuator**

Check CMP actuator for pitting, scratches, wear or damage.

If any defective condition is found, replace.

**ENGINE MOUNTINGS COMPONENTS**

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| | | |
|---|---|---|
| 1. Engine front mounting right bracket | 4. Engine front mounting cover | [a]: Forward |
| 2. Engine front mounting left bracket | 5. Engine rear mounting | (a): 55 N·m (5.6 kgf-m, 40.5 lbf-ft) |
| 3. Engine front mounting :Be sure to align dowel pin with dowel hole of engine front mounting bracket. | 6. Engine rear mounting member | |

**Fig. 52: Identifying Engine Mountings Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

## ENGINE ASSEMBLY REMOVAL AND INSTALLATION

### Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELIEF PROCEDURE** .
2. Remove battery.
3. Disconnect ECM connectors. See **ENGINE CONTROL MODULE (ECM) REMOVAL AND INSTALLATION** .
4. Remove engine cover.

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**CAUTION: When removing engine cover, be sure to lift up its front side to prevent breakage of engine cover claws.**

5. Remove engine front under cover and engine rear under cover.
6. Drain engine oil. See **ENGINE OIL AND FILTER CHANGE** .
7. Drain A/T fluid (5A/T model). See **A/T FLUID CHANGE** .
8. Drain front differential oil (4WD model). See **FRONT DIFFERENTIAL OIL CHANGE** .
9. Drain transfer oil (4WD model). See **TRANSFER OIL CHANGE** .
10. Drain coolant. See **COOLING SYSTEM DRAINING** .
11. Drain P/S fluid. See **P/S FLUID CHANGE** .
12. Recover refrigerant from A/C system. See **OPERATION PROCEDURE FOR CHARGING A/C WITH REFRIGERANT** .
13. Remove air cleaner assembly and air cleaner suction pipe. See **AIR CLEANER ASSEMBLY REMOVAL AND INSTALLATION**.
14. Disconnect suction hose and discharge hose from compressor. See **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
15. Remove glove box (1) and instrument panel under cover (2).

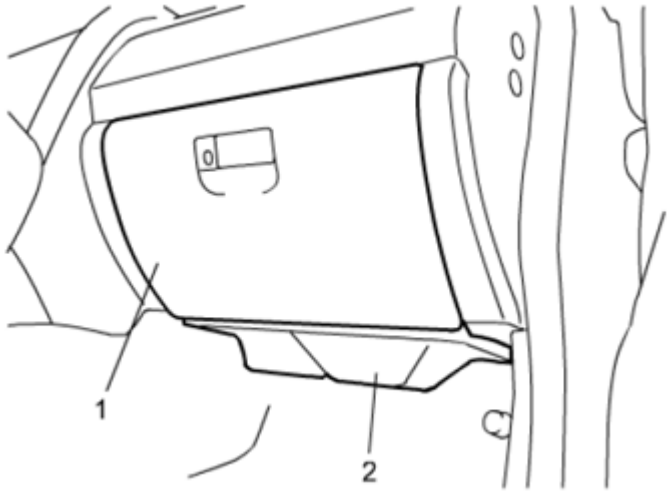



**Fig. 53: Identifying Glove Box And Instrument Panel Under Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

16. Remove P/S reservoir tank (1) from bracket.
17. Remove fuse block (2) from bracket.
18. Remove engine wire harness clamps from vehicle body.
19. Disconnect the following electric wires and connectors.
    - Connector from relay box (3)
    - Ground terminal (4)
    - Radiator cooling fan connector (5)

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- Fuse block connector (6)
- TCM connector (7)
- 4WD Control Module connector (4WD model) (8)
- Height sensor connector (9)

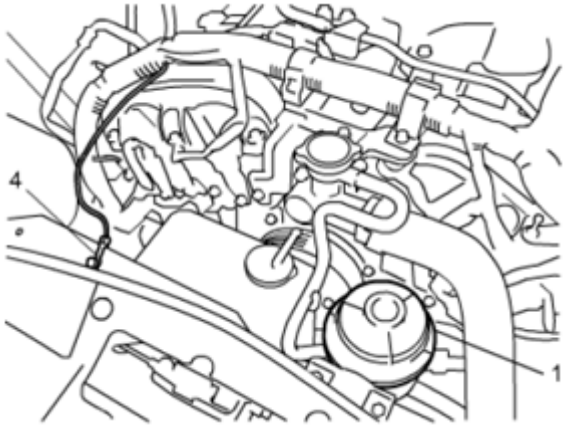



**Fig. 54: Identifying Ground Terminal And P/S Reservoir Tank**
**Courtesy of SUZUKI OF AMERICA CORP.**

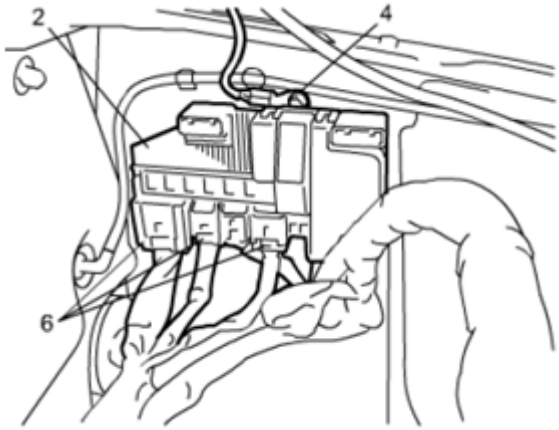



**Fig. 55: Identifying Fuse Block And Fuse Block Connector**
**Courtesy of SUZUKI OF AMERICA CORP.**

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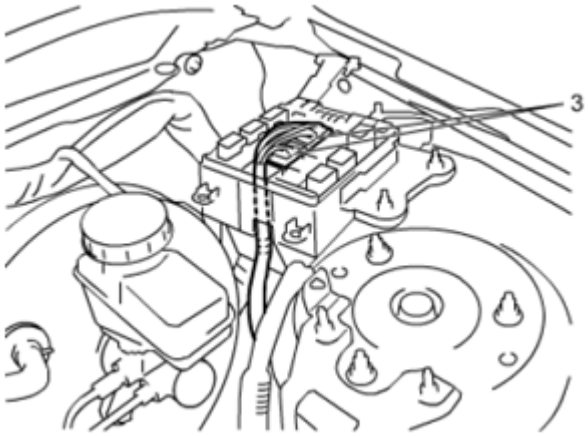



**Fig. 56: Identifying Relay Box**
**Courtesy of SUZUKI OF AMERICA CORP.**

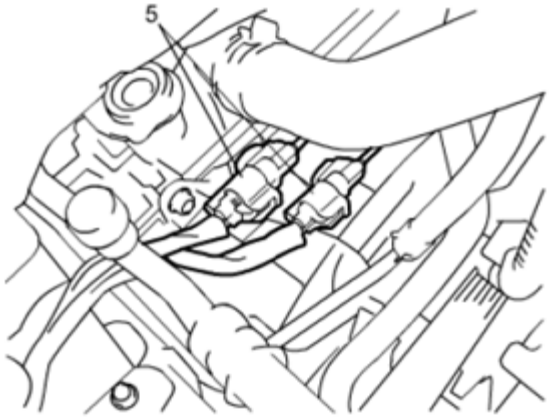



**Fig. 57: Identifying Radiator Cooling Fan Connector**
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**Fig. 58: Identifying TCM Connector And 4WD Control Module Connector**
**Courtesy of SUZUKI OF AMERICA CORP.**


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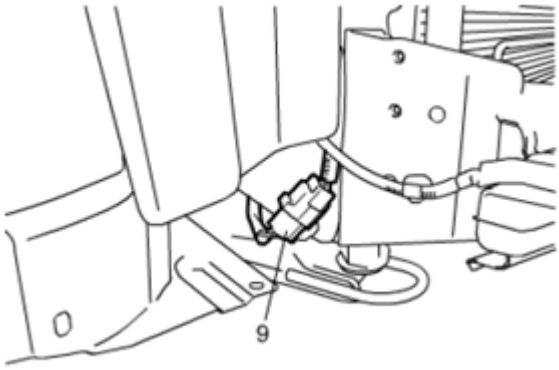



**Fig. 59: Identifying Height Sensor Connector**
**Courtesy of SUZUKI OF AMERICA CORP.**

20. Disconnect engine harness from cabin.
21. Disconnect the following hoses.
    - Brake booster hose (1)
    - Heater hoses (2)
    - Fuel feed hose (3)

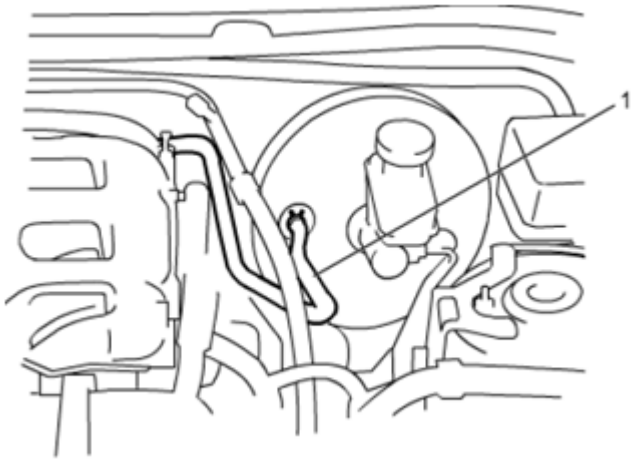



**Fig. 60: Identifying Brake Booster Hose**
**Courtesy of SUZUKI OF AMERICA CORP.**

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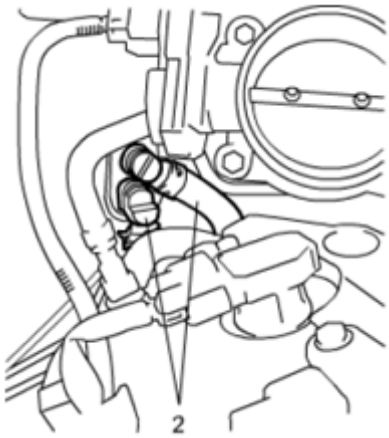



**Fig. 61: Identifying Heater Hoses**
**Courtesy of SUZUKI OF AMERICA CORP.**

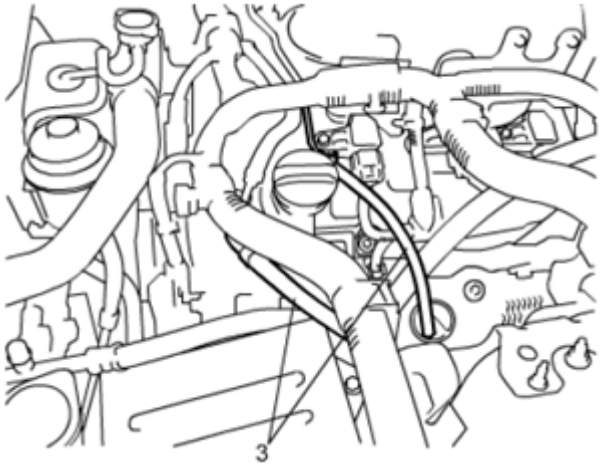



**Fig. 62: Identifying Fuel Feed Hose**
**Courtesy of SUZUKI OF AMERICA CORP.**

22. Remove front bumper. See **FRONT BUMPER COMPONENTS** .
23. Remove liquid pipe (1) from condenser.

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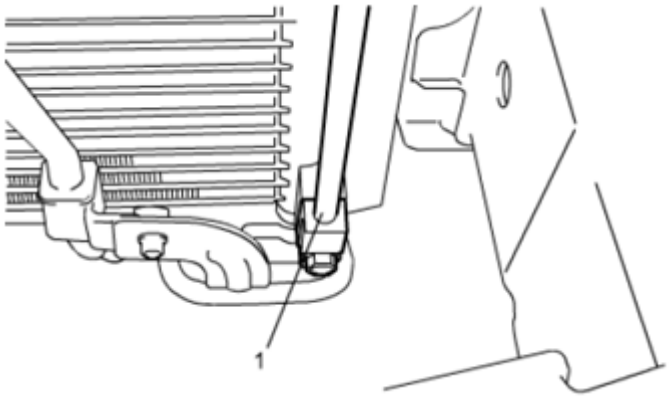



**Fig. 63: Identifying Liquid Pipe**
**Courtesy of SUZUKI OF AMERICA CORP.**

24. Disconnect steering lower shaft assembly from pinion shaft of P/S gear case assembly. See **STEERING LOWER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
25. Remove exhaust center pipe and exhaust No. 1 pipe. See **EXHAUST PIPE AND MUFFLER REMOVAL AND INSTALLATION** .
26. Remove front propeller shaft (4WD model) and rear propeller shaft. See **PROPELLER SHAFT REMOVAL AND INSTALLATION** .
27. Remove front drive shaft. See **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
28. Disconnect select cable from transmission range sensor and bracket (5A/T model). See **SELECT CABLE COMPONENTS** .
29. Before removing engine with transmission, transfer, front suspension frame and engine rear mounting member from engine compartment, make sure all hoses, electric wires and cables from them are disconnected.
30. Support front suspension frame and engine rear mounting member using engine jack.
31. Remove front suspension frame mounting bolts and engine rear mounting member bolts.
32. Lower engine with transmission, transfer, front suspension frame and engine rear mounting member from engine compartment.
33. Remove engine harness from engine, transmission and transfer.
34. Disconnect high pressure hose and suction hose from P/S pump. See **P/S HOSE/PIPE COMPONENTS** .
35. Disconnect transmission from engine (5A/T model). See **AUTOMATIC TRANSMISSION UNIT COMPONENTS** .

**NOTE: Only when over hauling engine proceed to Step 36) - 43).**

36. Using lifting device, support engine.
37. Remove intake manifold. See **INTAKE MANIFOLD REMOVAL AND INSTALLATION**.
38. Remove exhaust manifold. See **EXHAUST MANIFOLD REMOVAL AND INSTALLATION (N32A)** .

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39. Remove starting motor. See **STARTING MOTOR REMOVAL AND INSTALLATION** .
40. Remove generator. See **GENERATOR REMOVAL AND INSTALLATION** .
41. Remove P/S pump. See **P/S PUMP REMOVAL AND INSTALLATION** .
42. Remove A/C compressor. See **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
43. Remove front suspension frame. See **FRONT SUSPENSION FRAME, STABILIZER BAR AND/OR BUSHINGS REMOVAL AND INSTALLATION** .

**Installation**

1. Using lifting device, support engine.
2. Install front suspension frame to engine. See **FRONT SUSPENSION FRAME, STABILIZER BAR AND/OR BUSHINGS REMOVAL AND INSTALLATION** .
3. Install A/C compressor. See **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
4. Install P/S pump. See **P/S PUMP REMOVAL AND INSTALLATION** .
5. Install generator. See **GENERATOR REMOVAL AND INSTALLATION** .
6. Install starting motor. See **STARTING MOTOR REMOVAL AND INSTALLATION** .
7. Install exhaust manifold. See **EXHAUST MANIFOLD REMOVAL AND INSTALLATION (N32A)** .
8. Install intake manifold. See **INTAKE MANIFOLD REMOVAL AND INSTALLATION**.
9. Connect transmission to engine (5A/T model). See **AUTOMATIC TRANSMISSION UNIT COMPONENTS** .
10. Connect high pressure hose and suction hose to P/S pump. See **P/S HOSE/PIPE COMPONENTS** .
11. Install engine harness to engine, transmission and transfer.
12. Lift engine with transmission, transfer, front suspension frame and engine rear mounting member into engine compartment. See **ENGINE MOUNTINGS COMPONENTS**.
13. Tighten front suspension frame bolt. See **FRONT SUSPENSION FRAME, STABILIZER BAR AND/OR BUSHINGS COMPONENTS** .
14. Remove engine jack.
15. Connect select cable to transmission range sensor and bracket (5A/T model). See **SELECT CABLE COMPONENTS** .
16. Install front drive shaft. See **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
17. Install front propeller shaft (4WD model) and rear propeller shaft. See **PROPELLER SHAFT REMOVAL AND INSTALLATION** .
18. Install exhaust center pipe and exhaust No. 1 pipe. See **EXHAUST PIPE AND MUFFLER REMOVAL AND INSTALLATION** .
19. Connect steering lower shaft assembly to pinion shaft of P/S gear case assembly. See **STEERING LOWER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
20. Install liquid pipe (1) to condenser. See **A/C CONDENSER ASSEMBLY REMOVAL AND INSTALLATION** .
21. Install front bumper. See **FRONT BUMPER COMPONENTS** .
22. Connect suction hose and discharge hose to compressor. See **COMPRESSOR ASSEMBLY**

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**REMOVAL AND INSTALLATION** .

23. Put back disconnected hoses, cables and electric wires for connection noting the following.
    - Tighten ground terminal bolts to specified torque.

    **Tightening torque**

    **Ground terminal bolt (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)**




**Fig. 64: Identifying Ground Terminal Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

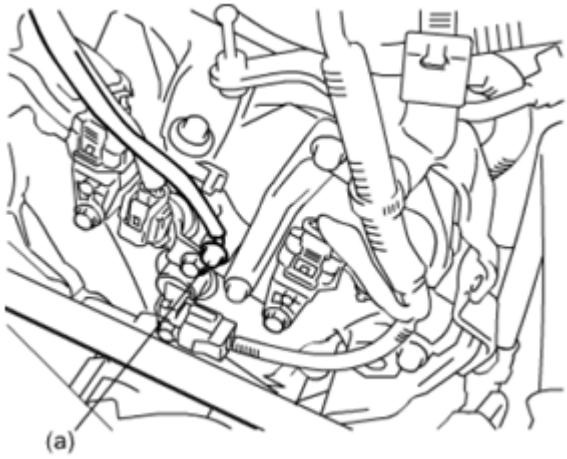



**Fig. 65: Identifying Ground Terminal Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

24. Install glove box (1) and instrument panel under cover (2).

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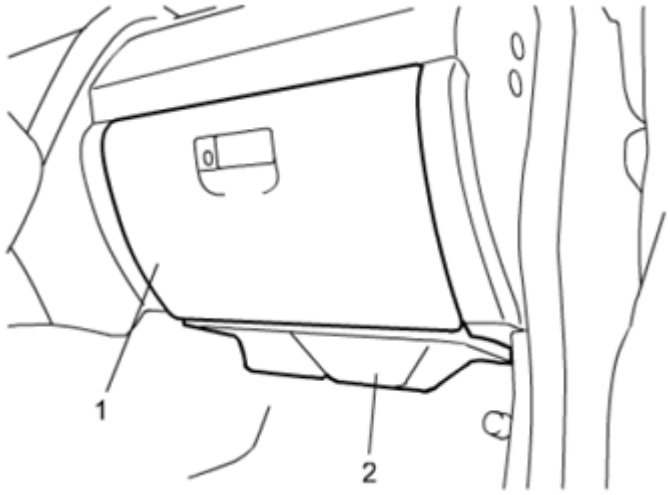
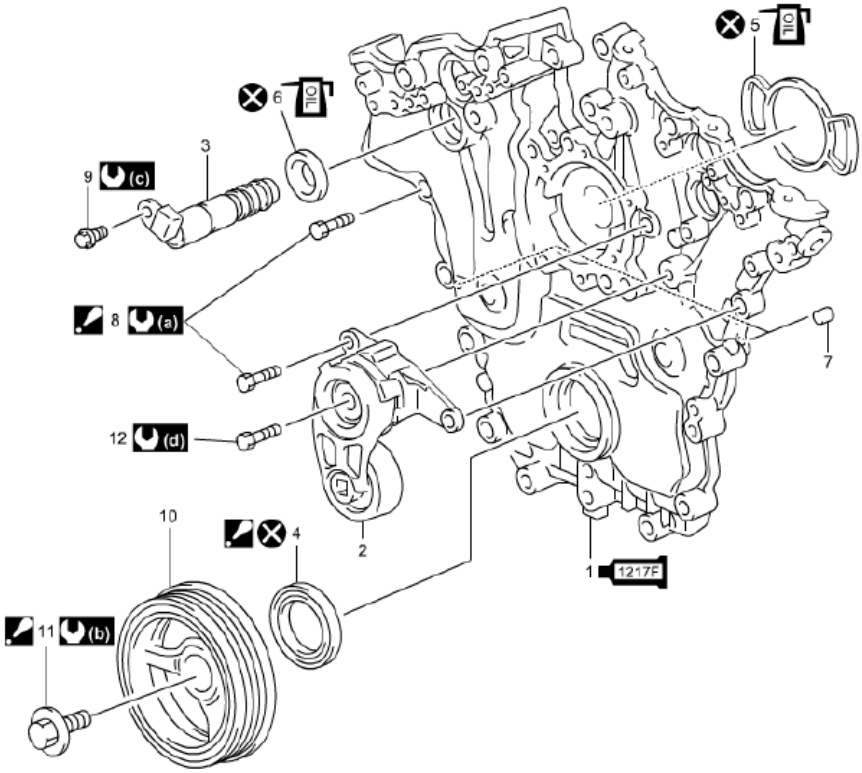



**Fig. 66: Identifying Glove Box And Instrument Panel Under Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

25. Install air cleaner assembly and air cleaner suction pipe. See **AIR CLEANER ASSEMBLY REMOVAL AND INSTALLATION**.
26. Check to ensure that all removed parts are back in place.
27. Evacuate and charge the A/C system. See **OPERATION PROCEDURE FOR CHARGING A/C WITH REFRIGERANT** .
28. Refill P/S system. See **P/S FLUID CHANGE** .
29. Refill cooling system with coolant. See **COOLING SYSTEM REFILLING** .
30. Refill transfer (4WD model). See **TRANSFER OIL CHANGE** .
31. Refill front differential (4WD model). See **FRONT DIFFERENTIAL OIL CHANGE** .
32. Refill A/T (5A/T model). See **A/T FLUID CHANGE** .
33. Refill engine with engine oil. See **ENGINE OIL AND FILTER CHANGE** .
34. Install engine front under cover and engine rear under cover.
35. Install engine cover.
36. Connect ECM connectors. See **ENGINE CONTROL MODULE (ECM) REMOVAL AND INSTALLATION** .
37. Install battery.

**TIMING CHAIN COVER COMPONENTS**

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| | | |
|---|---|---|
| 1217F 1. Timing chain cover : Apply sealant 99000-31290 referring to *Timing Chain Cover Removal and Installation:N32A*. | 7. Dowel pin | (a): 20 N·m → +60° (20.0 kgf-m → +60°, 15.0 lbf-ft → +60°) |
| 2. Accessory drive belt tensioner | 8. Timing chain cover bolt : For tightening order, refer to *Timing Chain Cover Removal and Installation:N32A*. | (b): 120 N·m → 0 N·m → 100 N·m → +150° (12.2 kgf-m → 0 kgf-m → 10.2 kgf-m → +150°, 88.5 lbf-ft → 0 lbf-ft → 74.0 lbf-ft → +150°) |
| 3. OCV | 9. OCV bolt | (c): 25 N·m (2.5 kgf-m, 18.5 lbf-ft) |
| 4. Crankshaft oil seal : Do not apply engine oil and grease. | 10. Crankshaft pulley | (d): 10 N·m (1.0 kgf-m, 7.5 lbf-ft) |
| OIL 5. Water pump inner gasket : Apply engine oil | 11. Crankshaft pulley bolt : For tightening order, refer to *Timing Chain Cover Removal and Installation:N32A*. | : Do not reuse. |
| OIL 6. Oil seal : Apply engine oil to oil seal lip. | 12. Accessory drive belt tensioner bolt | |

**Fig. 67: Identifying Timing Chain Cover Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Tightening Order/Removal and Installation figure callout references:**

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1), 8), 11): **TIMING CHAIN COVER REMOVAL AND INSTALLATION**

## TIMING CHAIN COVER REMOVAL AND INSTALLATION

***Reference:*** **TIMING CHAIN COVER COMPONENTS**

**CAUTION:**
- **Keep working table, tools and hands clean while overhauling.**
- **Use special care to handle aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Keep them always clean.**

**Removal**

1. Remove engine assembly from vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
3. Remove cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
4. Remove water pump pulley. See **WATER PUMP REMOVAL AND INSTALLATION** .
5. Remove P/S pump bracket. See **P/S PUMP REMOVAL AND INSTALLATION** .
6. Remove OCV. See **OCV REMOVAL AND INSTALLATION**.
7. Remove belt idler arm from generator bracket.
8. Remove water outlet pipe No. 1 (1), water outlet pipe No. 2 (2), O-ring (3) and gasket (4).

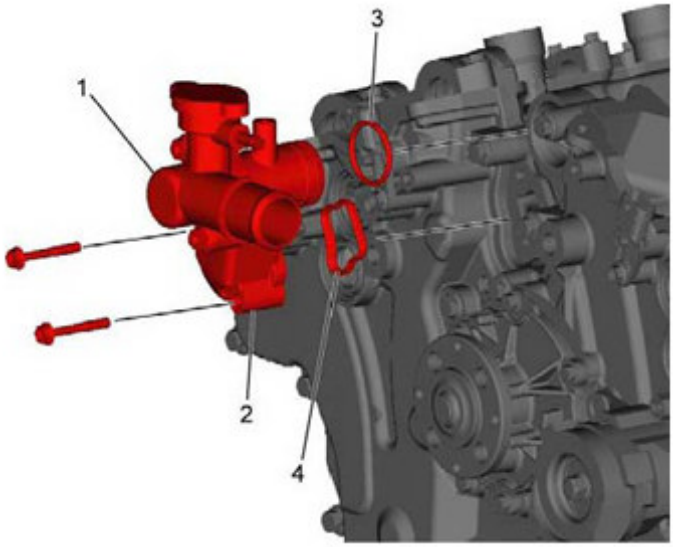



**Fig. 68: Identifying Water Outlet Pipe No. 1, Water Outlet Pipe No. 2, O-Ring And Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Lock flywheel with special tool as shown in figure.

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**Special Tool**

**(A): 09916-97830**

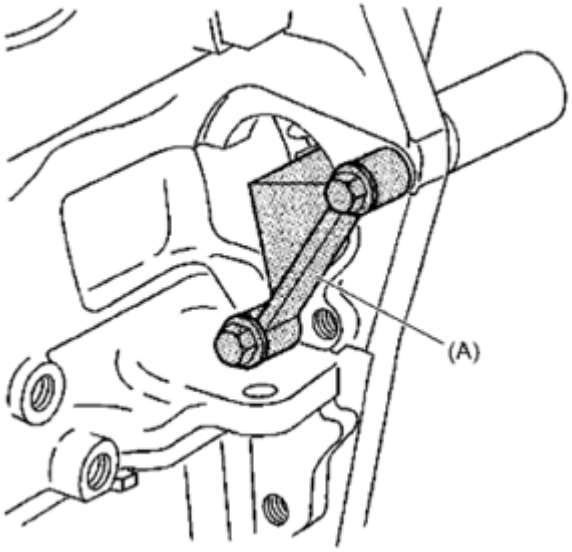



**Fig. 69: Locking Flywheel With Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Remove crankshaft pulley bolt (1).

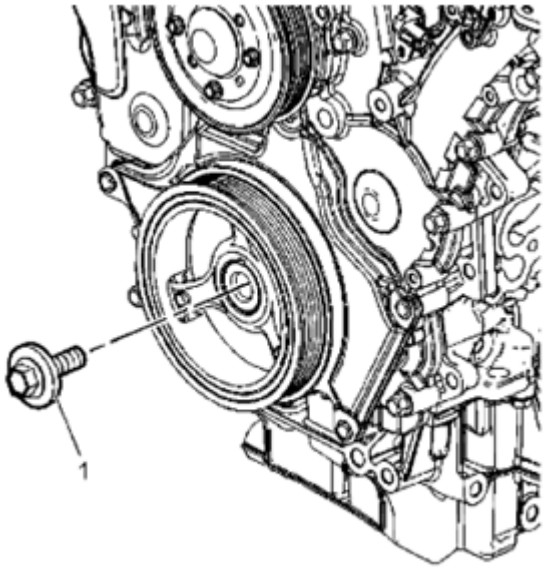



**Fig. 70: Identifying Crankshaft Pulley Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

11. Using special tools, remove crankshaft pulley (1) as shown in figure.

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**Special Tool**

**(A): 09910-97810**

**(B): 09912-37830**

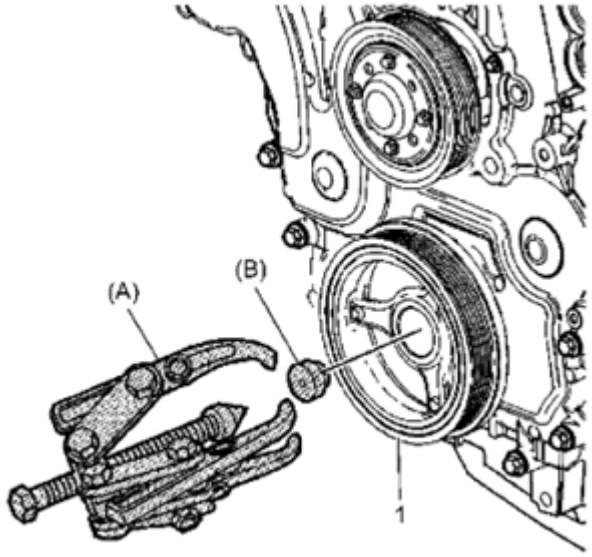



**Fig. 71: Removing Crankshaft Pulley**
**Courtesy of SUZUKI OF AMERICA CORP.**

12. Remove accessory drive belt tensioner (1) from timing chain cover.

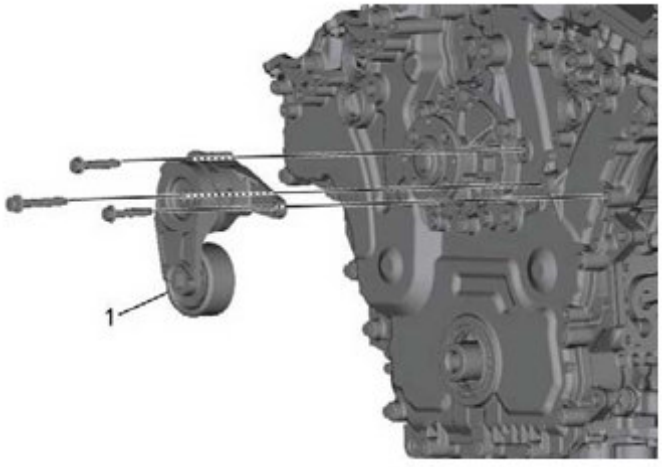



**Fig. 72: Identifying Accessory Drive Belt Tensioner**
**Courtesy of SUZUKI OF AMERICA CORP.**

13. Remove timing chain cover.
14. Remove water pump inner gasket (1) from timing chain cover (2).

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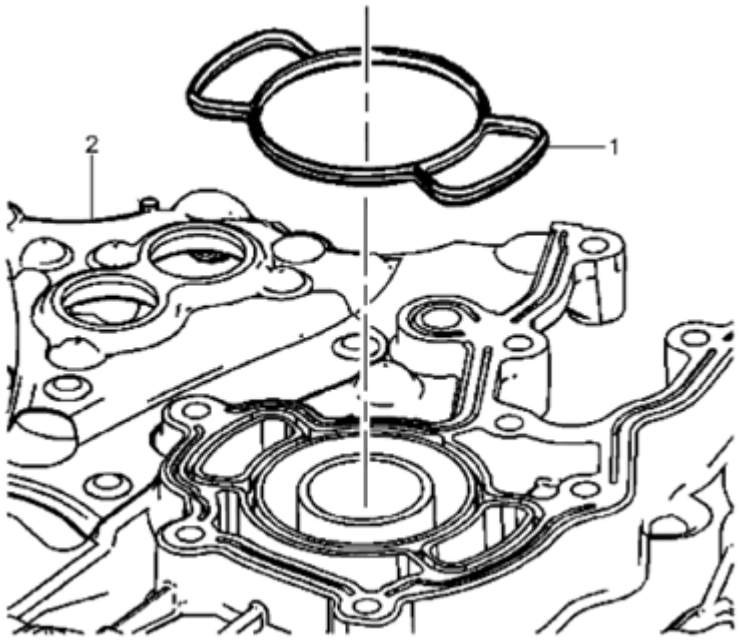



**Fig. 73: Identifying Water Pump Inner Gasket And Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

15. Remove oil seal (1) from timing chain cover (2).

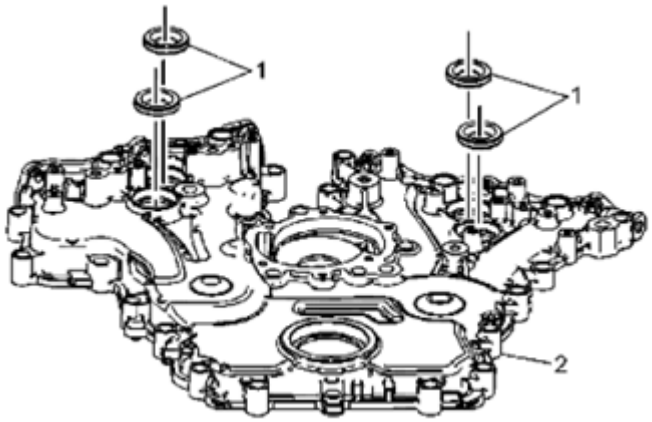



**Fig. 74: Identifying Oil Seal And Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

16. Using special tool, remove crankshaft oil seal (1) from timing chain cover (2) as shown in figure.

**Special Tool**

**(A): 09913-57830**

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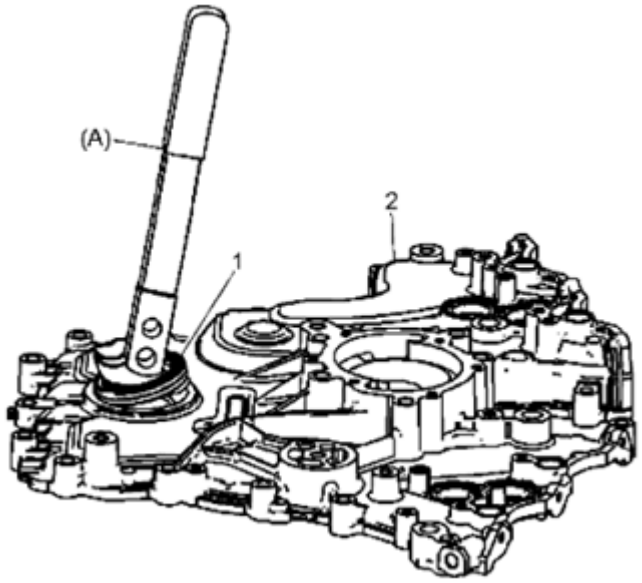



**Fig. 75: Removing Crankshaft Oil Seal From Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

17. If necessary, remove water pump from timing chain cover. See **WATER PUMP REMOVAL AND INSTALLATION** .
18. If necessary, remove CMP sensor from timing chain cover. See **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .

**Installation**

1. Clean sealing surface on timing chain cover, cylinder block and cylinder head.
2. Install new water pump inner gasket (1) to timing chain cover (2).

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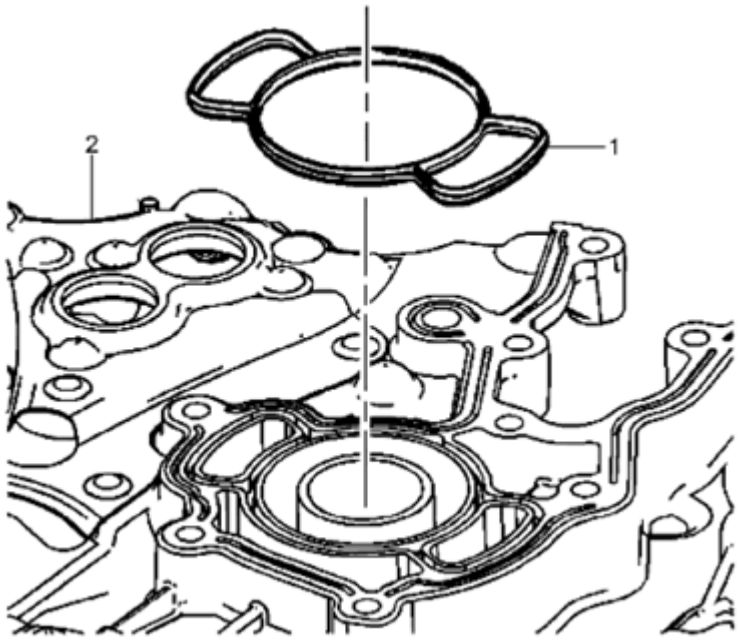



**Fig. 76: Identifying Water Pump Inner Gasket And Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Using special tool, install new crankshaft oil seal (1) to timing chain cover (2) as shown in figure [A] or [B].

**NOTE: Do not apply engine oil and grease to crankshaft oil seal.**

**Special Tool**

**(A): 09926-68310**

**(B): 09913-75821**

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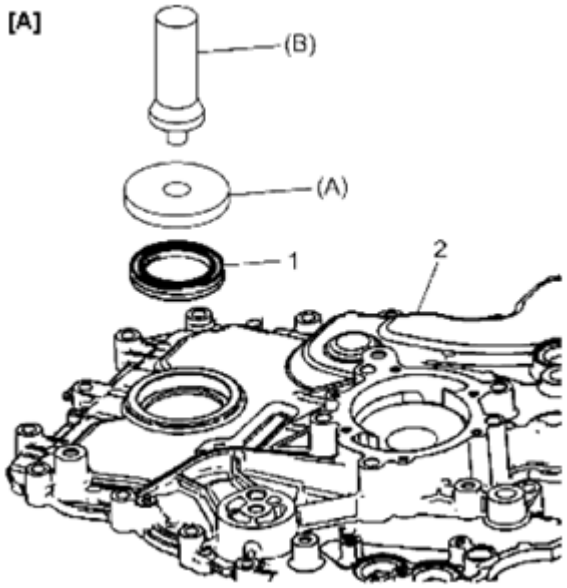



**Fig. 77: Installing Crankshaft Oil Seal To Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Special Tool**

**(C): Oil seal installer (J-29184)**

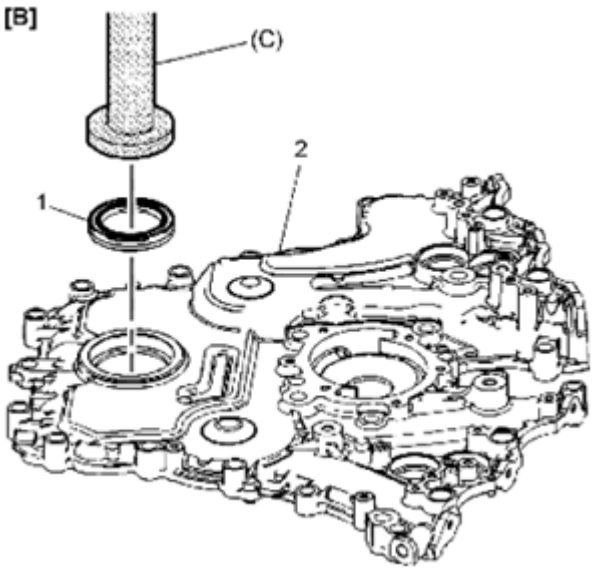


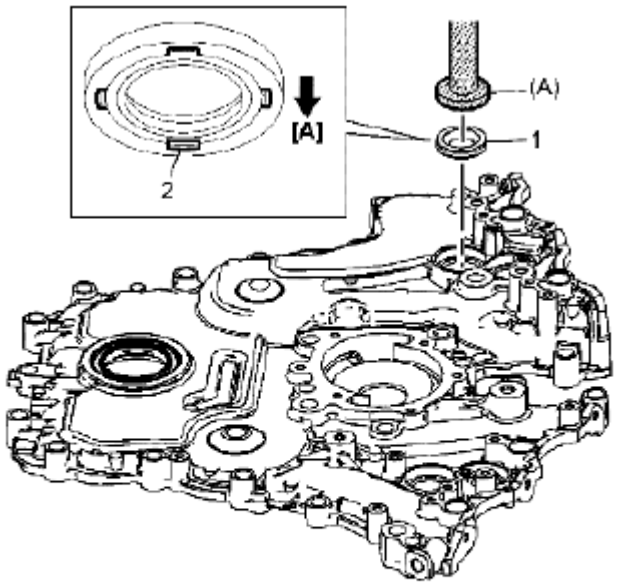

**Fig. 78: Identifying Crankshaft Oil Seal And Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Using special tool, install new oil seal (1) to timing chain cover as shown in figure.

**Special Tool**

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**(A): 09913-57810**




| | |
|---|---|
| [A]: Timing chain cover side | 2. Groove |

**Fig. 79: Installing Oil Seal To Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Install special tool to cylinder head.

**Special Tool**

**(A): Engine front cover installation guide pins (EN-46109)**

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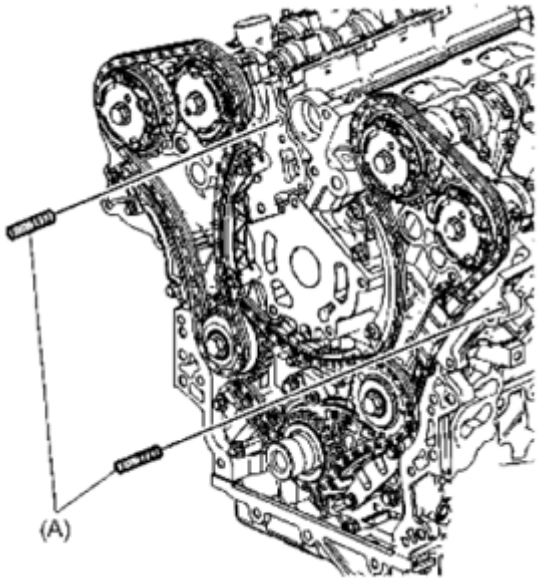



**Fig. 80: Identifying Engine Front Cover Installation Guide Pins**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Apply sealant "A" to mating surface of cylinder head (1) and cylinder block (2) as shown in figure.

   **"A": Sealant 99000-31290 (SUZUKI Bond No. 1217F)**

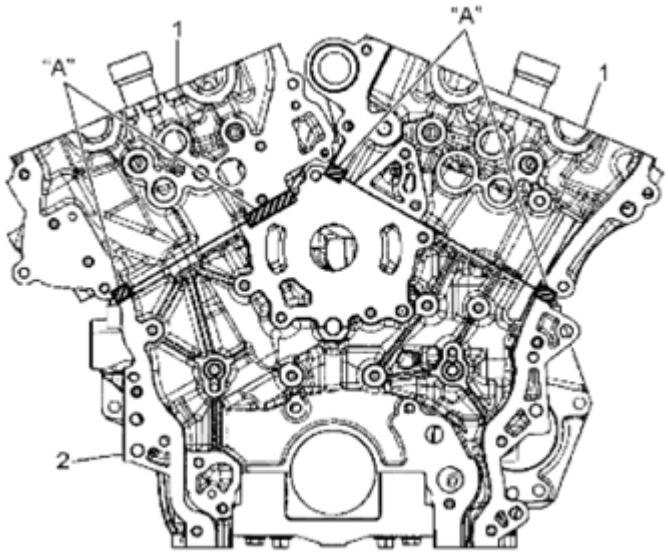



**Fig. 81: Applying Sealant To Mating Surface Of Cylinder Head And Cylinder Block**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Apply sealant "A" to mating surface of timing chain cover (1) as shown in figure.

   **"A": Sealant 99000-31290 (SUZUKI Bond No. 1217F)**

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**Sealant amount for timing chain cover**

**Width "a": 3 mm (0.12 in.)**

**Width "b": 5 mm (0.20 in.)**

**Height "c": 2.5 mm (0.10 in.)**

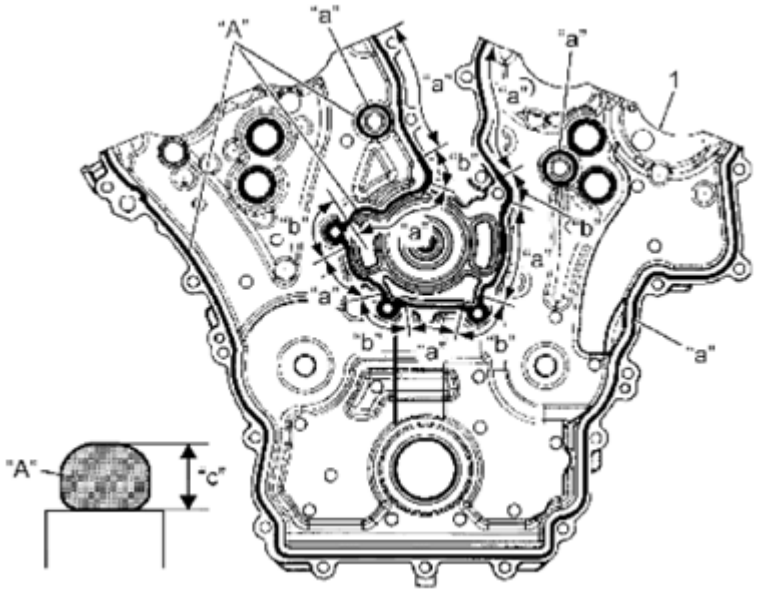



**Fig. 82: Applying Sealant To Mating Surface Of Timing Chain Cover**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Install timing chain cover and accessory drive belt tensioner as follows.

**NOTE: Before installing timing chain cover, check that dowel pin is securely fitted.**

a. Tighten timing chain cover bolt to 20 N.m (2.0 kgf-m, 15.0 lbf-ft) in numerical order ("1" - "22") shown in figure evenly and gradually.
b. In the same manner as Step a), retighten them to 60°.
c. Tighten accessory drive belt tensioner bolt ("23") to 25 N.m (2.5 kgf-m, 18.5 lbf-ft).

**Tightening torque**

**Timing chain cover bolt * (a): 20 N.m --> +60° (2.0 kgf-m --> +60°, 15 lbf-ft --> +60°)**

**Accessory drive belt tensioner bolt* (b): 25 N.m (2.5 kg-m, 18.5 lbf-ft)**

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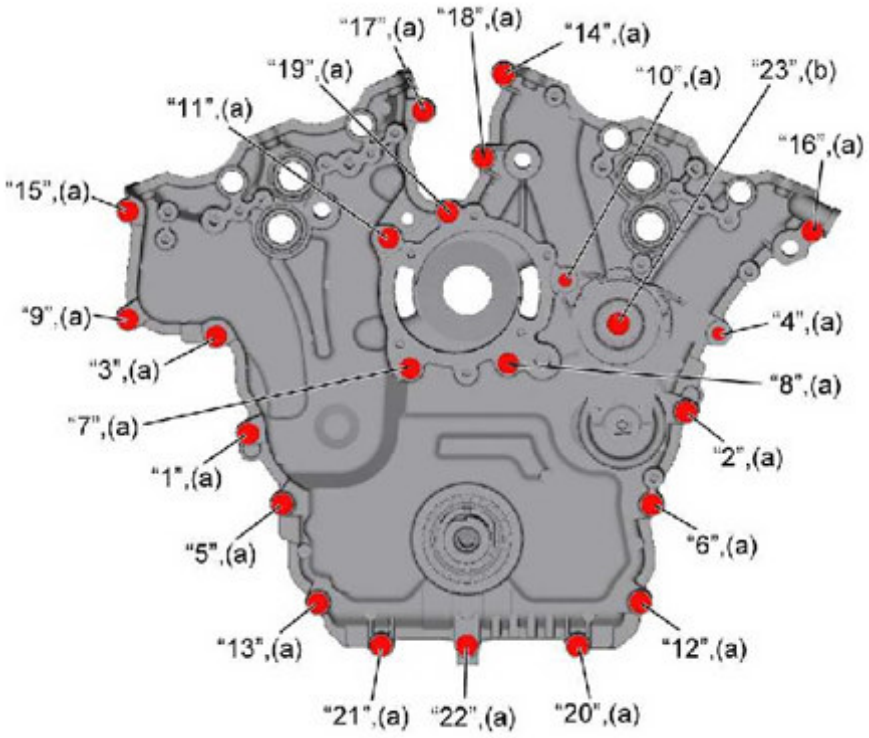
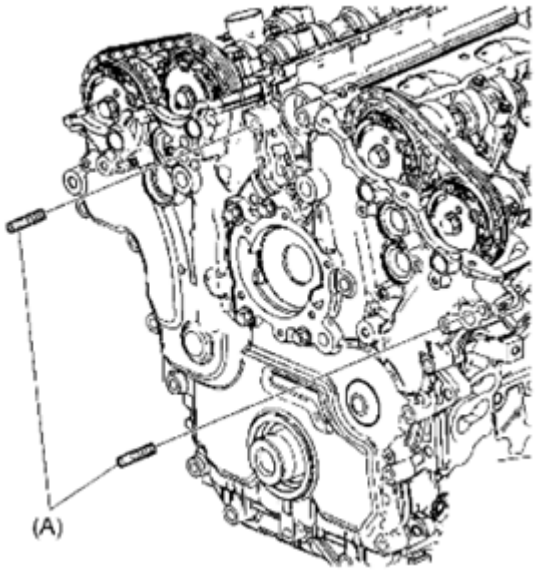



**Fig. 83: Identifying Timing Chain Cover Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Remove special tool.

**Special Tool**

**(A): Engine front cover installation guide pins (EN-46109)**




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**Fig. 84: Identifying Engine Front Cover Installation Guide Pins**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Install new O-ring (3) and new gasket (4).
11. Install water outlet pipe No. 1 (1) and water outlet pipe No. 2 (2)

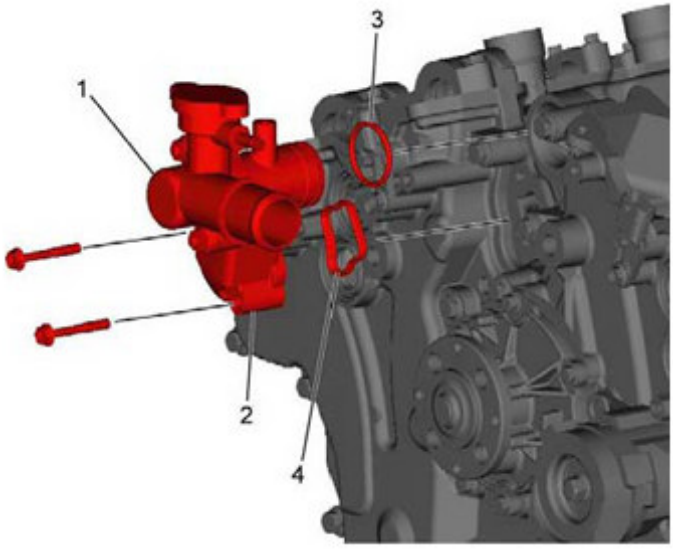
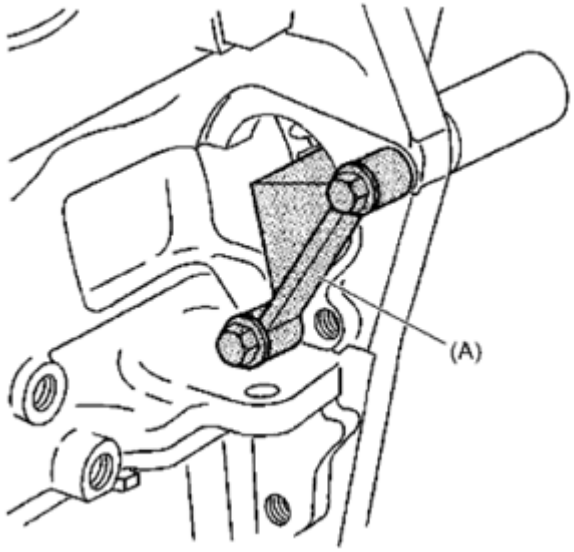



**Fig. 85: Identifying Water Outlet Pipe No. 1 And No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

12. Lock flywheel with special tool as shown in figure.

**Special Tool**

**(A): 09916-97830**




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**Fig. 86: Locking Flywheel With Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

13. Apply engine oil between crankshaft pulley and crankshaft.

**NOTE: Do not apply engine oil between crankshaft oil seal and crankshaft pulley.**

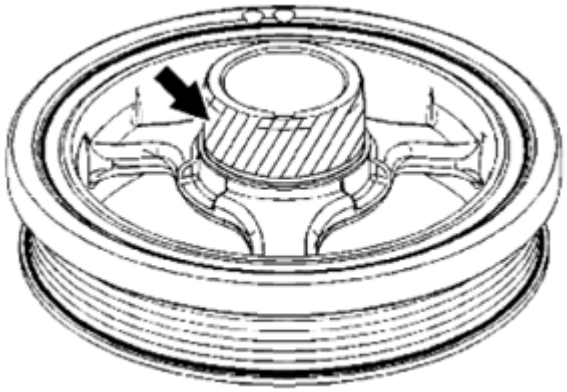


**Fig. 87: Applying Engine Oil Between Crankshaft Pulley And Crankshaft**
**Courtesy of SUZUKI OF AMERICA CORP.**

14. Using special tool, install crankshaft pulley (1) to crankshaft as shown in figure.

**Special Tool**

**(A): 09912-37820**

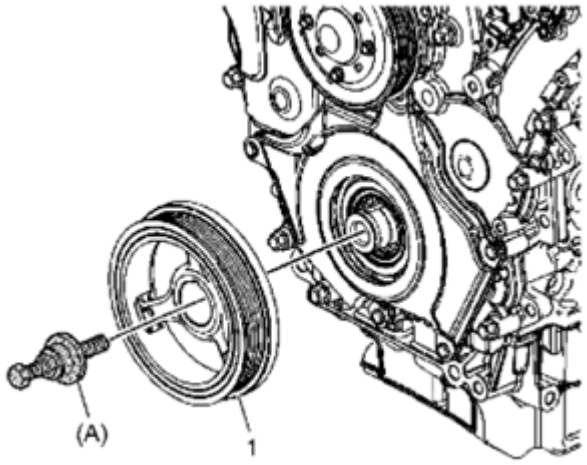



**Fig. 88: Installing Crankshaft Pulley To Crankshaft**
**Courtesy of SUZUKI OF AMERICA CORP.**

15. Remove special tool, tighten crankshaft pulley bolt as follows.
    a. Tighten crankshaft pulley bolt to 120 N.m (12.2 kgf-m, 88.5 lbf-ft).

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b. Loosen crankshaft pulley bolt until loosening torque is 0.
c. Tighten crankshaft pulley bolt to 100 N.m (10.2 kgf-m, 74.0 lbf-ft).
d. Retighten crankshaft pulley bolt to 150°.

**Tightening torque**

**Timing chain cover bolt * (a): 120 N.m --> 0 N.m --> 100 N.m --> +150° (12.2 kgf-m --> 0 kgf-m --> 10.2 kgf-m --> +150°, 88.5 lbf-ft --> 0 lbf-ft --> 74.0 lbf-ft --> +150°)**

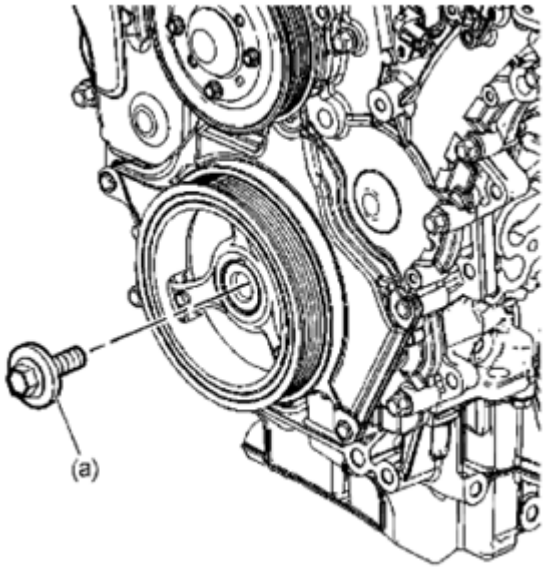



**Fig. 89: Identifying Crankshaft Pulley Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

16. Install belt idler arm to generator bracket. See **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
17. Install OCV. See **OCV REMOVAL AND INSTALLATION**.
18. Install P/S pump bracket. See **P/S PUMP REMOVAL AND INSTALLATION** .
19. Install water pump pulley. See **WATER PUMP REMOVAL AND INSTALLATION** .
20. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
21. Install accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
22. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## TIMING CHAIN COVER INSPECTION

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

**Oil Seal**

Check oil seal lip for damage. Replace as necessary.

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## ENGINE BLOCK HEATER REMOVAL AND INSTALLATION (CANADIAN SPECIFICATION)

**Removal**

1. Remove engine block heater (1) while lock lever (2) is unlocked.
2. Disconnect engine block heater harness (3) from engine block heater.

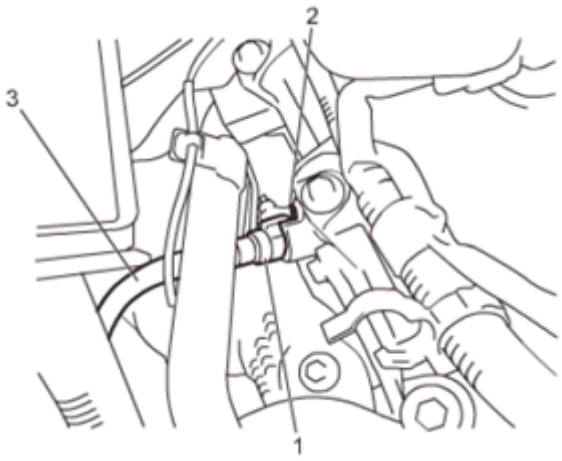



**Fig. 90: Identifying Engine Block Heater Harness**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Installation**

Reverse removal procedure for installation.

## ENGINE BLOCK HEATER INSPECTION (CANADIAN SPECIFICATION)

***Reference:*** **ENGINE BLOCK HEATER REMOVAL AND INSTALLATION (CANADIAN SPECIFICATION)**

Check continuity between terminal "a" and "b". If there is no continuity, replace engine block heater.

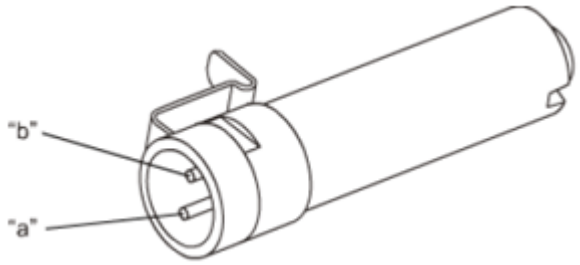



**Fig. 91: Identifying Engine Block Heater Terminal**
**Courtesy of SUZUKI OF AMERICA CORP.**

## OCV REMOVAL AND INSTALLATION

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**Removal**

1. Disconnect negative cable from battery.
2. With hose connected, detach P/S reservoir tank (1) from its bracket.
3. With hose connected, detach water reservoir tank (2) from radiator.
4. Disconnect OCV connector (3).
5. Remove OCV (4) from timing chain cover.

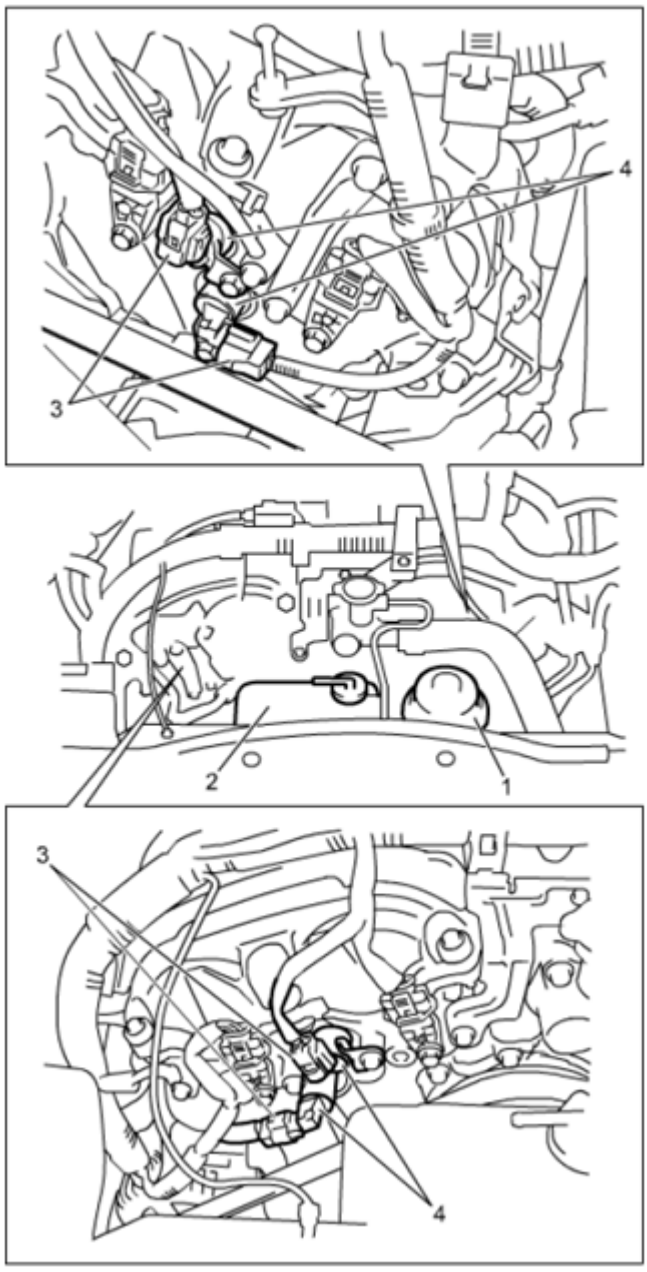



**Fig. 92: Identifying OCV Connector And Water Reservoir Tank**
**Courtesy of SUZUKI OF AMERICA CORP.**

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**Installation**

Reverse removal procedure for installation noting the following.

- Tighten OCV bolt to specified torque.

  **Tightening torque**

  **OCV bolt (a): 12 N.m (1.2 kg-m, 9.0 lbf-ft)**

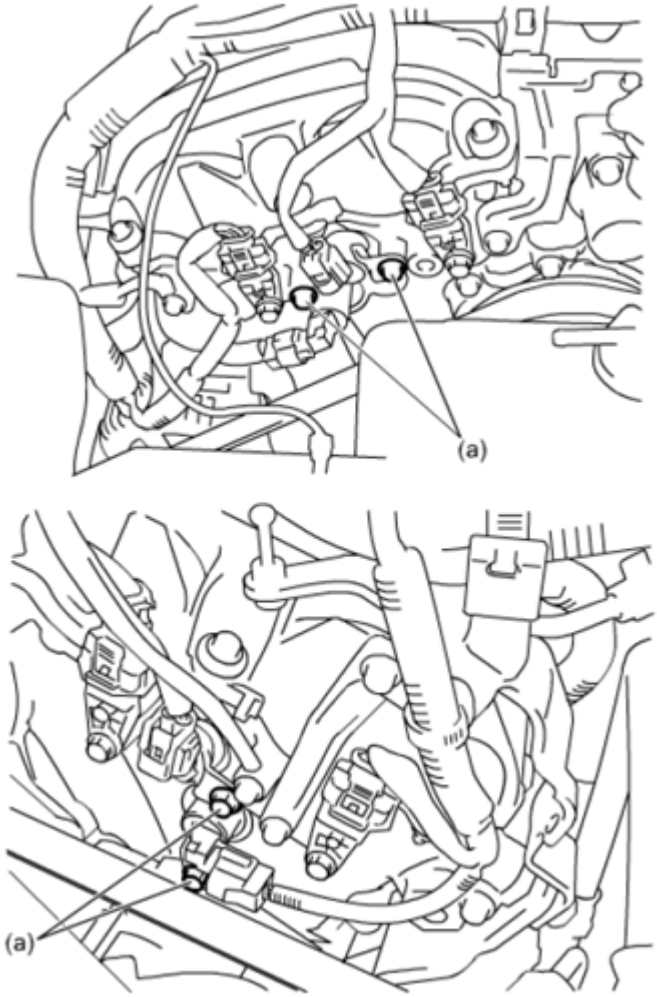



**Fig. 93: Identifying OCV Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Check to ensure that all removed parts are back in place.
- Finally, start engine and check for engine oil leaks.

**OCV INSPECTION**

***Reference:*** **OCV REMOVAL AND INSTALLATION**

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Refer to **OCV INSPECTION**

## DRIVE PLATE REMOVAL AND INSTALLATION

**Removal**

1. Remove engine assembly from vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Lock flywheel with special tool as shown in figure.

   **Special Tool**

   **(A): 09916-97830**

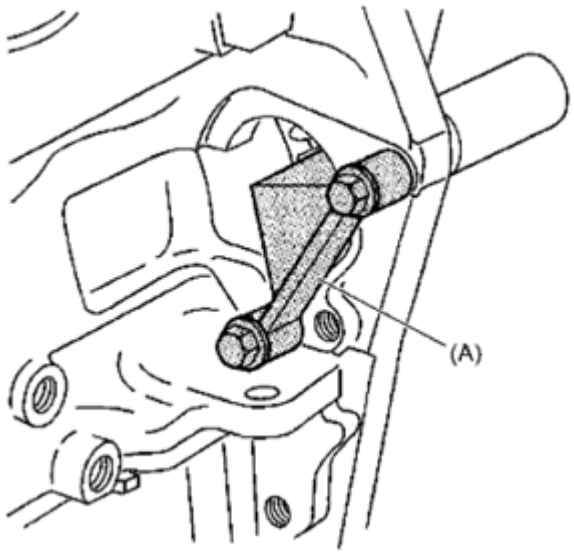



**Fig. 94: Locking Flywheel With Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Remove drive plate (1).

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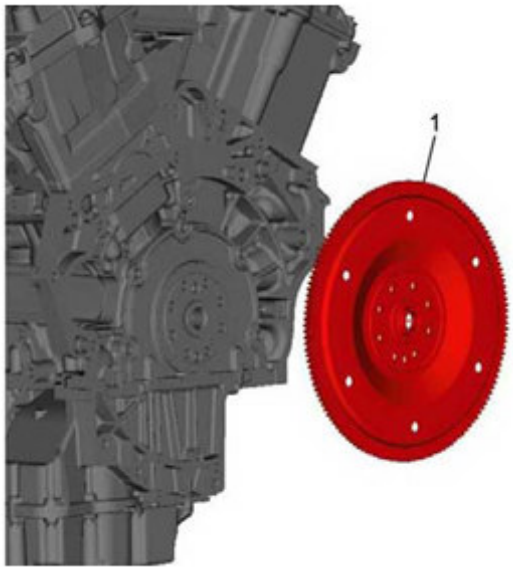



**Fig. 95: Identifying Drive Plate**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Installation**

Reverse removal procedure for installation noting the following.

- Use new drive plate bolt.
- Tighten drive plate bolt as follows.
  a. Tighten drive plate bolt to 30 N.m (3.1 kgf-m, 22.5 lbf-ft) in numerical order ("1" - "8") evenly and gradually.
  b. In the same manner as Step a), retighten them to 45°.

**Tightening torque**

**Drive plate bolt * (a): 30 N.m --> +45° (3.1 kgf-m --> +45°, 22.5 lbf-ft --> +45°)**

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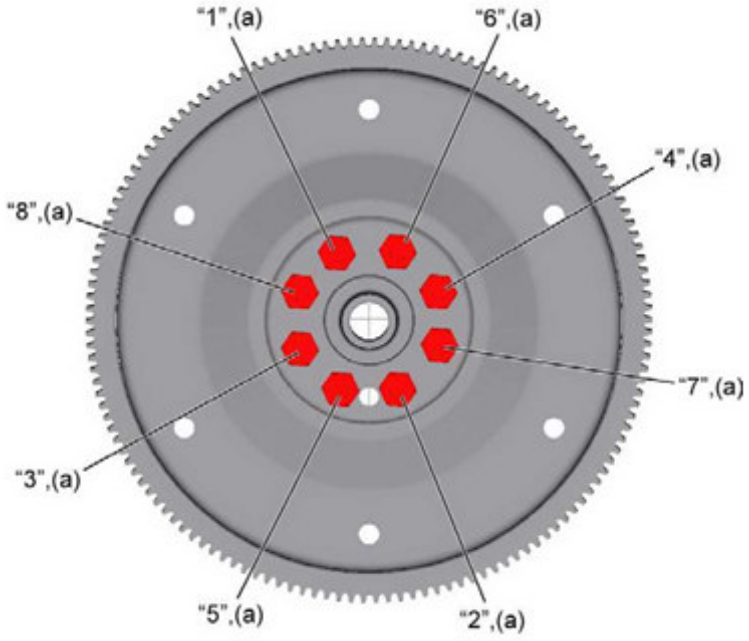



**Fig. 96: Identifying Drive Plate Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

## DRIVE PLATE INSPECTION

*Reference:* **DRIVE PLATE REMOVAL AND INSTALLATION**

### Visual Inspection

- If ring gear is damaged, cracked or worn, replace drive plate.

### Drive Plate Face Runout

Check drive plate face runout with a dial gauge.

If runout exceeds its limit, replace drive plate.

**Drive plate face runout**

**Limit: 0.2 mm (0.0079 in.)**

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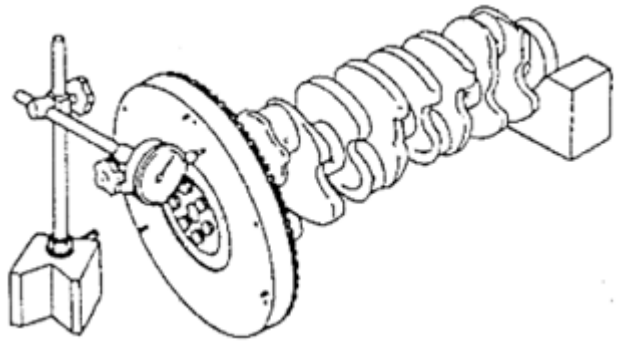
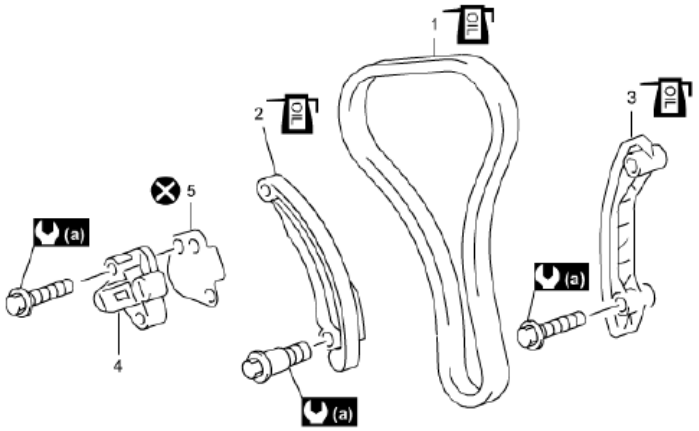


**Fig. 97: Checking Drive Plate Face Runout**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**




| | | |
|---|---|---|
| OIL 1. 2nd timing chain (bank 1) : Apply engine oil to sliding surface. | 4. Timing chain tensioner adjuster No.1 | : Do not reuse. |
| OIL 2. Timing chain tensioner No.1 : Apply engine oil to sliding surface. | 5. Gasket | |
| OIL 3. Timing chain guide No.1 : Apply engine oil to sliding surface. | (a): 23 N·m (2.3 kgf-m, 17.0 lbf-ft) | |

**Fig. 98: Identifying 2nd Timing Chain (Bank 1) And Timing Chain Tensioner Adjuster No. 1 Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

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

**NOTE: For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

**Removal**

1. Remove timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
2. By turning crankshaft, align camshaft (bank 1) and crankshaft at specific position as follows.
   a. Using special tool, align circle mark (1) on crankshaft timing sprocket with circle mark (2) on oil pump.

   **Special Tool**

   **(A): Crankshaft rotation socket (EN-46111)**

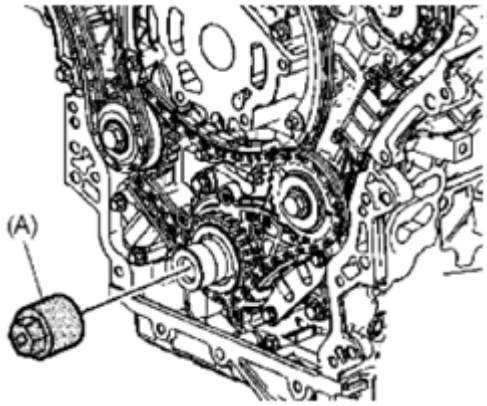



**Fig. 99: Identifying Crankshaft Rotation Socket**
**Courtesy of SUZUKI OF AMERICA CORP.**

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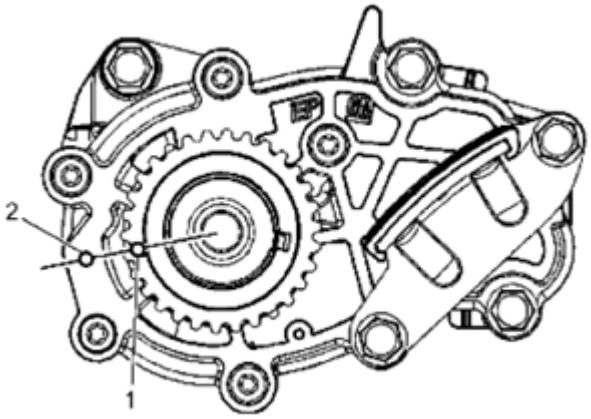



**Fig. 100: Aligning Circle Mark On Crankshaft Timing Sprocket With Circle Mark On Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Make sure that the flat sections (1) of camshafts are parallel to cylinder head (2).

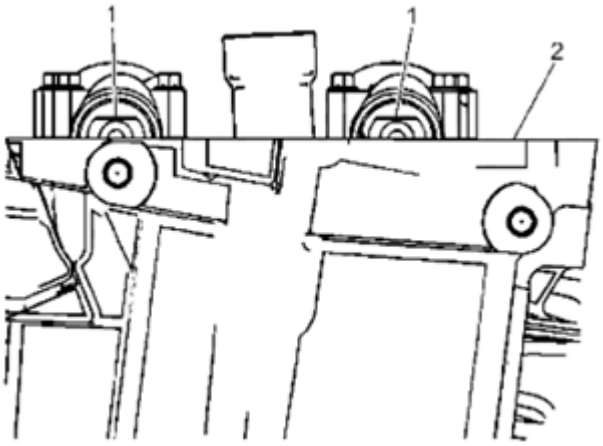



**Fig. 101: Identifying Flat Sections Of Camshafts**
**Courtesy of SUZUKI OF AMERICA CORP.**

c. Hold camshafts (bank 1) with special tool as shown in figure.

**Special Tool**

**(A): 09917-67810**

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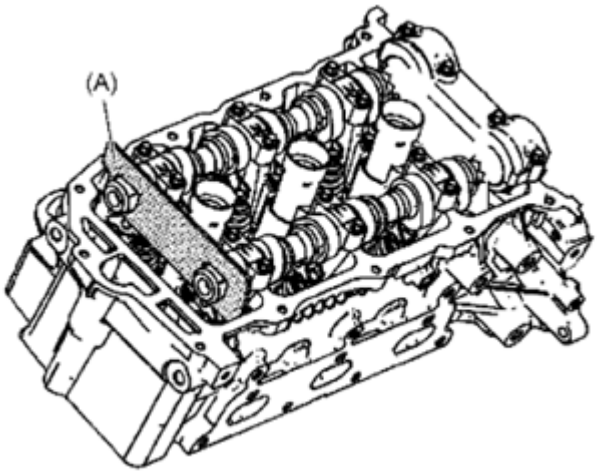



**Fig. 102: Holding Camshafts (Bank 1) With Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Remove timing chain tensioner adjuster No. 1 (1) and gasket (2).

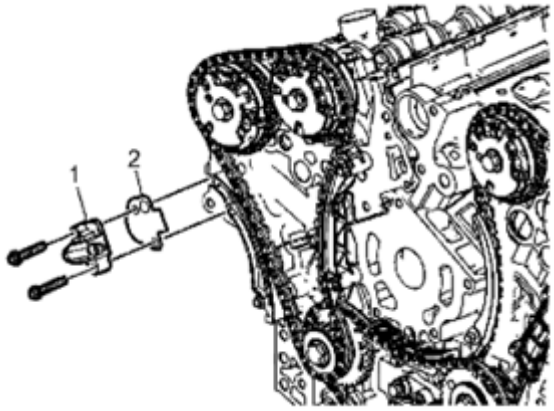



**Fig. 103: Identifying Timing Chain Tensioner Adjuster No. 1 (1) And Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

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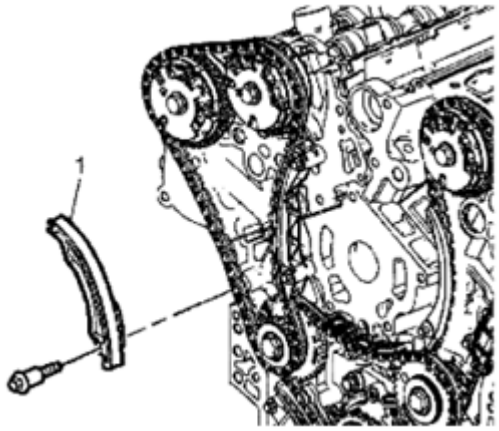



**Fig. 104: Identifying Timing Chain Tensioner No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Remove timing chain guide No. 1 (1).

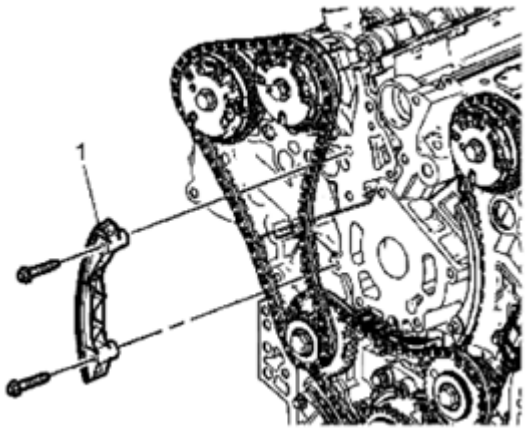



**Fig. 105: Identifying Timing Chain Guide No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Remove 2nd timing chain (Bank 1).

**Installation**

1. Check that circle mark (1) on crankshaft timing sprocket is in alignment with circle mark (2) on oil pump.

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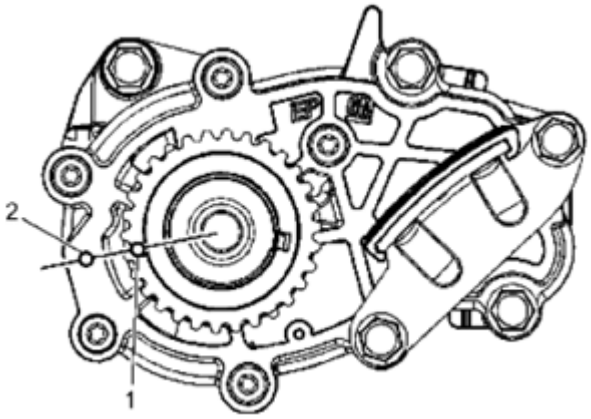



**Fig. 106: Aligning Circle Mark Crankshaft Timing Sprocket And On Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**

2. Install timing chain by aligning discrimination plates (2) of timing chain and triangle mark (1) on intake and exhaust CMP actuator as shown in figure.
3. Fit idler sprocket No. 1 to timing chain by aligning discrimination plate (2) of timing chain and match mark (3) on idler sprocket No. 1.

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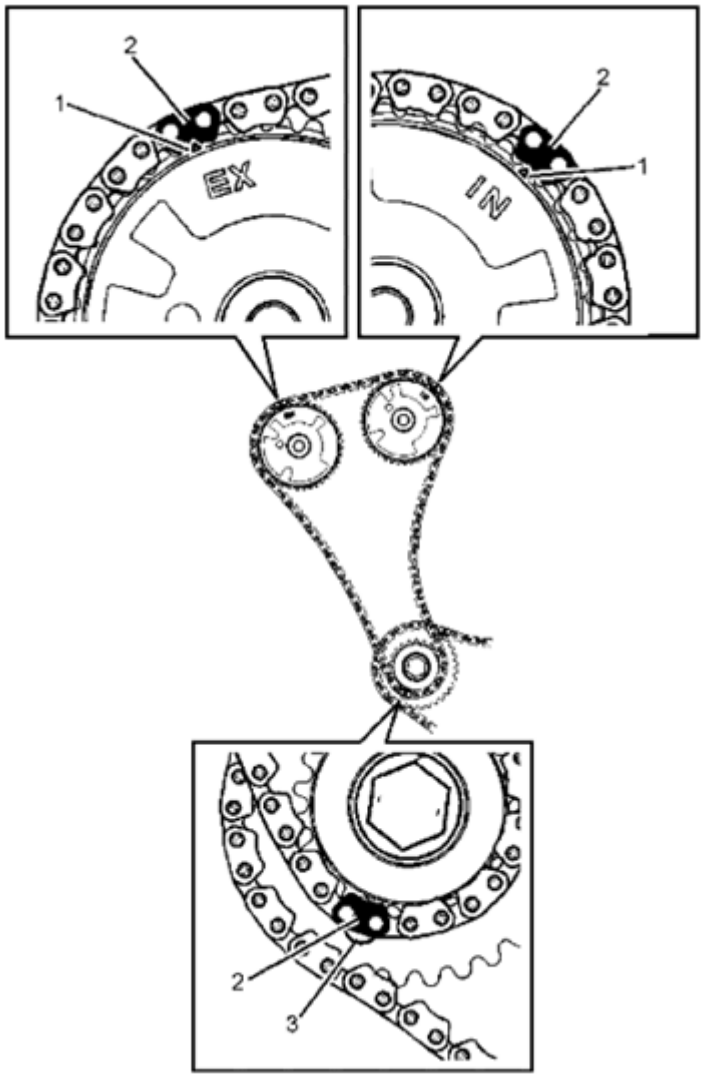



**Fig. 107: Aligning Discrimination Plate Of Timing Chain And Match Mark On Idler Sprocket No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Remove special tool from camshaft (bank 1).

   **Special Tool**

   **(A): 09917-67810**

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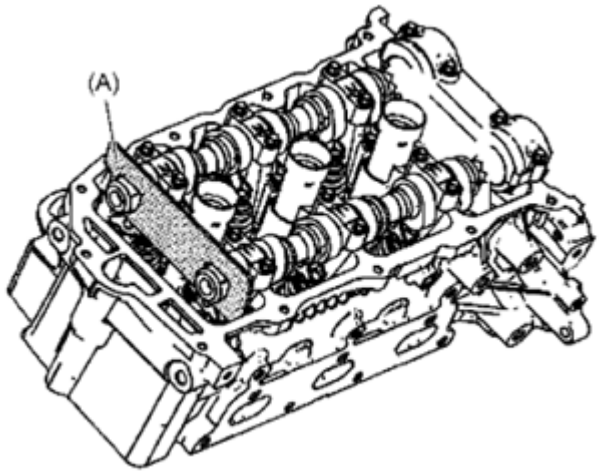



**Fig. 108: Removing Special Tool From Camshaft (Bank 1)**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Turn crankshaft by about 90° paying attention to keep the alignment of timing chain.
6. Apply engine oil to sliding surface of timing chain guide No. 1 (1) and install it. Tighten timing chain guide No. 1 bolt to specified torque.

**Tightening torque**

**Timing chain guide No. 1 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

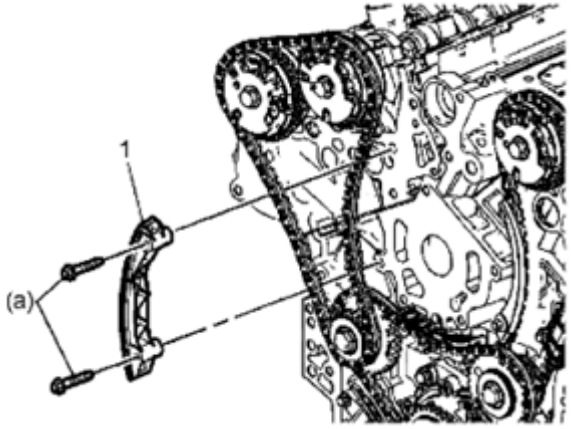



**Fig. 109: Identifying Timing Chain Guide**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Apply engine oil to sliding surface of timing chain tensioner No. 1 (1) and install it. Tighten timing chain tensioner No. 1 bolt to specified torque.

**Tightening torque**

**Timing chain tensioner No. 1 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

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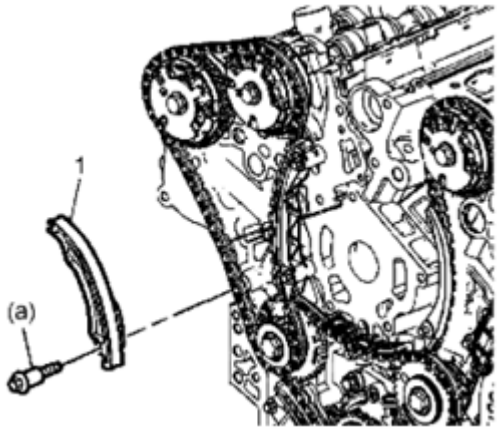



**Fig. 110: Identifying Timing Chain Tensioner**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Fix plunger in timing chain tensioner adjuster No. 1 as follows.
   a. Remove plunger (1) from timing chain tensioner adjuster No. 1 (2).

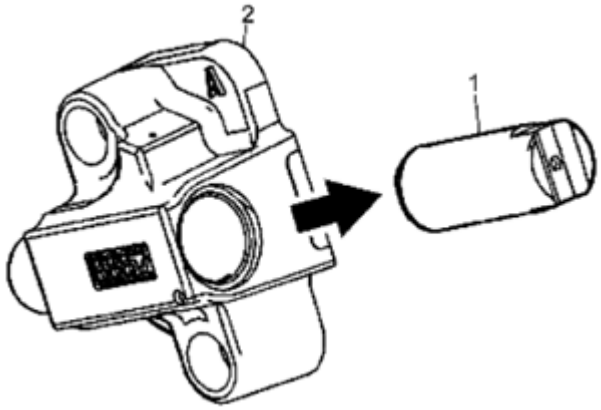



**Fig. 111: Removing Plunger From Timing Chain Tensioner Adjuster No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

   b. Using special tool, turn plunger in arrow direction to contract it and install it to timing chain tensioner adjuster No. 1.

**Special Tool**

**(A): 09917-67810**

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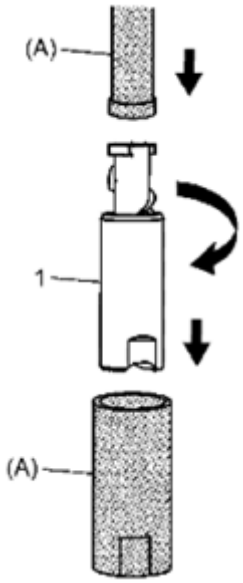



**Fig. 112: Installing Timing Chain Tensioner Adjuster No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

c. Hold plunger using lock pin (1) as follows.

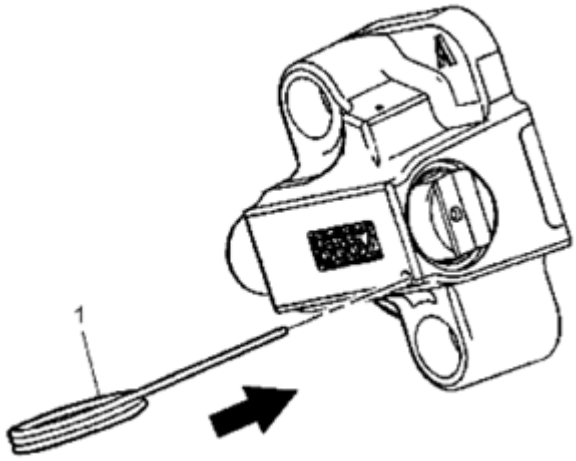



**Fig. 113: Holding Plunger**
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Install new gasket (1) and timing chain tensioner adjuster No. 1 (2) and tighten timing chain tensioner adjuster No. 1 bolt to specified torque.

**Tightening torque**

**Timing chain tensioner adjuster No. 1 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

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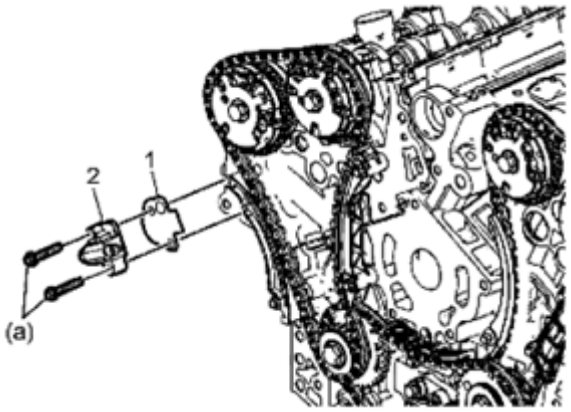



**Fig. 114: Identifying Timing Chain Tensioner Adjuster No. 1 Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Check that triangle mark (1) on intake CMP actuator, triangle mark (2) on exhaust CMP actuator and match mark (3) on idler sprocket No. 1 are in alignment with discrimination plates (4) of timing chain.

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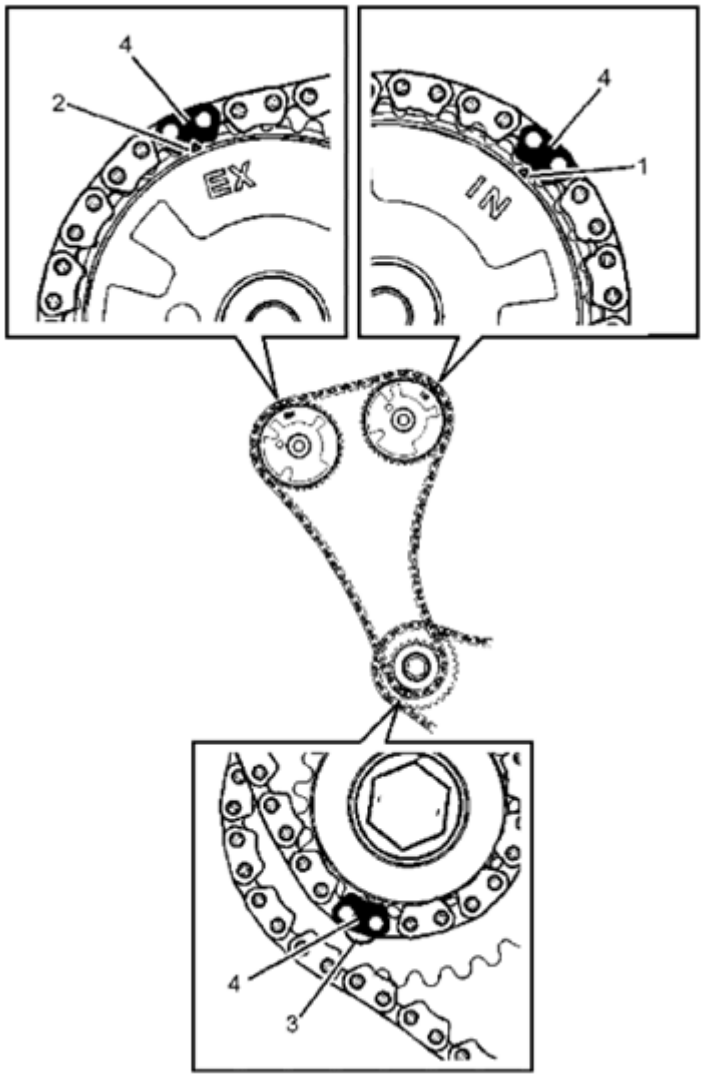



**Fig. 115: Identifying Timing Mark Location**
**Courtesy of SUZUKI OF AMERICA CORP.**

11. Remove lock pin (1) from timing chain tensioner adjuster No. 1.

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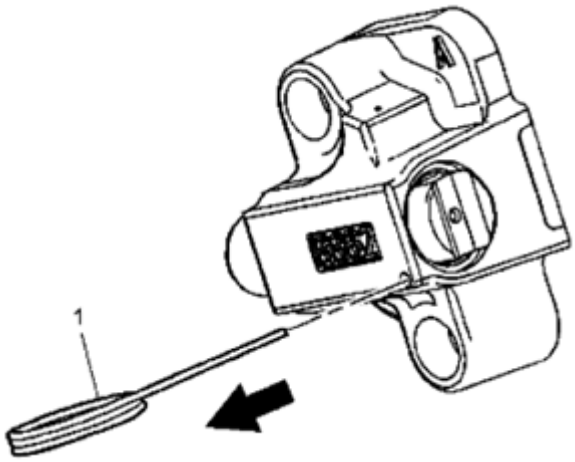



**Fig. 116: Removing Lock Pin From Timing Chain Tensioner Adjuster No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

12. Turn crankshaft clockwise by 2 revolutions and check that circle mark (1) on crankshaft timing sprocket are in alignment with circle mark (2) on oil pump.

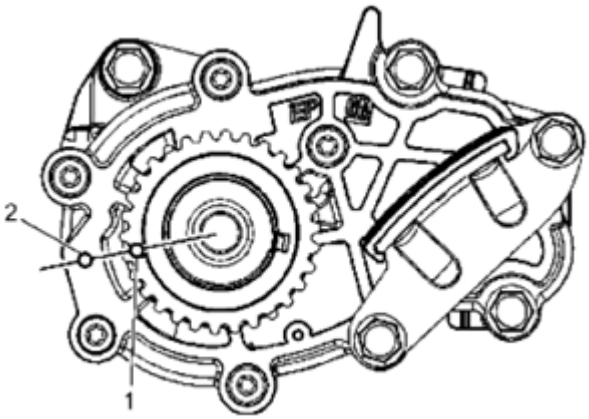



**Fig. 117: Aligning Mark Crankshaft Timing Sprocket And Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**

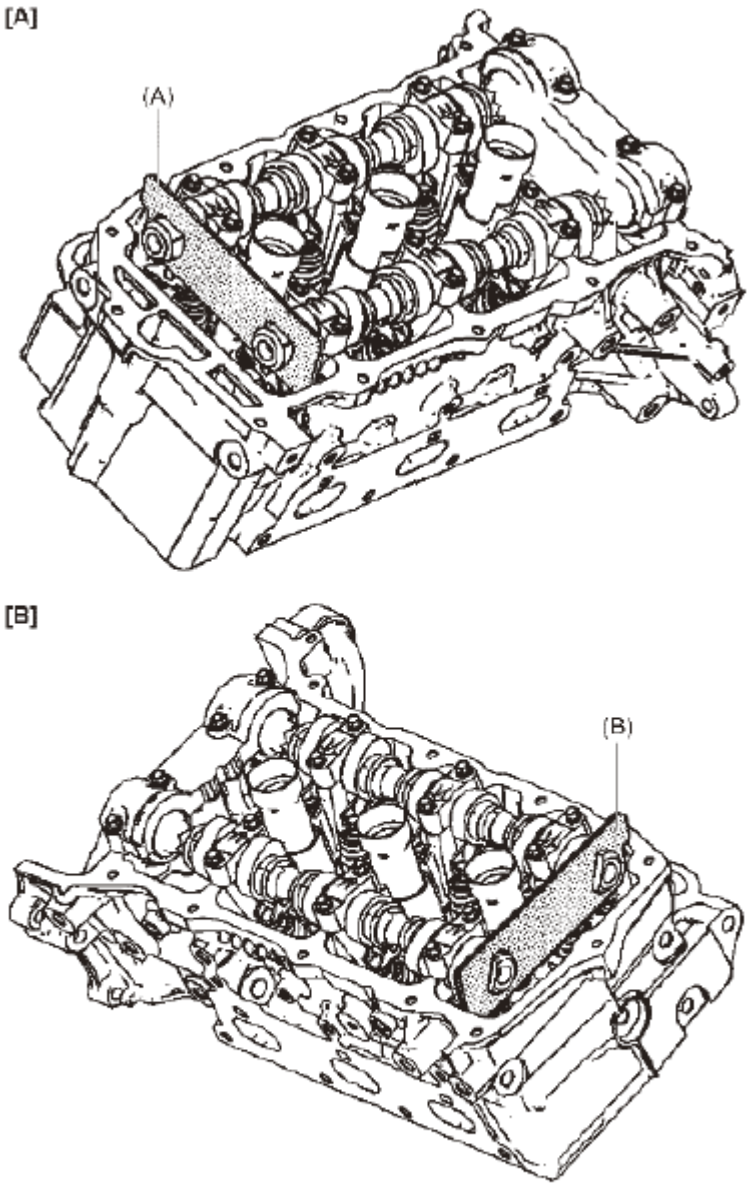
13. Confirm that special tool is installed to camshaft (bank 1) and camshaft (bank 2).

    **Special Tool**

    **(A): 09917-67830**

    **(B): 09917-67810**

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 118: Identifying Special Tool Installed To Camshaft (Bank 1) And Camshaft (Bank 2)**
**Courtesy of SUZUKI OF AMERICA CORP.**

14. Remove special tool.

**Special Tool**

**(A): Crankshaft rotation socket (EN-46111)**

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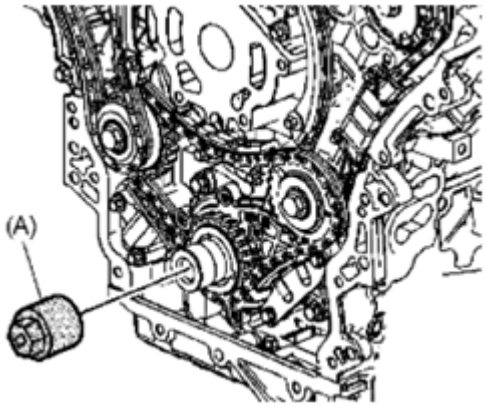



**Fig. 119: Identifying Crankshaft Rotation Socket**
**Courtesy of SUZUKI OF AMERICA CORP.**

15. Install timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
16. Install belt idler arm to generator bracket. See **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
17. Install OCV. See **OCV REMOVAL AND INSTALLATION**.
18. Install P/S pump bracket. See **P/S PUMP REMOVAL AND INSTALLATION** .
19. Install water pump pulley. See **WATER PUMP REMOVAL AND INSTALLATION** .
20. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
21. Install accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
22. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

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

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

**Timing Chain Guide No. 1**

Check shoe (1) for wear or damage.




**Fig. 120: Identifying Timing Chain Guide No. 1 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Tensioner No. 1**

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Check shoe (1) and contact surface of plunger (2) for wear or damage.

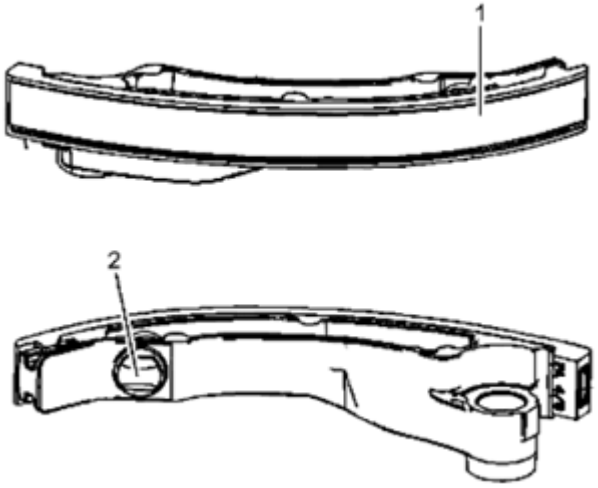



**Fig. 121: Identifying Timing Chain Tensioner No. 1 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**2nd Timing Chain (Bank 1)**

Check timing chain for wear or damage.

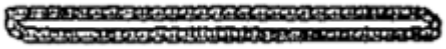


**Fig. 122: Identifying 2nd Timing Chain (Bank 1) Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Tensioner Adjuster No. 1**

- Check timing chain tensioner adjuster No. 1 and contact surface (1) of timing chain tensioner No. 1 for wear or damage.

  If any malfunction is found, replace adjuster No. 1.

- Check that plunger (2) operates smoothly.

  If any malfunction is found, replace plunger (2).

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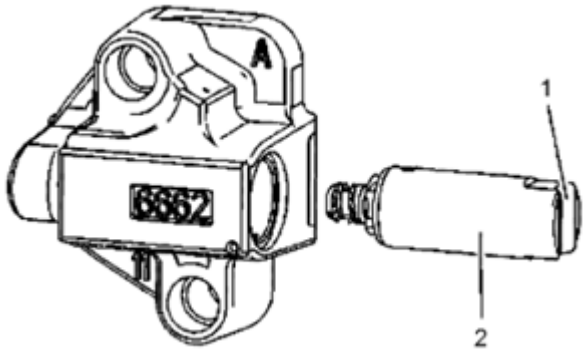
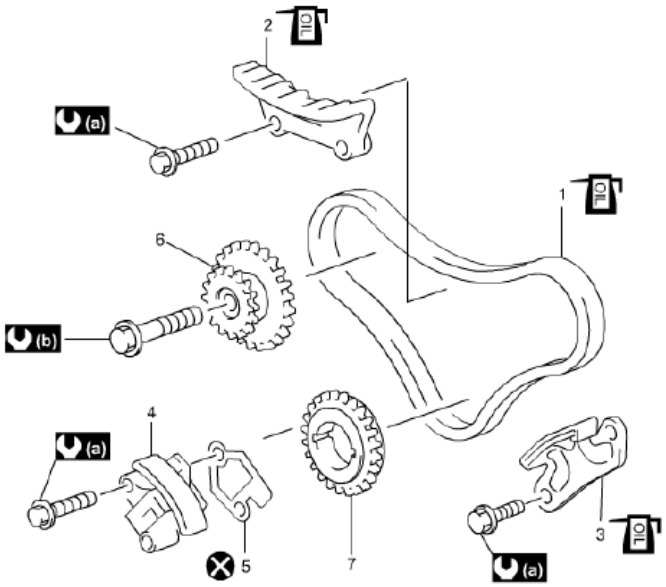



**Fig. 123: Checking Plunger Operates Smoothly**
**Courtesy of SUZUKI OF AMERICA CORP.**

## 1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 COMPONENTS

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**




| | | |
|---|---|---|
| OIL 1. 1st timing chain : Apply engine oil to sliding surface. | 5. Gasket | (b): 58 N·m (5.9 kgf-m, 43.0 lbf-ft) |
| OIL 2. Timing chain guide No.2 : Apply engine oil to sliding surface. | 6. Idler sprocket No.1 | : Do not reuse. |
| OIL 3. Timing chain lower guide : Apply engine oil to sliding surface. | 7. Crankshaft timing sprocket | |
| 4. Timing chain tensioner adjuster No.2 | (a): 23 N·m (2.3 kgf-m, 17.0 lbf-ft) | |


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**Fig. 124: Identifying 1st Timing Chain And Timing Chain Tensioner Adjuster No. 2 Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

## 1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 REMOVAL AND INSTALLATION

*Reference:* **1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 COMPONENTS**

**NOTE: For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

**Removal**

1. Remove 2nd timing chain (bank 1). See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
2. By turning crankshaft, align camshaft (bank 2) and crankshaft at specific position as follows.
   a. By using special tool, align circle mark (1) on crankshaft timing sprocket with circle mark (2) on oil pump.

      **Special Tool**

      **(A): Crankshaft rotation socket (EN-46111)**

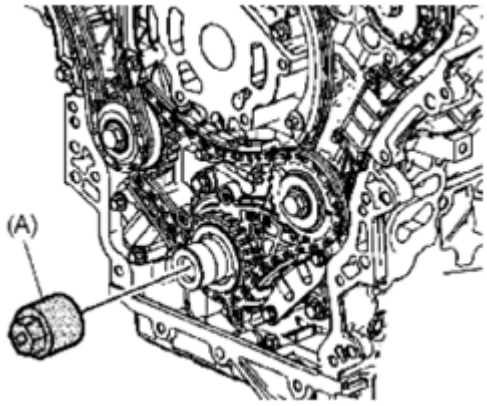



**Fig. 125: Identifying Crankshaft Rotation Socket**
**Courtesy of SUZUKI OF AMERICA CORP.**

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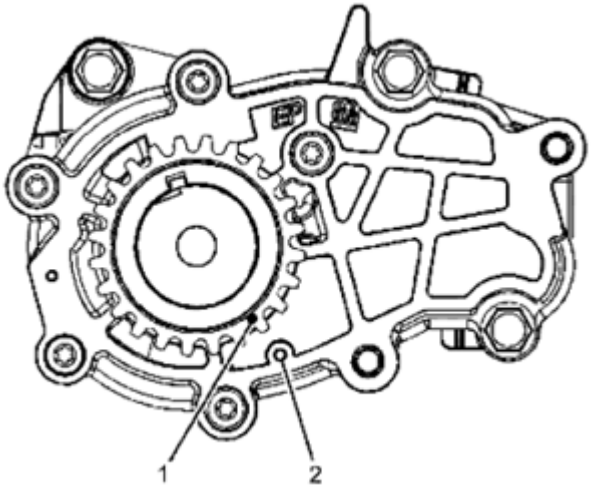



**Fig. 126: Aligning Circle Mark On Crankshaft Timing Sprocket With Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Make sure that the flat sections (1) of camshafts (bank 2) is parallel to cylinder head (2).

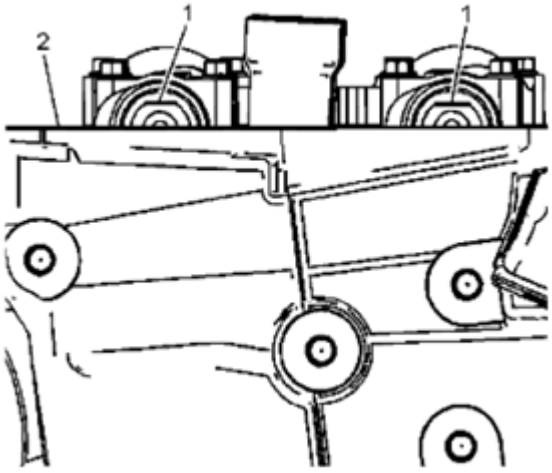



**Fig. 127: Identifying Flat Sections Of Camshafts (Bank 2)**
**Courtesy of SUZUKI OF AMERICA CORP.**

c. Hold camshafts (bank 2) with special tool as shown in figure.

**Special Tool**

**(A): 09917-67810**

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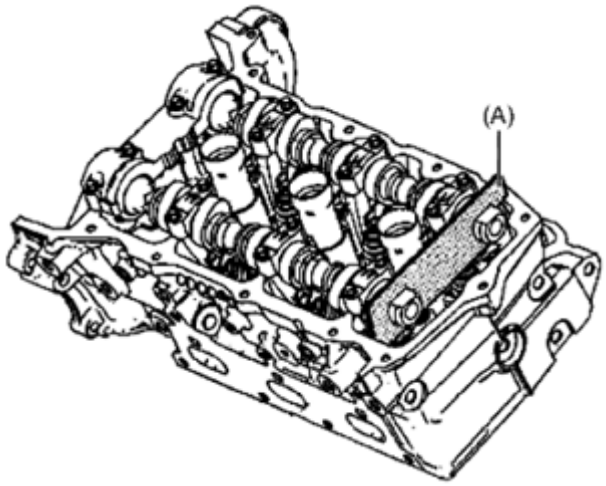



**Fig. 128: Holding Camshafts (Bank 2) With Special Tool**
**Courtesy of SUZUKI OF AMERICA CORP.**

d. Remove special tool.

**Special Tool**

**(A): Crankshaft rotation socket (EN-46111)**

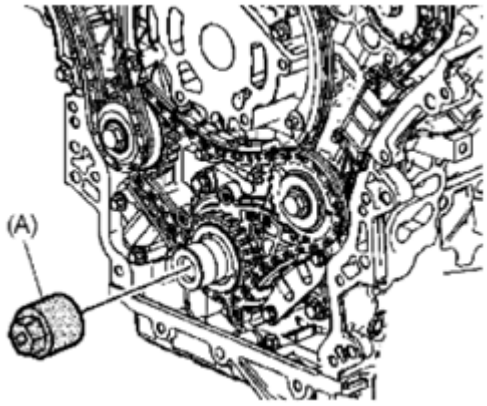



**Fig. 129: Identifying Crankshaft Rotation Socket**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Remove timing chain tensioner adjuster No. 2 (1) and gasket (2).

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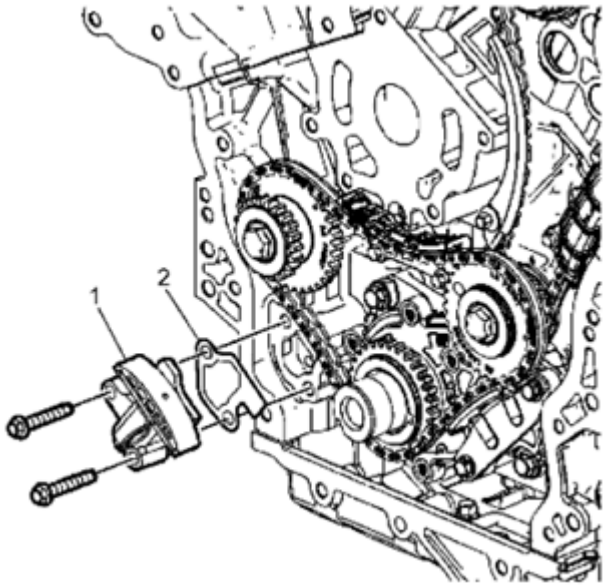



**Fig. 130: Identifying Timing Chain Tensioner Adjuster No. 2 And Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Remove timing chain guide No. 2 (1).

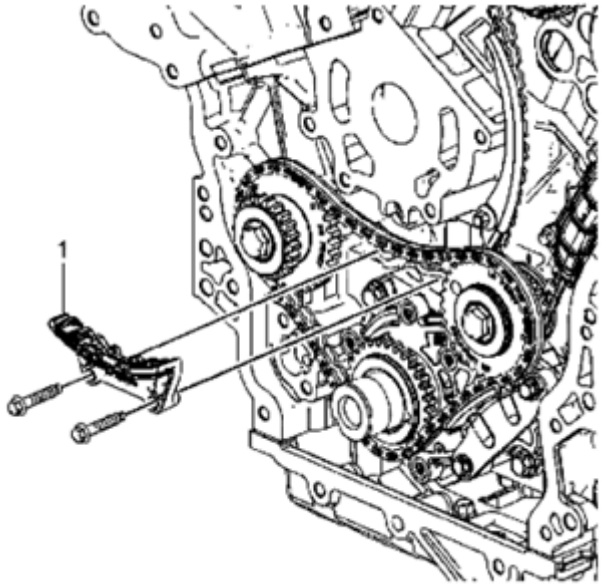



**Fig. 131: Identifying Timing Chain Guide No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Remove timing chain lower guide (1).

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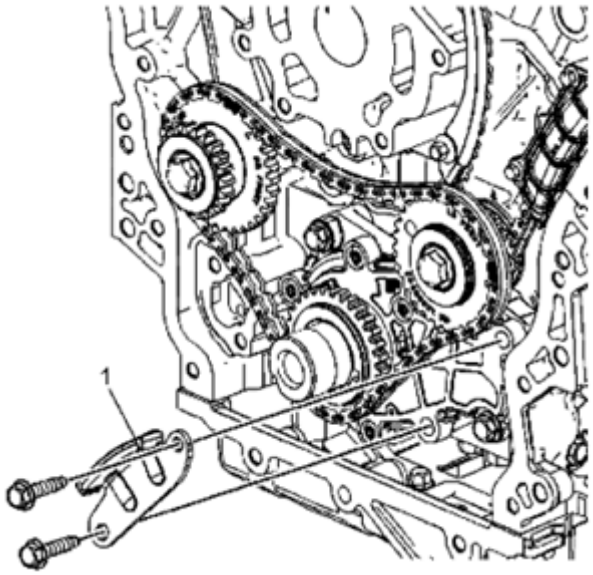



**Fig. 132: Identifying Timing Chain Lower Guide**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Remove 1st timing chain.
7. Remove idler sprocket No. 1 (1).

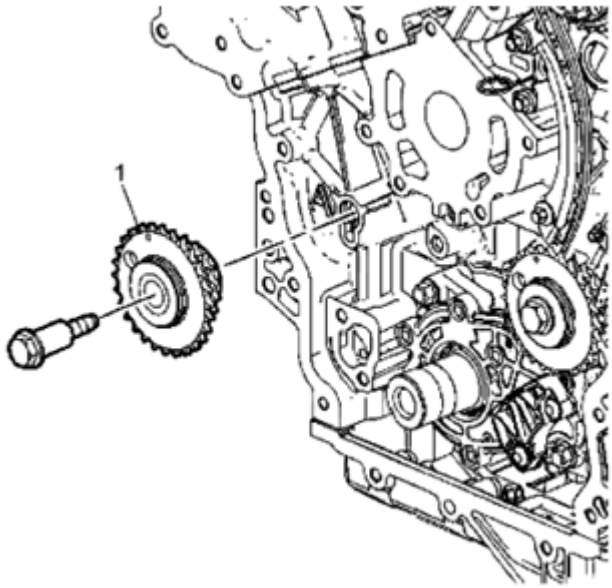



**Fig. 133: Identifying Idler Sprocket No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Remove crankshaft timing sprocket (1) and key (2).

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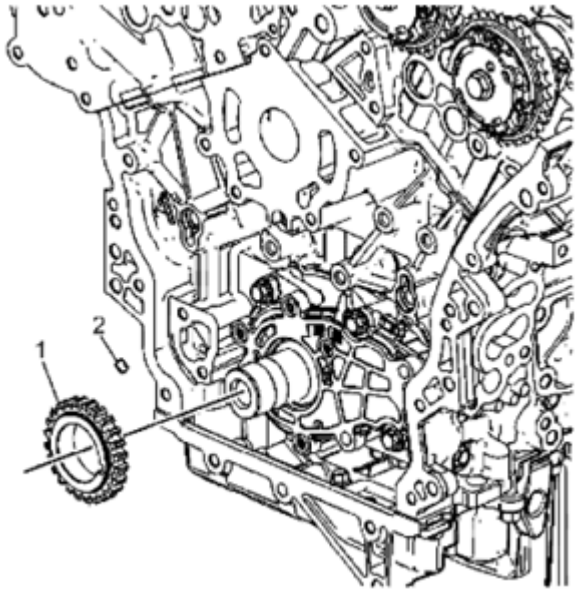



**Fig. 134: Identifying Crankshaft Timing Sprocket And Key**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Installation**

1. Install idler sprocket No. 1 (1) and tighten idler sprocket No. 1 bolt to specified torque.

   **Tightening torque**

   **Idler sprocket No. 1 bolt (a): 58 N.m (5.9 kg-m, 43.0 lbf-ft)**

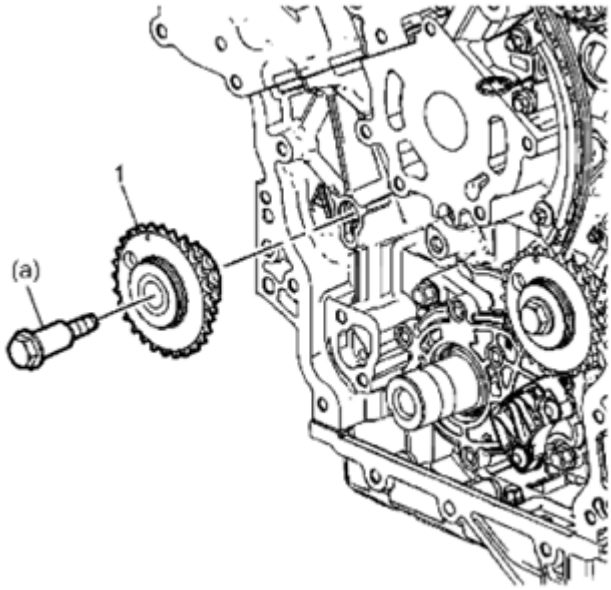



**Fig. 135: Identifying Idler Sprocket No. 1**
**Courtesy of SUZUKI OF AMERICA CORP.**

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2. Install key (2) to crankshaft.
3. Install crankshaft timing sprocket (1) to crankshaft.

**NOTE: Be sure to face circle mark (3) on crankshaft timing sprocket to timing chain cover side.**

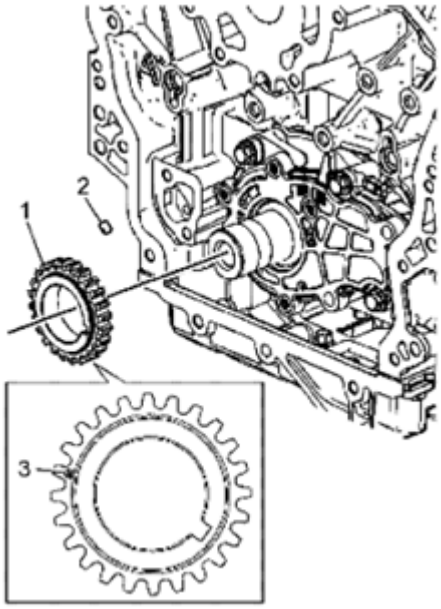



**Fig. 136: Identifying Crankshaft Timing Sprocket And Key**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Check that circle mark (1) on crankshaft timing sprocket is in alignment with circle mark (2) on oil pump.

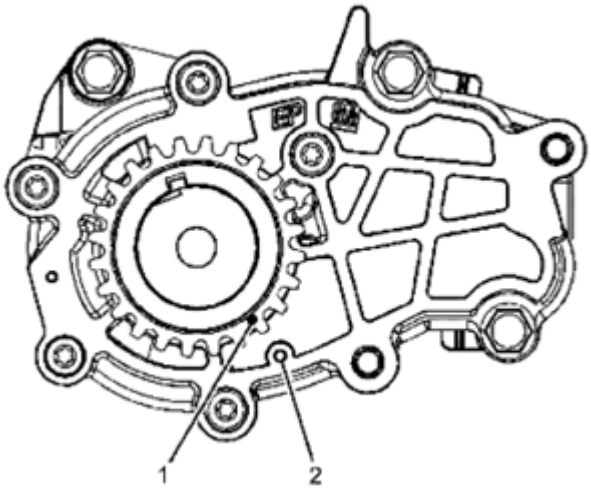



**Fig. 137: Aligning Circle Mark Crankshaft Timing Sprocket And Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**


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5. Install timing chain by aligning discrimination plates (2) of timing chain and triangle mark (1) on idler sprocket No. 1 and No. 2 as shown in figure.
6. Fit crankshaft timing sprocket to timing chain by aligning discrimination plate (2) of timing chain and circle mark (3) on crankshaft timing sprocket.

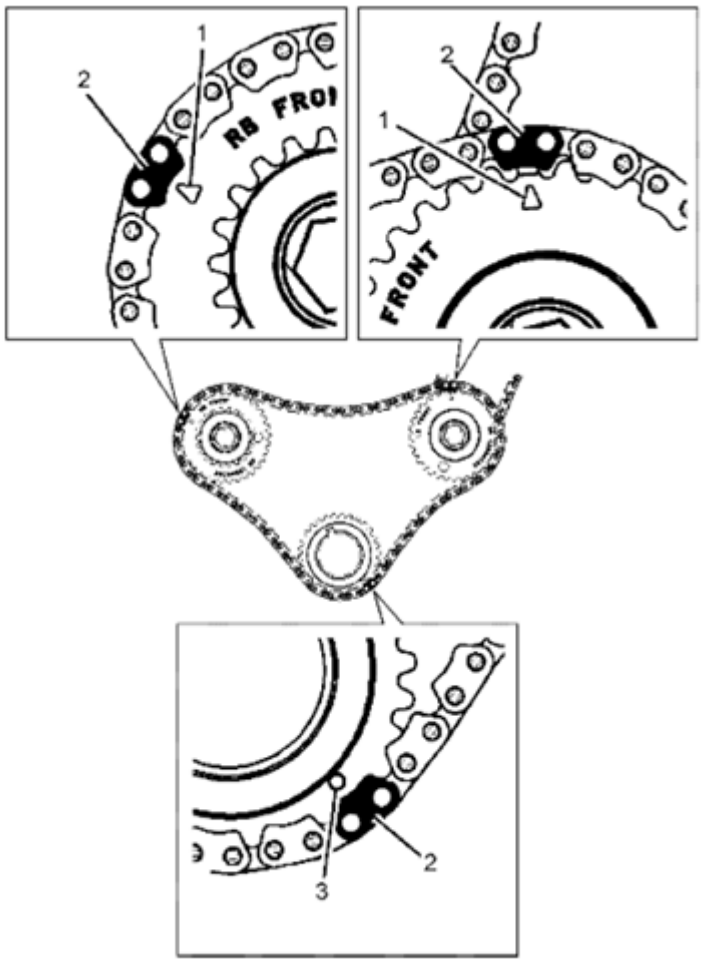



**Fig. 138: Identifying Timing Chain Mark Location**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Apply engine oil to sliding surface of timing chain lower guide (1) and install it. Tighten timing chain lower guide bolt to specified torque.

**Tightening torque**

**Timing chain lower guide bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

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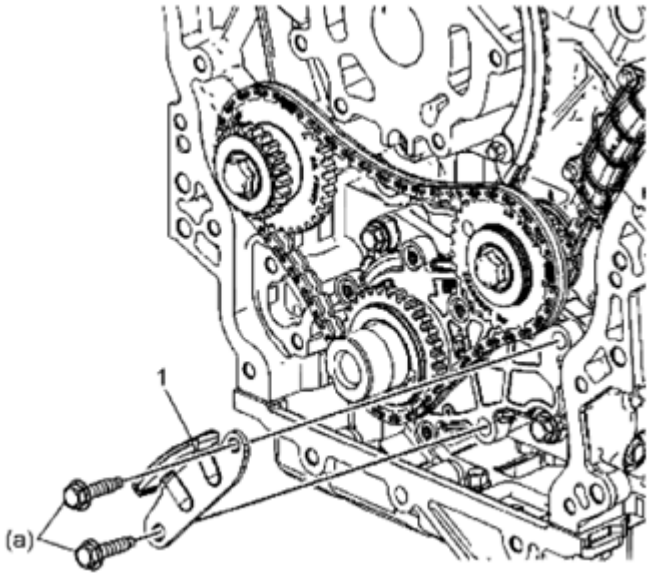



**Fig. 139: Identifying Timing Chain Lower Guide**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Apply engine oil to sliding surface of timing chain guide No. 2 (1) and install it. Tighten timing chain guide No. 2 bolt to specified torque.

**Tightening torque**

**Timing chain guide No. 2 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

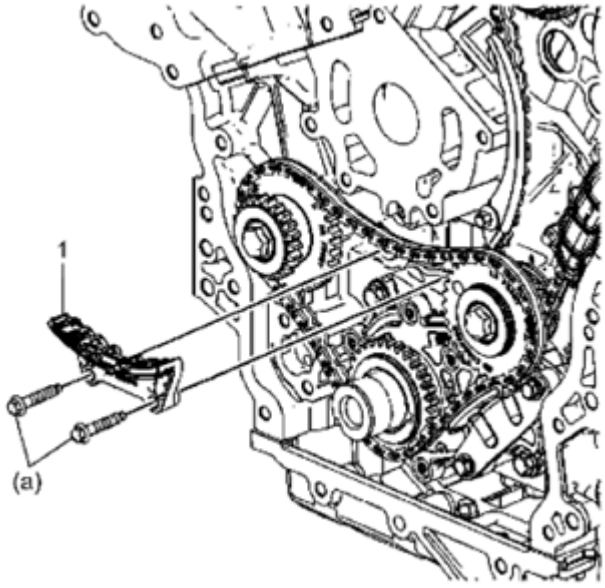



**Fig. 140: Identifying Timing Chain Guide No. 2 With Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

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9. Fix plunger in timing chain tensioner adjuster No. 2 as follows.
   a. Remove plunger (1) from timing chain tensioner adjuster No. 2 (2).

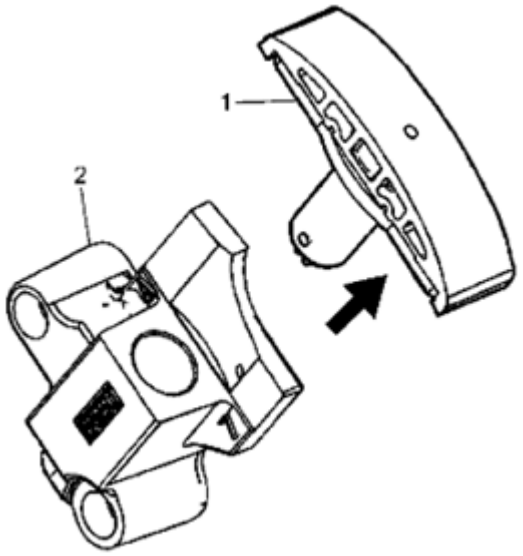



**Fig. 141: Removing Plunger From Timing Chain Tensioner Adjuster No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

   b. Using special tool, turn plunger in arrow direction to contract it and install it to timing chain tensioner adjuster No. 2.

**Special Tool**

**(A): 09918-57810**

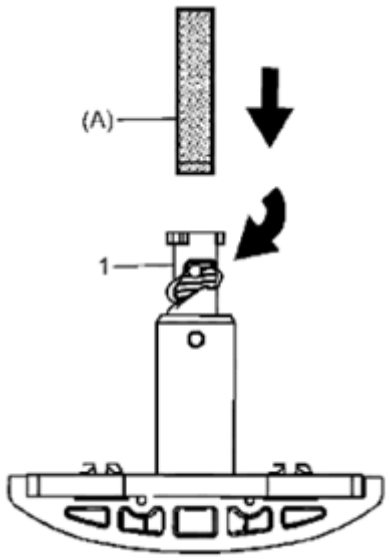



**Fig. 142: Installing Timing Chain Tensioner Adjuster No. 2**

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**Courtesy of SUZUKI OF AMERICA CORP.**

c. Hold plunger using lock pin (1) as follows.

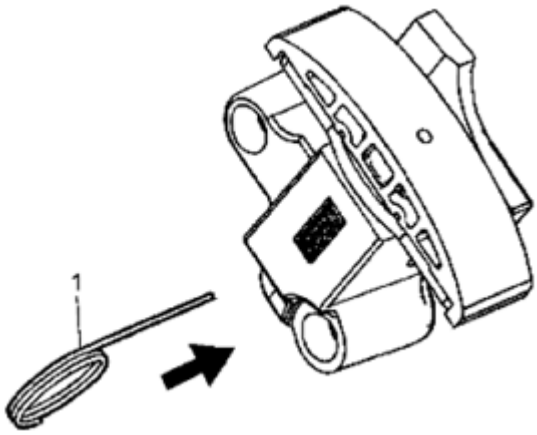



**Fig. 143: Holding Plunger Using Lock Pin**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Install new gasket (1) and timing chain tensioner adjuster No. 2 (2) and tighten timing chain tensioner adjuster No. 2 bolt to specified torque.

**Tightening torque**

**Timing chain tensioner adjuster No. 2 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

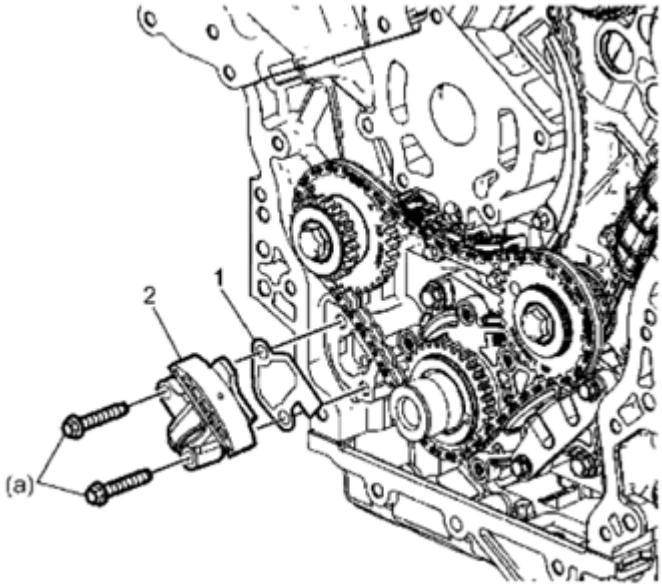



**Fig. 144: Identifying Gasket And Timing Chain Tensioner Adjuster No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

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11. Check that triangle mark (1) on idler sprocket No. 1, triangle mark (2) on idler sprocket No. 2 and circle mark (3) on crankshaft timing sprocket are in alignment with discrimination plates (4) of timing chain.

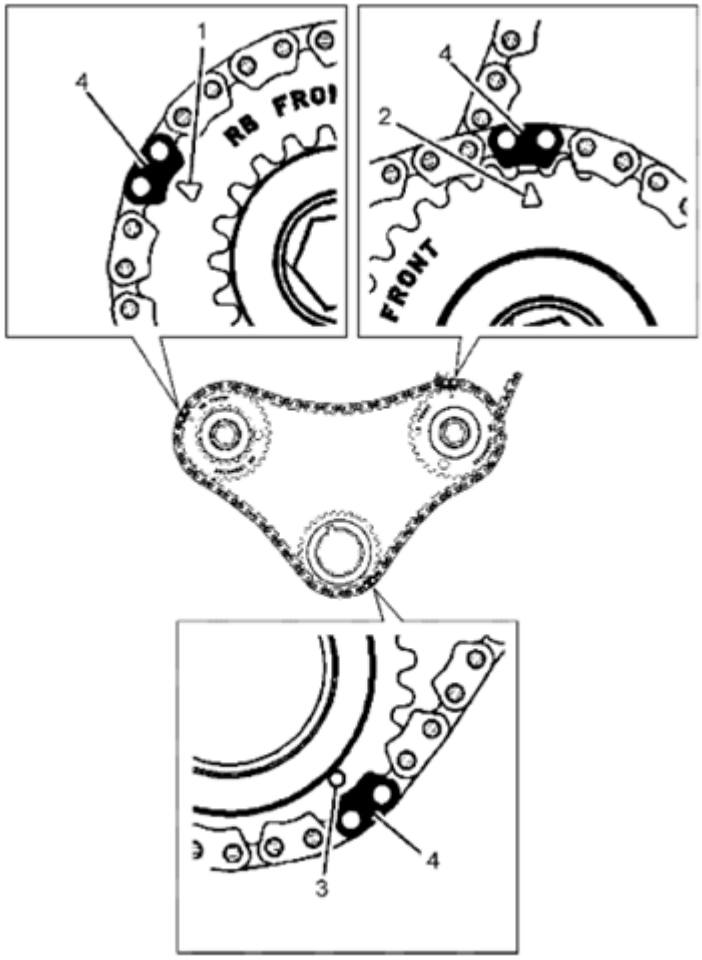



**Fig. 145: Identifying Timing Mark Location**
**Courtesy of SUZUKI OF AMERICA CORP.**

12. Remove lock pin (1) from timing chain tensioner adjuster No. 2.

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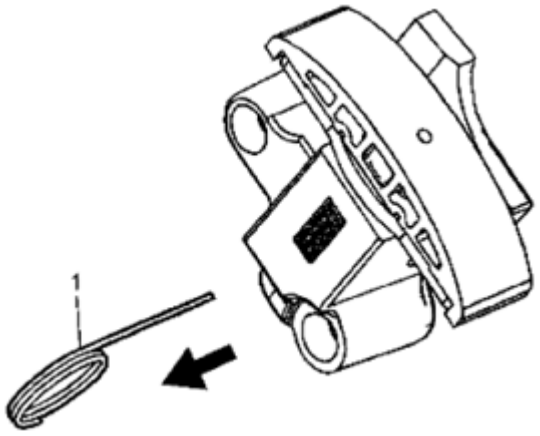



**Fig. 146: Removing Lock Pin From Timing Chain Tensioner Adjuster No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

13. Turn crankshaft clockwise by 2 revolutions and check that circle mark (1) on crankshaft timing sprocket are in alignment with circle mark (2) on oil pump.

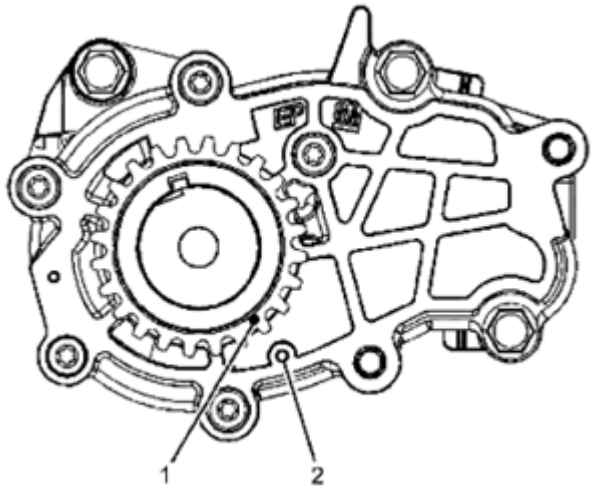



**Fig. 147: Aligning Mark Crankshaft Timing Sprocket And On Oil Pump**
**Courtesy of SUZUKI OF AMERICA CORP.**

14. Confirm that special tool is installed to camshaft (bank 2).
15. Remove special tool from camshaft (bank 2).

**Special Tool**

**(A): 09917-67810**

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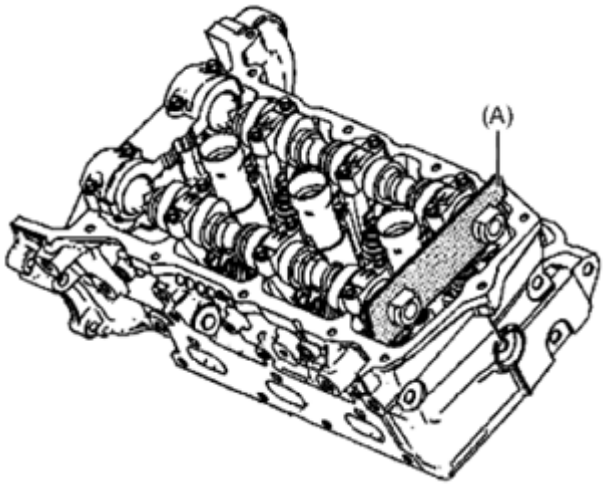



**Fig. 148: Removing Special Tool From Camshaft (Bank 2)**
**Courtesy of SUZUKI OF AMERICA CORP.**

16. Install 2nd timing chain (bank 1). See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
17. Install timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
18. Install belt idler arm to generator bracket. See **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
19. Install OCV. See **OCV REMOVAL AND INSTALLATION**.
20. Install P/S pump bracket. See **P/S PUMP REMOVAL AND INSTALLATION** .
21. Install water pump pulley. See **WATER PUMP REMOVAL AND INSTALLATION** .
22. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
23. Install accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
24. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## 1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 INSPECTION

**Timing Chain Guide No. 2**

Check shoe (1) for wear or damage.

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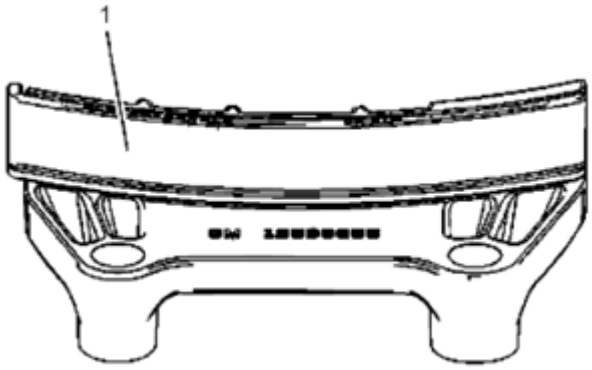



**Fig. 149: Identifying Timing Chain Guide No. 2 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Lower Guide**

Check shoe (1) for wear or damage.




**Fig. 150: Identifying Timing Chain Lower Guide Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**1st Timing Chain**

Check timing chain for wear or damage.

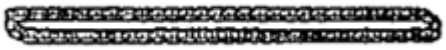


**Fig. 151: Identifying 1st Timing Chain Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Tensioner Adjuster No. 2**

- Check shoe (1) of timing chain tensioner adjuster No. 2 for wear or damage. If any malfunction is found, replace it.
- Check that plunger (2) operates smoothly. If any malfunction is found, replace it.

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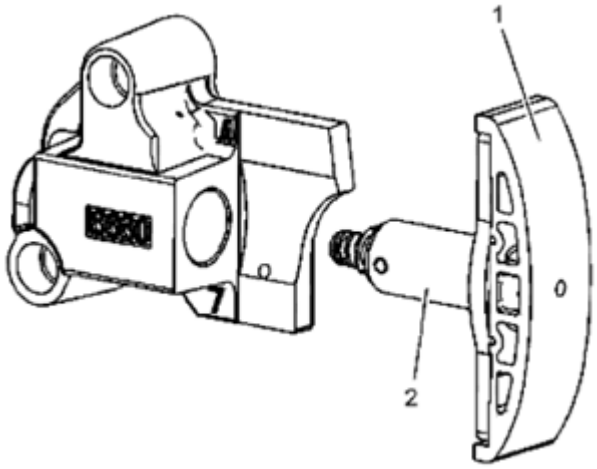



**Fig. 152: Identifying Shoe Of Timing Chain Tensioner Adjuster No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Idler Sprocket No. 1**

Check teeth of idler sprocket No. 1 for wear or damage.

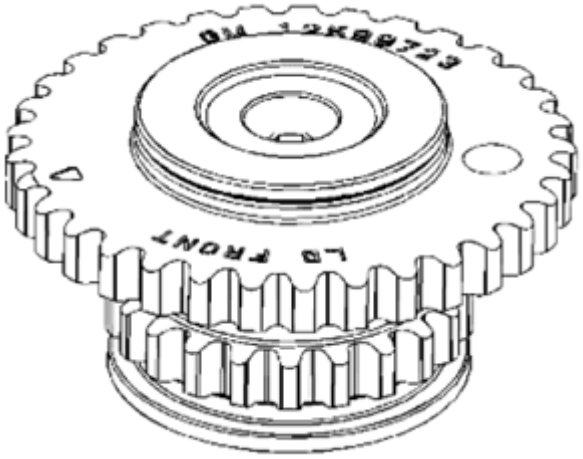



**Fig. 153: Identifying Idler Sprocket No. 1 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Crankshaft Timing Sprocket**

Check teeth of crankshaft timing sprocket for wear or damage.

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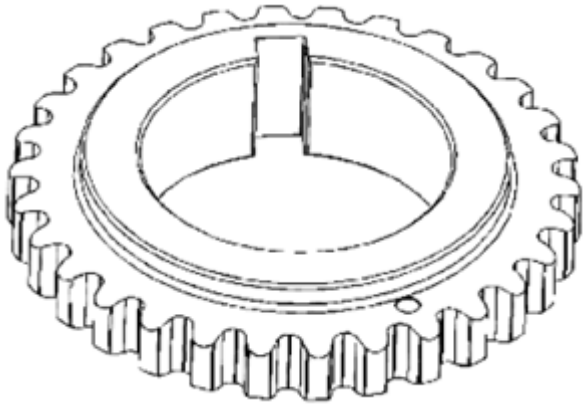
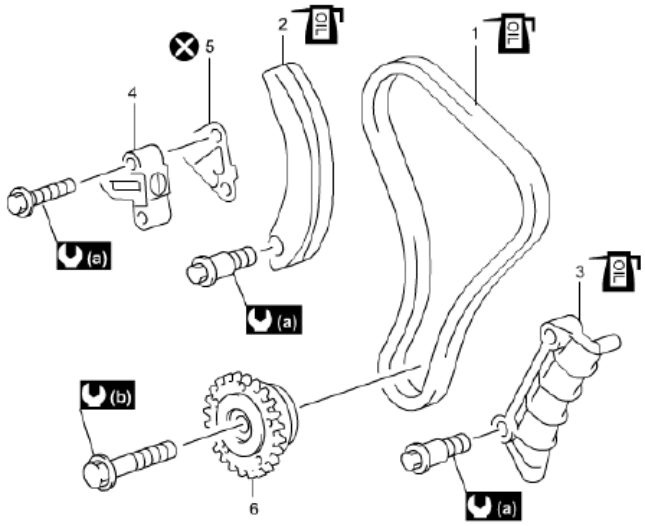


**Fig. 154: Identifying Crankshaft Timing Sprocket Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

## 2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 COMPONENTS

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**




| | | |
|---|---|---|
| OIL 1. 2nd timing chain (bank 2) : Apply engine oil to sliding surface. | 4. Timing chain tensioner adjuster No.3 | (a): 23 N·m (2.3 kgf-m, 17.0 lbf-ft) |
| OIL 2. Timing chain tensioner No.2 : Apply engine oil to sliding surface. | 5. Gasket | (b): 58 N·m (5.9 kgf-m, 43.0 lbf-ft) |
| OIL 3. Timing chain guide No.3 : Apply engine oil to sliding surface. | 6. Idler sprocket No.2 | : Do not reuse. |

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**Fig. 155: Identifying 2nd Timing Chain (Bank 2) And Timing Chain Tensioner Adjuster No. 3 Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

## 2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 REMOVAL AND INSTALLATION

*Reference:* **2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 COMPONENTS**

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

**Removal**

1. Remove 1st timing chain. See **1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 REMOVAL AND INSTALLATION**.
2. Remove timing chain tensioner adjuster No. 3 (1) and gasket (2).

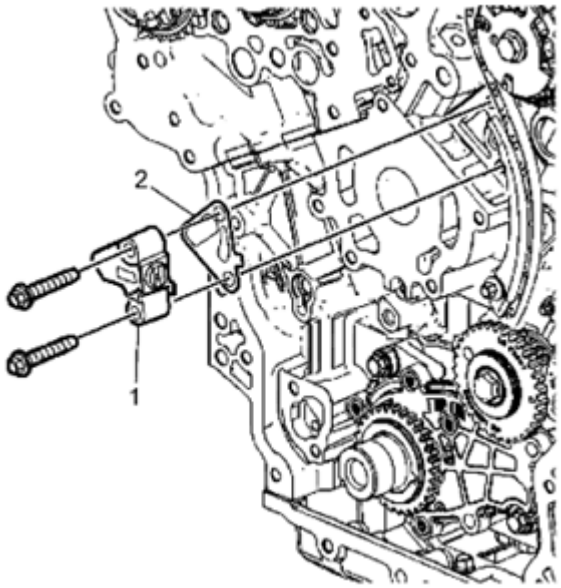



**Fig. 156: Identifying Timing Chain Tensioner Adjuster No. 3 And Gasket**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Remove timing chain tensioner No. 2 (1).

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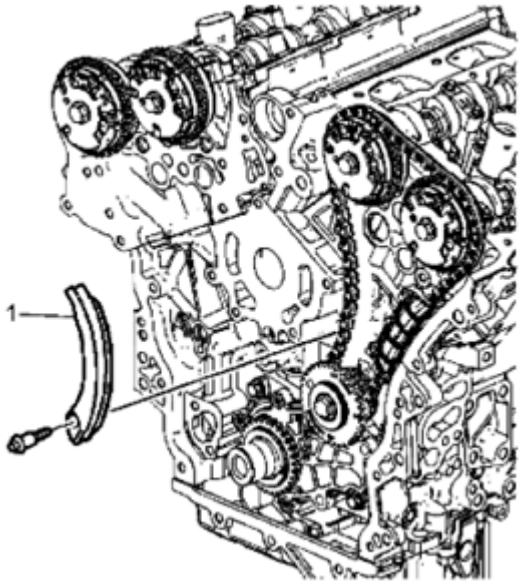



**Fig. 157: Identifying Timing Chain Tensioner No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

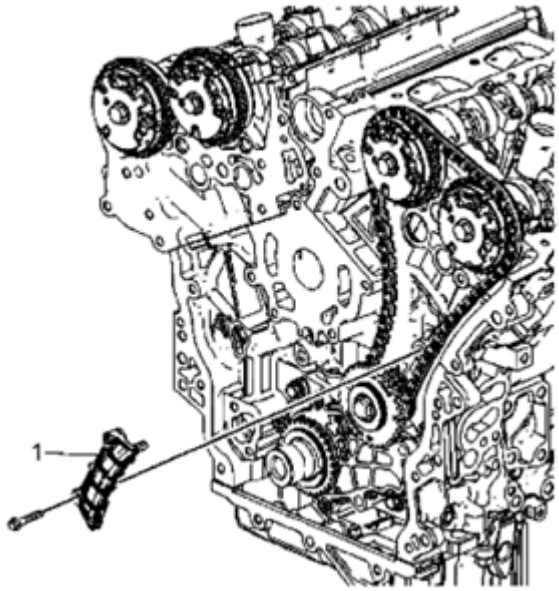



**Fig. 158: Identifying Timing Chain Guide No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Remove 2nd timing chain (bank 2).
6. Remove idler sprocket No. 2 (1).

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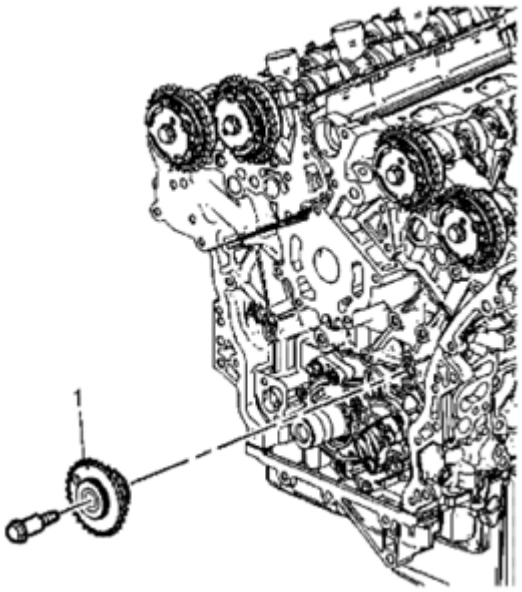



**Fig. 159: Identifying Idler Sprocket No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Installation**

1. Install idler sprocket No. 2 (1) and tighten idler sprocket No. 2 bolt to specified torque.

   **Tightening torque**

   **Idler sprocket No. 2 bolt (a): 58 N.m (5.9 kg-m, 43.0 lbf-ft)**

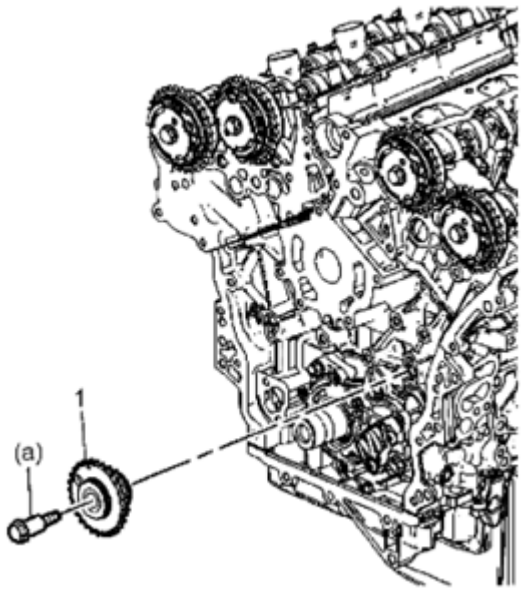



**Fig. 160: Identifying Idler Sprocket No. 2 With Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

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2. Install timing chain by aligning discrimination plates (2) of timing chain and circle mark (1) on intake and exhaust CMP actuator as shown in figure.
3. Fit idler sprocket No. 2 to timing chain by aligning discrimination plate (2) of timing chain and match mark (3) on idler sprocket No. 2.

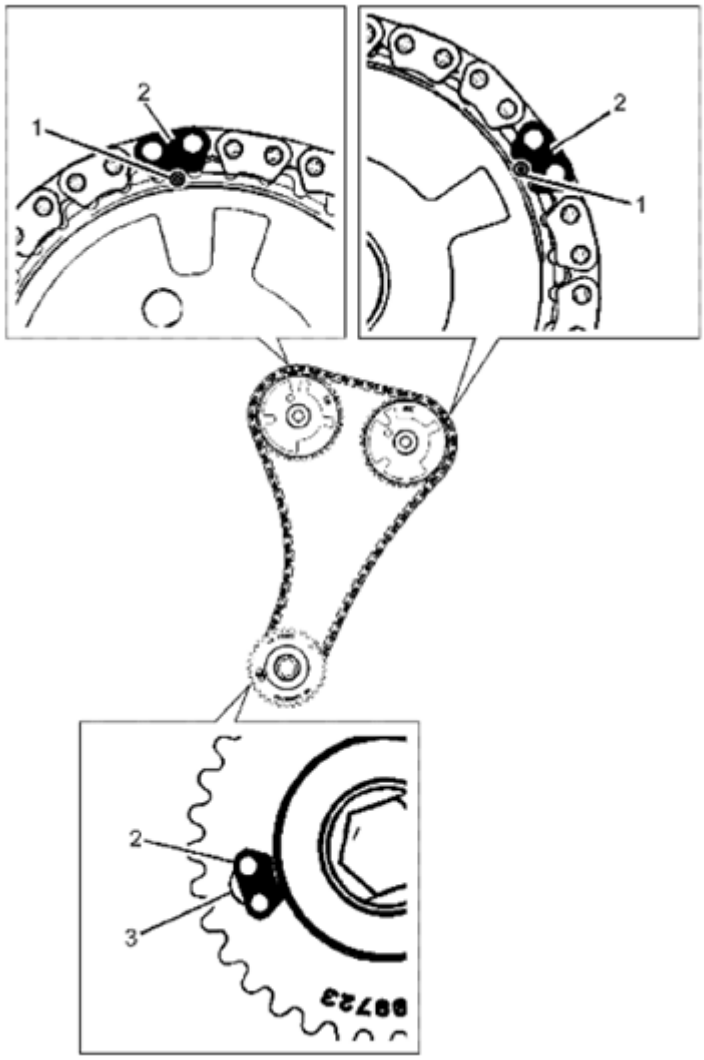



**Fig. 161: Aligning Mark Discrimination Plate And Idler Sprocket No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Apply engine oil to sliding surface of timing chain guide No. 3 (1) and install it. Tighten timing chain guide No. 3 bolt to specified torque.

**Tightening torque**

**Timing chain guide No. 3 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

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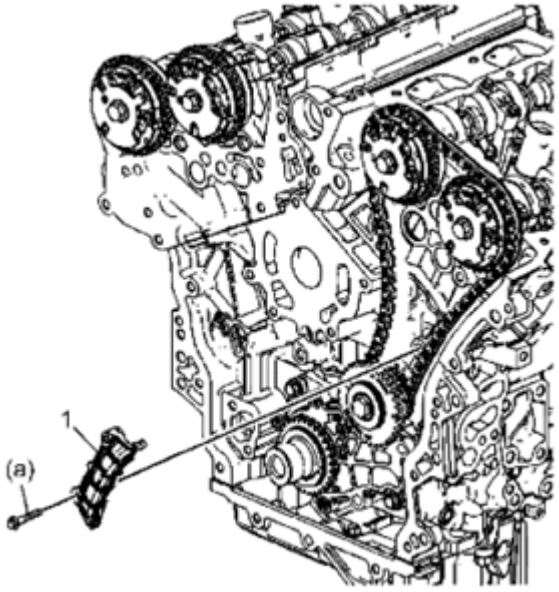



**Fig. 162: Identifying Timing Chain Guide No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Apply engine oil to sliding surface of timing chain tensioner No. 2 (1) and install it. Tighten timing chain tensioner No. 2 bolt to specified torque.

**Tightening torque**

**Timing chain tensioner No. 2 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

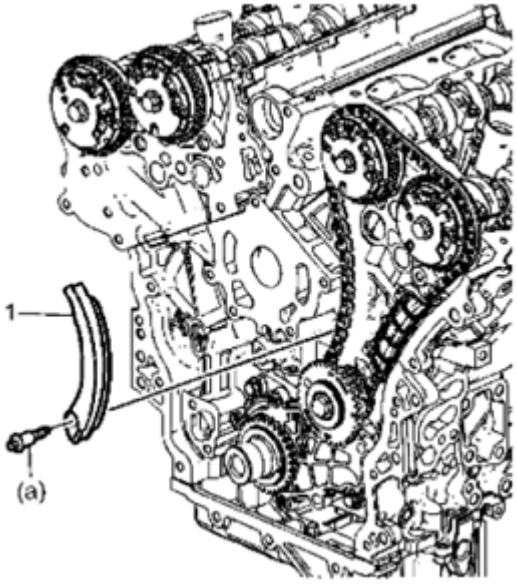



**Fig. 163: Identifying Timing Chain Tensioner No. 2**
**Courtesy of SUZUKI OF AMERICA CORP.**

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6. Fix plunger in timing chain tensioner adjuster No. 3 as follows.
   a. Remove plunger (1) from timing chain tensioner adjuster No. 3 (2).

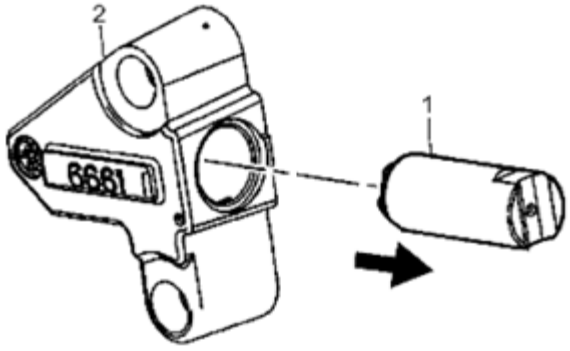



**Fig. 164: Removing Plunger From Timing Chain Tensioner Adjuster No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

   b. Using special tool, turn plunger in arrow direction to contract it and install it to timing chain tensioner adjuster No. 3.

**Special Tool**

**(A): 09918-57810**

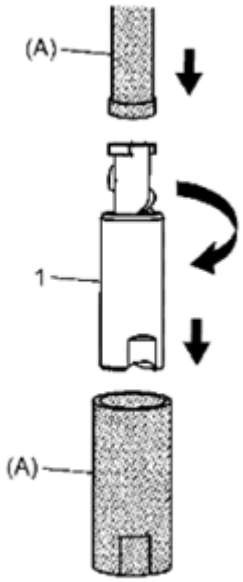



**Fig. 165: Installing Timing Chain Tensioner Adjuster No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

   c. Hold plunger using lock pin (1) as follows.

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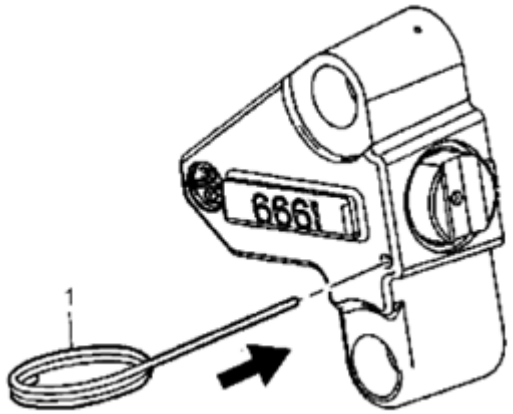



**Fig. 166: Holding Plunger Using Lock Pin**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Install new gasket (1) and timing chain tensioner adjuster No. 3 (2) and tighten timing chain tensioner adjuster No. 3 bolt to specified torque.

   **Tightening torque**

   **Timing chain tensioner adjuster No. 3 bolt (a): 23 N.m (2.3 kg-m, 17.0 lbf-ft)**

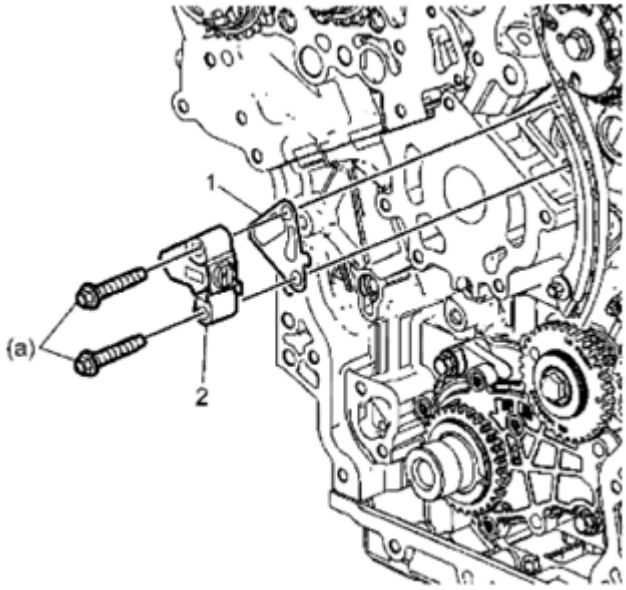



**Fig. 167: Identifying Timing Chain Tensioner Adjuster No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Check that circle mark (1) on intake CMP actuator, circle mark (2) on exhaust CMP actuator and alignment mark (3) on idler sprocket No. 2 are in match with discrimination plates (4) of timing chain.

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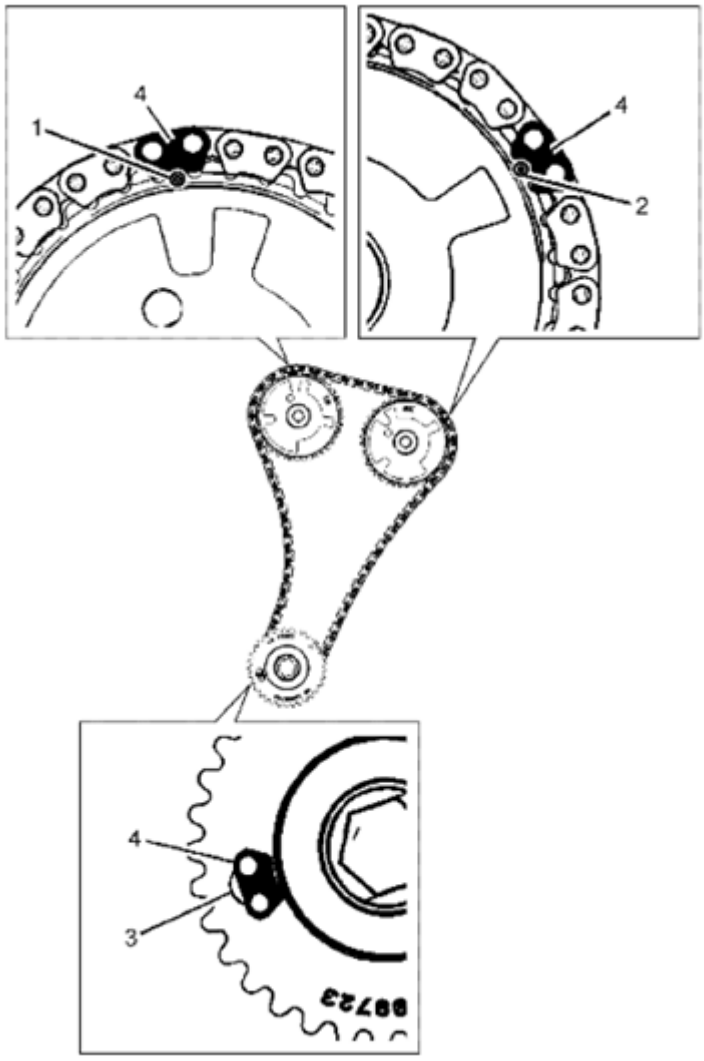
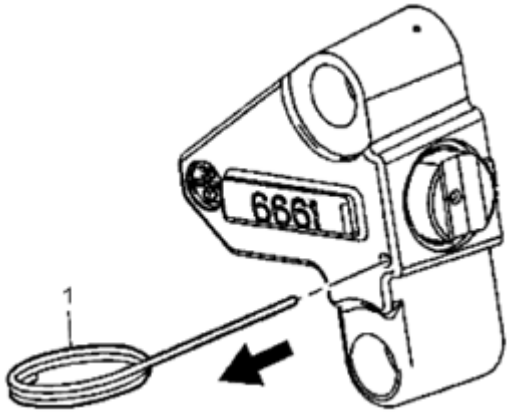



**Fig. 168: Aligning Timing Mark Idler Sprocket No. 2 And Timing Chain**
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Remove lock pin (1) from timing chain tensioner adjuster No. 3.




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**Fig. 169: Removing Lock Pin From Timing Chain Tensioner Adjuster No. 3**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Install 1st timing chain. See **1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 REMOVAL AND INSTALLATION**.
11. Install 2nd timing chain (bank 1). See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
12. Install timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
13. Install belt idler arm to generator bracket. See **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
14. Install OCV. See **OCV REMOVAL AND INSTALLATION**.
15. Install P/S pump bracket. See **P/S PUMP REMOVAL AND INSTALLATION** .
16. Install water pump pulley. See **WATER PUMP REMOVAL AND INSTALLATION** .
17. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
18. Install accessory drive belt. See **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
19. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## 2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 INSPECTION

**Timing Chain Tensioner No. 2**

Check shoe (1) and contact surface (2) of plunger for wear or damage.

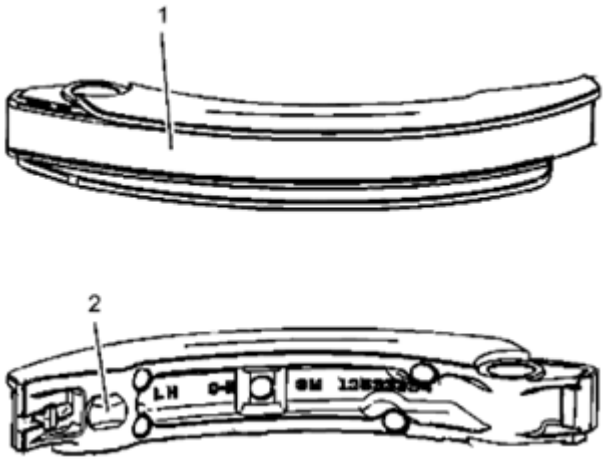



**Fig. 170: Identifying Timing Chain Tensioner No. 2 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Guide No. 3**

Check shoe (1) for wear or damage.

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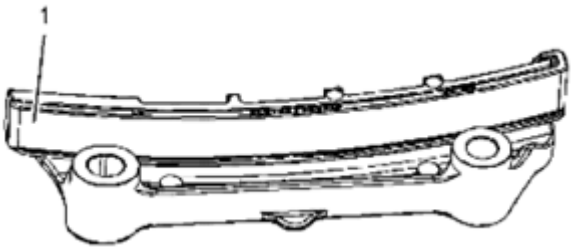



**Fig. 171: Identifying Timing Chain Guide No. 3 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**2nd Timing Chain (Bank 2)**

Check timing chain for wear or damage.

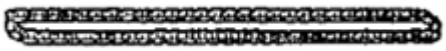


**Fig. 172: Identifying 2nd Timing Chain (Bank 2) Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Timing Chain Tensioner Adjuster No. 3**

- Check timing chain tensioner adjuster No. 3 and contact surface (1) of timing chain tensioner No. 2 for wear or damage. If any malfunction is found, replace it.
- Check that plunger (2) operates smoothly. If any malfunction is found, replace it.

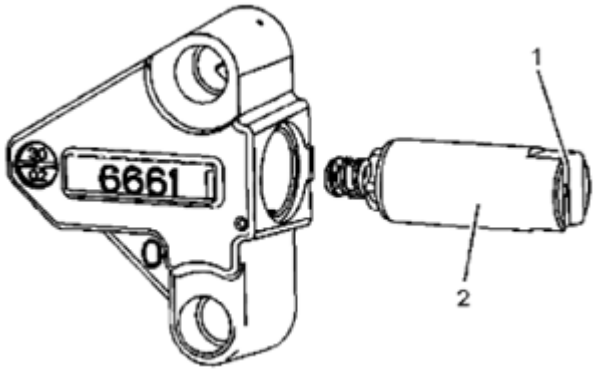



**Fig. 173: Checking Plunger Operates Smoothly**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Idler Sprocket No. 2**

Check teeth of idler sprocket No. 2 for wear or damage.

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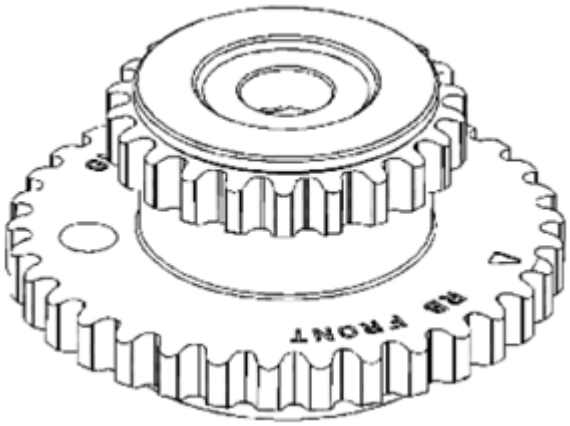
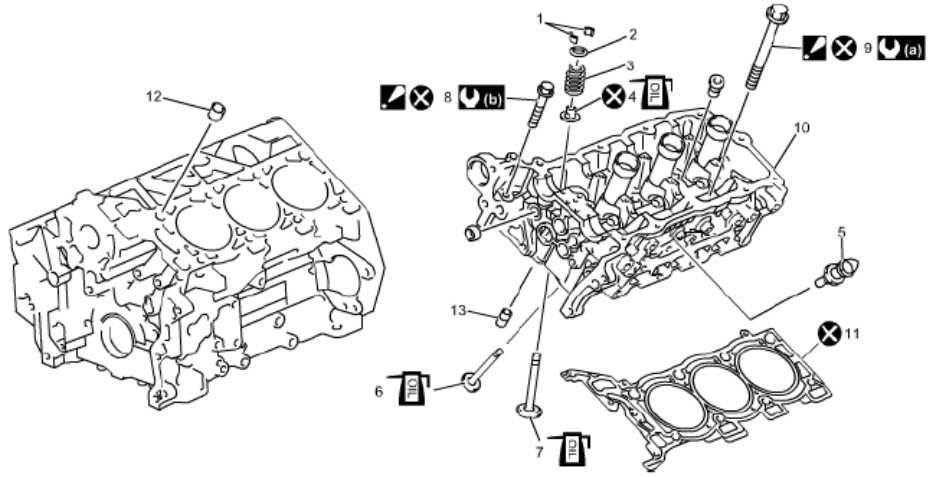



**Fig. 174: Identifying Idler Sprocket No. 2 Damage Area**
**Courtesy of SUZUKI OF AMERICA CORP.**

## VALVE AND CYLINDER HEAD COMPONENTS

**NOTE:** **For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**




| | | |
|---|---|---|
| 1. Valve cotters | 7. Exhaust valve | 13. Oil relief valve |
| 2. Valve spring retainer | 8. Cylinder head bolt No.2 : For tightening order, refer to *Valve and Cylinder Head Removal and Installation:N32A*. | (a): 30 N·m → +150° (3.1 kgf-m → +150°, 22.5 lbf-ft → +150°) |
| 3. Valve spring | 9. Cylinder head bolt No.1 : For tightening order, refer to *Valve and Cylinder Head Removal and Installation:N32A*. | (b): 15 N·m → +75° (1.5 kgf-m → +75°, 11.0 lbf-ft → +75°) |
| 4. Valve stem seal | 10. Cylinder head | : Do not reuse. |
| 5. ECT sensor | 11. Cylinder head gasket | OIL: Apply engine oil to sliding surface. |
| 6. Intake valve | 12. Dowel pin | |

**Fig. 175: Identifying Valve And Cylinder Head Components With Torque Specifications**

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**Courtesy of SUZUKI OF AMERICA CORP.**

**Cylinder Head Bolt Tightening Order**

See **VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**.

**VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**

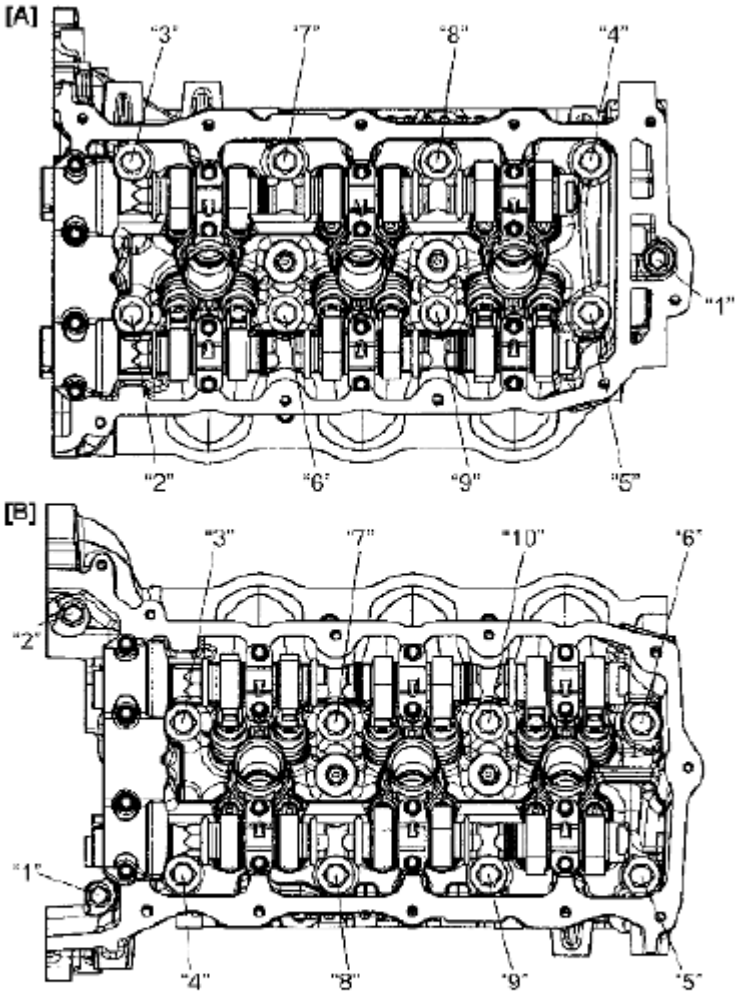
***Reference:*** **VALVE AND CYLINDER HEAD COMPONENTS**

**NOTE: For identification of each cylinder and bank, refer to PRECAUTION FOR IDENTIFICATION OF CYLINDER AND BANK .**

**Removal**

1. Remove engine assembly from vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
3. Remove generator bracket. See **GENERATOR REMOVAL AND INSTALLATION** .
4. Remove timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
5. Remove 2nd timing chain (bank 1), timing chain tensioner adjuster No. 1, timing chain tensioner No. 1 and timing chain guide No. 1. See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
6. Remove 2nd timing chain (bank 2), timing chain tensioner adjuster No. 3, timing chain tensioner No. 2 and timing chain guide No. 3. See **2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 REMOVAL AND INSTALLATION**.
7. Loosen cylinder head bolts No. 1 and No. 2 in numerical order ("1" - "10") as shown in figure, and remove cylinder head bolts No. 1 and No. 2.

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 176: Identifying Cylinder Head Bolts**
**Courtesy of SUZUKI OF AMERICA CORP.**

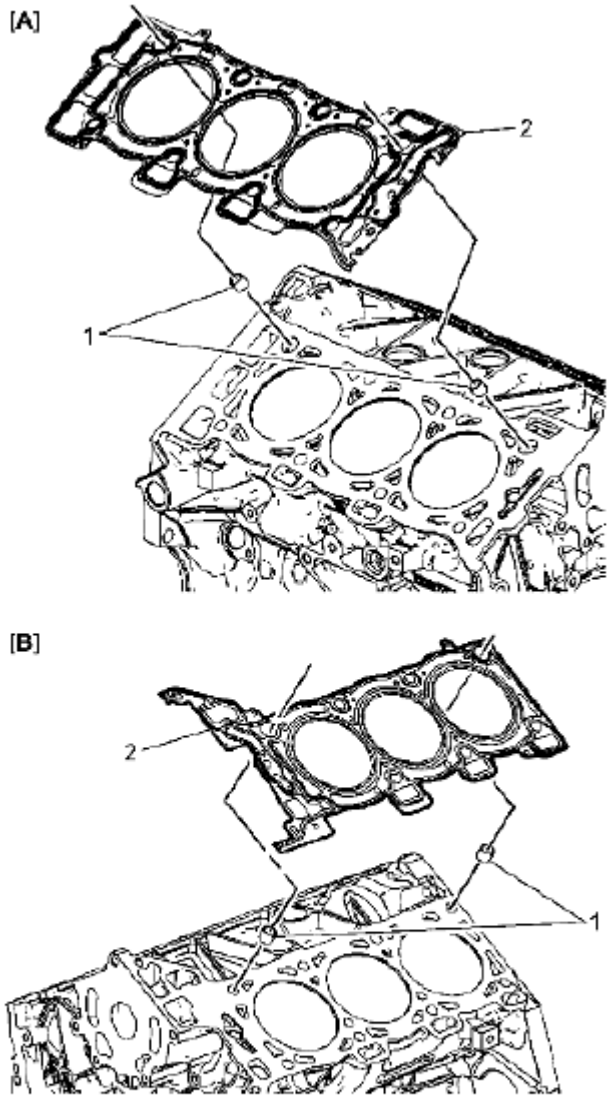
8. If necessary, remove exhaust manifold. See **EXHAUST MANIFOLD REMOVAL AND INSTALLATION (N32A)** .
9. If necessary, remove valve lash adjusters, valve rocker arms, intake and exhaust camshafts. See **CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM REMOVAL AND INSTALLATION**.
10. Remove cylinder head.

**Installation**

1. Clean mating surface of cylinder head and cylinder block.

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2. Install dowel pins (1) to cylinder block.
3. Install new cylinder head gaskets (2) to cylinder block.




| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 177: Identifying Cylinder Head Gaskets**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Install cylinder head as follows.

**CAUTION: Do not apply engine oil to cylinder head bolts No. 1 and No. 2.**

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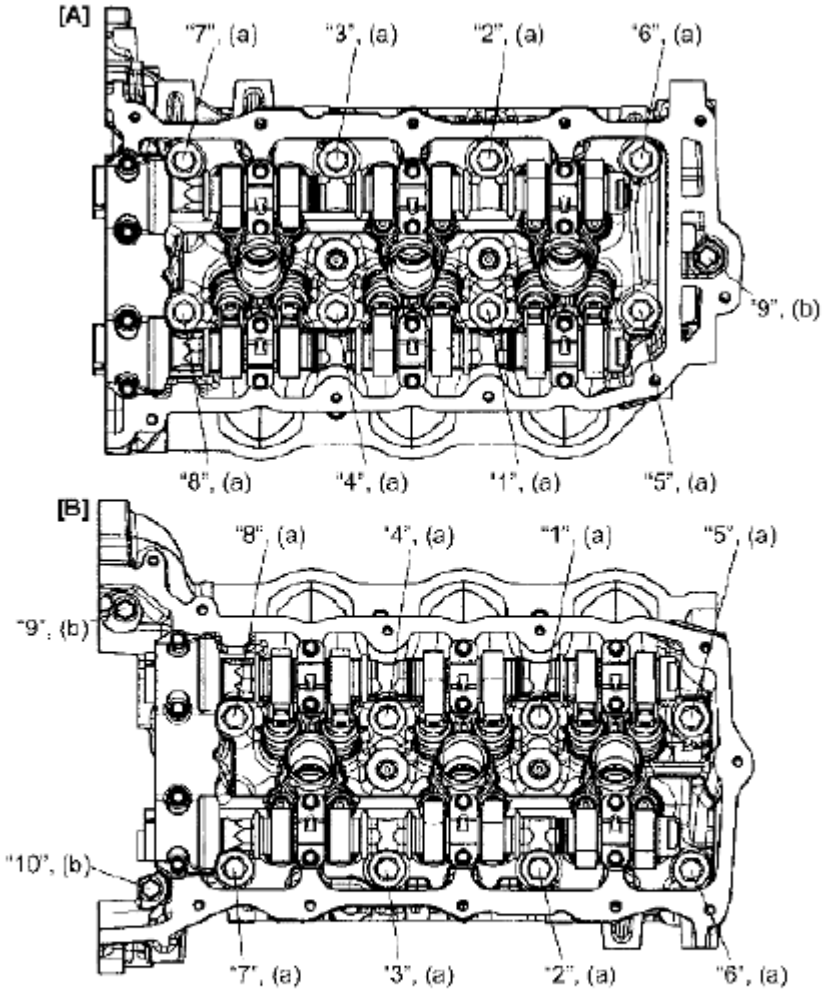
a. Tighten cylinder head bolts No. 1 to 30 N.m (3.1 kgf-m, 22.5 lbf-ft) in numerical order ("1" - "8") shown in figure evenly and gradually.
b. In the same manner as Step a), retighten them to +150°.
c. Tighten cylinder head bolt No. 2 to 15 N.m (1.5 kgf-m, 11.0 lbf-ft) in numerical order ("9" - "10") shown in figure evenly and gradually.
d. In the same manner as Step c), retighten them to +75°.

**Tightening torque**

**Cylinder head bolt No. 1 bolt* (a): 30 N.m --> +150° (3.1 kgf-m --> +150°, 22.5 lbf-ft --> +150°)**

**Cylinder head bolt No. 2 bolt* (a): 15 N.m --> +75° (1.5 kgf-m --> +75°, 11.0 lbf-ft --> +75°)**

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| | |
|---|---|
| [A]: Bank 1 | [B]: Bank 2 |

**Fig. 178: Identifying Cylinder Head Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Install 2nd timing chain (bank 2), timing chain tensioner adjuster No. 3, timing chain tensioner No. 2 and timing chain guide No. 3. See **2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 REMOVAL AND INSTALLATION**.
6. Install 2nd timing chain (bank 1), timing chain tensioner adjuster No. 1, timing chain tensioner No. 1 and timing chain guide No. 1. See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
7. Install timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
8. Install generator bracket. See **GENERATOR REMOVAL AND INSTALLATION** .
9. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.

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10. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## VALVES AND CYLINDER HEAD DISASSEMBLY AND REASSEMBLY

***Reference:*** **VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**

**Disassembly**

1. Place disassembled parts except valve stem seal in order so that they can be installed in their original positions.
2. For ease in servicing cylinder head, remove ECT sensor, spark plug, exhaust manifold from cylinder head.
   - **ENGINE COOLANT TEMPERATURE (ECT) SENSOR REMOVAL AND INSTALLATION**
   - **SPARK PLUG REMOVAL AND INSTALLATION**
   - **EXHAUST MANIFOLD REMOVAL AND INSTALLATION (N32A)**
3. Using special tools (Valve lifter) as shown in figure [A] or [B], compress valve spring and then remove valve cotters using special tool (Forceps).

   **Special Tool**

   **(A): 09916-14510**

   **(B): 09916-14530**

   **(C): 09916-84511**

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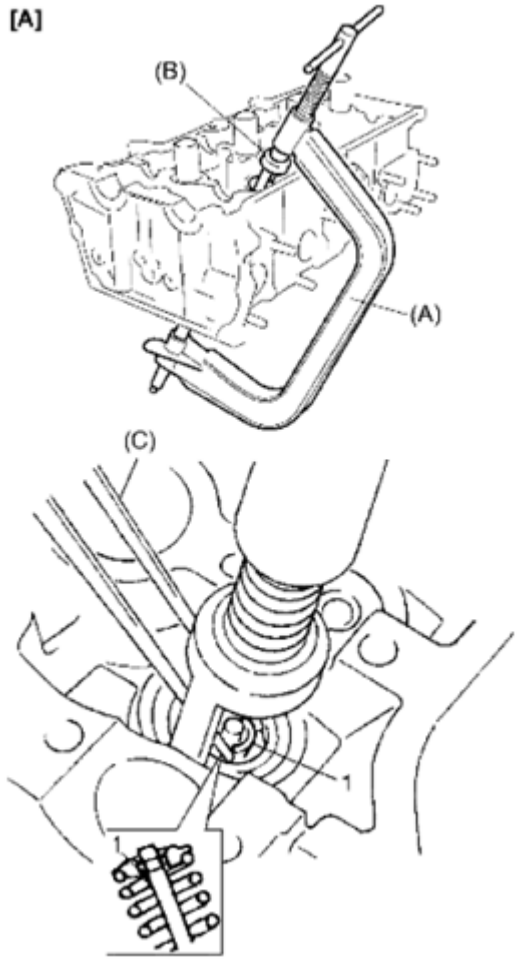



**Fig. 179: Compressing Valve Spring**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Special Tool**

**(D): Off-vehicle valve spring compressor adapter (EN-46119)**

**(E): Valve stem key remover/installer (EN-46117)**

**(F): Valve spring compressor head off (J-8062)**

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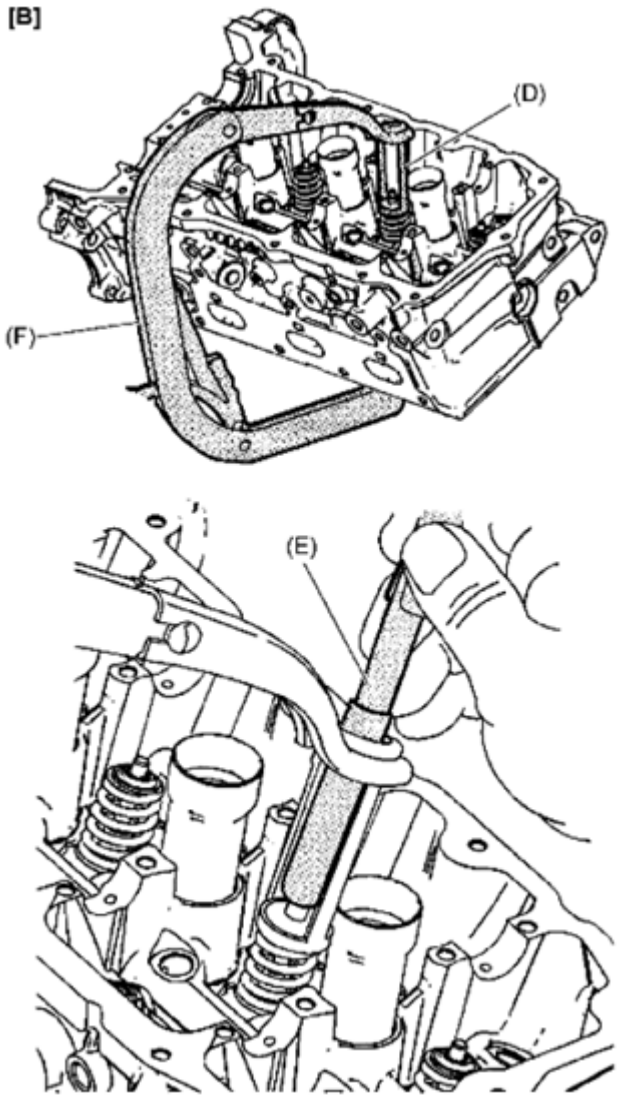



**Fig. 180: Removing Valve Cotters**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Release special tools (Valve lifter), and remove valve spring retainer (1) and valve spring (2).

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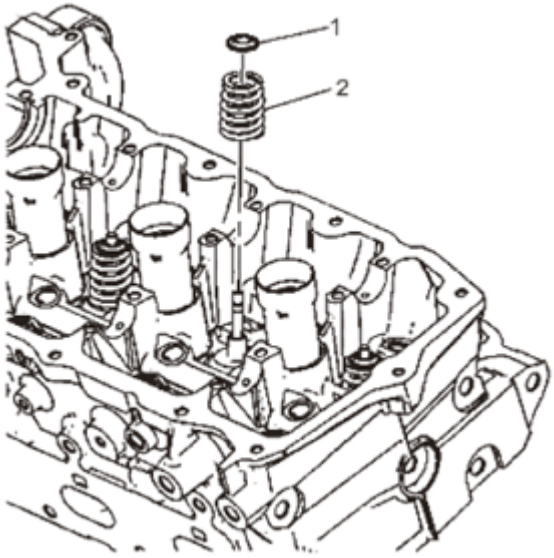



**Fig. 181: Identifying Valve Spring Retainer And Valve Spring**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Remove valve (1) from cylinder block.

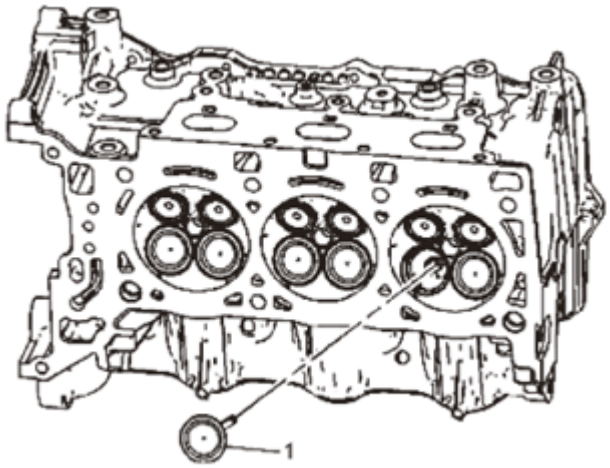



**Fig. 182: Identifying Cylinder Block Valve**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Remove valve stem seal (1).

**Special Tool**

**(A): 09917-97810**

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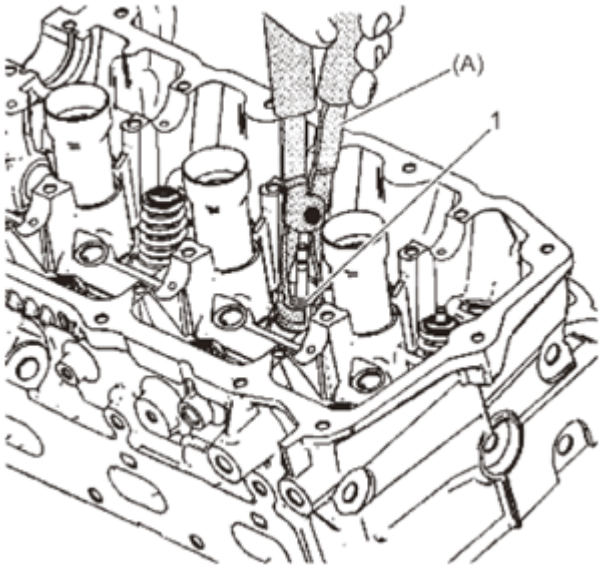



**Fig. 183: Removing Valve Stem Seal**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. If necessary, remove oil relief valve as follows.

**CAUTION: After removing oil relief valve, clean dust from cylinder block.**

a. Using special tool, cut down upper part of oil relief valve up to the extent that the ball in the valve can be removed.

**Special Tool**

**(A): 09917-66520**

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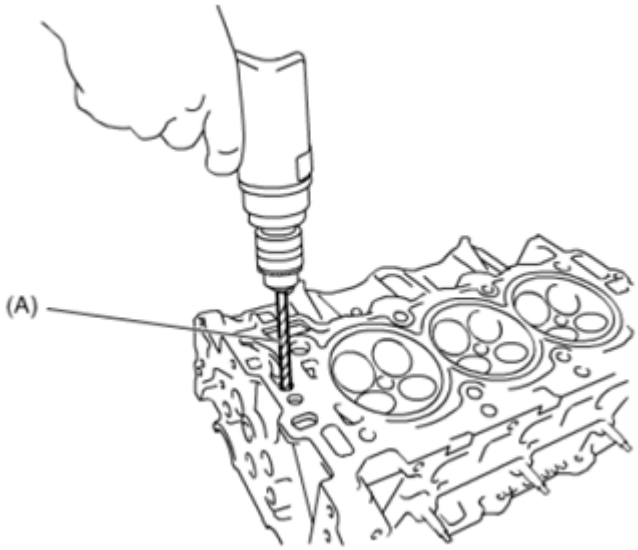



**Fig. 184: Drilling Oil Relief Valve**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Remove check ball and spring from oil relief valve.
c. Using special tool, tap the threads of oil relief valve.

**Special Tool**

**(A): 09917-66520**

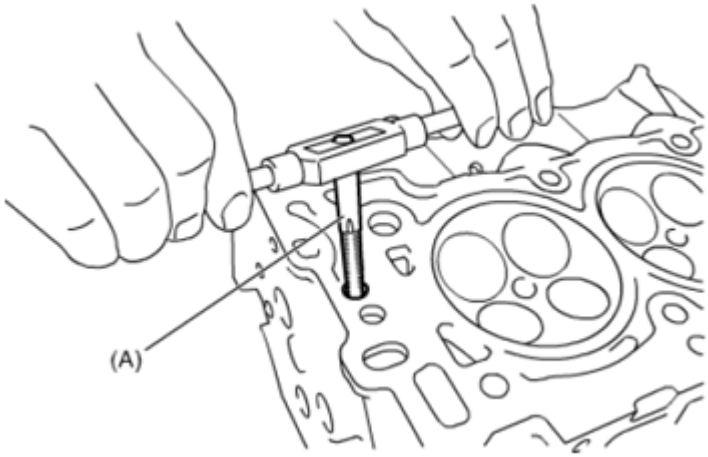



**Fig. 185: [Tapping Threads Of Oil Relief Valve]**
**Courtesy of SUZUKI OF AMERICA CORP.**

d. Using special tool, Remove oil relief valve from cylinder head.

**Special Tool**

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**(A): 09921-96010**

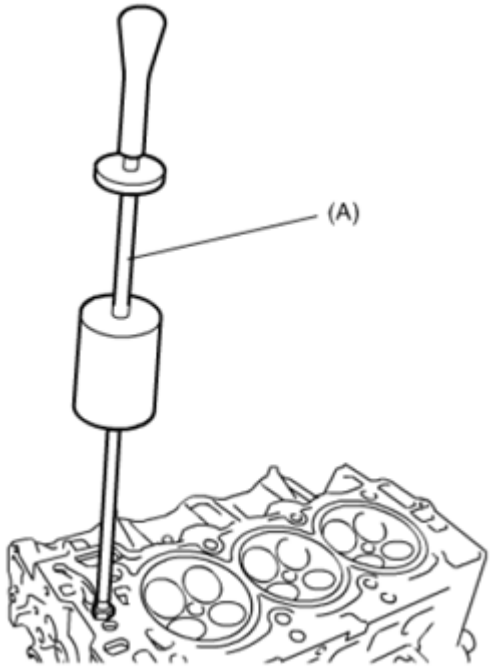



**Fig. 186: Removing Oil Relief Valve From Cylinder Head**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Reassembly**

1. Using special tool, Install new oil relief valve to cylinder head.

   **Special Tool**

   **(A): 09917-66520**

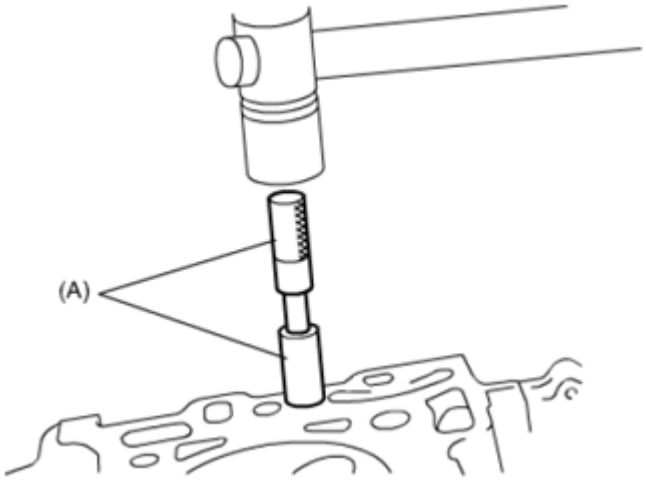



**Fig. 187: Tapping Oil Relief Valve To Cylinder Head**

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**Courtesy of SUZUKI OF AMERICA CORP.**

2. After applying engine oil to new valve stem seal (1), install valve stem seal to valve guide by pushing special tool by hand. After installing, check to be sure that valve stem seal is properly fixed to valve guide.

**CAUTION: When installing, never tap or hit special tool with a hammer or else. Install valve stem seal to valve guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to valve stem seal.**

**Special Tool**

**(A): 09917-97810**

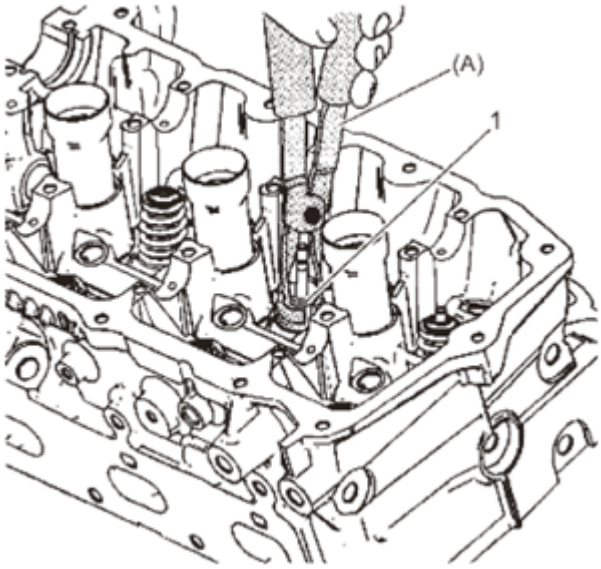
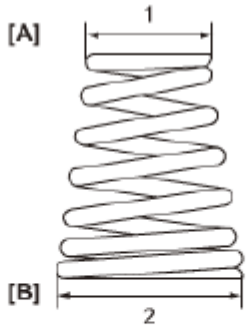



**Fig. 188: Installing Valve Stem Seal**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Apply engine oil to valve stem seal and valve guide hole.
4. Install valve spring and valve spring retainer. Each valve spring has top end (small-pitch (1)) and bottom end (large-pitch (2)). Be sure to position spring in place with its bottom end (large-pitch) facing the bottom (valve stem seal side).

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| | |
|---|---|
| [A]: Valve spring retainer side | [B]: Valve stem seal side |

**Fig. 189: Identifying Valve Spring**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Using special tools (Valve lifter) as shown in figure [A] or [B], compress valve spring and fit two valve cotters (1) into groove in valve stem.

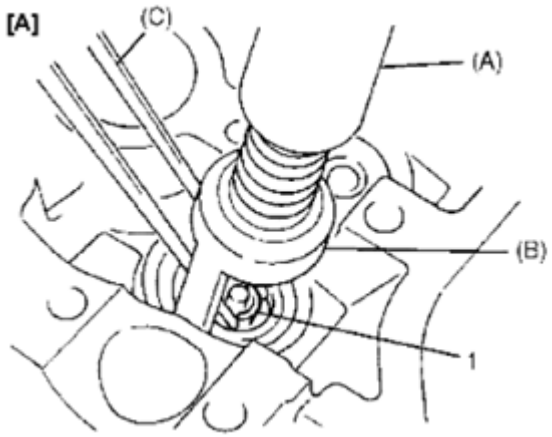
**CAUTION: Do not compress valve spring by 24 mm (0.94 in.) or more.**

**Special Tool**

**(A): 09916-14510**

**(B): 09916-14530**

**(C): 09916-84511**




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**Fig. 190: Compressing Valve Spring And Valve Cotters Into Groove In Valve Stem**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Special Tool**

**(D): Off-vehicle valve spring compressor adapter (EN-46119)**

**(E): Valve stem key remover/installer (EN-46117)**

**(F): Valve spring compressor head off (J-8062)**

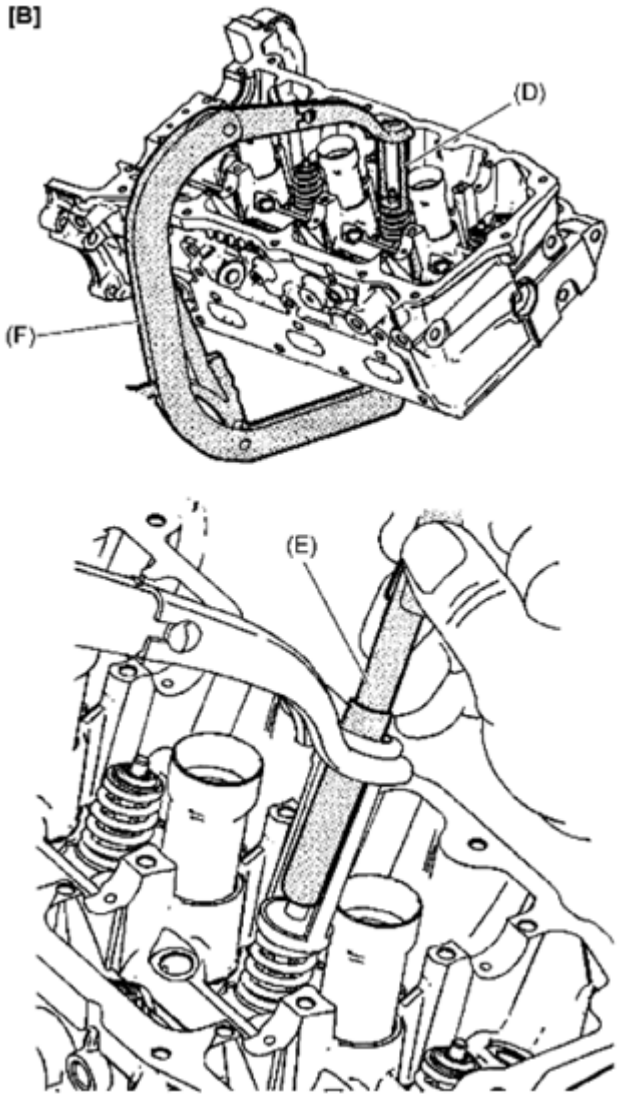



**Fig. 191: Compressing Valve Spring**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Install ECT sensor. See **ENGINE COOLANT TEMPERATURE (ECT) SENSOR REMOVAL AND INSTALLATION** .

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7. Install spark plugs. See **SPARK PLUG REMOVAL AND INSTALLATION** .
8. Install exhaust manifold. See **EXHAUST MANIFOLD REMOVAL AND INSTALLATION (N32A)** .

## VALVE AND VALVE GUIDES INSPECTION

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

**Valve Guide**

**Valve stem-to-guide clearance**

Using 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 cylinder head.

**Valve stem and valve guide specification**

**VALVE STEM AND VALVE GUIDE SPECIFICATION**

| Item | | Standard | Limit |
|---|---|---|---|
| Valve stem diameter [A] | In | 5.955 - 5.975 mm (0.2344 - 0.2352 in.) | - |
| | Ex | 5.945 - 5.965 mm (0.2341 - 0.2348 in.) | - |
| Valve guide bore [B] | In & Ex | 6.000 - 6.020 mm (0.2362 - 0.2370 in.) | - |
| Stem-to-guide clearance | In | 0.025 - 0.065 mm (0.0010 - 0.0026 in.) | 0.070 mm (0.0028 in.) |
| | Ex | 0.035 - 0.075 mm (0.0014 - 0.0030 in.) | 0.090 mm (0.0035 in.) |

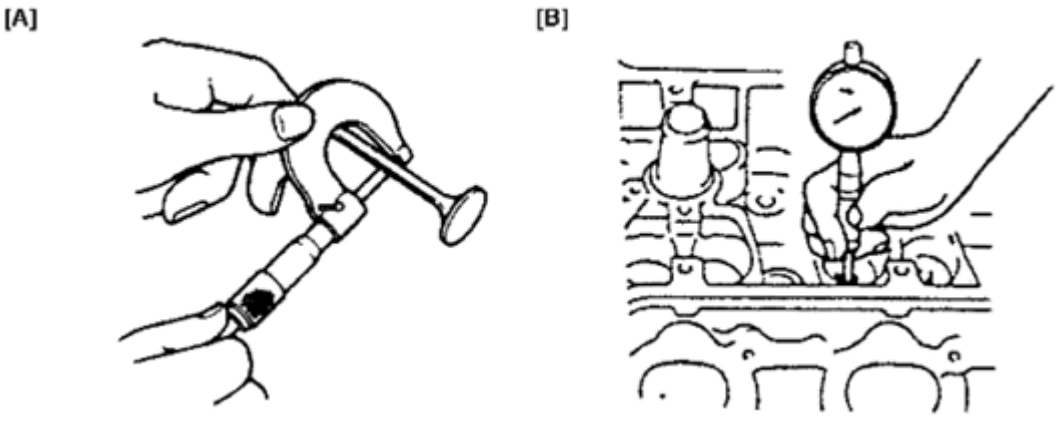



**Fig. 192: Measuring Valve Stems Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Valve stem end deflection**

If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.

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Move stem end in directions (1) and (2) to measure end deflection.

If deflection exceeds its limit, replace valve stem and cylinder head.

**Valve stem end deflection limit**

**In: 0.14 mm (0.0055 in.)**

**Ex: 0.18 mm (0.0071 in.)**

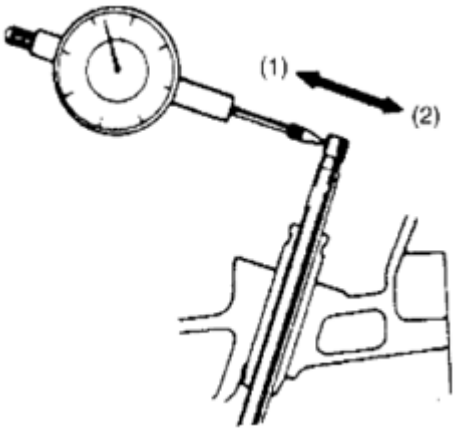



**Fig. 193: Checking Valve Stem End Deflection**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Valve**

**Visual inspection**

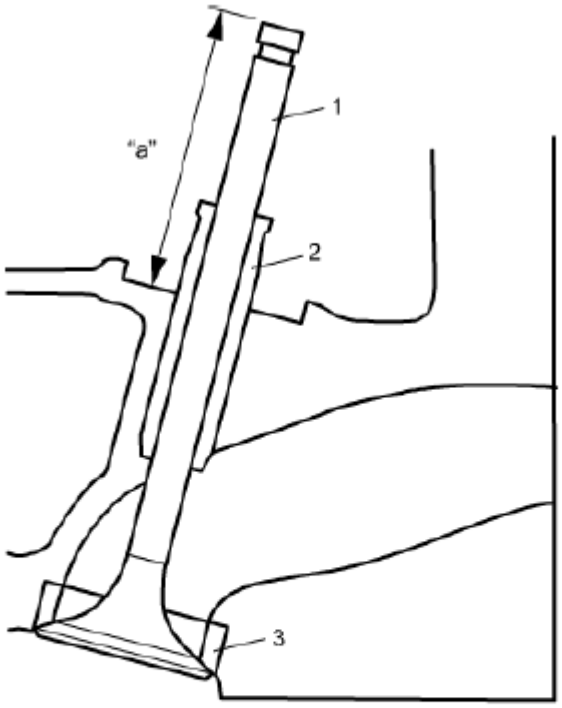
- Remove all carbon from valves (1).
- Inspect each valve for wear, burn or distortion at its face and stem end, as necessary, replace it.
- Measure each valve installation height.

  If measured height exceeds specification, replace valve.

  **Valve installation height**

  **IN & EX: 35.23 - 36.69 mm (1.3870 - 1.4445 in.)**

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| | |
|---|---|
| 2. Valve guide | "a" Valve installation height |
| 3. Valve seat | |

**Fig. 194: Identifying Valve Installation Height**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Valve head radial runout**

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**

**Standard: 0 - 0.038 mm (0 - 0.0015 in.)**

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

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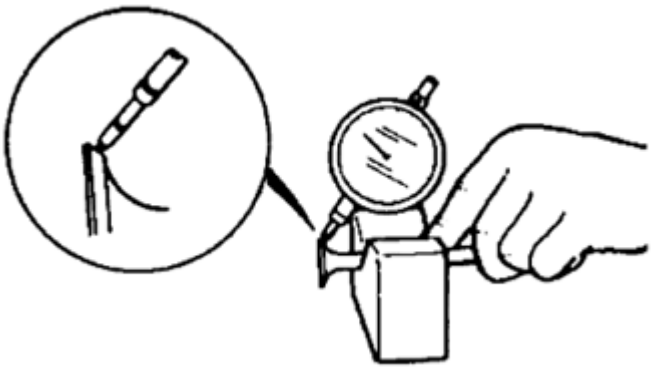


**Fig. 195: Measuring Valve Head Radial Runout**
**Courtesy of SUZUKI OF AMERICA CORP.**

**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 "a" revealed by contact pattern on valve face**

**Intake: 1.0 - 1.4 mm (0.0394 - 0.0551 in.)**

**Exhaust: 1.4 - 1.8 mm (0.0551 - 0.0709 in.)**

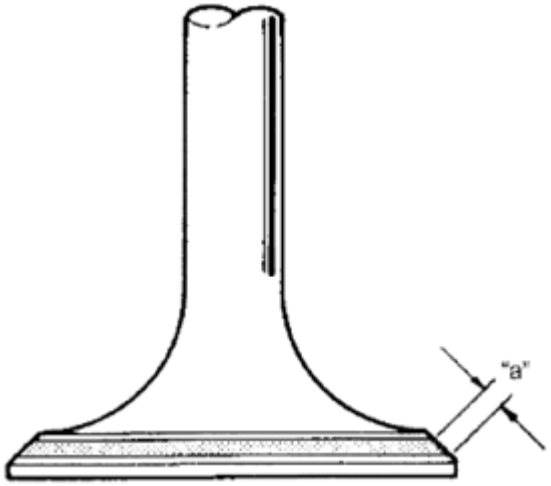



**Fig. 196: Identifying Standard Seating Width**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Valve seat repair**

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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.

1. Use valve seat cutters (1) to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 30° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

   **Seat width for valve seat "a"**

   **Intake: 1.0 - 1.4 mm (0.0394 - 0.0551 in.)**

   **Exhaust: 1.4 - 1.8 mm (0.0551 - 0.0709 in.)**

2. **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.




| | |
|---|---|
| 1. 30° | 3. 60° |
| 2. 45° | |

**Fig. 197: Cutting Valve Seat**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Oil relief valve**

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Check that oil relief valve in not clogged.

If oil relief valve is clogged, clean or replace oil relief valve.



**Fig. 198: Identifying Oil Relief Valve**
**Courtesy of SUZUKI OF AMERICA CORP.**

**CYLINDER HEAD INSPECTION**

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

- Remove all carbon deposits from combustion chambers.

**NOTE:** **Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when removing carbon. The same applies to valves and valve seats, too.**

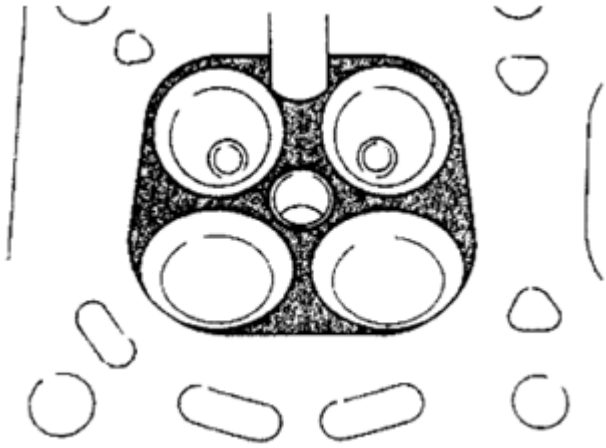


**Fig. 199: Identifying Carbon Deposits From Combustion Chambers**
**Courtesy of SUZUKI OF AMERICA CORP.**

- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface.
- Using a straightedge (1) and thickness gauge (2), check flatness of cylinder block mating surface at a total of 6 locations. If distortion limit is exceeded, correct mating surface with surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place abrasive paper on surface plate and rub

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mating surface against paper to grind off high spots. If distortion exceeds 0.25 mm (0.0098 in.), replace cylinder head.

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

**Distortion for cylinder head surface on piston side**

**Standard: 0 - 0.05 mm (0 - 0.0020 in.)**

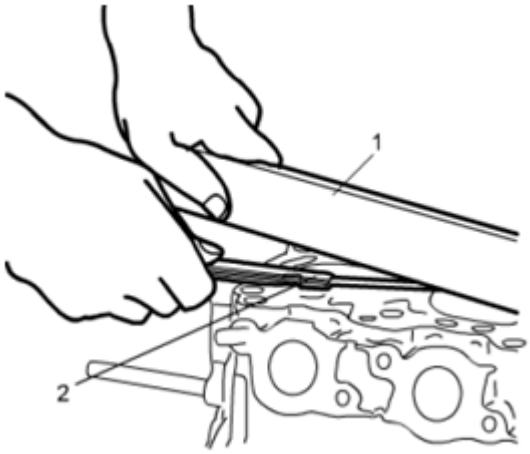



**Fig. 200: Checking Flatness Of Cylinder Block Mating Surface**
**Courtesy of SUZUKI OF AMERICA CORP.**

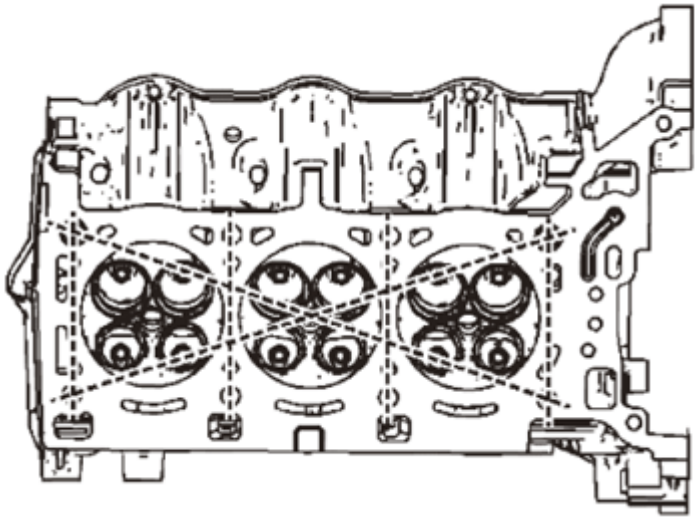


**Fig. 201: Identifying Distortion For Cylinder Head Surface On Piston Side**
**Courtesy of SUZUKI OF AMERICA CORP.**

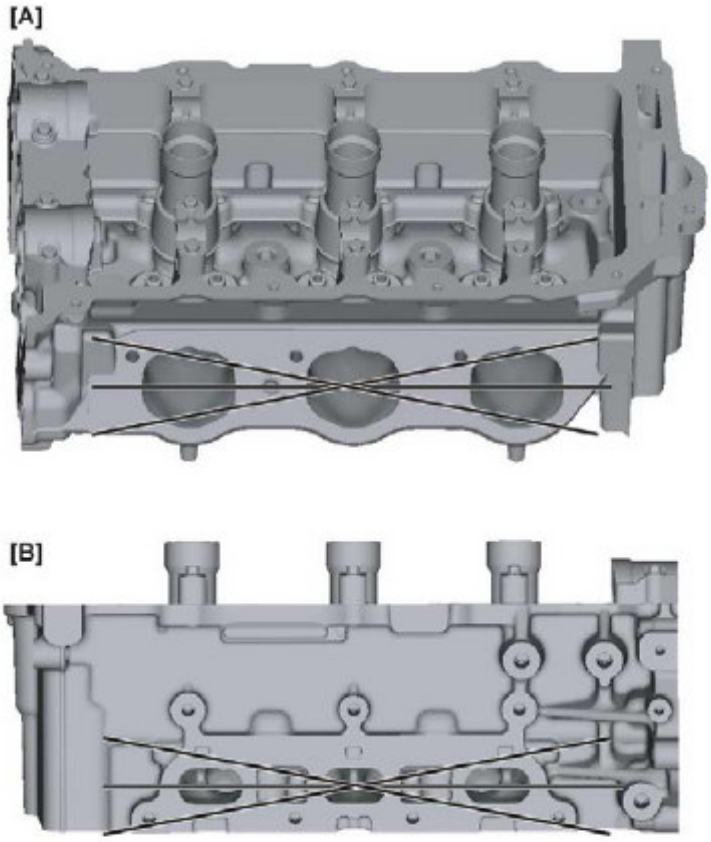
- Distortion of manifold seating faces:

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

**Distortion for cylinder head surface on intake and exhaust manifold**

**Standard: 0 - 0.05 mm (0 - 0.0020 in.)**




| | |
|---|---|
| [A]: Intake side | [B]: Exhaust side |

**Fig. 202: Identifying Distortion For Cylinder Head Surface On Intake And Exhaust Manifold**
**Courtesy of SUZUKI OF AMERICA CORP.**

**VALVE SPRING INSPECTION**

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

**Valve Spring Free Length and Preload**

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Referring to data, check that each spring is in good 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.

**Valve spring free length**

**Standard: 42.5 - 45.5 mm (1.6732 - 1.7913 in.)**

**Limit: 42 mm (1.6535 in.)**

**Valve spring preload**

**Standard: 247 - 273 N (25.2 - 27.8 kgf) for 35 mm (55.5 - 61.4 lbf/1.378 in.)**

**Limit: 240 N (24.5 kgf/54.0 lbf) for 35 mm (1.3780 in.)**

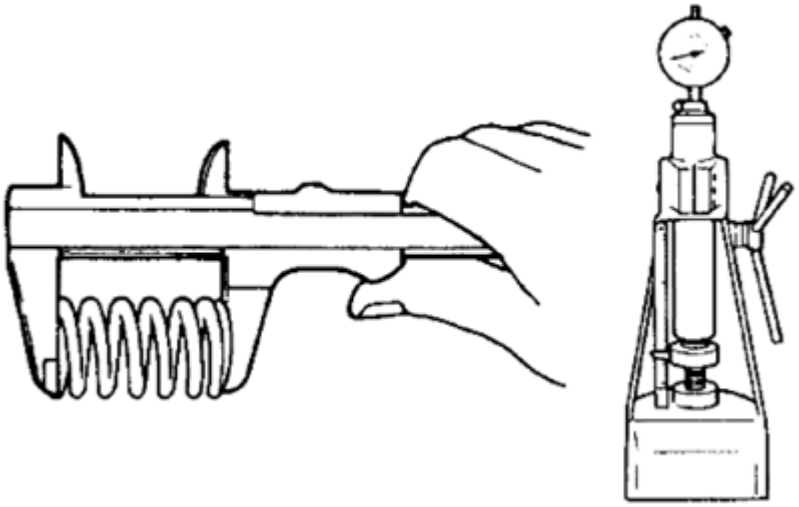
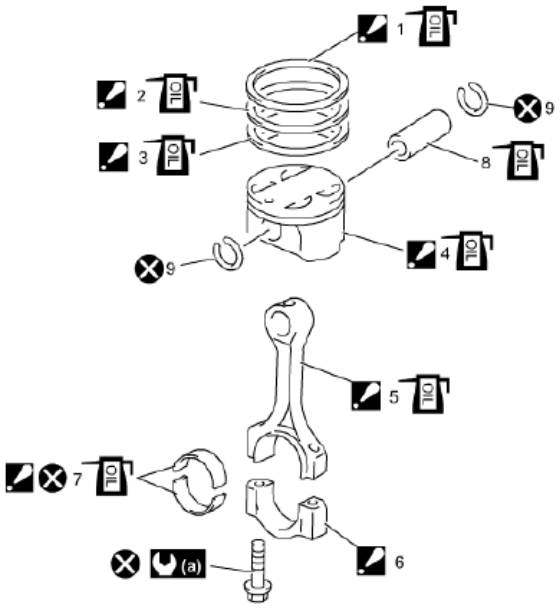


**Fig. 203: Checking Valve Spring Free Length**
**Courtesy of SUZUKI OF AMERICA CORP.**

**PISTON, PISTON RING AND CONNECTING ROD COMPONENTS**

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| | |
|---|---|
| 1. 1st ring<br>For installation, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation:N32A***. | 7. Connecting rod bearing<br>: Do not apply engine oil between connecting rod big end and bearing, between bearing cap and bearing. |
| 2. 2nd ring<br>For installation, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation:N32A***. | 8. Piston pin |
| 3. Oil ring<br>For installation, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation:N32A***. | 9. Piston pin circlip |
| 4. Piston<br>For installation, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation:N32A***. | (a): Tighten 30 N·m → 0 N·m → 25 N·m → +110° (3.1 kgf-m → 0 kgf-m → 2.5 kgf-m → +110°, 22.5 lbf-ft → 0 lbf-ft → 18.5 lbf-ft → +110°). |
| 5. Connecting rod<br>: Do not apply engine oil between connecting rod and connecting rod bearing. | OIL: Apply engine oil to sliding surface of each part. |
| 6. Connecting rod bearing cap<br>: Point projection part on cap to crankshaft pulley side. Do not apply engine oil between bearing cap and bearing. | : Do not reuse. |

**Fig. 204: Identifying Piston, Piston Ring And Connecting Rod Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Removal and Installation figure callout references:**

1) - 4): **PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION**

## PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION

*Reference:* **PISTON, PISTON RING AND CONNECTING ROD COMPONENTS**

### Removal

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1. Remove engine assembly from vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove cylinder head. See **VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**.
3. Mark cylinder number on all pistons, connecting rods and connecting rod caps using silver pencil or quick drying paint.
4. Remove connecting rod bearing caps.
5. Remove carbon from top of cylinder bore before removing piston from cylinder.
6. Push out piston and connecting rod assembly through the top of cylinder bore.
7. Remove connecting rod bearings from connecting rod and connecting rod bearing cap, if necessary.

**Installation**

*Reference:* **PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY**

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

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

2. Install new connecting rod bearing to connecting rod bearing cap and connecting rod as follows, if removed.
   a. Fit tab (1) of connecting rod bearing to groove (2) of connecting rod and bearing cap.
   b. Press bearing end (3) until bearing end be comes flush with surface of connecting rod and bearing cap.

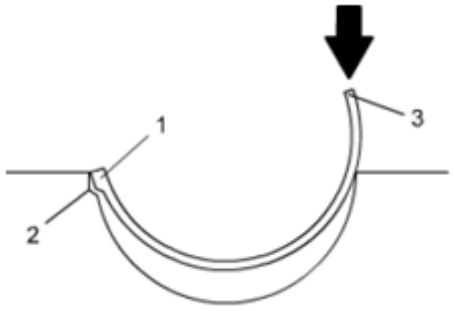
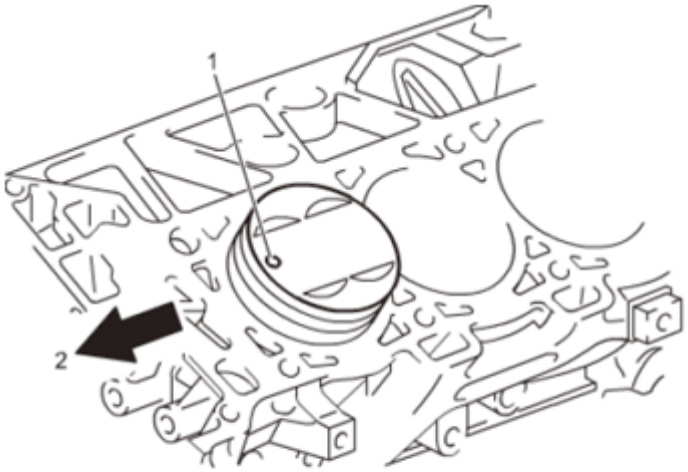



**Fig. 205: Pressing Bearing End Of Connecting Rod And Bearing Cap**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

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2: Crankshaft pulley side

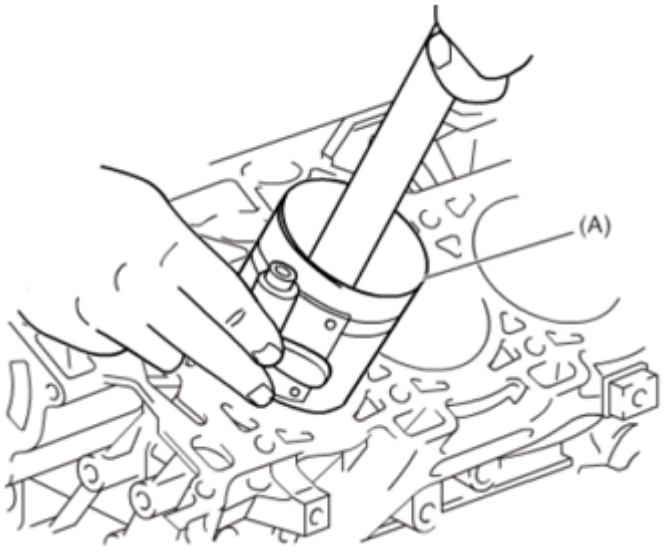
**Fig. 206: Installing Piston And Connecting Rod Assembly Into Cylinder Bore**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. 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**




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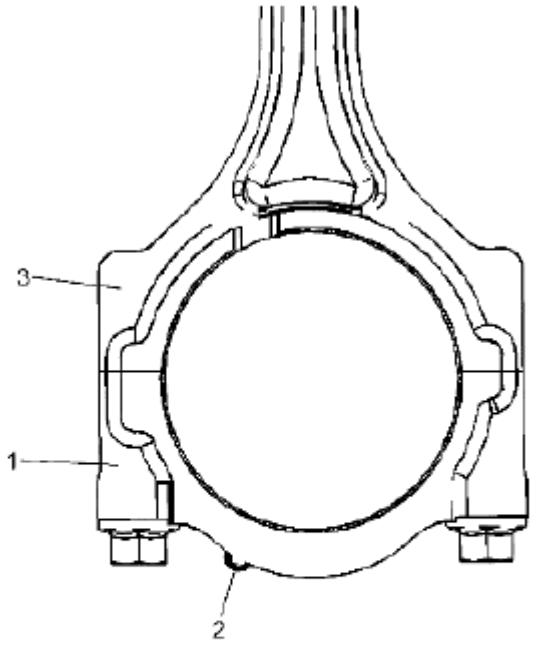
**Fig. 207: Installing Piston And Connecting Rod Assembly Into Cylinder Bore**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. Install bearing cap (1) as follows.

**CAUTION: Do not apply engine oil to new connecting rod bolt.**

**NOTE: Tighten connecting rod bolt gradually till they are tightened to specified torque.**

a. Point projection part (2) on cap to cylinder head (bank 1) side.




3. Connecting rod

**Fig. 208: Identifying Connecting Rod Bearing Cap Installation Position**
**Courtesy of SUZUKI OF AMERICA CORP.**

b. Tighten all connecting rod bolts to 30 N.m (3.1 kgf-m, 22.5 lbf-ft) evenly and gradually.
c. Loosen all bolts until loosening torque becomes 0.
d. In the same manner as Step a), tighten them to 25 N.m (2.5 kgf-m, 18.5 lbf-ft).
e. In the same manner as Step a), retighten them by 110°.

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**Tightening torque**

**Connecting rod bolt*: 30 N.m --> 0 N.m --> 25 N.m --> +110° (3.1 kgf-m --> 0 kgf-m --> 2.5 kgf-m --> +110°, 22.5 lbf-ft --> 0 lbf-ft --> 18.5 lbf-ft --> +110°)**

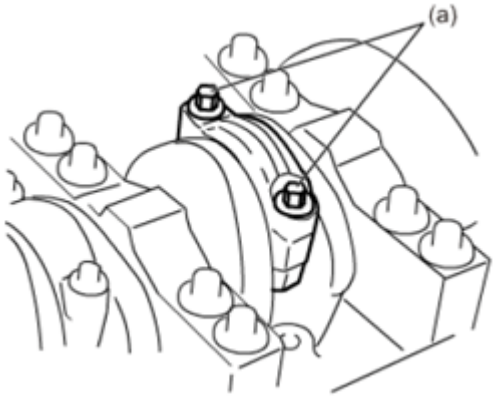



**Fig. 209: Identifying Connecting Rod Bolts**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Install cylinder head. See **VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**.

## PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY

*Reference:* **PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION**

**Disassembly**

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

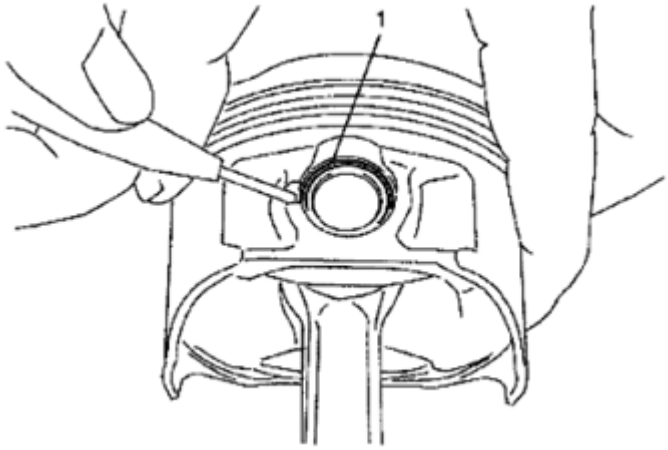



**Fig. 210: Removing Piston Pin Circlips From Connecting Rod**

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**Courtesy of SUZUKI OF AMERICA CORP.**

b. Force piston pin out.

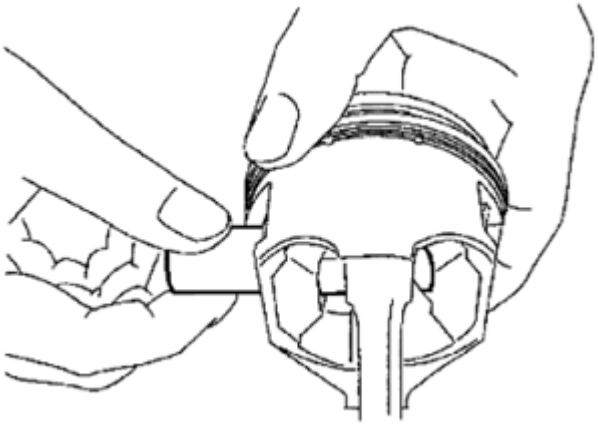


**Fig. 211: Removing Piston Pin From Connecting Rod**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Reassembly**

*Reference:* **PISTON AND PISTON RING INSPECTION**

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

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

1. Remove carbon from piston head and ring grooves using suitable tool.
2. Install piston pin to piston (1) and connecting rod (2) as follows.
   a. Apply engine oil to piston pin and piston pin holes in piston and connecting rod.
   b. Fit connecting rod as shown in figure.

**NOTE: Be sure to position front mark (4) on piston and match mark (5) of connecting rod (2) at specified position as shown in figure.**

   c. Insert piston pin to piston and connecting rod.
   d. Install new piston pin circlips (3).

**NOTE: Install circlip so that its end gap comes within the range indicated by arrow (6).**

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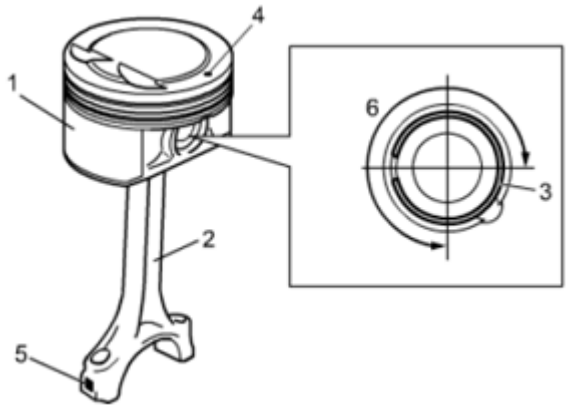



**Fig. 212: Identifying Piston Pin Circlips Position**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Install piston rings to piston noting the following.
   - As indicated in figure, 1st and 2nd rings have direct discrimination mark (1) respectively. When installing these piston rings to piston, direct discrimination mark side of each ring toward top of piston.
   - 1st ring (2) differs from 2nd ring (3) in thickness, shape and color of surface contacting cylinder wall.

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

   - When installing oil ring (4), install spacer (5) first and then two rails.

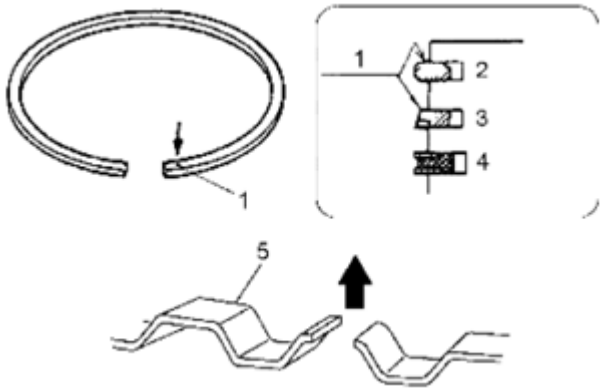
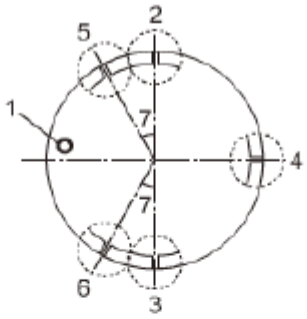



**Fig. 213: Identifying Piston Rings Position**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

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| | |
|---|---|
| 1. Front mark | 5. Oil ring upper rail gap |
| 2. 1st ring end gap | 6. Oil ring lower rail gap |
| 3. 2nd ring end gap | 7. 30° |
| 4. Oil ring spacer gap | |

**Fig. 214: Identifying Oil Rings Gap**
**Courtesy of SUZUKI OF AMERICA CORP.**

## PISTON AND PISTON RING INSPECTION

*Reference:* **PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY**

#### Piston

##### Visual inspection

Inspect piston for cracks or other damages.

Damaged or faulty piston should be replaced.

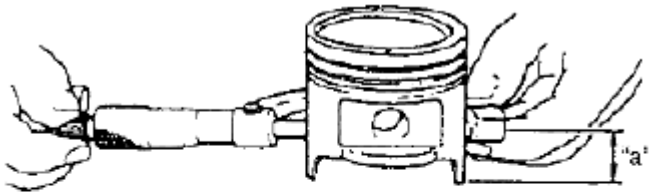
##### Piston diameter

As indicated in figure, piston diameter should be measured at specified position "a" from piston skirt end in the direction perpendicular to piston pin.

### Piston diameter specification

**Standard size: 88.949 - 88.961 mm (3.5019 - 3.5024 in.)**

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| | |
|---|---|
| "a": | 12.0 mm (0.4724 in.) |

**Fig. 215: Measuring Piston Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Piston clearance**

Measure cylinder bore diameter and piston diameter to find their difference called piston clearance. Piston clearance should be within specification. If it is out of specification, replace cylinder block, piston rings and/or pistons.

**NOTE: Cylinder bore diameters used here are measured in thrust direction at two positions.**

**Piston clearance**

**Standard: 0.031 - 0.059 mm (0.0012 - 0.0023 in.)**

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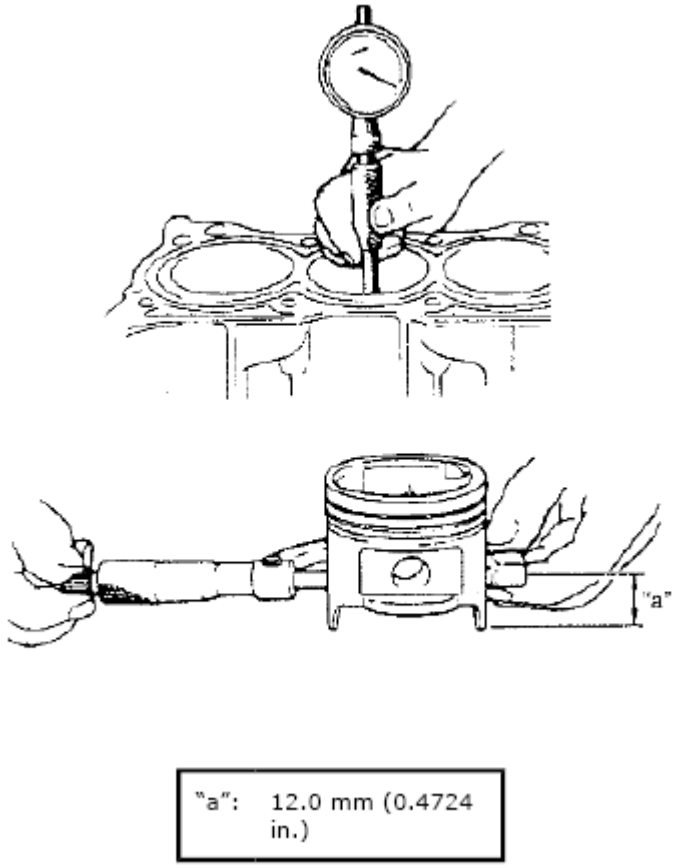



**Fig. 216: Measuring Cylinder Bore And Piston Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Ring groove clearance**

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

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 limit, replace piston.

**Ring groove clearance**

**RING GROOVE CLEARANCE SPECIFICATION**

| | Standard | Limit |
|---|---|---|
| 1st ring | 0.04 - 0.08 mm (0.0015 - 0.0031 in.) | 0.12 mm (0.0047 in.) |
| 2nd ring | 0.03 - 0.07 mm (0.0012 - 0.0028 in.) | 0.10 mm (0.0039 in.) |
| Oil ring | 0.04 - 0.12 mm (0.0016 - 0.0047 in.) | - |


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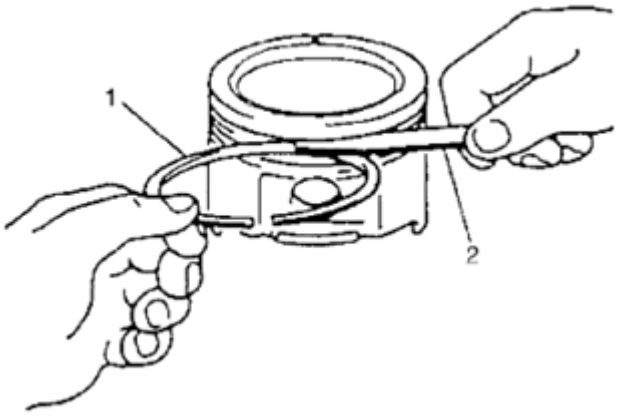



**Fig. 217: Measuring Clearance Between Ring And Ring Land**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Piston Ring**

**Piston ring end gap**

To measure end gap, insert piston ring (1) into cylinder bore and then measure the gap using thickness gauge (2).

If measured gap exceeds limit, replace ring.

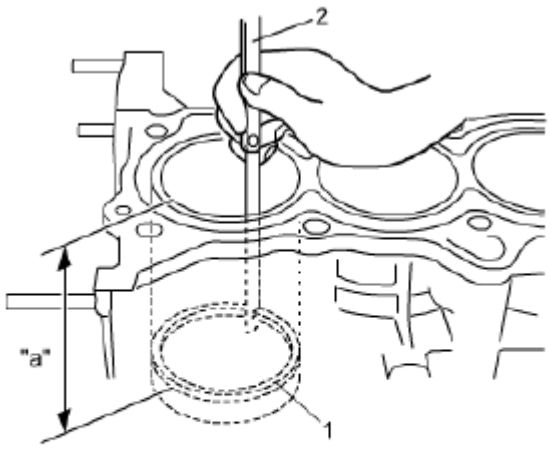
**NOTE: Remove carbon and clean top of cylinder bore before inserting piston ring.**

**Piston ring end gap**

**PISTON RING END GAP SPECIFICATION**

| Item | Standard | Limit |
|---|---|---|
| Top ring | 0.20 - 0.32 mm (0.0079 - 0.0126 in.) | 0.7 mm (0.0276 in.) |
| 2nd ring | 0.33 - 0.45 mm (0.0130 - 0.0177 in.) | 1.0 mm (0.0394 in.) |
| Oil ring | 0.10 - 0.50 mm (0.0039 - 0.0197 in.) | 1.2 mm (0.0472 in.) |


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| |
|---|
| "a". 42 mm (1.6535 in.) |

**Fig. 218: Measuring Piston Ring End Gap**
**Courtesy of SUZUKI OF AMERICA CORP.**

**PISTON PINS AND CONNECTING RODS INSPECTION**

*Reference:* **PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY**

**Piston Pin**

**Visual inspection**

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 and/or piston.

**Piston pin clearance**

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

**Piston pin clearance in connecting rod small end**

**Standard: 0.007 - 0.024 mm (0.0003 - 0.0009 in.)**

**Limit: 0.034 mm (0.00013 in.)**

**Piston pin clearance in piston**

**Standard: 0.004 - 0.012 mm (0.00016 - 0.00047 in.)**


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**Limit: 0.017 mm (0.0007 in.)**

**Small-end bore**

**24.007 - 24.021 mm (0.9452 - 0.9457 in.)**

**Piston pin diameter**

**23.997 - 24.0000 mm (0.9448 - 0.9449 in.)**

**Piston bore**

**24.004 - 24.009 mm (0.94503 - 0.94523 in.)**

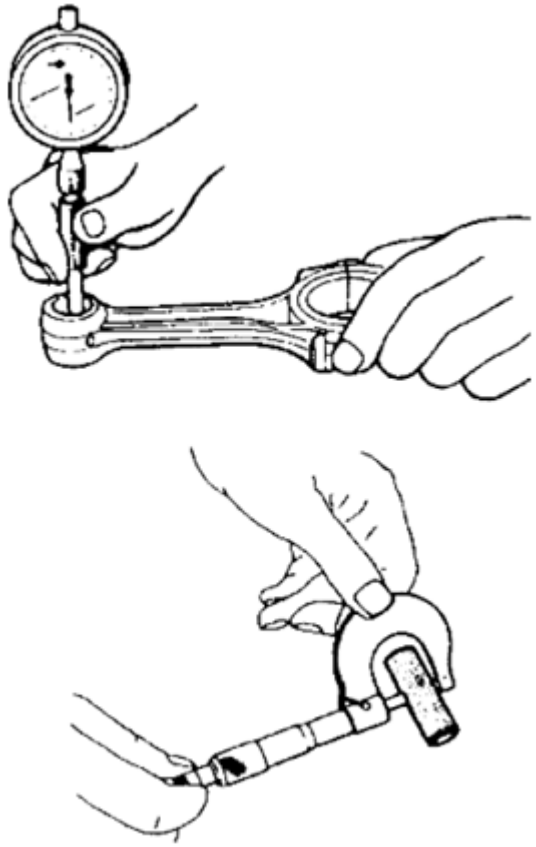


**Fig. 219: Measuring Piston Pin Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Connecting Rod**

**Big-end side clearance**

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

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**Big-end side clearance**

**Standard: 0.095 - 0.355 mm (0.0037 - 0.0140 in.)**

**Limit: 0.42 mm (0.0165 in.)**

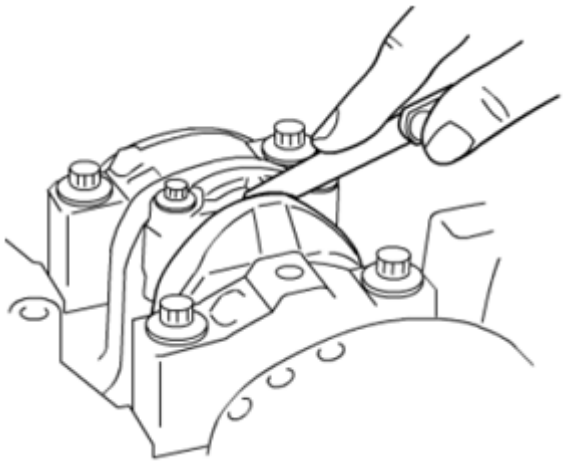


**Fig. 220: Checking Big-End Of Connecting Rod For Side Clearance**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Connecting rod alignment**

Mount connecting rod on aligner to check it for bow and twist. If measured value exceeds the limit, replace it.

**Connecting rod alignment**

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

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

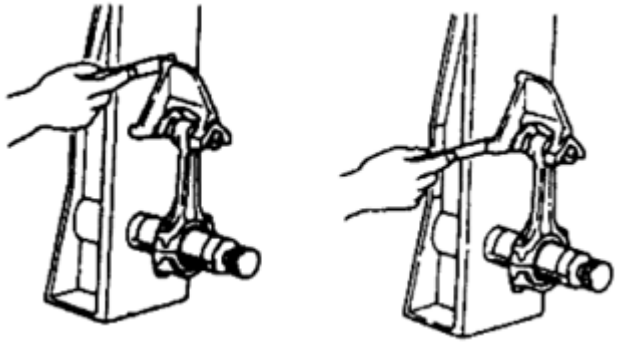


**Fig. 221: Checking Connecting Rod Alignment**
**Courtesy of SUZUKI OF AMERICA CORP.**

**CRANK PIN AND CONNECTING ROD BEARINGS INSPECTION**

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*Reference:* **PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY**

**Crank Pin Diameter**

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

**Crank pin diameter**

**Standard: 55.992 - 56.008 mm (2.2044 - 2.2050 in.)**

**Crank pin taper (a, b) and out-of-round (A - B)**

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

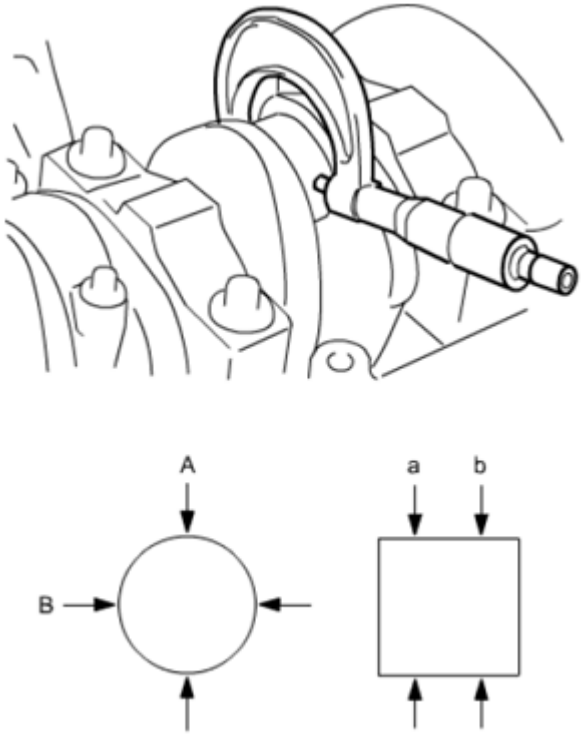



**Fig. 222: Measuring Crank Pin Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Connecting Rod Bearing Visual Inspection**

Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Defective bearing shells must be replaced.

**Connecting Rod Bearing Clearance**

1. Clean bearing and crank pin.

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2. Place a piece of gauging plastic (1) to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.

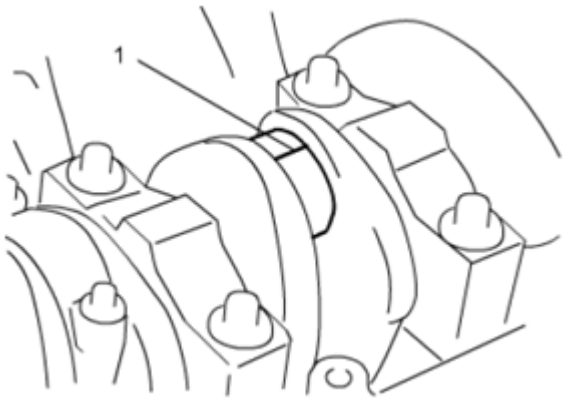



**Fig. 223: Placing Piece Of Gauging Plastic**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Install new connecting rod bearing and its cap. See **PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION**.
4. After three minutes, remove cap and using scale (2) on gauging plastic envelope, measure gauging plastic (1) width at the widest point (clearance).

   **Connecting rod bearing clearance**

   **Standard: 0.027 - 0.081 mm (0.0011 - 0.0032 in.)**

   **Limit: 0.081 mm (0.0032 in.)**

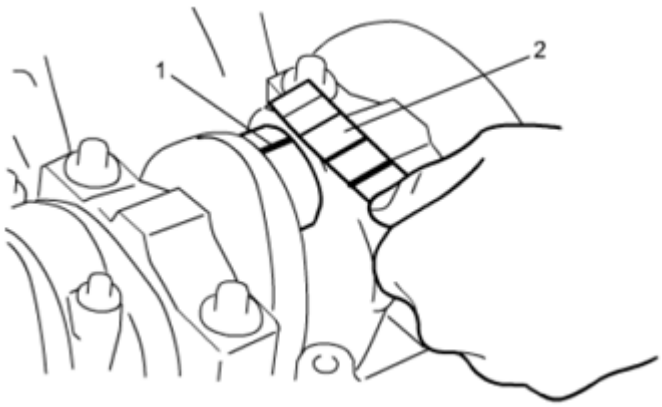



**Fig. 224: Measuring Connecting Rod Bearing Clearance**
**Courtesy of SUZUKI OF AMERICA CORP.**

5. If clearance is out of specification, measure crank pin diameter referring to **CRANK PIN AND CONNECTING ROD BEARINGS INSPECTION**.

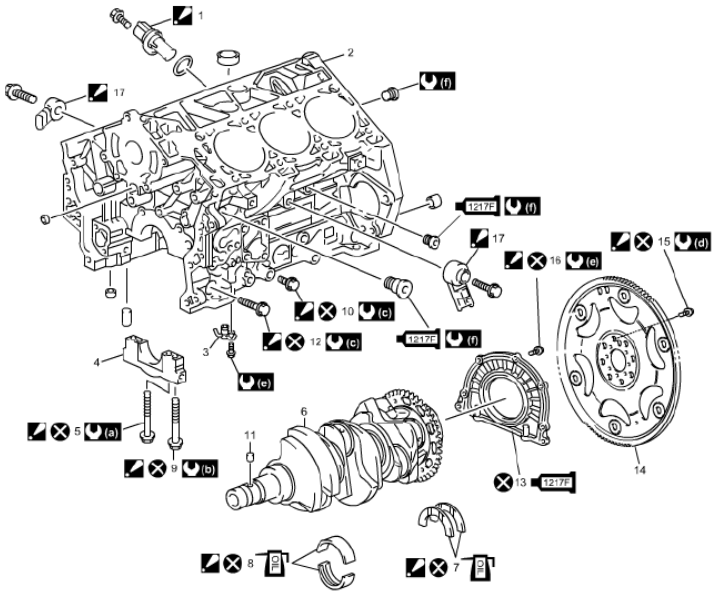
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If crank pin diameter is out of specification, replace crankshaft.

If crank pin diameter is within specification, replace connecting rod.

**MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS**

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| | | |
|---|---|---|
| 1. CKP sensor : For removal and installation of CKP sensor, refer to ***Crankshaft Position (CKP) Sensor Removal and Installation:N32A***. | 10. Main bearing cap side bolt No.1 : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation:N32A***. | (b): 15 N·m → +110° (1.5 kgf-m → +110°, 11.0 lbf-ft → +110°) |
| 2. Cylinder block | 11. Key | (c): 30 N·m → +60° (3.1 kgf-m → +60°, 22.5 lbf-ft → +60°) |
| 3. Oil jet | 12. Main bearing cap side bolt No.2 : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation:N32A***. | (d): 30 N·m → +45° (3.1 kgf-m → +45°, 22.5 lbf-ft → +45°) |
| 4. Main bearing cap | 1217F 13. Engine rear crankshaft oil seal housing | (e): 10 N·m (1.0 kgf-m, 7.5 lbf-ft) |
| 5. Main bearing cap bolt No.1 : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation:N32A***. | 14. Drive plate | (f): 31 N·m (3.2 kgf-m, 23.0 lbf-ft) |
| 6. Crankshaft | 15. Drive plate bolt : For tightening order, refer to ***Drive Plate Removal and Installation:N32A***. | : Do not reuse. |
| 7. Thrust bearing : Be sure to face oil groove side to crank web. | 16. Engine rear crankshaft oil seal housing bolt : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation:N32A***. | : Apply engine oil to inside / sliding surface. |
| 8. Main bearing : Do not apply engine oil between main bearing cap and cylinder block. | 17. Knock sensor : For removal and installation of knock sensor, refer to ***Knock Sensor Removal and Installation:N32A***. | |
| 9. Main bearing cap bolt No.2 : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation:N32A***. | (a): 20 N·m → +80° (2.0 kgf-m → +80°, 15.0 lbf-ft → +80°) | |

**Fig. 225: Identifying Main Bearing, Crankshaft And Cylinder Block Components With Torque Specifications**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Tightening Order/Removal and Installation figure callout references:**

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1): **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL AND INSTALLATION**

5), 9), 10), 12), 16): **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**

15): **DRIVE PLATE REMOVAL AND INSTALLATION**

17): **KNOCK SENSOR REMOVAL AND INSTALLATION**

**CRANKSHAFT THRUST BEARING INSPECTION**

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

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

   **Crankshaft thrust play**

   **Standard: 0.10 - 0.33 mm (0.0039 - 0.0130 in.)**

   **Limit: 0.42 mm (0.0165 in.)**

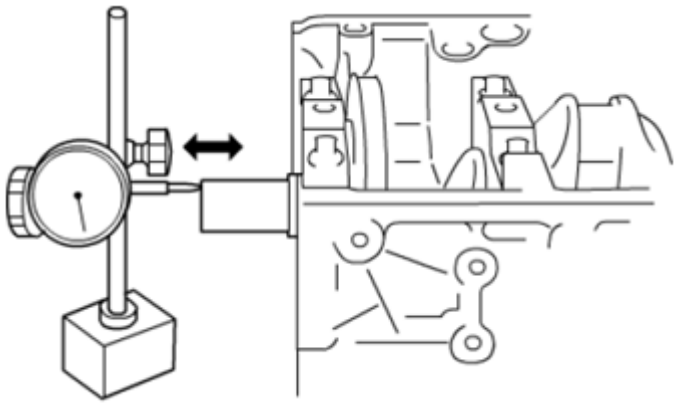


**Fig. 226: Checking Crankshaft Thrust Play**
**Courtesy of SUZUKI OF AMERICA CORP.**

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

*Reference:* **MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS**

**Removal**

1. Remove engine assembly from vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.
2. Remove drive plate. See **DRIVE PLATE REMOVAL AND INSTALLATION**.
3. Remove piston and connecting rod. See **PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION**.

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4. Remove oil pan. See **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
5. Remove engine rear crankshaft oil seal housing (1).

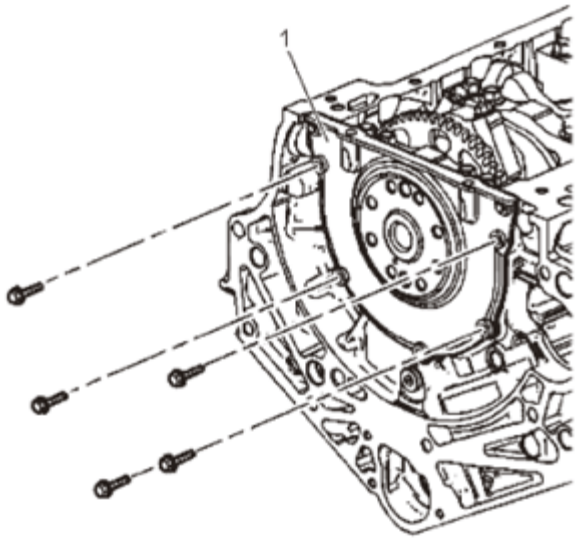



**Fig. 227: Identifying Engine Rear Crankshaft Oil Seal Housing**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Remove main bearing cap bolt and crank bearing cap side bolt in numerical order ("1" - "24") as indicated in figure.

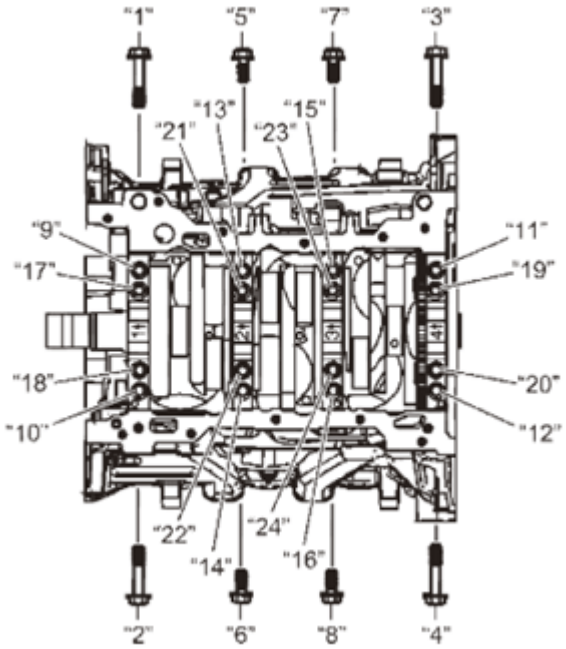



**Fig. 228: Identifying Main Bearing Cap Bolt Removing Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

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7. Using special tool, remove main bearing caps (1).

   **Special Tool**

   **(A): 09912-36510**

   **(B): 09912-36520**

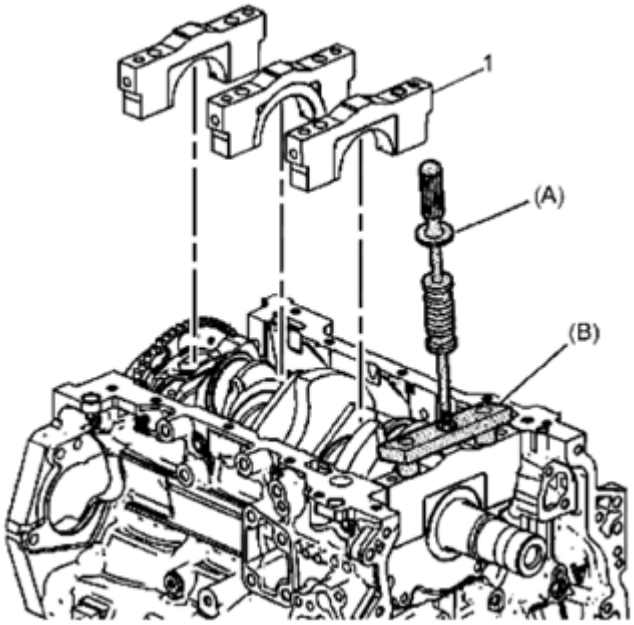



**Fig. 229: Identifying Main Bearing Caps**
**Courtesy of SUZUKI OF AMERICA CORP.**

8. Remove crankshaft from cylinder block.
9. Remove oil jets from cylinder block, if necessary.

**Installation**

*Reference:* **CRANKSHAFT INSPECTION**

*Reference:* **MAIN BEARINGS INSPECTION**

*Reference:* **SENSOR PLATE INSPECTION**

*Reference:* **DRIVE PLATE INSPECTION**

*Reference:* **CYLINDER BLOCK INSPECTION**

**CAUTION:**
- **Be sure to apply oil to crankshaft journals, journal bearings, thrust bearings, crank pins, connecting rod bearings, pistons, piston rings**

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**and cylinder bores.**

- **Main bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**

1. Install oil jets (1) to cylinder block and tighten oil jet bolts (2) to specified torque.

   **Tightening torque**

   **Oil jet bolt (a): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**

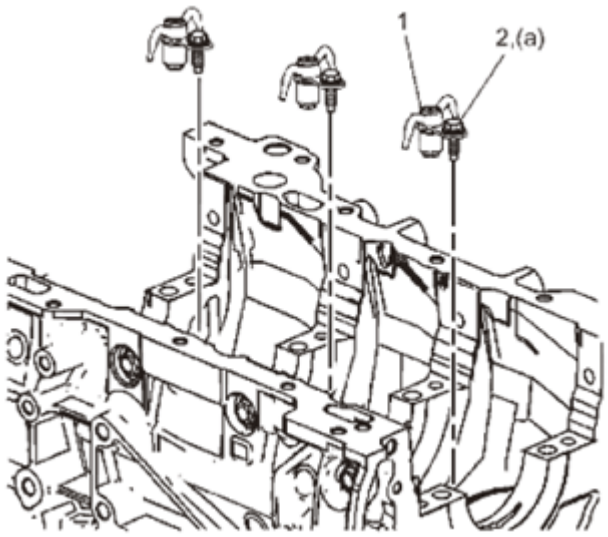



**Fig. 230: Identifying Oil Jets And Bolt**
**Courtesy of SUZUKI OF AMERICA CORP.**

2. Install new main bearings (1) to cylinder block. Upper half of bearing has an oil groove (2). Install it to cylinder block (3), and the other half without oil groove to bearing cap.

   **CAUTION: Do not apply engine oil between main bearing and main bearing cap, between main bearing and cylinder block.**

   a. Fit tab (4) of crankshaft upper and lower bearing to groove (5) of cylinder block or bearing cap.
   b. Press bearing end (6) until bearing end surface becomes flush with surface of cylinder block or bearing cap.

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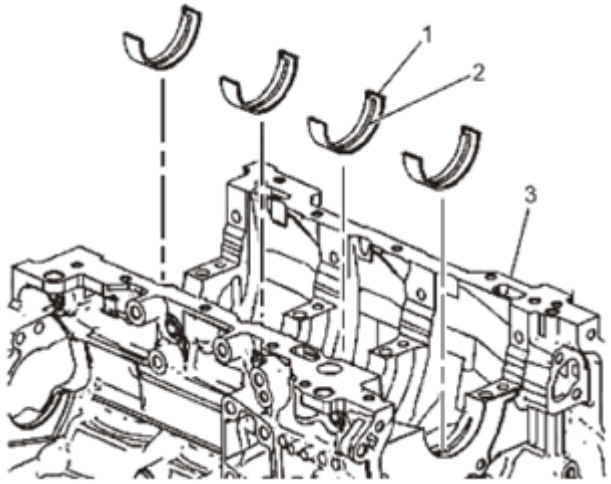



**Fig. 231: Identifying Main Bearings And Cylinder Block**
**Courtesy of SUZUKI OF AMERICA CORP.**

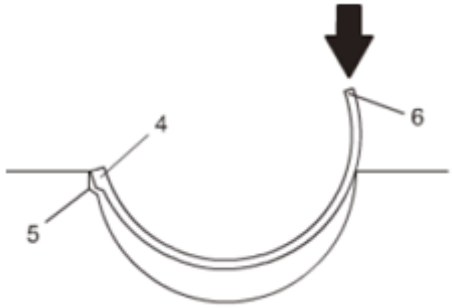



**Fig. 232: Pressing Bearing Cap**
**Courtesy of SUZUKI OF AMERICA CORP.**

3. Apply engine oil to new thrust bearings (1), install thrust bearings to cylinder block between No. 4 and No. 5 cylinders.

**NOTE: Be sure to face oil groove (2) side to crank web.**

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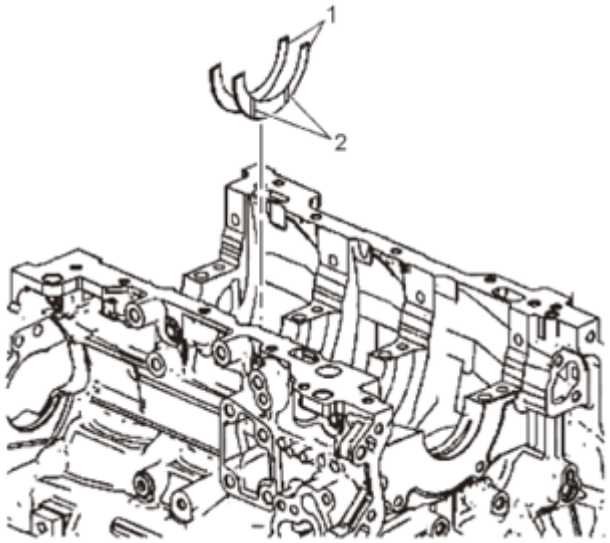
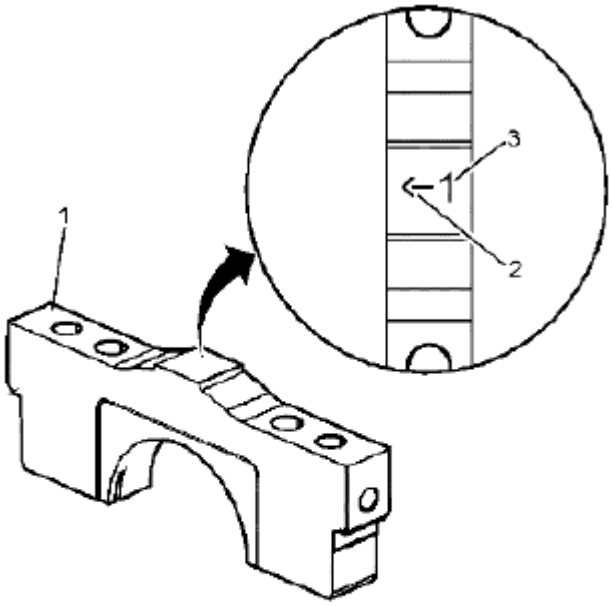



**Fig. 233: Identifying Thrust Bearings**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Apply engine oil to main bearings and sliding surface of crankshaft, install crankshaft to cylinder block.
5. Install bearing caps (1) to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3 and 4, starting from pulley side.

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| | |
|---|---|
| 2. | Crankshaft pulley side |
| 3. | Installation position from crankshaft pulley side |

**Fig. 234: Identifying Bearing Caps Installation Position**
**Courtesy of SUZUKI OF AMERICA CORP.**

6. Tighten main bearing cap bolts and main bearing cap side bolts as follows.

**CAUTION:**
- **Do not apply engine oil to main bearing cap bolts and main bearing cap side bolts.**
- **After tightening cap bolts, check that crankshaft rotates smoothly.**

a. Tighten new main bearing cap bolts No. 1 to 20 N.m (2.0 kgf-m, 14.5 lbf-ft) in numerical order ("1" - "8") shown in figure evenly and gradually.
b. In the same manner as Step a), retighten them by +80°.
c. Tighten new main bearing cap bolts No. 2 to 15 N.m (1.5 kgf-m, 11.0 lbf-ft) in numerical order ("9" - "16") shown in figure evenly and gradually.
d. In the same manner as Step c), retighten them by +110°.
e. Tighten new main bearing cap side bolts No. 1 and new main bearing cap side bolts No. 2 to 30 N.m (3.1 kgf-m, 22.5 lbf-ft) in numerical order ("17" - "24") shown in figure evenly and gradually.
f. In the same manner as Step e), retighten them by +60°.

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**Tightening torque**

**Main bearing cap bolt No. 1* (a): 20 N.m --> +80° (2.0 kgf-m --> +80°, 15.0 lbf-ft --> +80°)**

**Main bearing cap bolt No. 2* (a): 15 N.m --> +110° (1.5 kgf-m --> +110°, 11.0 lbf-ft --> +110°)**

**Main bearing cap side bolt No. 1* (a): 30 N.m --> +60° (3.1 kgf-m --> +60°, 22.5 lbf-ft --> +60°)**

**Main bearing cap side bolt No. 2* (a): 30 N.m --> +60° (3.1 kgf-m --> +60°, 22.5 lbf-ft --> +60°)**

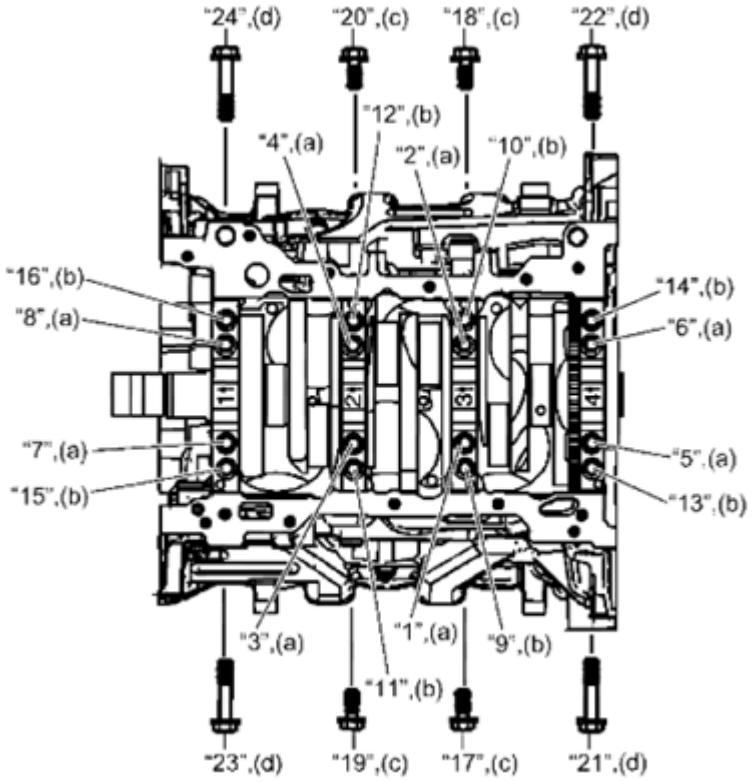



**Fig. 235: Identifying Main Bearing Cap Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

7. Clean sealing surface between oil seal housing and cylinder block.
8. Install special tool to cylinder block.

**Special Tool**

**(A): Engine front cover installation guide pins (EN-46109)**

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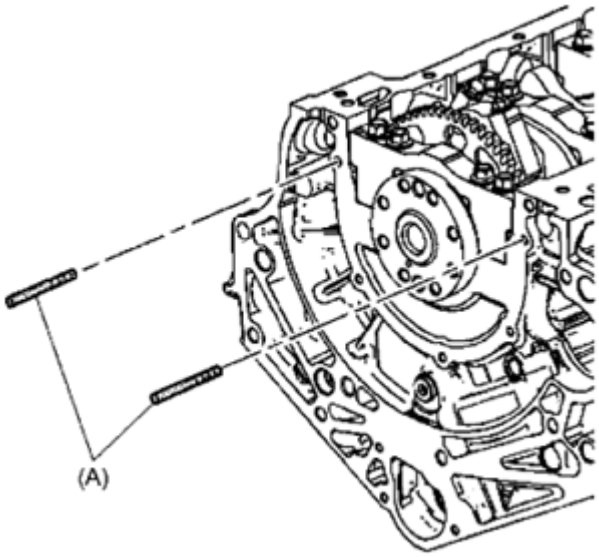



**Fig. 236: Identifying Engine Front Cover Installation Guide Pins**
**Courtesy of SUZUKI OF AMERICA CORP.**

9. Install special tool to cylinder block.

   **Special Tool**

   **(A): 09919-87800**

   **(B): 09913-57820**

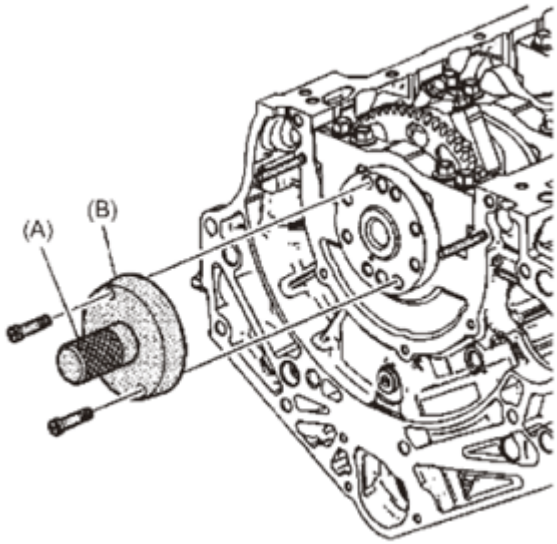



**Fig. 237: Identifying Special Tool To Cylinder Block**
**Courtesy of SUZUKI OF AMERICA CORP.**

10. Apply sealant to mating surface of new rear oil seal housing as shown in figure.

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**"A": Sealant 99000-31290 (SUZUKI Bond No. 1217F)**

**Sealant bead size for rear oil seal housing**

**Width: "a": 3 mm (0.12 in.)**

**Height: "b": 2.5 mm (0.10 in.)**

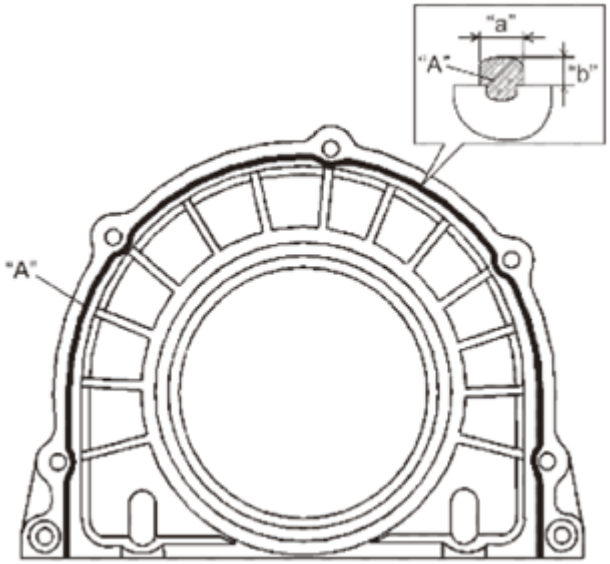



**Fig. 238: Applying Sealant To Mating Surface Of Rear Oil Seal Housing**
**Courtesy of SUZUKI OF AMERICA CORP.**

11. Install oil seal housing to cylinder block.

**NOTE: Do not apply engine oil to oil seal housing.**

12. Tighten oil seal housing bolt in numerical order ("1" - "5") shown in figure evenly and gradually.

**CAUTION: Confirm that engine rear crankshaft oil seal lip is not turned over after engine rear crankshaft oil seal housing is installed.**

**Tightening torque**

**Oil seal housing bolt* (a): 10 N.m (1.0 kg-m, 7.5 lbf-ft)**

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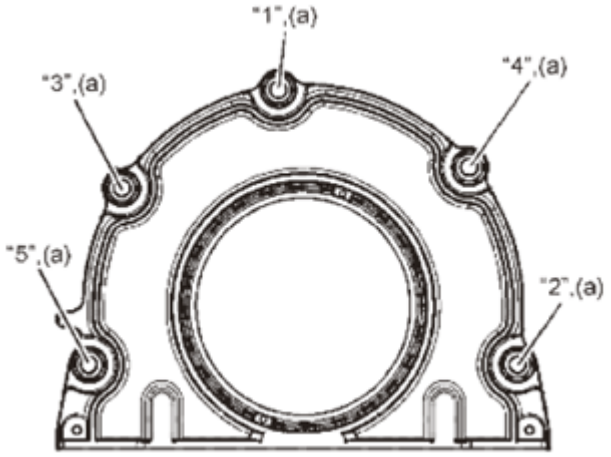



**Fig. 239: Identifying Oil Seal Housing Bolt Tightening Sequence**
**Courtesy of SUZUKI OF AMERICA CORP.**

13. Install piston and connecting rod. See **PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION**.
14. Install drive plate. See **DRIVE PLATE REMOVAL AND INSTALLATION**.
15. Install cylinder head. See **VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION**.
16. Install 2nd timing chain (bank 2). See **2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 REMOVAL AND INSTALLATION**.
17. Install 1st timing chain. See **1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 REMOVAL AND INSTALLATION**.
18. Install 2nd timing chain (bank 1). See **2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 REMOVAL AND INSTALLATION**.
19. Install timing chain cover. See **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
20. Install cylinder head cover. See **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
21. Install engine assembly to vehicle. See **ENGINE ASSEMBLY REMOVAL AND INSTALLATION**.

## CRANKSHAFT INSPECTION

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

#### Crankshaft Runout

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

**Crankshaft runout**

**Limit: 0.03 mm (0.0012 in.)**

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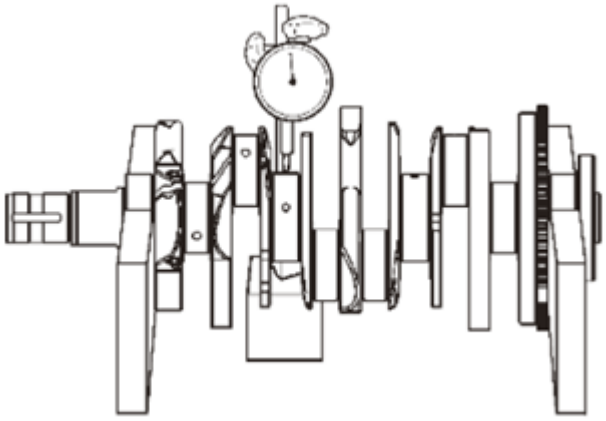


**Fig. 240: Measuring Runout Center Of Journal**
**Courtesy of SUZUKI OF AMERICA CORP.**

**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 exceeds its limit, regrind or replace crankshaft.

**Crankshaft journal diameter**

**Standard: 67.992 - 68.008 mm (2.6769 - 2.6775 in.)**

**Crankshaft out-of-round (A - B) and taper (a - b)**

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

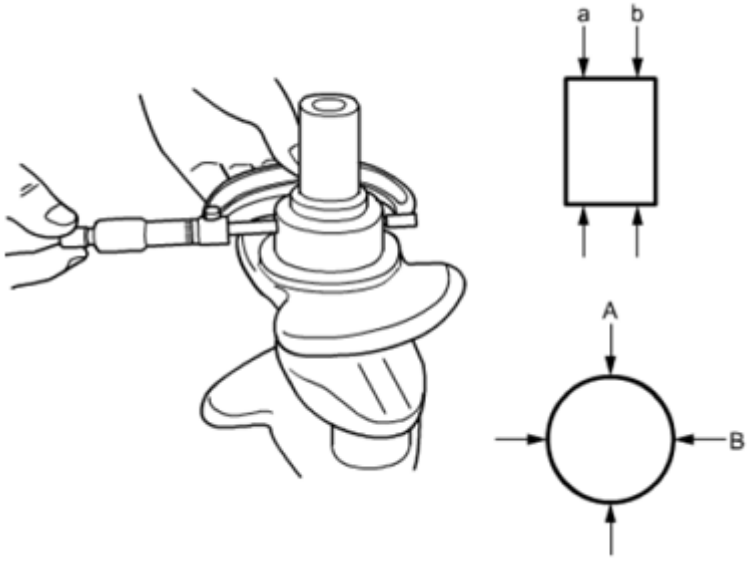



**Fig. 241: Checking Crankshaft Journal Diameter**

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**Courtesy of SUZUKI OF AMERICA CORP.**

## MAIN BEARINGS INSPECTION

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

### General Information

- Upper half of bearing (1) has oil groove (2) as shown in figure.

  Install this half with oil groove to cylinder block (3).

- Lower half of bearing does not have an oil groove.

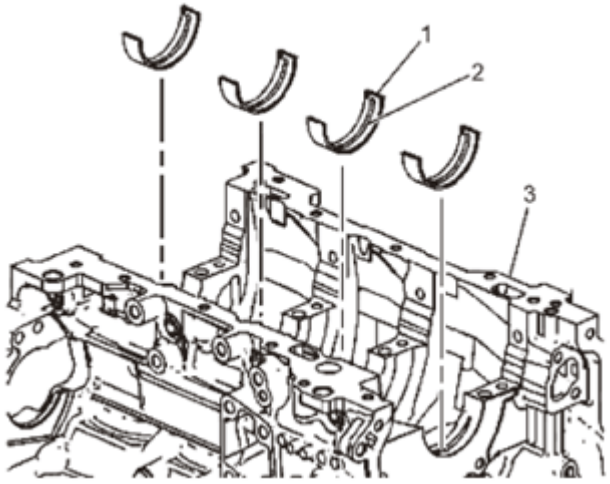



**Fig. 242: Identifying Bearing And Cylinder Block**
**Courtesy of SUZUKI OF AMERICA CORP.**

### Main Bearing Clearance

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

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

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

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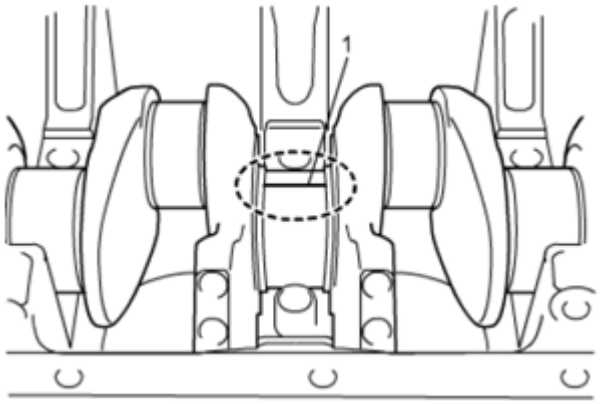



**Fig. 243: Placing Piece Of Gauging Plastic**
**Courtesy of SUZUKI OF AMERICA CORP.**

4. Install new main bearings and main bearing caps referring to steps 2) through 6) of "Installation" under **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**.

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

5. If clearance is out of specification, measure crankshaft journal diameter referring to **CRANKSHAFT INSPECTION**.

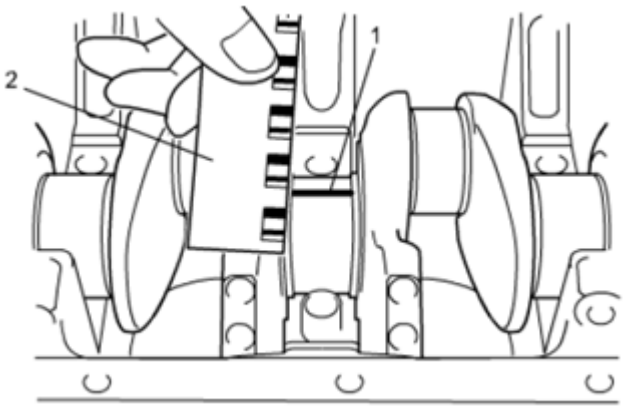
   If crankshaft journal diameter is out of specification, replace crankshaft.

   If crankshaft journal diameter is within specification, replace cylinder block and main bearing caps.

   **Main bearing clearance**

   **Standard: 0.032 - 0.083 mm (0.0013 - 0.0033 in.)**

   **Limit: 0.083 mm (0.0033 in.)**




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**Fig. 244: Measuring Main Bearing Clearance**
**Courtesy of SUZUKI OF AMERICA CORP.**

**SENSOR PLATE INSPECTION**

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

Check sensor plate (1) for crack or damage.

If defective condition is found, replace crankshaft (2).

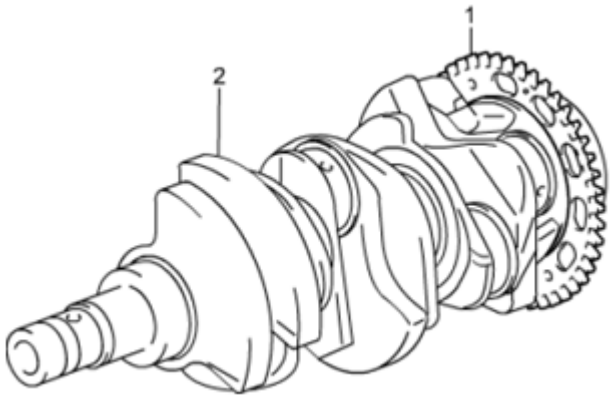



**Fig. 245: Identifying Sensor Plate And Crankshaft**
**Courtesy of SUZUKI OF AMERICA CORP.**

**OIL JET INSPECTION**

Check that there is no blocking in the oil jet.

If oil jet is blocked, clean or replace it.



**Fig. 246: Identifying Oil Jet**
**Courtesy of SUZUKI OF AMERICA CORP.**

**CYLINDER BLOCK INSPECTION**

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

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**Visual inspection**

Inspect cylinder walls for scratches, roughness or ridges which indicate excessive wear. If cylinder bore is very rough, deeply scratched, ridged, replace cylinder block, piston rings and/or pistons.

**Distortion of Cylinder Head Mating Surface**

Using straightedge and thickness gauge, check cylinder head mating surface for distortion and, if flatness exceeds its limit, correct It.

**Cylinder block flatness**

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

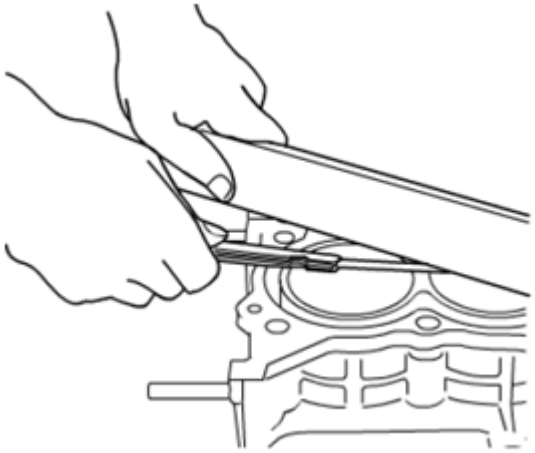
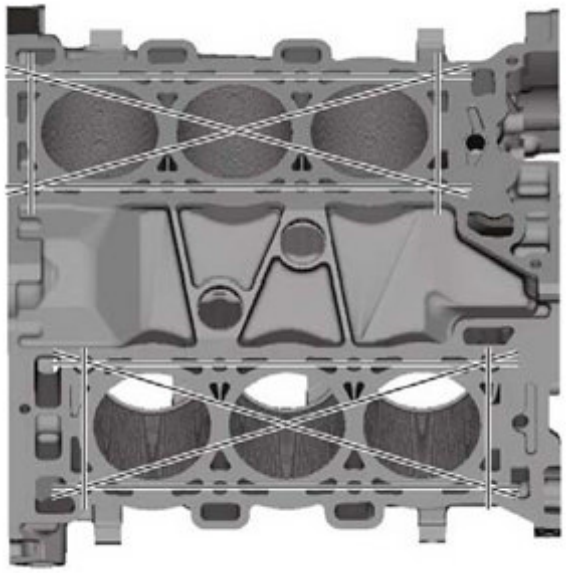


**Fig. 247: Checking Cylinder Head Mating Surface For Distortion**
**Courtesy of SUZUKI OF AMERICA CORP.**



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**Fig. 248: Inspecting Cylinder Head Mating Surface**
**Courtesy of SUZUKI OF AMERICA CORP.**

**Cylinder bore diameter, taper and out-of-round**

Using a cylinder gauge (1), measure cylinder bore in thrust and axial directions at two positions ("a" and "b") and cylinder taper ("A" and "B") as shown in figure.

If any of the following conditions is noted, replace cylinder block.

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

**Cylinder bore diameter**

**Standard: 88.992 - 89.008 mm (3.5036 - 3.5043 in.)**

**Limit: 89.050 mm (3.5059 in.)**

**Cylinder out-of-roundness**

**Limit: 0.020 mm (0.0008 in.)**

**Cylinder taper**

**Limit: 0.013 mm (0.0005 in.)**

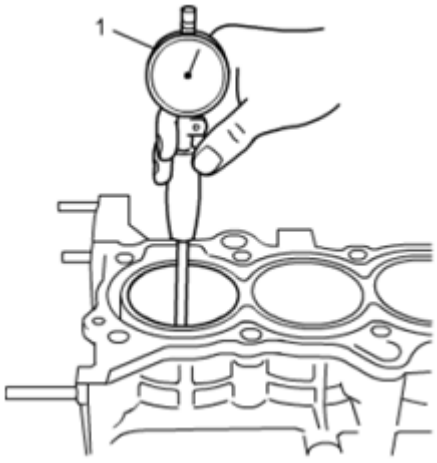
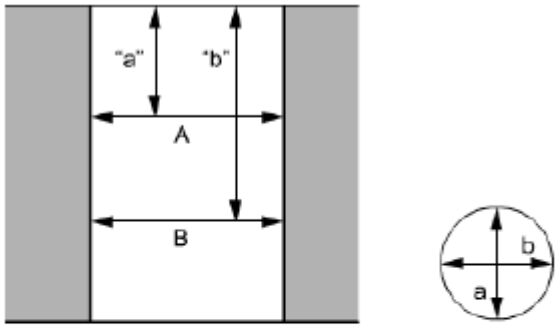



**Fig. 249: Checking Cylinder Bore Diameter**
**Courtesy of SUZUKI OF AMERICA CORP.**

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| | |
|---|---|
| "a": | 42 mm (1.65 in.) |
| "b": | 119.4 mm (4.70 in.) |

**Fig. 250: Identifying Cylinder Measuring Points**
**Courtesy of SUZUKI OF AMERICA CORP.**

# SPECIFICATIONS

## TIGHTENING TORQUE SPECIFICATIONS

**CAUTION: For fastener with * (asterisk) below, be sure to tighten it according to specified procedure in "Repair Instructions".**

### TORQUE SPECIFICATION

| Fastening part | Tightening torque | | |
|---|---|---|---|
| | N.m | kgf-m | lbf-ft |
| MAF sensor bolt | 3 | 0.3 | 2.5 |
| Intake manifold bolt No. 1* | 10 N.m --> 25 N.m (1.0 kgf-m --> 2.5 kgf-m, 7.5 lbf-ft --> 18.5 lbf-ft) | | |
| Intake manifold bolt No. 2* | 10 N.m --> 25 N.m (1.0 kgf-m --> 2.5 kgf-m, 7.5 lbf-ft --> 18.5 lbf-ft) | | |
| Intake manifold bolt No. 3* | 25 | 2.5 | 18.5 |
| Purge pipe bolt | 10 | 1.0 | 7.5 |
| Purge valve bracket bolt | 10 | 1.0 | 7.5 |
| Cylinder head cover bolt* | 10 | 1.0 | 7.5 |
| Camshaft housing bolt* | 10 | 1.0 | 7.5 |
| CMP actuator bolt | 58 | 5.9 | 43.0 |
| Ground terminal bolt | 11 | 1.1 | 8.5 |
| Timing chain cover bolt * | 20 N.m --> +60° (2.0 kgf-m --> +60°, 15 lbf-ft --> +60°) | | |
| | | | |


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| | | | |
|---|---|---|---|
| Accessory drive belt tensioner bolt* | 25 | 2.5 | 18.5 |
| OCV bolt | 12 | 1.2 | 9.0 |
| Drive plate bolt * | 30 N.m --> +45° (3.1 kgf-m --> +45°, 22.5 lbf-ft --> +45°) | | |
| Timing chain guide No. 1 bolt | 23 | 2.3 | 17.0 |
| Timing chain tensioner No. 1 bolt | 23 | 2.3 | 17.0 |
| Timing chain tensioner adjuster No. 1 bolt | 23 | 2.3 | 17.0 |
| Idler sprocket No. 1 bolt | 58 | 5.9 | 43.0 |
| Timing chain lower guide bolt | 23 | 2.3 | 17.0 |
| Timing chain guide No. 2 bolt | 23 | 2.3 | 17.0 |
| Timing chain tensioner adjuster No. 2 bolt | 23 | 2.3 | 17.0 |
| Idler sprocket No. 2 bolt | 58 | 5.9 | 43.0 |
| Timing chain guide No. 3 bolt | 23 | 2.3 | 17.0 |
| Timing chain tensioner No. 2 bolt | 23 | 2.3 | 17.0 |
| Timing chain tensioner adjuster No. 3 bolt | 23 | 2.3 | 17.0 |
| Cylinder head bolt No. 1 bolt* | 30 N.m --> +150° (3.1 kgf-m --> +150°, 22.5 lbf-ft --> +150°) | | |
| Cylinder head bolt No. 2 bolt* | 15 N.m --> +75° (1.5 kgf-m --> +75°, 11.0 lbf-ft --> +75°) | | |
| Connecting rod bolt* | 30 N.m --> 0 N.m --> 25 N.m --> +110° (3.1 kgf-m --> 0 kgf-m --> 2.5 kgf-m --> +110°, 22.5 lbf-ft --> 0 lbf-ft --> 18.5 lbf-ft --> +110°) | | |
| Oil jet bolt | 10 | 1.0 | 7.5 |
| Main bearing cap bolt No. 1* | 20 N.m --> +80° (2.0 kgf-m --> +80°, 15.0 lbf-ft --> +80°) | | |
| Main bearing cap bolt No. 2* | 15 N.m --> +110° (1.5 kgf-m --> +110°, 11.0 lbf-ft --> +110°) | | |
| Main bearing cap side bolt No. 1* | 30 N.m --> +60° (3.1 kgf-m --> +60°, 22.5 lbf-ft --> +60°) | | |
| Main bearing cap side bolt No. 2* | 30 N.m --> +60° (3.1 kgf-m --> +60°, 22.5 lbf-ft --> +60°) | | |
| Oil seal housing bolt* | 10 | 1.0 | 7.5 |

**NOTE: The specified tightening torque is described in the following.**
**AIR CLEANER COMPONENTS**
**INTAKE MANIFOLD AND THROTTLE BODY COMPONENTS**


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**CYLINDER HEAD COVER COMPONENTS**
**CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM COMPONENTS**
**ENGINE MOUNTINGS COMPONENTS**
**TIMING CHAIN COVER COMPONENTS**
**2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 COMPONENTS**
**1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 COMPONENTS**
**2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 COMPONENTS**
**VALVE AND CYLINDER HEAD COMPONENTS**
**PISTON, PISTON RING AND CONNECTING ROD COMPONENTS**
**MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS**

**Reference:**

For the tightening torque of fastener not specified in this information, refer to **FASTENER INFORMATION** .

## SPECIAL TOOLS AND EQUIPMENT

### RECOMMENDED SERVICE MATERIAL

### MATERIAL SPECIFICATION

| Material | SUZUKI recommended product or Specification | |
|---|---|---|
| Sealant | SUZUKI Bond No. 1217F | P/No.: 99000-31290 |

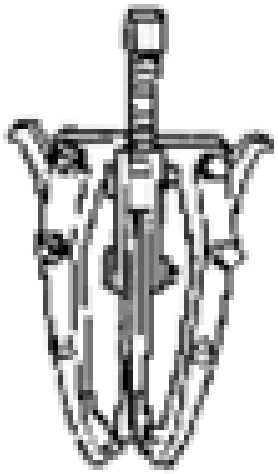
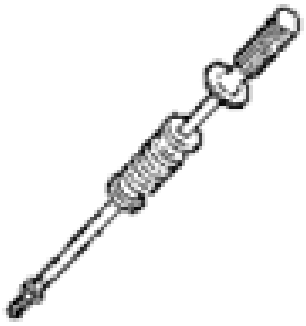
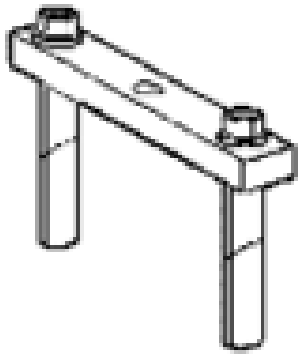
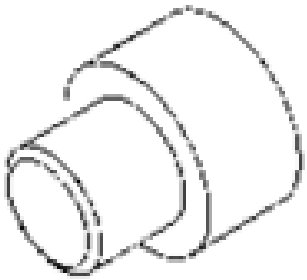
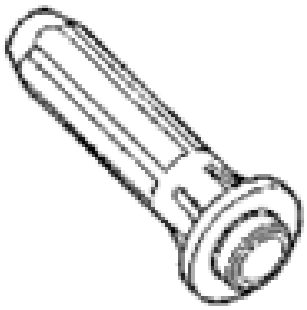
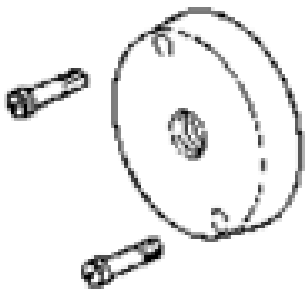
**NOTE:** **Required service material is also described in the following.**
**CYLINDER HEAD COVER COMPONENTS**
**CAMSHAFT, CMP ACTUATOR, VALVE LASH ADJUSTER AND VALVE ROCKER ARM COMPONENTS**
**TIMING CHAIN COVER COMPONENTS**
**2ND TIMING CHAIN (BANK 1) AND TIMING CHAIN TENSIONER ADJUSTER NO. 1 COMPONENTS**
**1ST TIMING CHAIN AND TIMING CHAIN TENSIONER ADJUSTER NO. 2 COMPONENTS**
**2ND TIMING CHAIN (BANK 2) AND TIMING CHAIN TENSIONER ADJUSTER NO. 3 COMPONENTS**
**VALVE AND CYLINDER HEAD COMPONENTS**
**PISTON, PISTON RING AND CONNECTING ROD COMPONENTS**
**MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS**

### SPECIAL TOOL

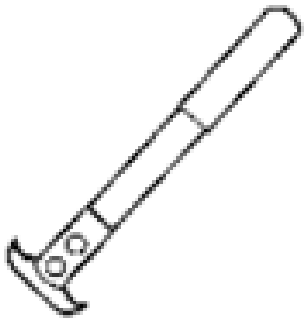
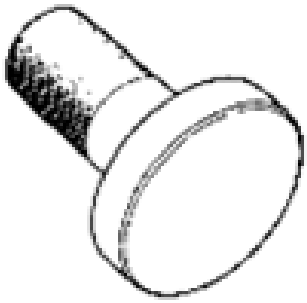
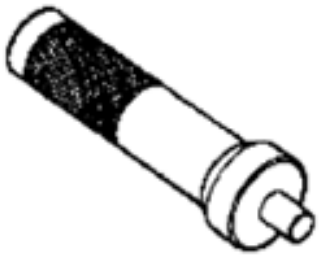
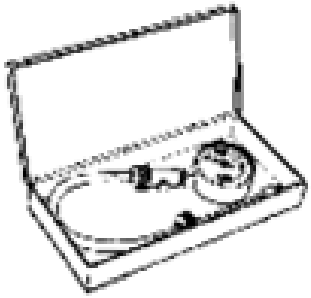
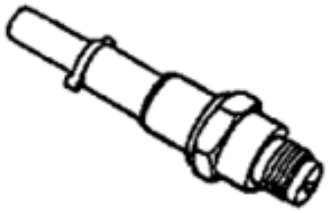
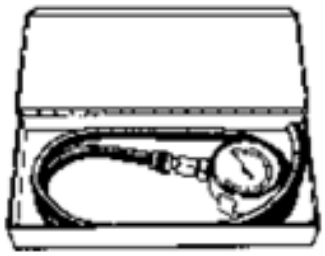
### SPECIAL TOOL SPECIFICATION

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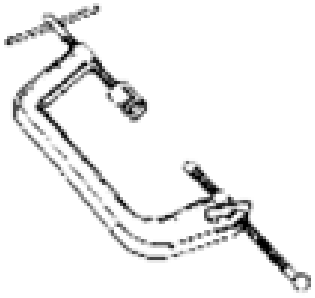
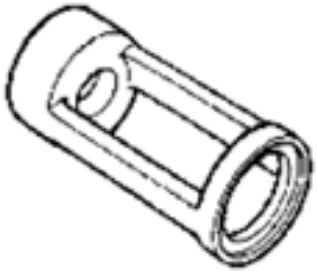
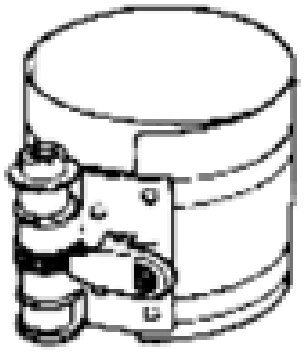
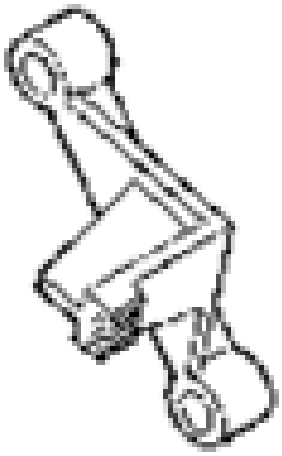
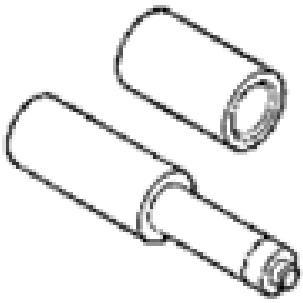
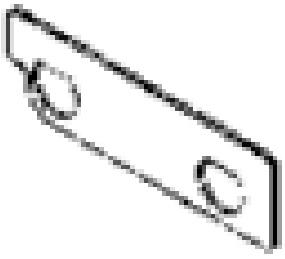
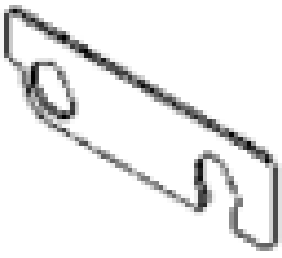

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| 09910-97810<br>Crankshaft Balancer Remover<br>J-41816<br> | 09912-36510<br>Slide Hammer Adapter<br>J-6125-1B<br> |
| 09912-36520<br>Crankshaft Bearing Cap Remover<br>J-41818<br> | 09912-37820<br>Crankshaft Balancer Installer<br>J-41998<br> |
| 09912-37830<br>Crankshaft Button<br>J-38416<br> | 09913-57810<br>OCV Seal Remover/Installer<br>EN-46103<br> |
| 09913-57820<br>Oil Seal Installer<br>EN-47893<br> | 09913-57830<br>Seal Remover<br>J-45000 |

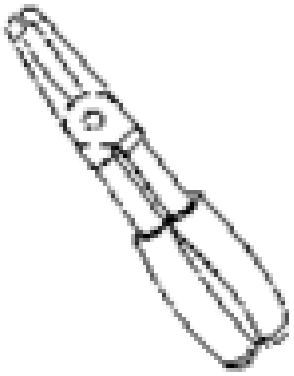
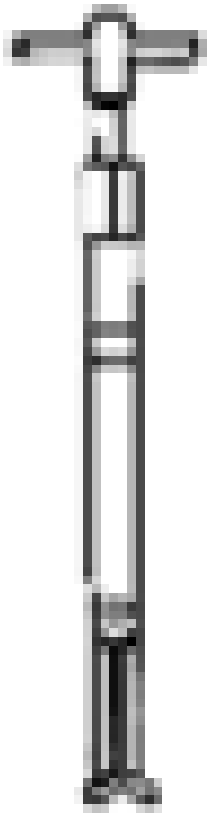
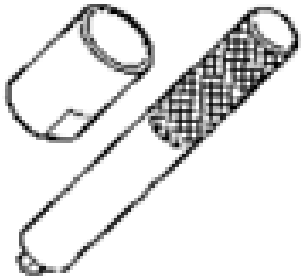
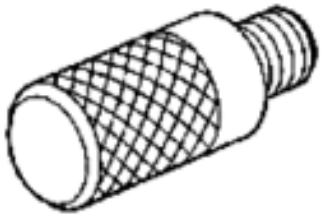
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| 09913-75510<br>Bearing installer  | 09913-75821<br>Bearing installer attachment  |
| 09915-64512<br>Compression gauge  | 09915-64530<br>Compression gauge hose  |
| 09915-67010<br>Compression gauge attachment (C)  | 09915-67311<br>Vacuum gauge  |
| 09916-14510<br>Valve lifter | 09916-14530<br>Valve spring compressor attachment |

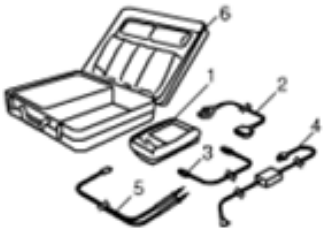
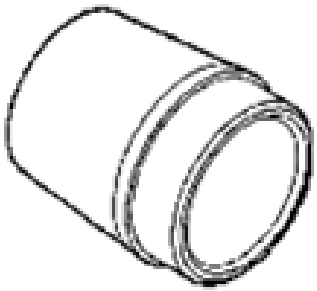
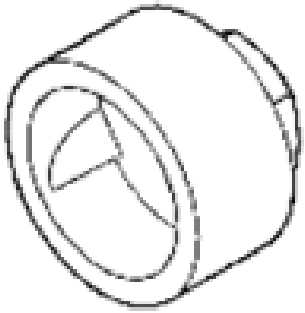
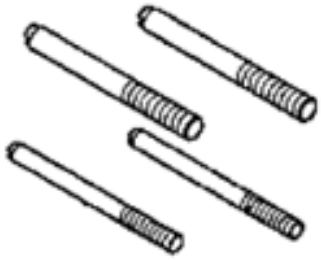
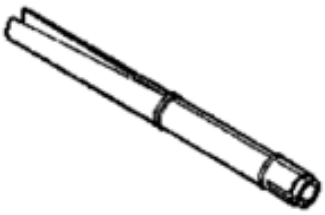
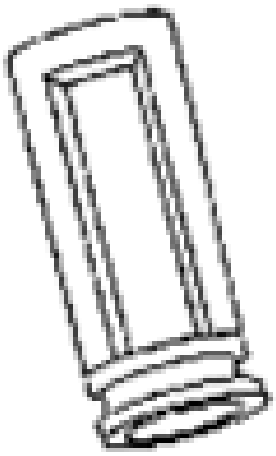
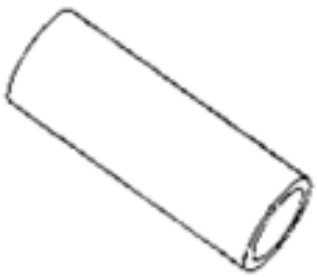
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|  |  |
| 09916-77310<br>Piston ring compressor<br>(50-125 mm)<br> | 09916-84511<br>Forceps<br> |
| 09916-97830<br>Flywheel Holding Tool<br>EN-46106<br> | 09917-66520<br>Check Valve<br>Remover/Installer<br>EN-46122<br> |
| 09917-67810<br>Camshaft Locking Tool<br>EN-48383-3<br> | 09917-67830<br>Camshaft Locking Tool<br>EN-48383-2<br> |
| | |

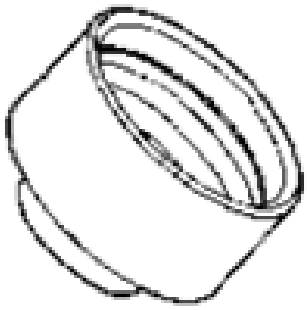
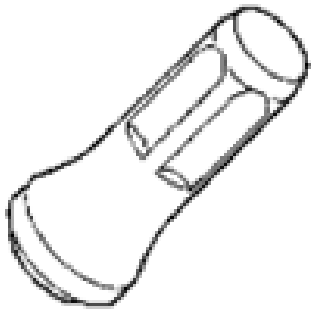
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| 09917-97810<br>Stem Seal<br>Remove/Installer<br>EN-46116  | 09918-57800<br>Timing Chain Retention<br>Tool<br>EN-48313  |
| 09918-57810<br>Tensioner Tool<br>J-45027  | 09919-87800<br>Handle<br>J-42183  |
| 09921-96010<br>Oil seal remover &<br>slider  | 09926-68310<br>Differential bevel<br>pinion bearing installer  |
| SUZUKI scan tool<br>(SUZUKI-SDT)<br>- | |

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| This kit includes following items.<br>1. SUZUKI-SDT<br>2. DLC3 cable<br>3. USB cable<br>4. AC/DC power supply<br>5. Voltage meter probe<br>6. Storage case  | Spark plug tube seal guide<br>-<br>EN-46101: This tool is not applied with SUZUKI part number.  |
| Crankshaft rotation socket<br>-<br>EN-46111: This tool is not applied with SUZUKI part number.  | Engine front cover installation guide pins<br>-<br>EN-46109: This tool is not applied with SUZUKI part number.  |
| Valve stem key remover/installer<br>-<br>EN-46117: Substitute special tool for 09916-14510, 09916-14530 and 09916-84510.  | Off-vehicle valve spring compressor adapter<br>-<br>EN-46119: Substitute special tool for 09916-14510, 09916-14530 and 09916-84510.  |
| Valve spring compressor head off<br>-<br>J-8062: Substitute special tool for 09916-14510, 09916-14530 and 09916-84510.  | Bearing and seal driver<br>-<br>J-5590: Substitute special tool for 09913-75510.  |
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| Oil seal installer<br>-<br>J-25254-A: Substitute special tool for 09913-75510. |  | Oil seal installer<br>-<br>J-29184: Substitute special tool for 09913-75820 and 09926-68310. |  |

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