2011 ENGINE

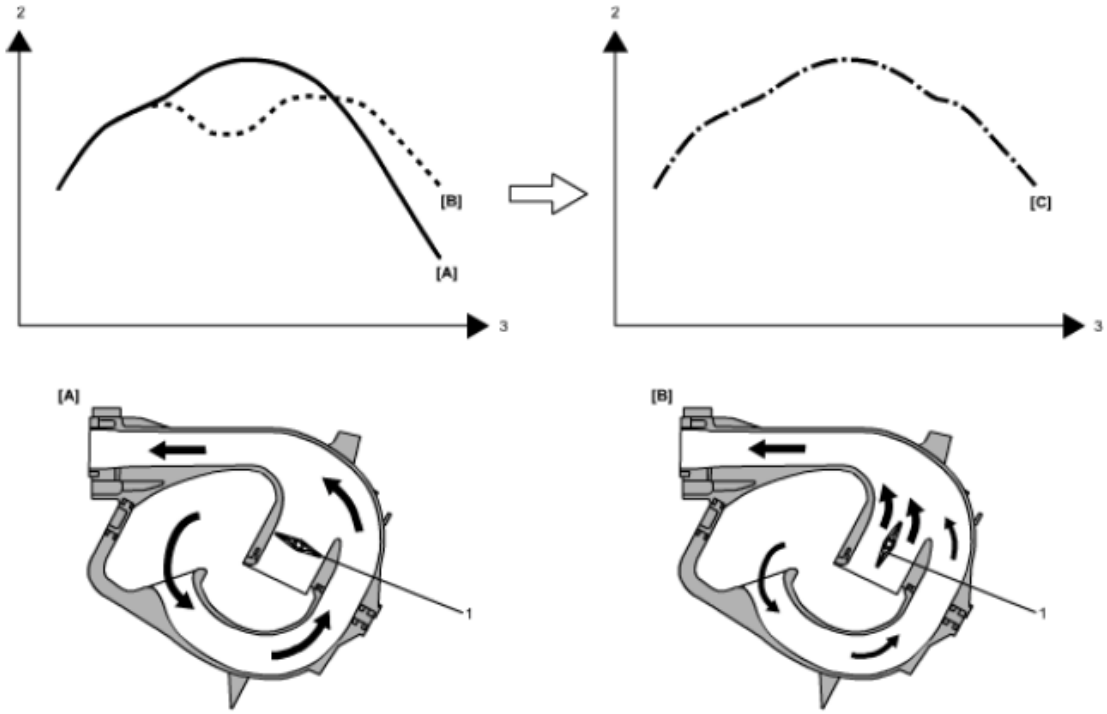
Engine Mechanical - Kizashi

GENERAL DESCRIPTION

ENGINE CONSTRUCTION DESCRIPTION

The engine is a water-cooled, in-line 4 cylinder, 4-stroke-cycle gasoline unit with a DOHC valve mechanism arranged in a "V" type valve configuration and has 16 valves (4 valves/one cylinder). The intake camshaft equipped with a VVT actuator and the exhaust camshaft are mounted over the cylinder head and are driven by a crankshaft with a silent-type timing chain. In addition, balancer shafts are combined with the oil pump located under the lower crankcase and driven by another silent chain.

IMT SYSTEM DESCRIPTION



[A]: IMT valve closed	[C]: IMT valve controlled	2. Engine torque
[B]: IMT valve open	1. IMT valve	3. Engine speed

Fig. 1: IMT Valve System Diagram (Open And Closed)
Courtesy of SUZUKI OF AMERICA CORP.

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

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As the intake valve in the cylinder head is opened and closed repeatedly, intake air pulsation occurs. If the intake valve is opened when air pressure is momentarily at the maximum level, the intake air volumetric efficiency increases. This momentary maximum air pressure depends on the effective intake pipe length.

When IMT valve is totally closed [A]:

The effective intake pipe length is longer. Engine torque in the high engine speed range drops, while it improves in the middle range.

When IMT valve is fully open [B]:

The effective intake pipe length is shorter. Engine torque in the high engine speed range improves, while it drops in the middle engine speed range.

IMT system utilizes this characteristic of engine. IMT valve is closed in middle engine speed range, and opened in high engine speed range.

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

DIAGNOSTIC INFORMATION AND PROCEDURES

COMPRESSION CHECK

1. Warm up engine to normal operating temperature.
2. Stop engine after warm-up.
3. For CVT model, place select lever in "P" and apply parking brake.

   For M/T model, place gear shift lever in "Neutral" and apply parking brake.

4. Remove engine cover.
5. Remove all ignition coils and spark plugs, see **SPARK PLUG REMOVAL AND INSTALLATION** .
6. Disconnect all fuel injector connectors.
7. Connect special tools together and install then into spark plug hole.

   Special Tool

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

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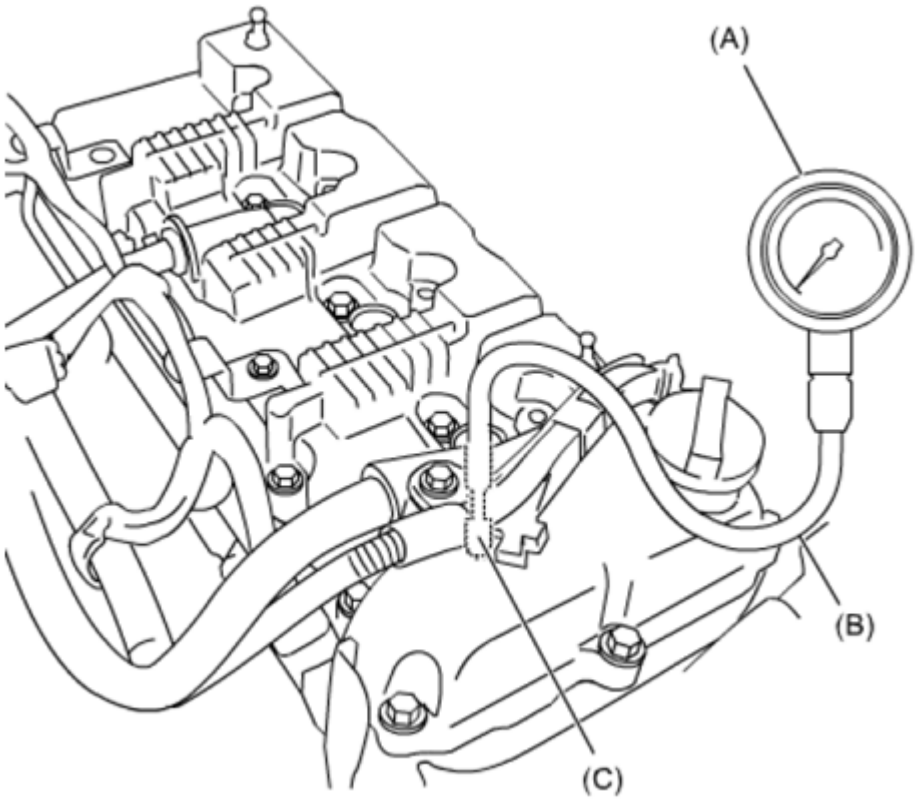


Fig. 2: Connecting Special Tools Into Spark Plug Hole
Courtesy of SUZUKI OF AMERICA CORP.

8. Depress accelerator pedal all the way to fully open throttle.

NOTE: For M/T model, disengage clutch to lighten starting load on engine, and depress accelerator pedal all the way to fully open throttle.

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

NOTE:

- **For measuring compression pressure, crank engine up to at least 200 rpm with fully charged battery.**
- **Check resting position of special tool if measured compression pressure is lower than the limit.**
- **If the measured compression pressure of particular cylinder is lower than the limit, add a bit of engine oil into the cylinder through the spark plug hole, and then repeat the compression check.**
  - **If the compression pressure increases after adding engine oil, the following may be the cause:**
    - **Pressure leakage due to worn piston rings or worn cylinder**
  - **If the compression pressure does not increase, one of the**

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following may be the causes:

- **Incorrect valve timing**
- **Pressure leakage from the valve or valve seats**
- **Pressure leakage from the cylinder head gasket**

Compression pressure

Standard: 1, 400 kPa (14.3 kgf/cm^2 , 203 psi)

Limit: 1, 100 kPa (11.2 kgf/cm^2 , 160 psi)

Max. difference between any two cylinders: 100 kPa (1.0 kgf/cm^2 , 14.5 psi)

10. Carry out Steps 7) through 9) on each cylinder.
11. Install spark plugs and ignition coil assemblies, see **SPARK PLUG REMOVAL AND INSTALLATION** .
12. Connect fuel injector connectors.
13. Install engine cover.

ENGINE VACUUM CHECK

1. Warm up engine to normal operating temperature.
2. For CVT model, place select lever in "P" and apply parking brake.

   For M/T model, place gear shift lever in "Neutral" and apply parking brake.

3. Remove engine cover.
4. Remove PCV hose (1) from PCV valve (2).
5. Connect special tool to PCV hose (1).

   Special Tool

   A. **09915-67311**
6. Close PCV valve (2) using tape (3) or the like.

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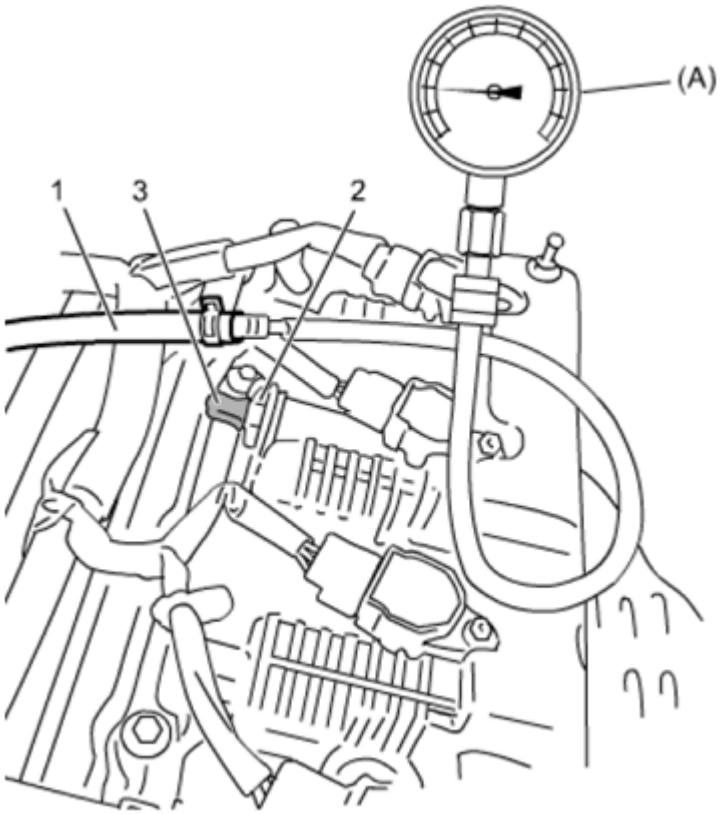


Fig. 3: Connecting Special Tool To PCV Hose
Courtesy of SUZUKI OF AMERICA CORP.

7. Start engine and turn off all electric loads.
8. Read vacuum gauge at specified idle speed, see **IDLE SPEED INSPECTION** .

   Vacuum specification (at sea level)

   Standard: -65 kPa (-0.66 kgf/cm^2 , -9.43 psi, -0.65 bar) or less at specified idle speed

9. After checking, disconnect special tool from PCV hose.
10. Peel off tape from PCV valve.
11. Connect PCV hose to PCV valve.
12. Install engine cover.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

Inspection

1. Disconnect negative (-) cable at battery.
2. Remove cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
3. Insert socket wrench through service hole (2) of front fender lower lining (1). Turn crankshaft pulley (3)

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clockwise and align crankshaft pulley notch mark (5) with timing chain cover at 0° (TDC) mark (4). Matchmark camshaft housing No. 1 (6) and exhaust camshaft timing sprocket (7) have to be aligned.

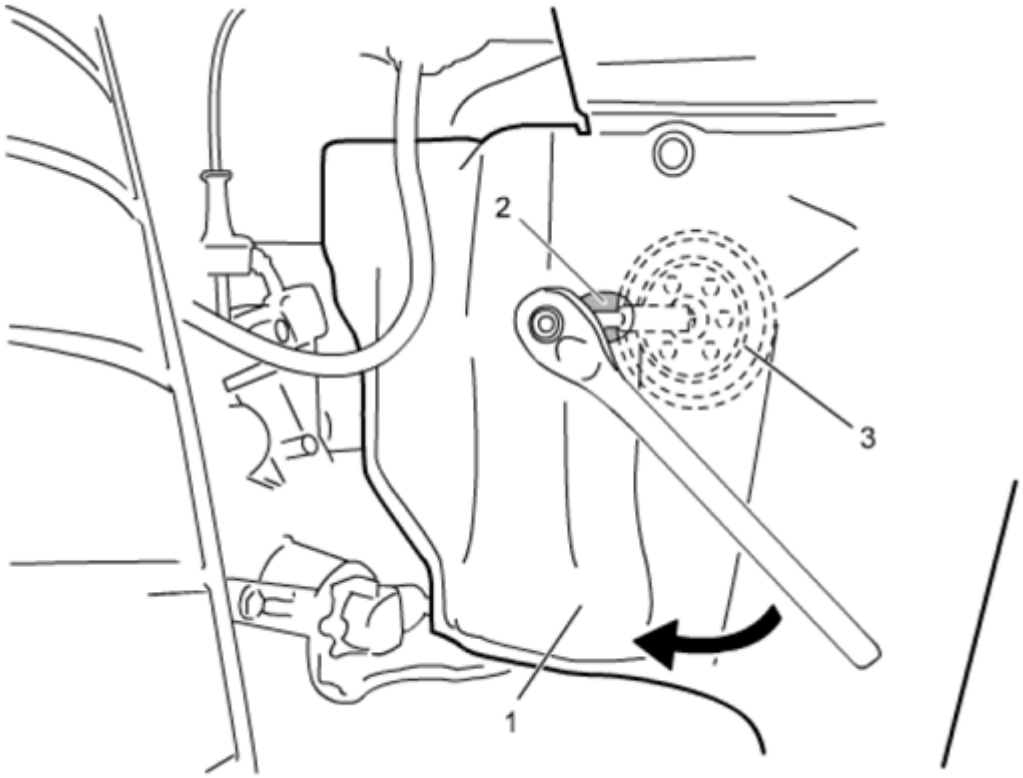
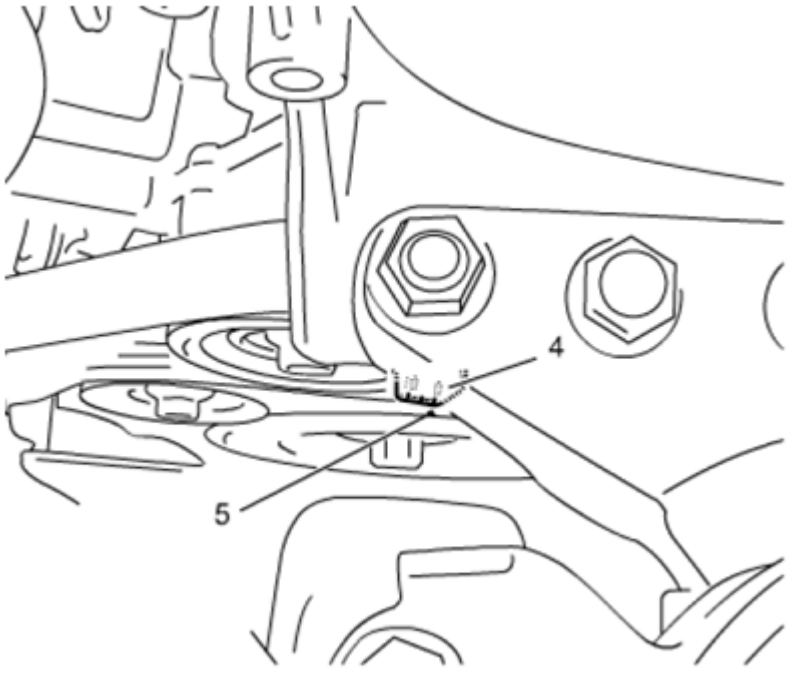


Fig. 4: Turning Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 5: Aligning Crankshaft Pulley Notch Mark With Timing Chain Cover 0° (TDC) Mark
Courtesy of SUZUKI OF AMERICA CORP.

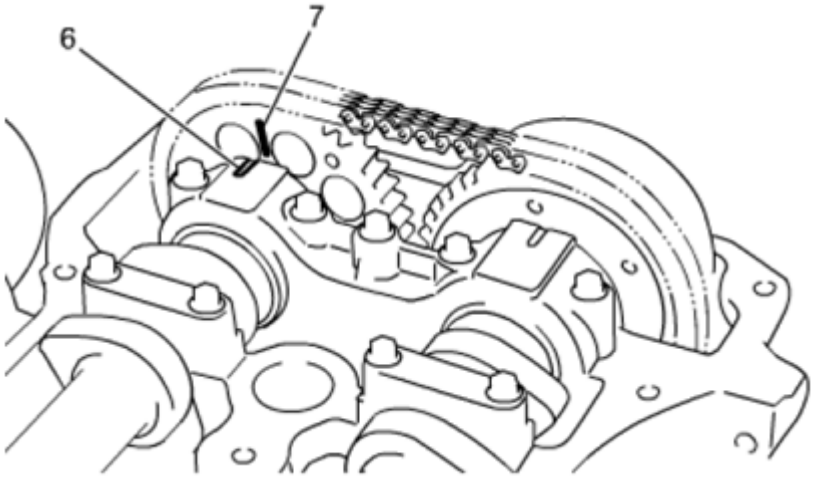


Fig. 6: Aligning Matchmark Camshaft Housing No. 1 And Exhaust Camshaft Timing Sprocket Have
Courtesy of SUZUKI OF AMERICA CORP.

4. Measure valve clearances with feeler gauge using the following procedures.
   a. Measure valve clearances of "A" valves as indicated in the following figure.
   b. Turn crankshaft pulley 360° clockwise.
   c. Measure valve clearances of "B" as indicated as valves in the following figure.

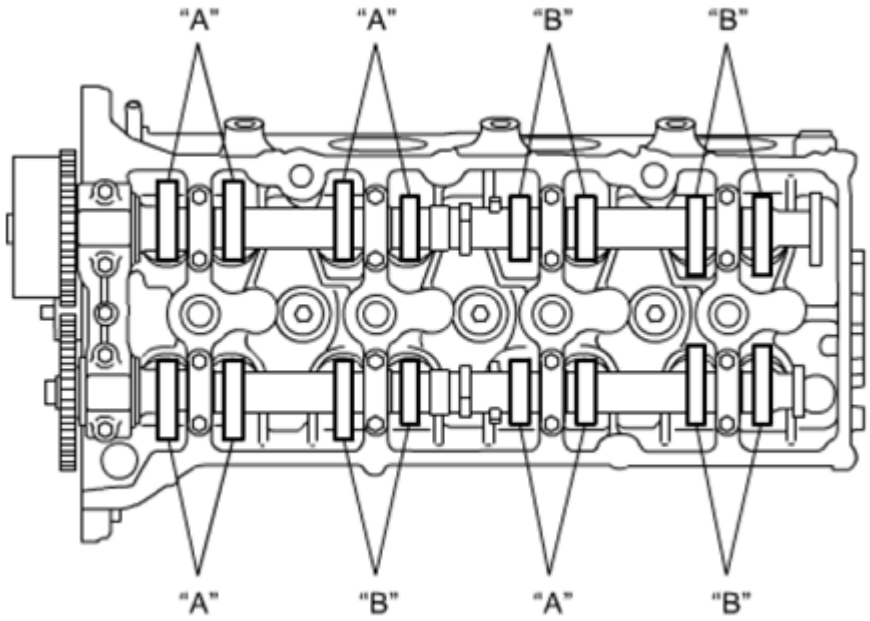


Fig. 7: Identifying Valve Clearances
Courtesy of SUZUKI OF AMERICA CORP.

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If valve clearance is out of specification, record valve clearance and adjust it to specified value.

Valve clearance specification

When cold (ECT: 15 - 25°C (59 - 77°F)):

- **Intake: 0.16 - 0.24 mm (0.0063 - 0.0094 in.)**
- **Exhaust: 0.31 - 0.39 mm (0.0122 - 0.0153 in.)**

Adjustment

1. Remove tappet to be replaced, see **Camshaft and Tappet Removal and Installation**.
2. Select proper size of tappet as follows.
   a. Using a micrometer, measure the thickness of the removed tappet (1).
   b. Calculate the thickness of new tappet using the following formula.

NOTE: If the number in the second decimal places is odd, use (A - 0.01) tappet.

Intake side:

A = B + C - 0.20 mm (0.0078 in.)

Exhaust side:

A = B + C - 0.35 mm (0.0137 in.)

A: Thickness "a" of new tappet

B: Thickness "a" of removed tappet

C: Measured valve clearance

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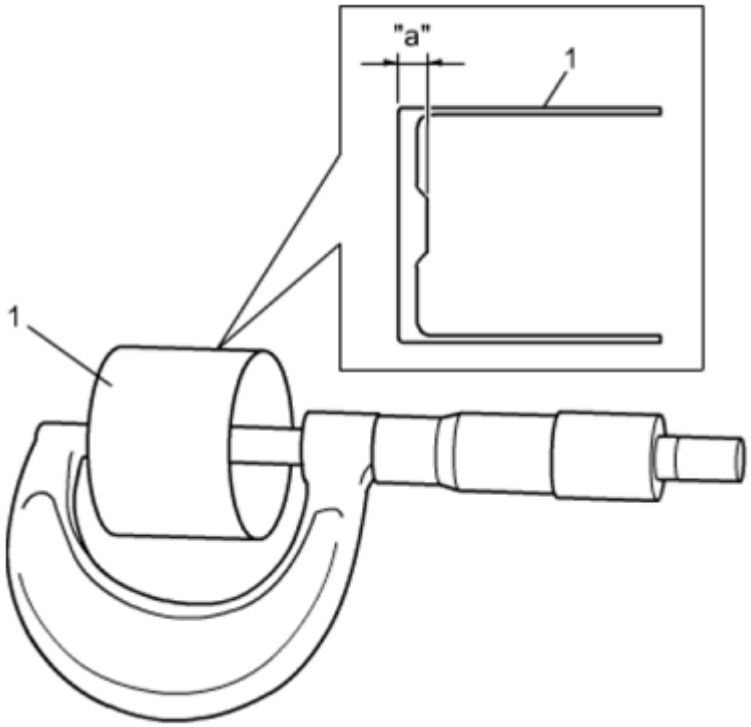


Fig. 8: Measuring Thickness Of Removed Tappet
Courtesy of SUZUKI OF AMERICA CORP.

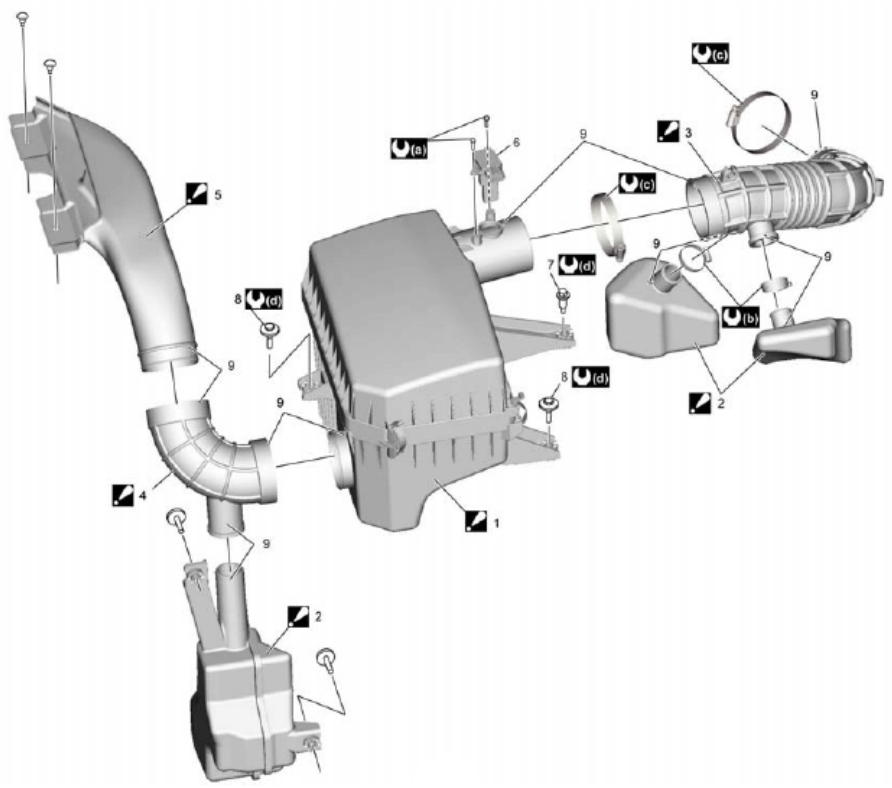
c. Select new tappet from available spare parts that is closest in size to the calculated value.

3. Install tappets and camshafts, see **Camshaft and Tappet Removal and Installation**.
4. Recheck valve clearance.

REPAIR INSTRUCTIONS

AIR CLEANER COMPONENTS

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1. Air cleaner assembly : Align matchmark	5. Air cleaner suction pipe : Align matchmark	9. Matchmark	(d): 10 N·m (1.00 kgf-m, 7.5 lbf-ft)
2. Resonator : Align matchmark	6. MAF and IAT sensor	(a): 0.9 N·m (0.09 kgf-m, 1.0 lbf-ft)	
3. Air cleaner outlet hose : Align matchmark	7. Air cleaner bolt No.1	(b): 1.0 N·m (0.10 kgf-m, 1.0 lbf-ft)	
4. Air cleaner suction hose : Align matchmark	8. Air cleaner bolt No.2	(c): 2.0 N·m (0.20 kgf-m, 1.5 lbf-ft)	

Fig. 9: Identifying Air Cleaner Components
Courtesy of SUZUKI OF AMERICA CORP.

AIR CLEANER FILTER REMOVAL AND INSTALLATION

Reference: **AIR CLEANER COMPONENTS**

Removal

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

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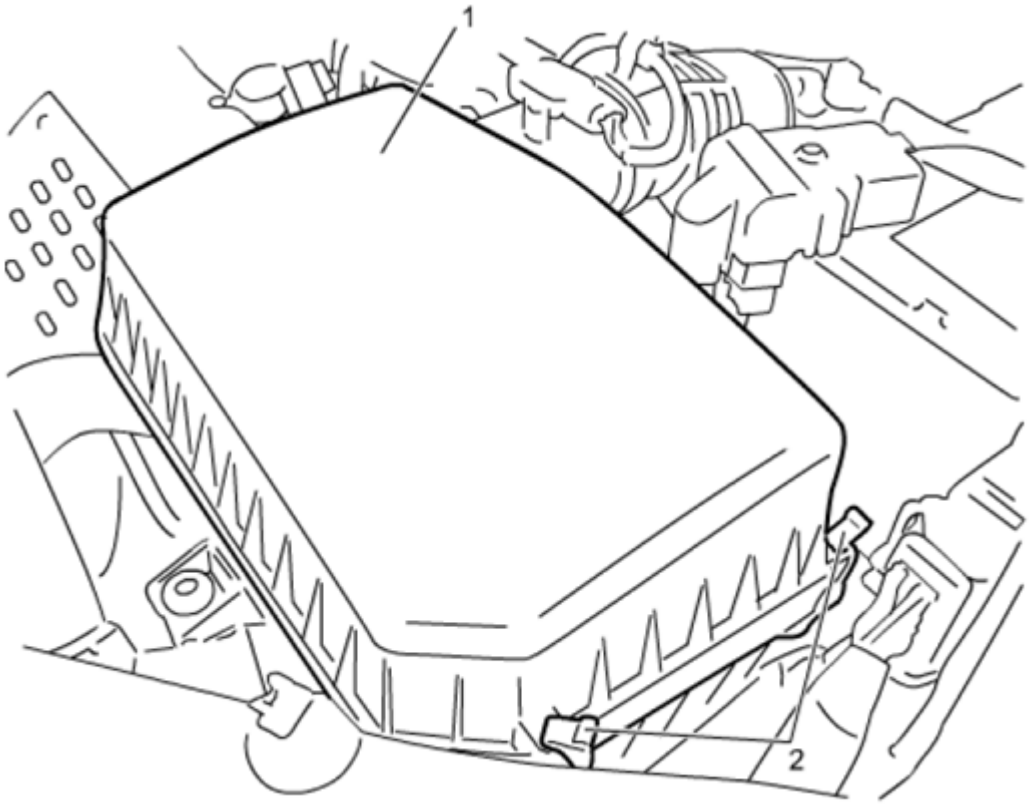


Fig. 10: Identifying Air Cleaner Case And Clamps
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove air cleaner filter from case.

Installation

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

Reverse removal procedure.

AIR CLEANER FILTER INSPECTION AND CLEANING

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

Inspection

Check air cleaner filter for dirt.

Replace filter if excessively dirty.

Cleaning

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

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Fig. 11: Cleaning Air Cleaner Filter
Courtesy of SUZUKI OF AMERICA CORP.

AIR CLEANER ASSEMBLY REMOVAL AND INSTALLATION

Reference: **AIR CLEANER COMPONENTS**

Removal

1. Disconnect negative (-) cable at battery.
2. Disconnect MAF and IAT sensor connector (1).
3. Remove air cleaner outlet hose (2).
4. Remove air cleaner bolts No. 1 (3) and No. 2 (4).
5. Remove air cleaner assembly (5).

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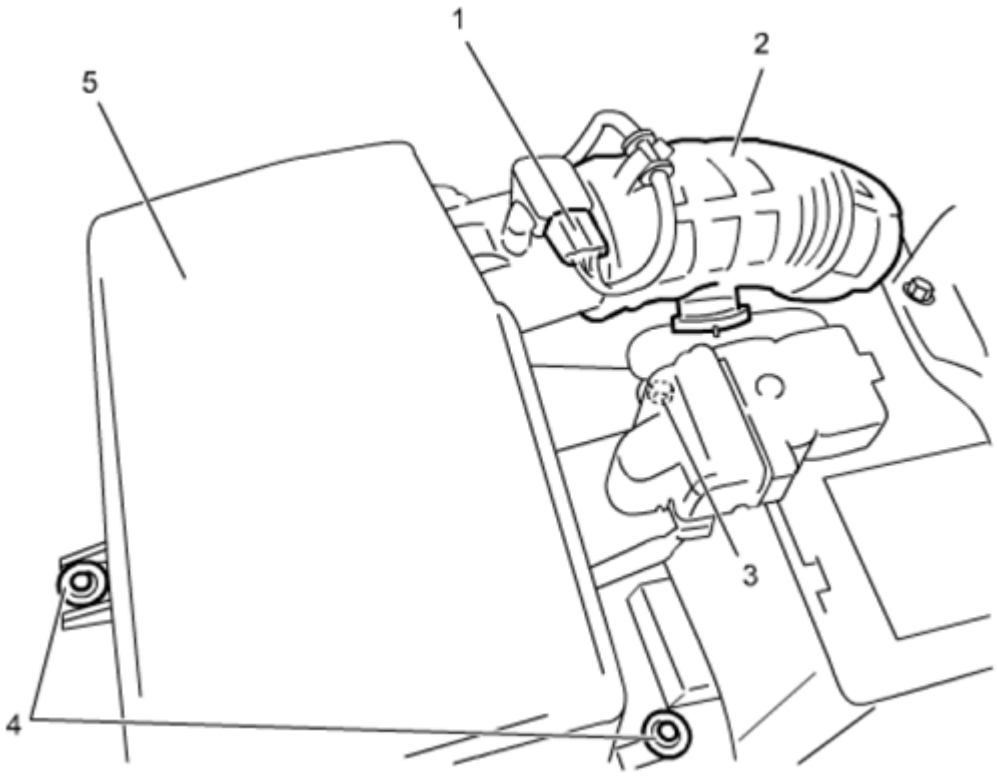


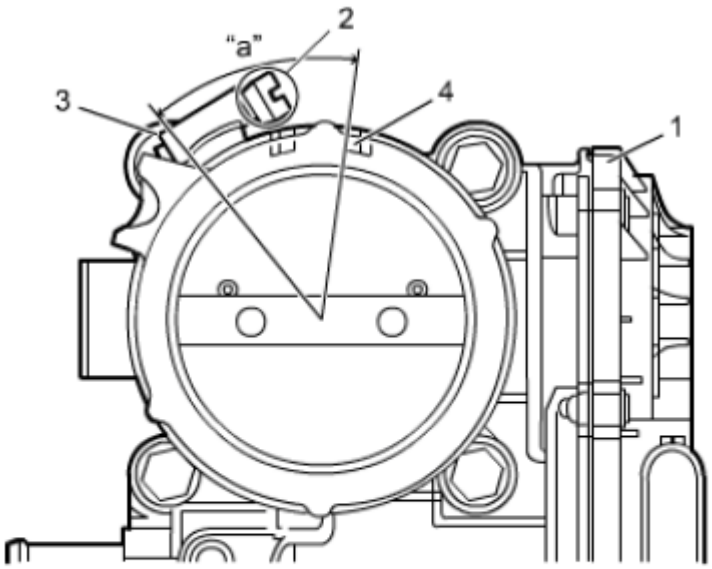
Fig. 12: Identifying Air Cleaner Assembly And Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation noting the following points:

- Align matchmark of air cleaner outlet hose and air cleaner suction hose when installing, see **AIR CLEANER COMPONENTS**.
- Install throttle body (1) side clamp bolt head (2) within specified range "a" shown below and tighten it to specified torque, see **AIR CLEANER COMPONENTS**.

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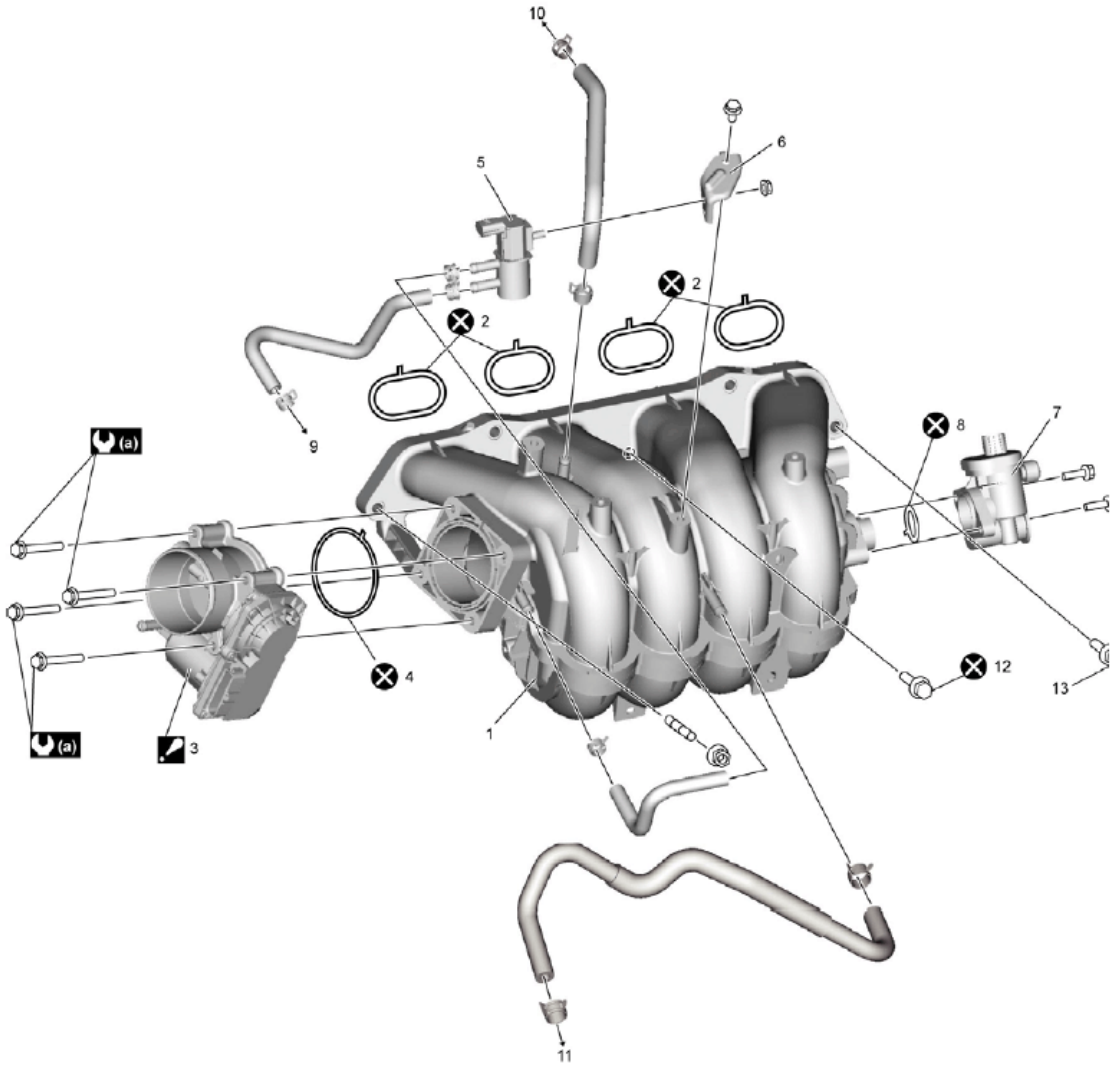
3.	Throttle body bolt
4.	Air cleaner outlet hose matchmark

Fig. 13: Identifying Air Cleaner Outlet Hose And Air Cleaner Suction Hose
Courtesy of SUZUKI OF AMERICA CORP.

- Tighten clamps and bolts to specified torque, see **AIR CLEANER COMPONENTS**.

THROTTLE BODY AND INTAKE MANIFOLD COMPONENTS

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1. Intake manifold	6. EVAP canister purge valve bracket	11. To brake booster
2. Intake manifold gasket	7. IMT valve actuator	12. Intake manifold bolt No.1 (precoated adhesive)
3. Throttle body : Do not disassemble.	8. IMT valve actuator gasket	13. Intake manifold bolt No.2
4. Throttle body gasket	9. To EVAP canister purge valve	(a): 12 N·m (1.2 kgf-m, 9.0 lbf-ft)
5. EVAP canister purge valve	10. To PCV valve	: Do not reuse.

Fig. 14: Identifying Throttle Body And Intake Manifold Components
Courtesy of SUZUKI OF AMERICA CORP.

THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION

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

CAUTION: Do not perform disassembly. Even if reassembly is performed, performance will be inferior to the original performance. If throttle body is found faulty, replace it with new one as an assembly.

Removal

1. Disconnect negative (-) cable at battery.
2. Drain coolant, see **COOLING SYSTEM DRAINING** .
3. Remove air cleaner outlet hose (1).

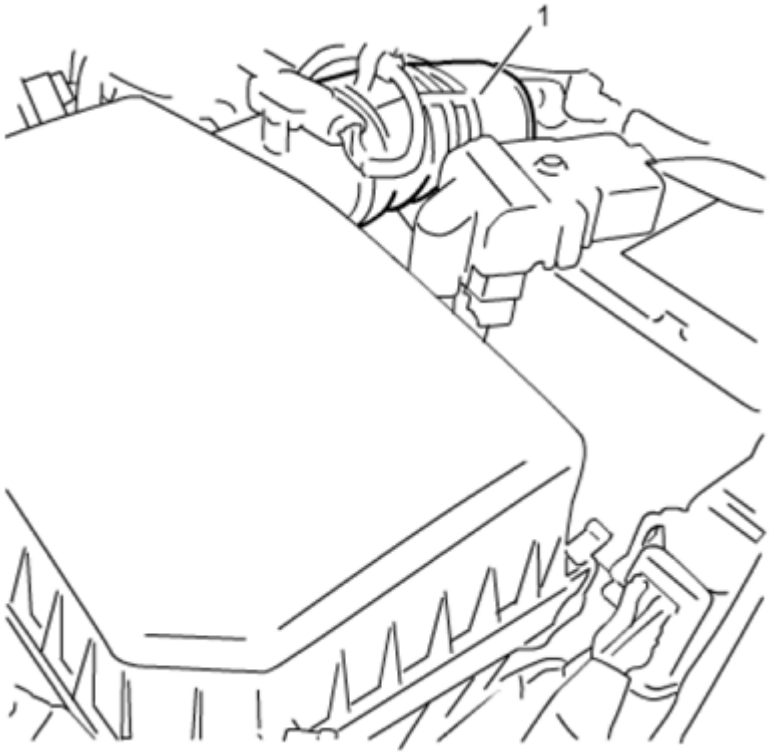


Fig. 15: Identifying Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

4. Disconnect engine coolant hoses (2) and connector (3) from throttle body assembly (1).
5. Remove throttle body bolts (4), and then remove throttle body assembly and gasket (5) from intake manifold.

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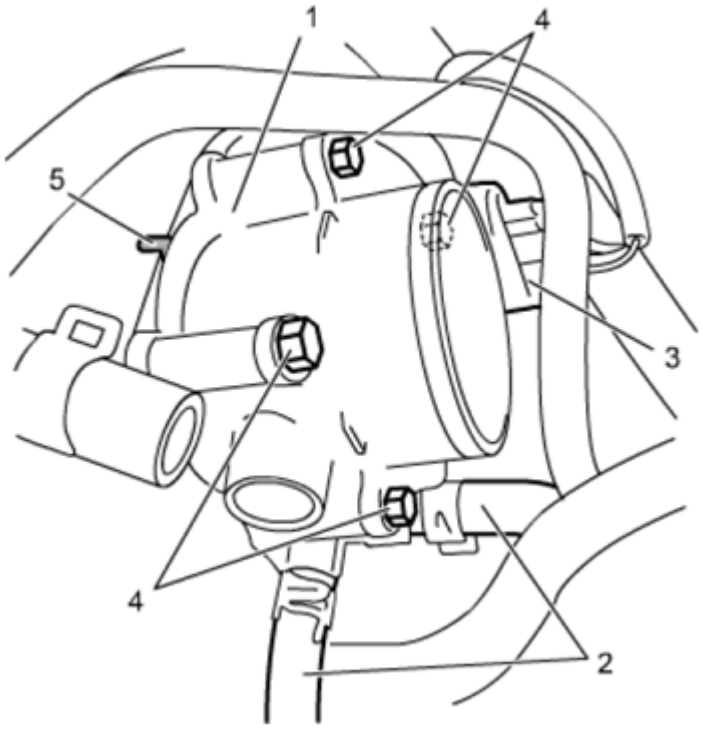


Fig. 16: Identifying Throttle Body Bolts And Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **THROTTLE BODY CLEANING**

1. Clean mating surfaces and install new throttle body gasket (1) to intake manifold.

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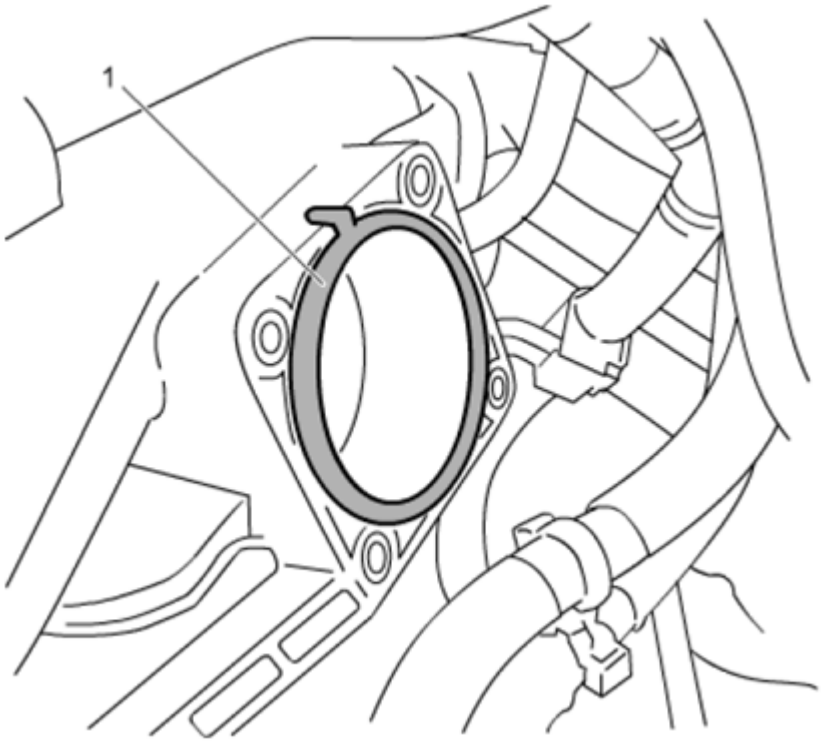


Fig. 17: Identifying Throttle Body Gasket
Courtesy of SUZUKI OF AMERICA CORP.

2. Install throttle body assembly (1) to intake manifold, and then tighten throttle body bolt (2) to specified torque.

   Tightening torque

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

3. Connect connector (4) and coolant hoses (3) to throttle body assembly (1).

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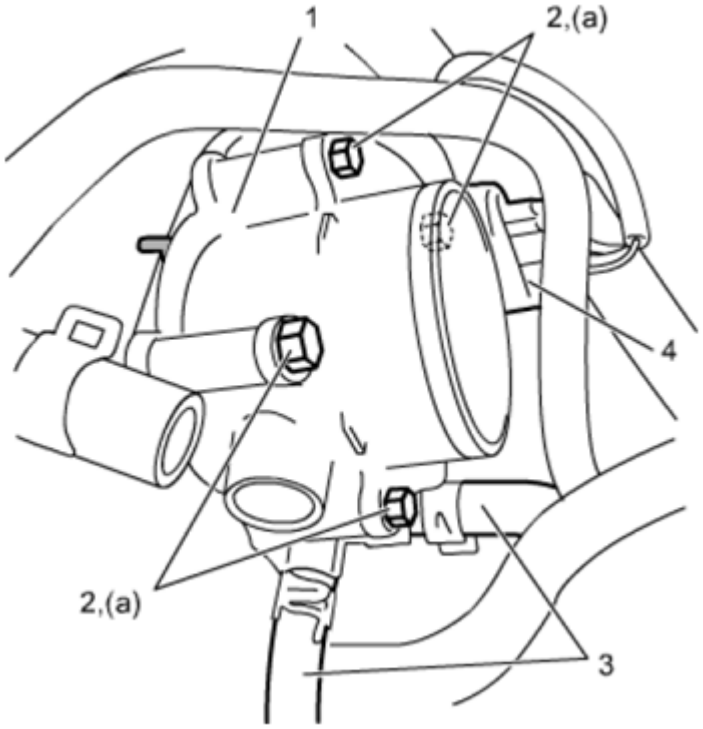


Fig. 18: Identifying Coolant Hoses And Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

4. Install air cleaner outlet hose, see **Air Cleaner Assembly Removal and Installation**.
5. Refill cooling system with coolant, see **COOLING SYSTEM REFILLING** .
6. Connect negative (-) cable at battery.
7. Check for coolant leaks, see **ENGINE COOLING SYSTEM INSPECTION** .

THROTTLE BODY CLEANING

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

Clean throttle body assembly according to "Throttle Valve Visual Check" under ***Electric Throttle Body Assembly On-Vehicle Inspection*** .

INTAKE MANIFOLD REMOVAL AND INSTALLATION

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

Removal

1. Disconnect negative (-) cable at battery.
2. Remove engine cover.
3. Remove throttle body assembly, see **Throttle Body Assembly Removal and Installation**.
4. Remove engine cover bolt (1).

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5. Disconnect the following connectors and hoses.
    - EVAP canister purge valve connector (2)
    - Brake booster hose (3)
    - PCV valve hose (4)
    - Purge hose (5)
    - IMT valve actuator connector (6)
    - IMT valve actuator clamp (7)
    - Engine harness bracket (8)
    - Engine harness clamp (Intake manifold lower side) (9)

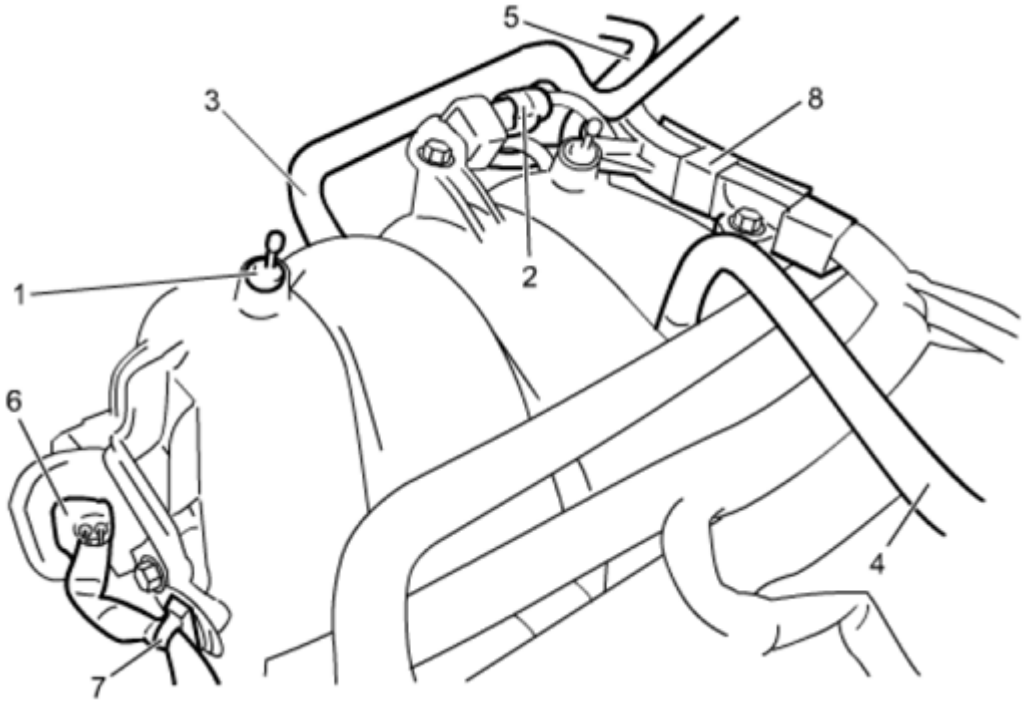


Fig. 19: Identifying Purge Hose And Brake Booster Hose
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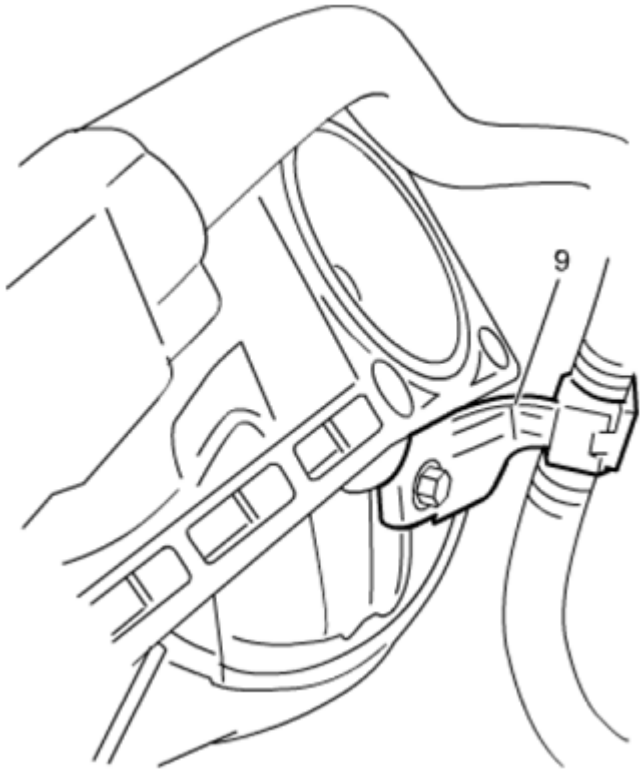


Fig. 20: Identifying Engine Harness Clamp (Intake Manifold Lower Side)
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove intake manifold (1) and gasket (2) from cylinder head.

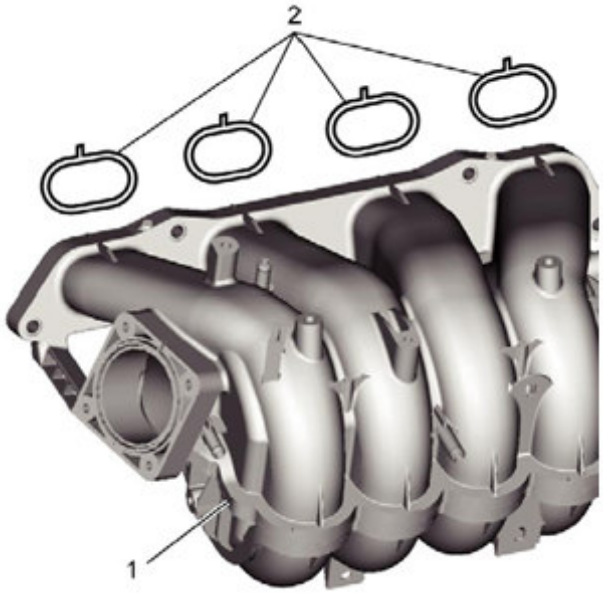


Fig. 21: Identifying Intake Manifold And Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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Installation

Reverse removal procedure for installation noting the following points:

- Use New gaskets
- The Intake manifold bolt No. 1 (1) is not reusable so use a new one.

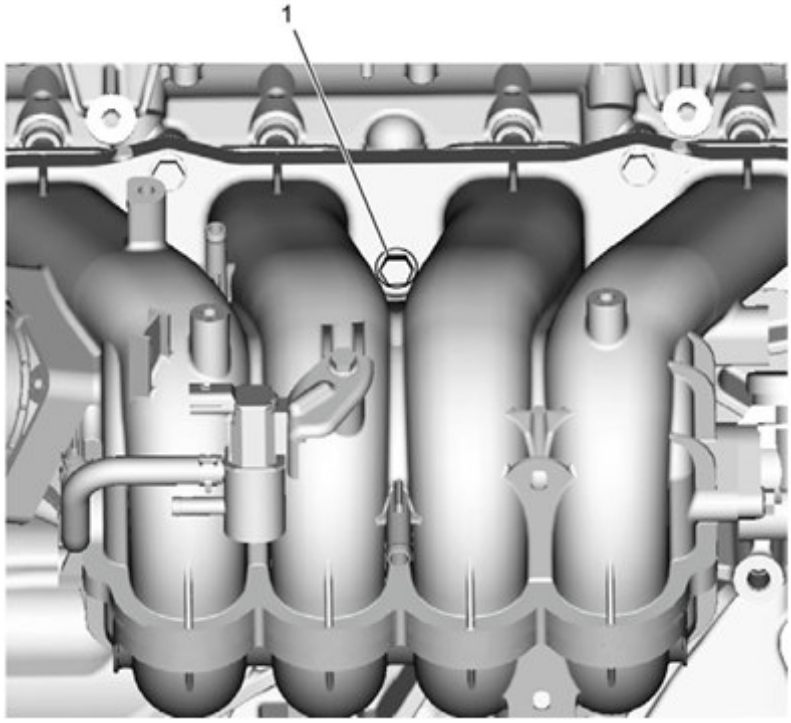


Fig. 22: Identifying Intake Manifold Bolt No. 1
Courtesy of SUZUKI OF AMERICA CORP.

- Refill cooling system, see **COOLING SYSTEM REFILLING** .
- Check for coolant leaks, see **ENGINE COOLING SYSTEM INSPECTION** .

IMT VALVE ACTUATOR REMOVAL AND INSTALLATION

Removal

1. Disconnect negative (-) cable at battery.
2. Disconnect IMT valve actuator connector.
3. Remove IMT valve actuator (2) and gasket (3) from intake manifold (1).

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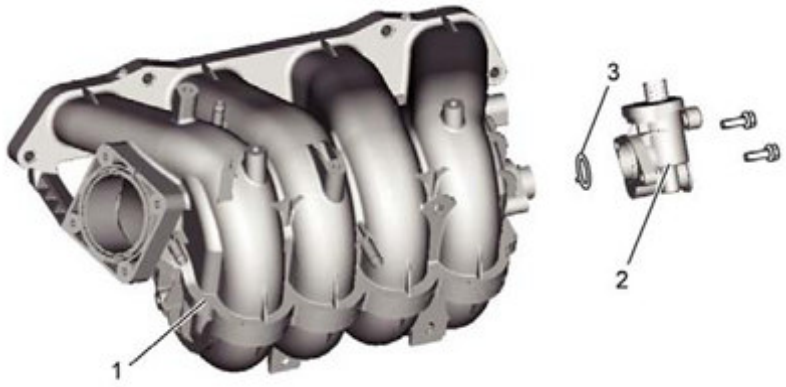


Fig. 23: Identifying IMT Valve Actuator And Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure noting the following points:

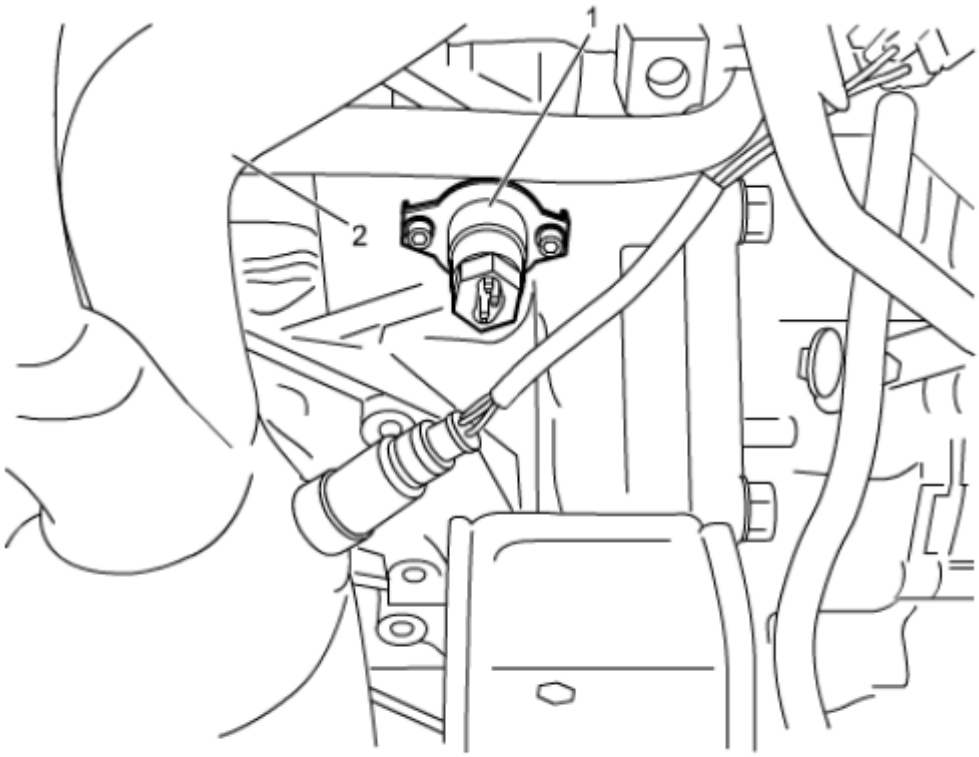
- Use new gasket.
- Check that IMT valve operates properly after installation.

CYLINDER BLOCK HEATER REMOVAL AND INSTALLATION (IF EQUIPPED)

Removal

1. Disconnect negative (-) cable at battery.
2. Drain coolant, see **COOLING SYSTEM DRAINING** .
3. Remove exhaust manifold cover.
4. Remove block heater protector, and then disconnect block heater harness connector.
5. Remove cylinder block heater (1).

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2. Exhaust manifold

Fig. 24: Identifying Cylinder Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Reverse removal procedure for installation noting the following points:

- Use new cylinder block heater bolts.
- Tighten cylinder block heater bolts (1) to specified torque.

Tightening torque

Cylinder block heater bolt (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)

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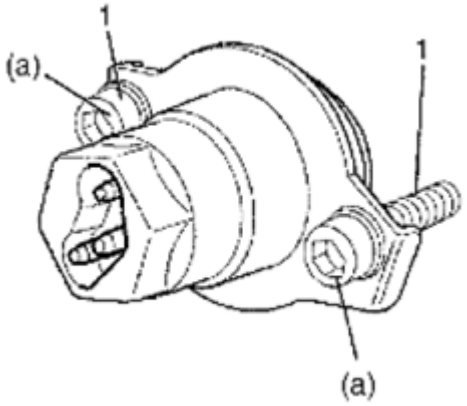


Fig. 25: Identifying Cylinder Block Heater Bolt
Courtesy of SUZUKI OF AMERICA CORP.

- Refill coolant, see **COOLING SYSTEM REFILLING** .
- Check for coolant leaks, see **ENGINE COOLING SYSTEM INSPECTION** .

CYLINDER BLOCK HEATER INSPECTION (IF EQUIPPED)

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

- Check continuity between terminals "a" and "c".

  Replace cylinder block heater. If there is no continuity, see **Cylinder Block Heater Removal and Installation (If Equipped)**.

- Check that there is no continuity between terminal "a" and "b".

  Replace cylinder block heater. If there is continuity, see **Cylinder Block Heater Removal and Installation (If Equipped)**.

- Check continuity between terminal "b" and cylinder block heater body.

  Replace cylinder block heater. If there is no continuity, see **Cylinder Block Heater Removal and Installation (If Equipped)**.

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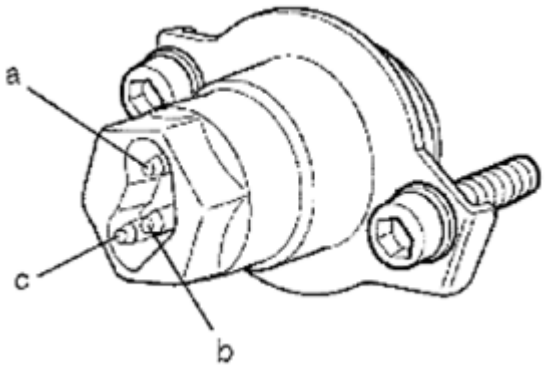
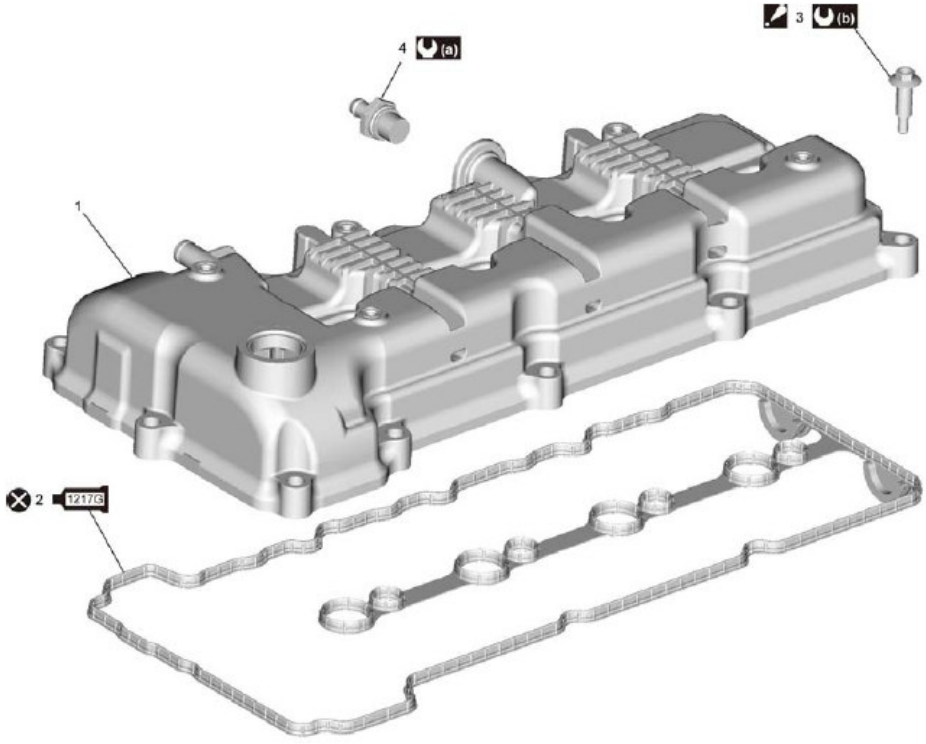


Fig. 26: Identifying Cylinder Block Heater Terminal
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD COVER COMPONENTS



1. Cylinder head cover	4. PCV valve	:	Do not reuse.
1217G 2. Cylinder head cover gasket : Apply sealant 99000-31260 referring to *Cylinder Head Cover Removal and Installation*.	(a) : 2.5 N·m (0.25 kgf-m, 2.0 lbf-ft)		
3. Cylinder head cover bolt : For tightening order, refer to *Cylinder Head Cover Removal and Installation*.	(b) : 3.0 N·m → 5.0 N·m → 7.5 N·m (0.31 kgf-m → 0.51 kgf-m → 0.76 kgf-m, 2.5 lbf-ft → 4.0 lbf-ft → 5.5 lbf-ft)		

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Fig. 27: Identifying Cylinder Head Cover Components
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD COVER REMOVAL AND INSTALLATION

Reference: **CYLINDER HEAD COVER COMPONENTS**

Removal

1. Disconnect negative (-) cable at battery.
2. Remove engine cover.
3. Remove ignition coil assemblies from cylinder head cover, see **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .
4. Disconnect IMT valve connector (1) and IMT valve harness clamp (2).



Fig. 28: Identifying IMT Valve Connector With Clamp
Courtesy of SUZUKI OF AMERICA CORP.

5. Disconnect PCV valve hose (1) and breather hose (2).
6. Detach engine harness clamps.
7. Remove engine harness bracket (3).

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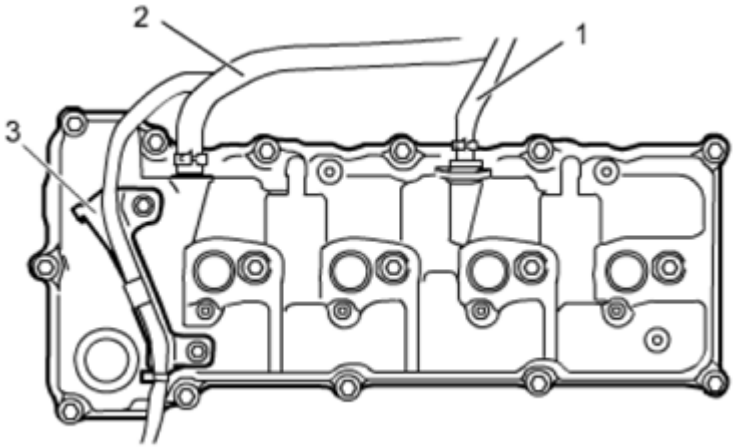


Fig. 29: Identifying PCV Valve Hose And Breather Hose
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove cylinder head cover bolts.
9. Remove cylinder head cover with its gasket.
10. Remove PCV valve if necessary.

Installation

1. Tighten PCV valve to specified torque, if removed.

   Tightening torque

   PCV valve: 2.5 N.m (0.25 kg-m, 2.0 lbf-ft)

2. Remove oil, old sealant, and dust from sealing surfaces on cylinder head and cover.
3. Install new cylinder head cover gasket (1) to cylinder head cover (2) as shown in figure.

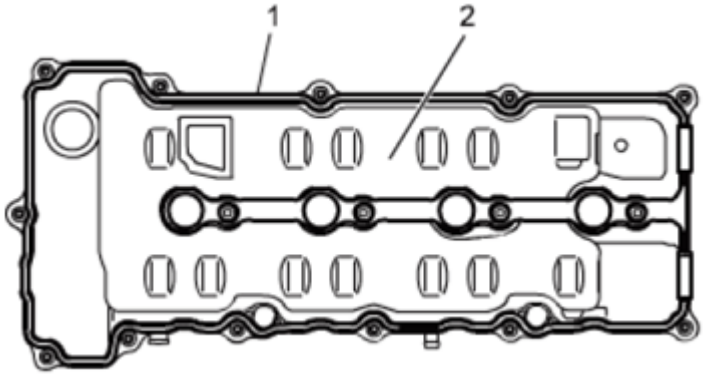


Fig. 30: Identifying Cylinder Head Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply sealant "A" to the designated area as shown in figure.

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

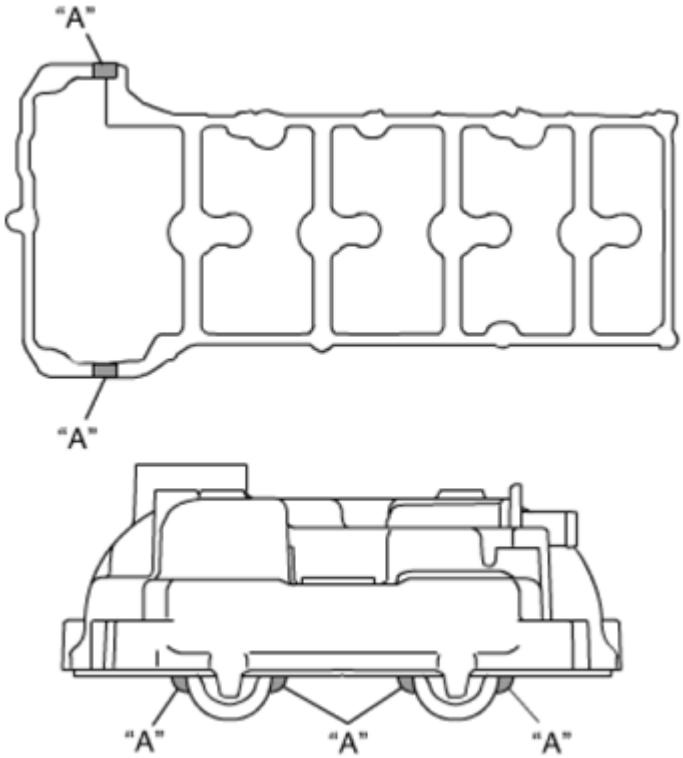


Fig. 31: Identifying Sealant Applying Area
Courtesy of SUZUKI OF AMERICA CORP.

5. Install cylinder head cover to cylinder head.

NOTE: Install cylinder head cover, making sure cylinder head cover gasket for proper fit in cylinder head cover.

6. Tighten cylinder head cover bolts using the following procedures:
   a. a) Tighten cylinder head cover bolts to 3.0 N.m (0.31 kgf-m, 2.5 lbf-ft) in numerical order ("1" - "16") evenly and gradually.
   b. Retighten them to 5.0 N.m (0.51 kgf-m, 4.0 lbf-ft). In the same manner as in Step a).
   c. Retighten them to 7.5 N.m (0.76 kgf-m, 5.5 lbf-ft). In the same manner as in Step a).

Tightening torque

Cylinder head cover bolt* (a): 3.0 N.m --> 5.0 N.m --> 7.5 N.m (0.31 kgf-m --> 0.51 kgf-m --> 0.76 kgf-m, 2.5 lbf-ft --> 4.0 lbf-ft --> 5.5 lbf-ft)

7. Install engine harness bracket (1).
8. Connect PCV valve hose (2) to PCV valve and breather hose (3) to cylinder head cover.

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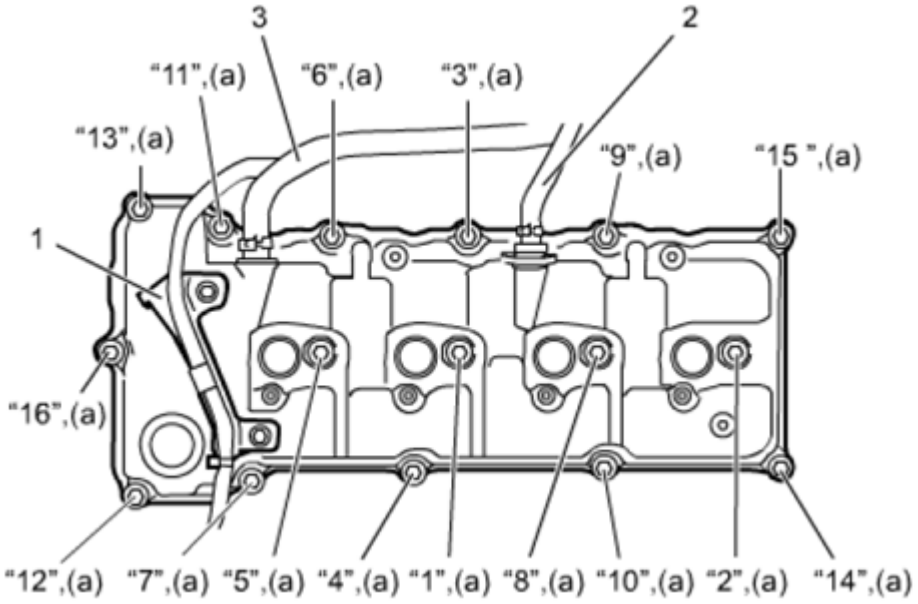


Fig. 32: Identifying PCV Valve Hose And Breather Hose
Courtesy of SUZUKI OF AMERICA CORP.

9. Connect IMT valve connector (1) and IMT valve harness clamp (2).

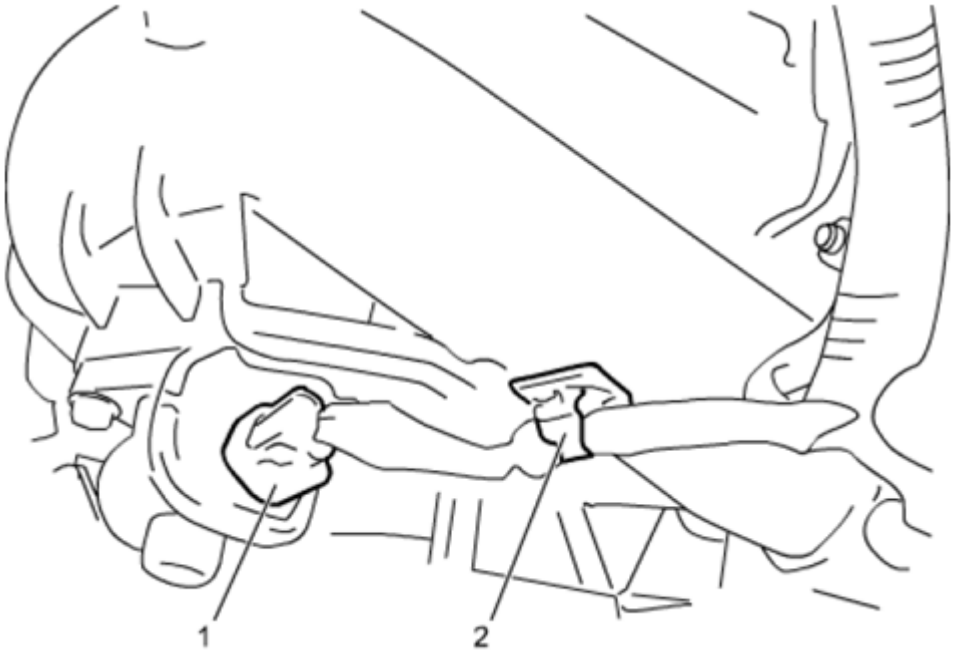


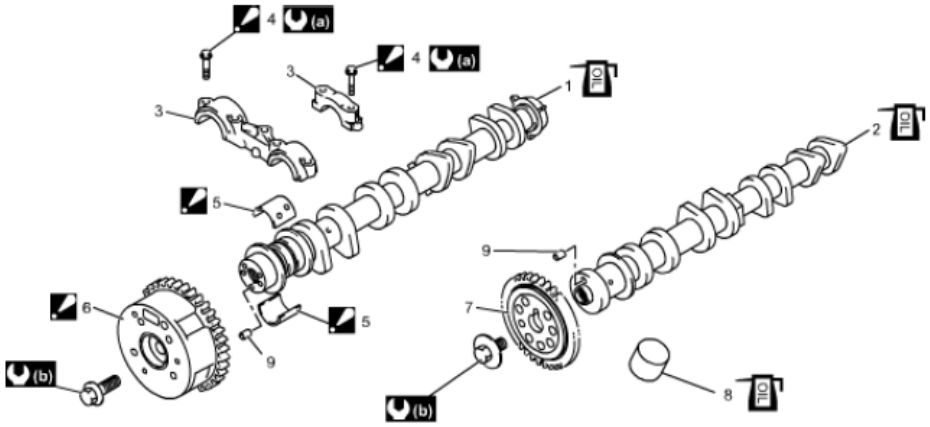
Fig. 33: Identifying IMT Valve Connector And Clamp
Courtesy of SUZUKI OF AMERICA CORP.

10. Install ignition coil assemblies, see **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .

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11. Install engine cover.
12. Connect negative (-) cable at battery.

CAMSHAFT AND TAPPET COMPONENTS



1. Intake camshaft : Apply engine oil to sliding surface.	5. Camshaft bearing : For applying engine oil, refer to *Camshaft and Tappet Removal and Installation*. : To distinguish upper and lower, refer to *Camshaft and Tappet Removal and Installation*.	9. Dowel pin
2. Exhaust camshaft : Apply engine oil to sliding surface.	6. CMP actuator : Do not disassemble.	(a): 11 N·m (1.1 kgf-m, 8.5 lbf-ft)
3. Camshaft housing	7. Exhaust camshaft timing sprocket	(b): 60 N·m (6.1 kgf-m, 44.5 lbf-ft)
4. Camshaft housing bolt : For tightening order, refer to *Camshaft and Tappet Removal and Installation*.	8. Tappet : Apply engine oil to sliding surface.	

Fig. 34: Identifying Camshaft And Tappet Components
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFT AND TAPPET REMOVAL AND INSTALLATION

Reference: **CAMSHAFT AND TAPPET COMPONENTS**

Removal

1. Remove cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
2. Remove accessory drive belt, see **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
3. Turn crankshaft clockwise, and position piston No. 1 at TDC on the compression stroke using the following procedures:
    a. Align the timing mark (1) on the CMP actuator and the timing mark (2) on the exhaust camshaft

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timing sprocket with the matchmark (3) on the camshaft housing No. 1.

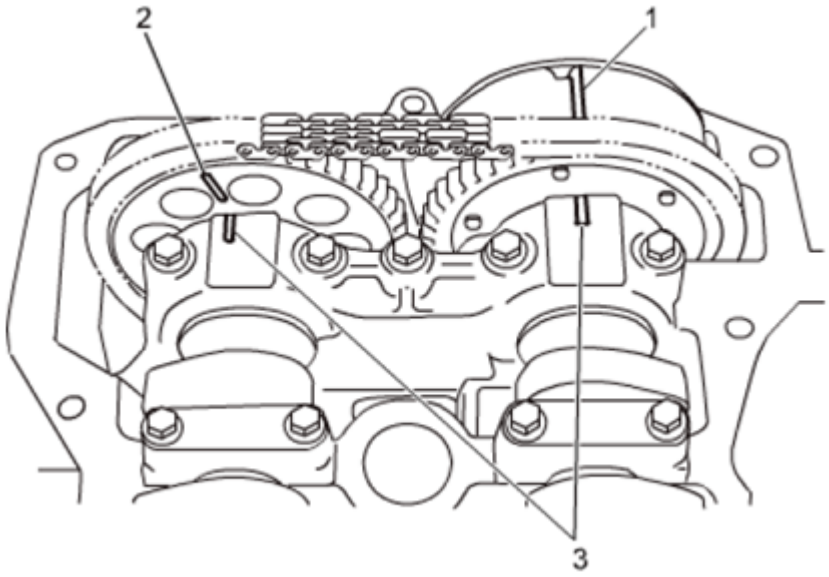


Fig. 35: Aligning Timing Mark On CMP Actuator
Courtesy of SUZUKI OF AMERICA CORP.

b. Align notch mark (1) on the crankshaft pulley with "0" (2) on the timing chain cover.

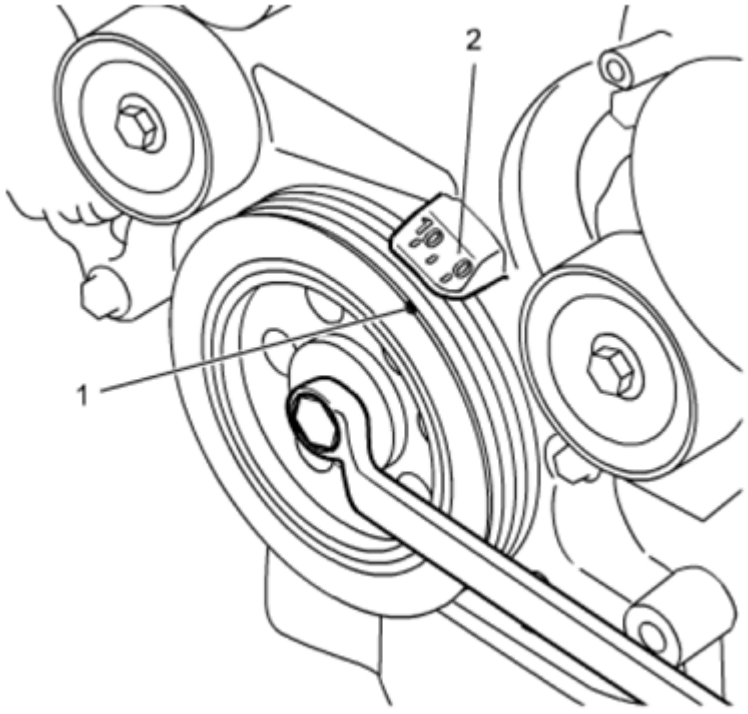


Fig. 36: Aligning Notch Mark On Crankshaft Pulley With Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

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4. Fix timing chain tensioner using the following procedures:
   a. Remove timing chain cover plug (1) and gasket (2).

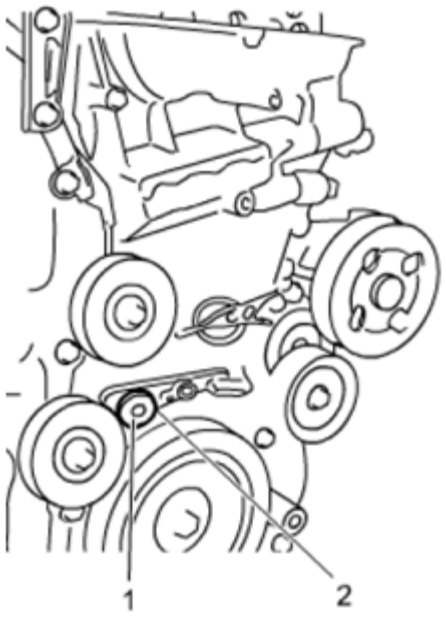


Fig. 37: Identifying Timing Chain Cover Plug And Gasket
Courtesy of SUZUKI OF AMERICA CORP.

   b. Insert fore-end of special tool into timing chain tensioner hole (1) from timing chain cover plug hole.

NOTE: **Make sure that special tool is inserted in timing chain tensioner hole, with mirrors or the like.**

Special Tool

A. **09917-16710**

   c. Fix special tool by special tool fixing bolt (2) to specified torque.

CAUTION:
- **Failure to observe the following cautions result in engine damage or incorrect installing of timing chain.**
- **Use the following bolt for special tool fixing bolt.**

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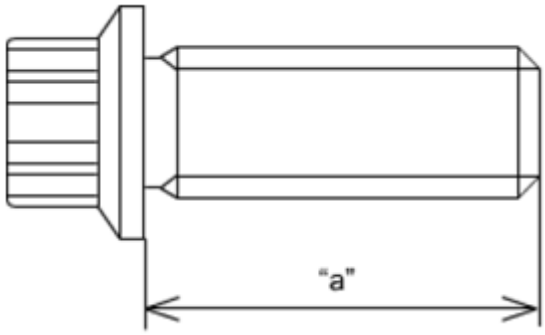


Fig. 38: Identifying Bolts Length
Courtesy of SUZUKI OF AMERICA CORP.

Special tool fixing bolt

BOLT LENGTH SPECIFICATION

Bolt size	M6
Pitch	1.0 mm (0.039 in.)
Length "a"	15.0 mm (0.590 in.)

- **Be sure to tighten specified tool fixing bolt (2) to specified torque. If bolt becomes loose, plunger of timing chain tensioner adjuster may extend, making it difficult to properly reinstall timing chain.**
- **Do not turn crankshaft after timing chain is fixed with special tool.**

Tightening torque

Special tool fixing bolt (a): 8 N.m (0.82 kg-m, 6.0 lbf-ft)

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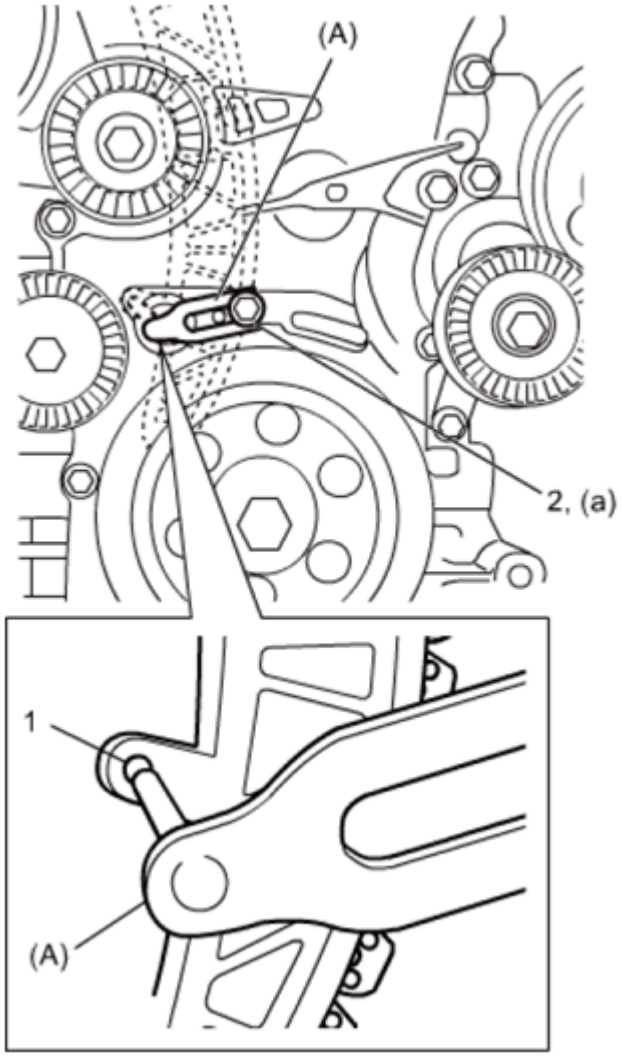


Fig. 39: Identifying Special Tool Fixing Bolt
Courtesy of SUZUKI OF AMERICA CORP.

5. Apply a dab of paint to two timing chain links (2) which meet timing marks (1) on CMP actuator and exhaust camshaft timing sprocket.

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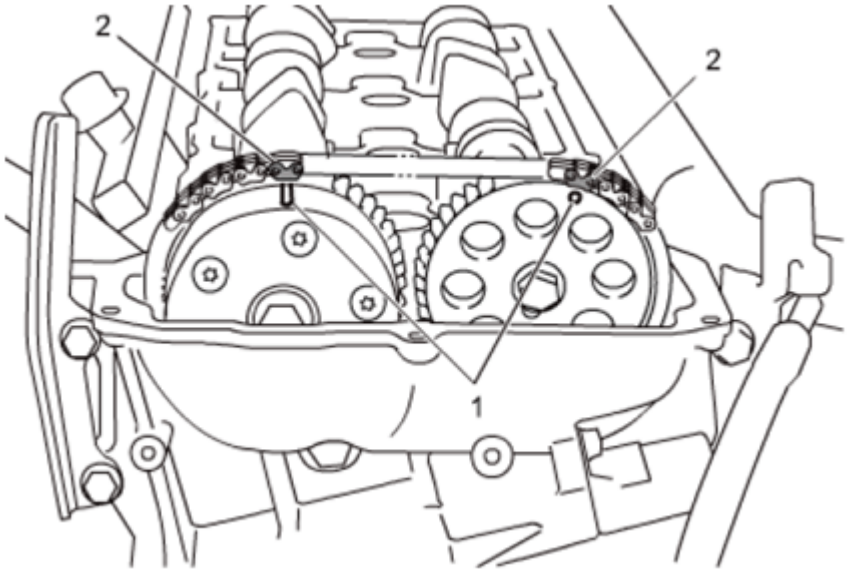


Fig. 40: Identifying Timing Marks On Exhaust Camshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove exhaust camshaft timing sprocket using the following procedures:
   a. Hold the hexagonal section of exhaust camshaft using a wrench.
   b. Remove exhaust camshaft timing sprocket bolt, then remove sprocket (1).

NOTE: Be careful not to drop dowel pin into the space between timing chain cover and cylinder block.

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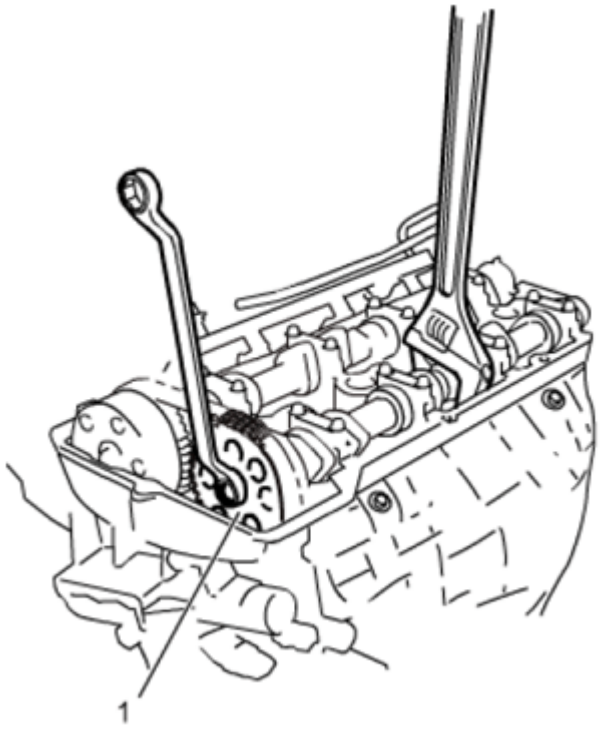


Fig. 41: Removing Exhaust Camshaft Timing Sprocket Bolt
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove dowel pin from exhaust camshaft.
8. Loosen camshaft housing bolts in numerical order ("1" - "21") evenly and gradually.

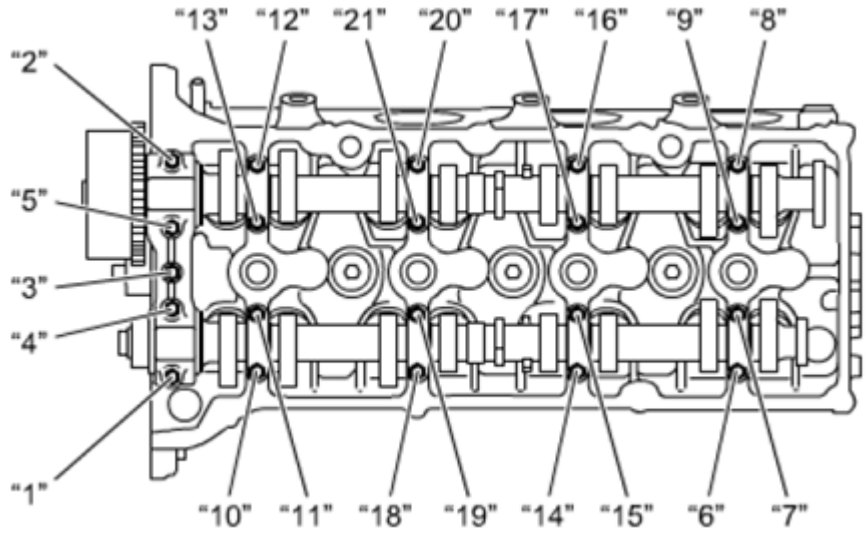


Fig. 42: Identifying Camshaft Housing Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove intake camshaft and exhaust camshaft.

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10. Remove camshaft bearings and tappets if necessary.
11. Remove CMP actuator from intake camshaft using the following procedures if necessary.
    a. Hold hexagonal section of intake camshaft using vice.
    b. Remove CMP actuator bolt, and then remove CMP actuator (1).

CAUTION: Do not disassemble CMP actuator.

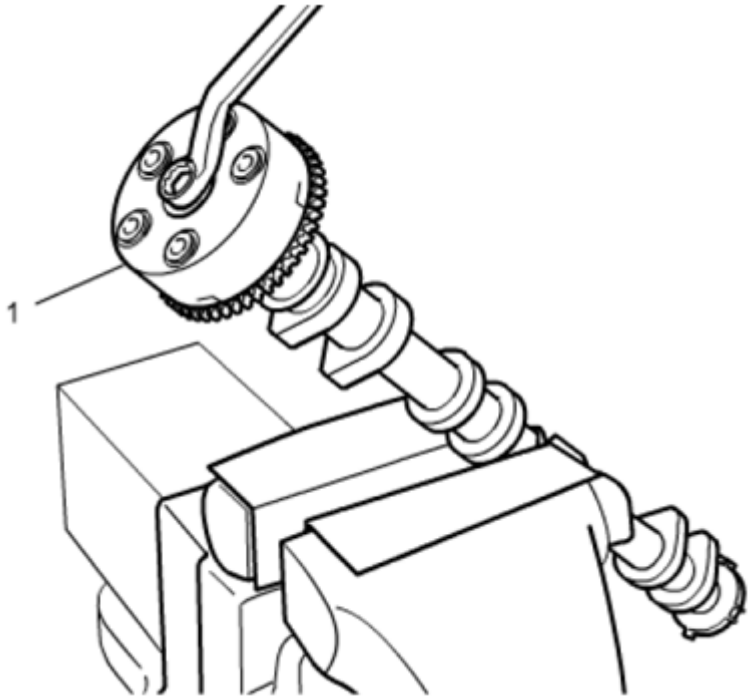


Fig. 43: Holding Hexagonal Section Of Intake Camshaft Using Vice
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **CAMSHAFT AND TAPPET INSPECTION**

1. Install CMP actuator (1) to intake camshaft.

   Tightening torque

   CMP actuator bolt (a): 60 N.m (6.1 kg-m, 44.5 lbf-ft)

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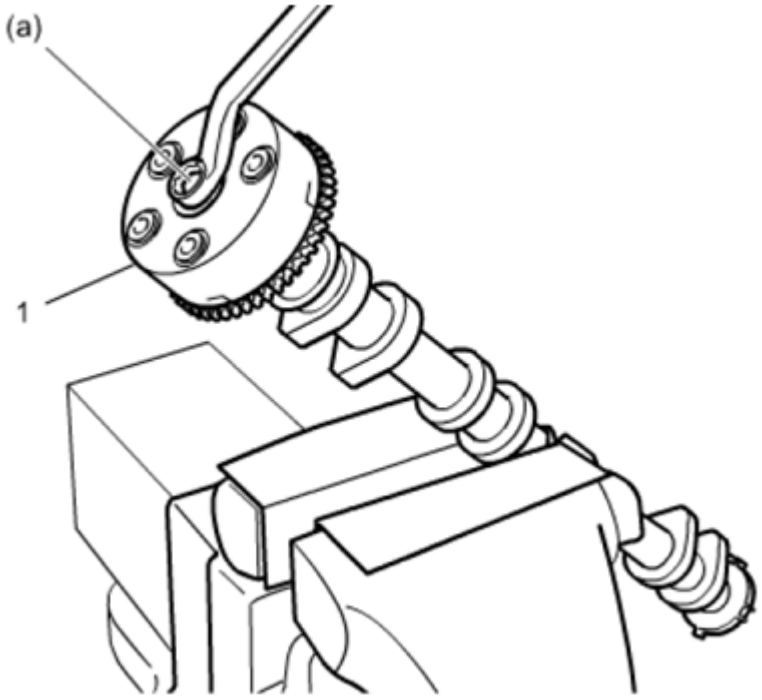


Fig. 44: Installing CMP Actuator To Intake Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

2. Apply engine oil to contact surface of tappets (hatched area), and then Install tappets (1) to cylinder head.

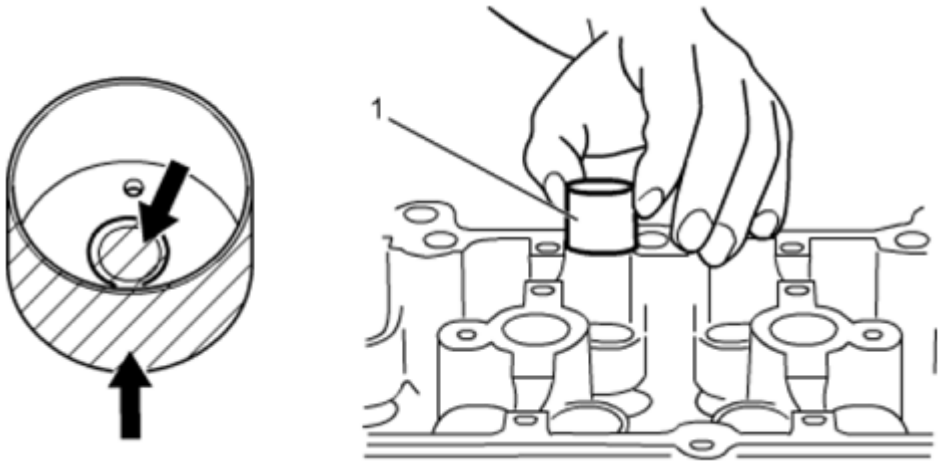


Fig. 45: Installing Tappets To Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

3. Install camshaft bearings using the following procedures:

CAUTION: When installing, distinguish between upper bearing (1) and lower bearing (2) referring to the following figure.

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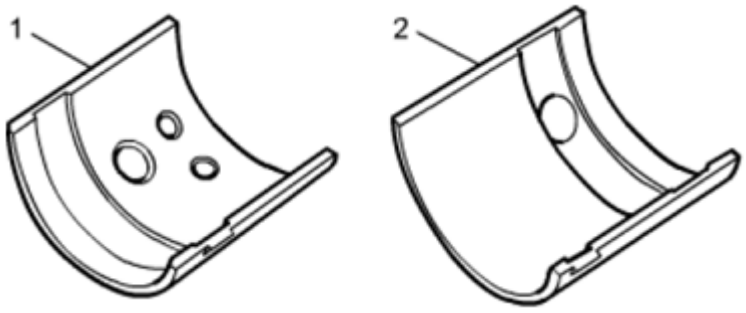


Fig. 46: Identifying Camshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

a. Fit tab (1) of camshaft bearing to groove (2) of cylinder head or camshaft housing.
b. Press camshaft bearing end (3) until it is firmly seated on the cylinder head or camshaft housing.
c. Apply engine oil to sliding surface (4) of camshaft bearing halves.

CAUTION: Do not apply engine oil between bearing halves (5) and camshaft housing or cylinder head (5).

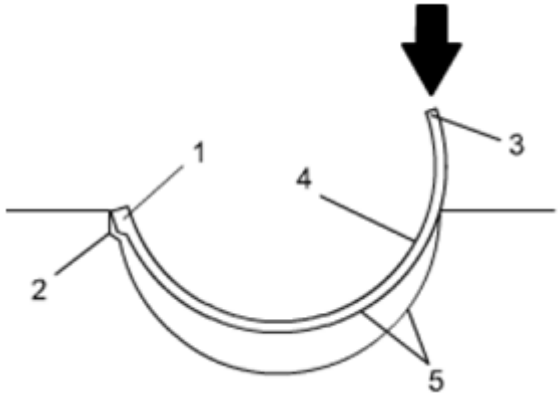


Fig. 47: Identifying Camshaft Bearing Installation Position
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply engine oil to sliding surfaces of camshafts, and then install camshafts to cylinder head using the following procedures:
   a. Align the timing chain link (2), which is painted in Step 5) of "Removal" under this section, with timing mark (1) on CMP actuator and install intake camshaft.
   b. Install the exhaust camshaft so that the dowel pin hole (3) is positioned downwards.

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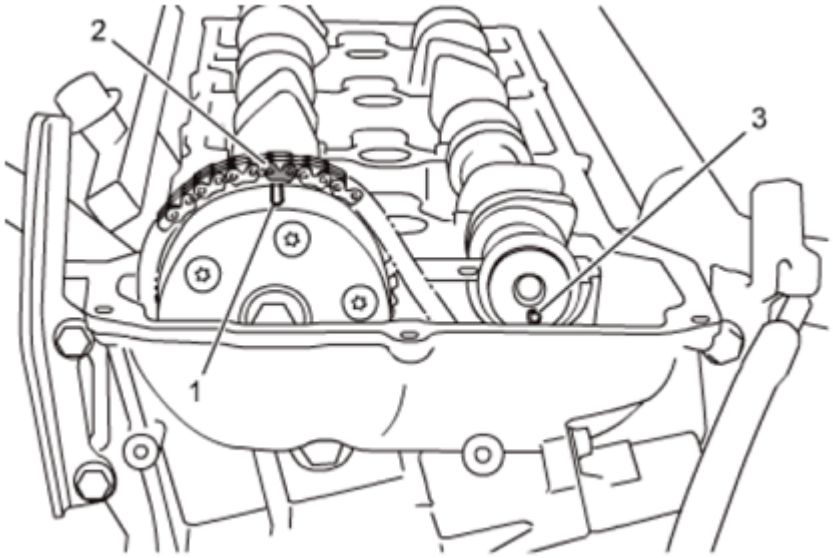
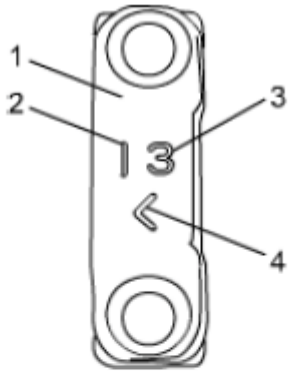


Fig. 48: Identifying Timing Chain Link And Dowel Pin Hole
Courtesy of SUZUKI OF AMERICA CORP.

5. Install camshaft housings (1) to proper places distinguished by letter (2), number (3) and arrow direction (4) on each camshaft housing.



2.	I: For intake camshaft E: For exhaust camshaft
3.	Position from timing chain side
4.	Point arrowhead to timing chain side

Fig. 49: Identifying Number Mark On Camshaft Housings
Courtesy of SUZUKI OF AMERICA CORP.

6. Tighten camshaft housing bolts using the following procedures:

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a. Install camshaft housing No. 1 (1).

   Install camshaft housing bolts, and tighten them by hand.

b. Tighten camshaft housing bolts in numerical order ("1" - "21") evenly and gradually.

   Tightening torque

   Camshaft housing bolt*: 11 N.m (1.1 kg-m, 8.5 lbf-ft)

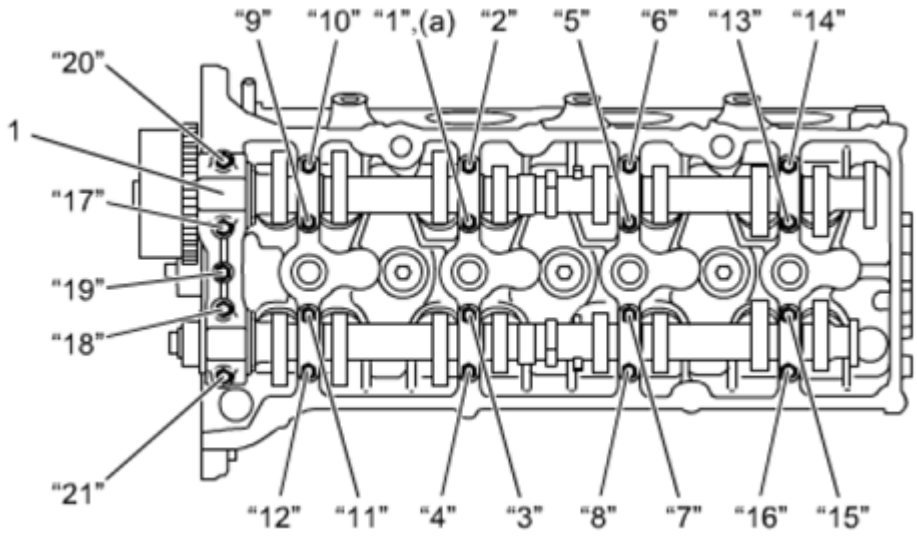


Fig. 50: Identifying Camshaft Housing Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

7. Install dowel pin to exhaust camshaft.

   CAUTION: Be careful not to drop dowel pin into the space between timing chain cover and cylinder block.

8. Install exhaust camshaft timing sprocket (3) to exhaust camshaft using the following procedures.
   a. Align the timing chain link (1), which is painted in Step 5) of "Removal", with timing mark (2) on exhaust camshaft timing sprocket (3), and loop timing chain up over exhaust camshaft timing sprocket.
   b. Install exhaust camshaft timing sprocket (3) with timing chain to the exhaust camshaft.

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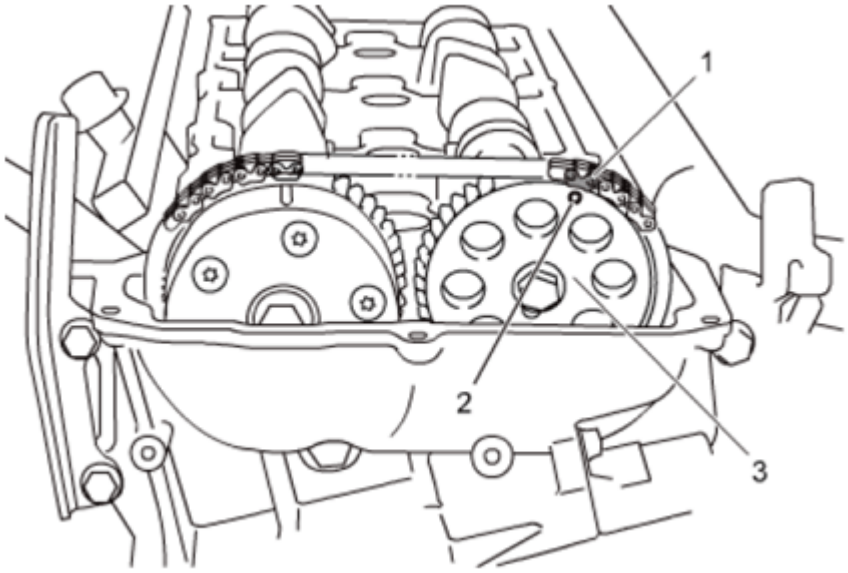


Fig. 51: Aligning Timing Mark On Exhaust Camshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

9. Tighten exhaust camshaft timing sprocket bolt (1) using special tool.

Special Tool

A. **09911-05120**

Tightening torque

Exhaust camshaft timing sprocket bolt (a): 60 N.m (6.1 kg-m, 44.5 lbf-ft)

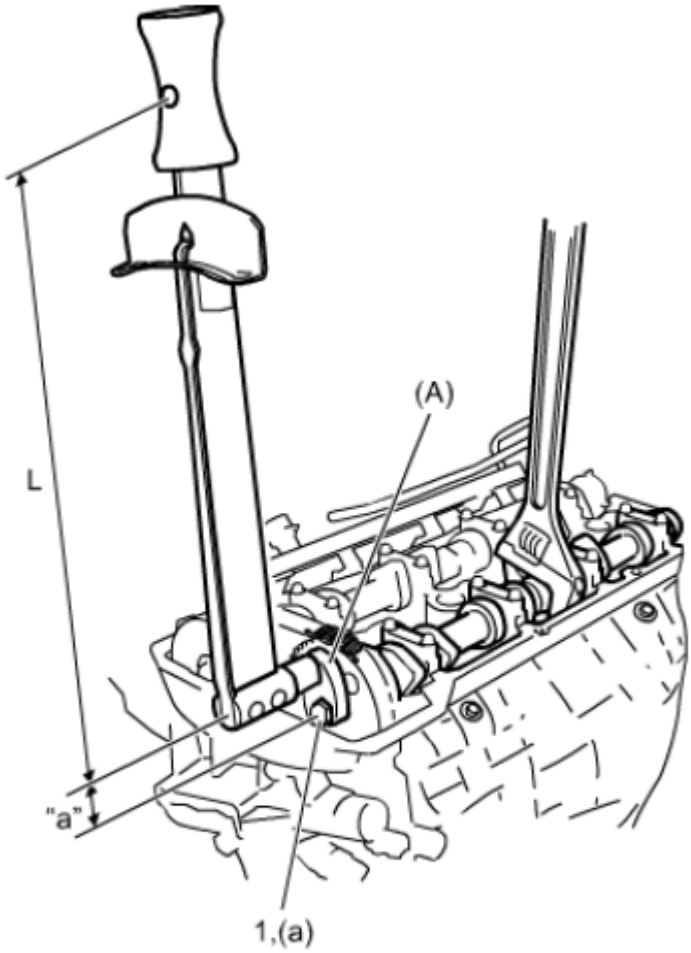
CAUTION: When using an extension special tool with a torque wrench, the reading value of the torque wrench is smaller than specified torque. When using extension special tool, reading value should be calculated using the formula below:

Formula for reading value of torque wrench .

M = T X L/(L + "a")

- **M: Reading value using extension special tool**
- **T: Specified torque**
- **L: Torque wrench length**
- **"a": Dimension of special tool**

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"a":	20 mm (0.78 in.)

Fig. 52: Identifying Torque Wrench Length
Courtesy of SUZUKI OF AMERICA CORP.

10. Confirm that painted timing chain links (2) are aligned with timing marks (1) on CMP actuator and exhaust camshaft timing sprocket.

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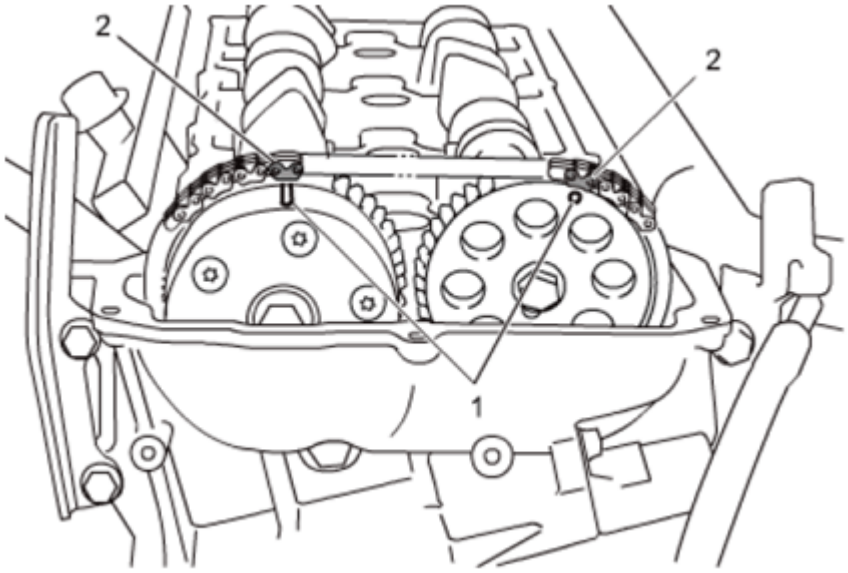


Fig. 53: Aligning Timing Marks On CMP Actuator And Exhaust Camshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove special tool from timing chain cover.
12. Install timing chain cover plug (1) with new gasket (2), and tighten it to specified torque.

Tightening torque

Timing chain cover plug (a): 27 N.m (2.8 kg-m, 20.0 lbf-ft)

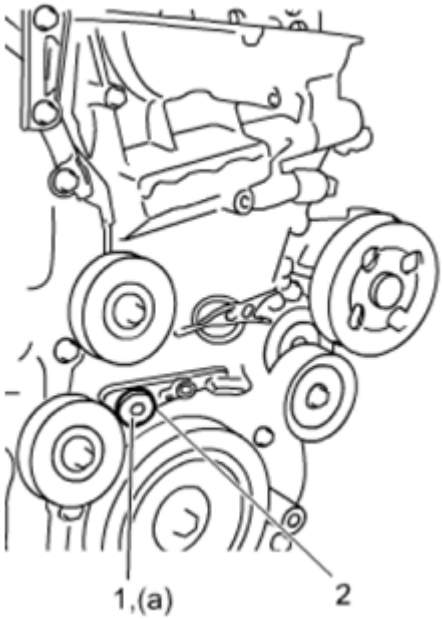


Fig. 54: Identifying Timing Chain Cover Plug With Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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13. Check that camshaft and timing chain are properly installed as follows:
    a. a) Check that timing mark (1) on CMP actuator and timing mark (2) on exhaust camshaft timing sprocket are aligned with matchmark (3) on camshaft housing No. 1.

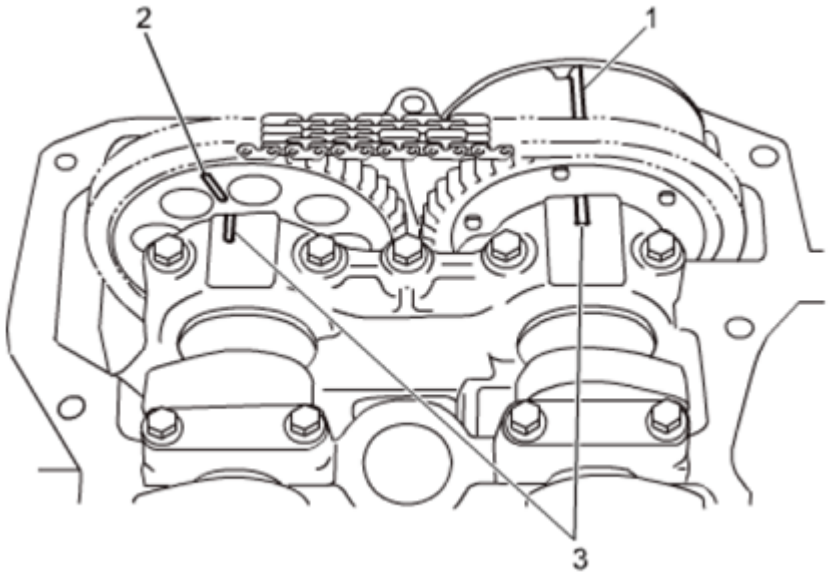
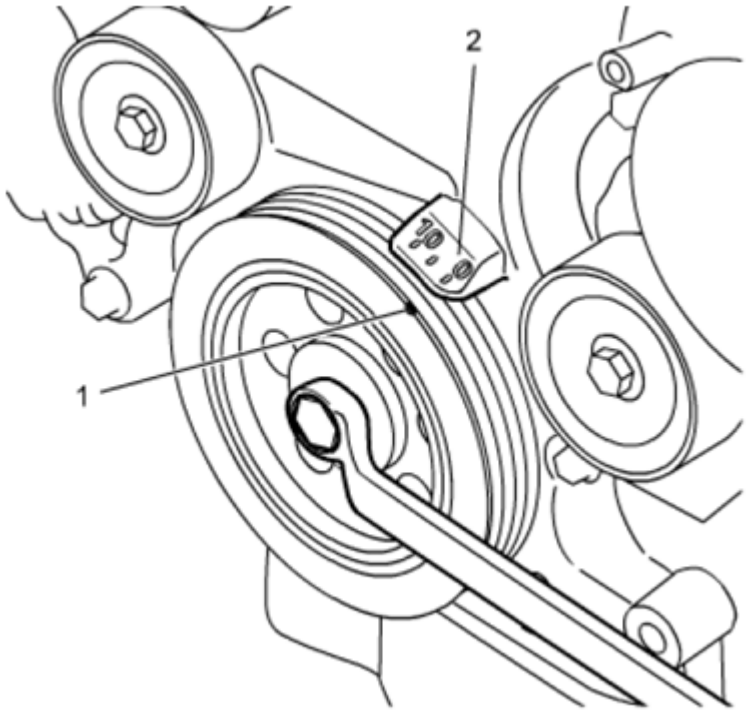


Fig. 55: Identifying Timing Mark On CMP Actuator
Courtesy of SUZUKI OF AMERICA CORP.

    b. b) Check that notch mark (1) on crankshaft pulley is aligned with "0" (2) on timing chain cover.



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Fig. 56: Aligning Timing Mark
Courtesy of SUZUKI OF AMERICA CORP.

c. Turn crankshaft clockwise 720° twice and repeat Step a) and b).

NOTE:

- **Be sure to turn crankshaft 720°. If it is turned only 360°, the timing marks on CMP actuator and exhaust camshaft timing sprockets will not meet matchmark on camshaft housing No. 1.**
- **After turning crankshaft 720°, the painted links of the timing chain will not be aligned with the timing marks on the CMP actuator and the exhaust timing sprocket, but this is normal.**

14. Check valve clearance, see **Valve Clearance Inspection and Adjustment**.
15. Install cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.

CAMSHAFT AND TAPPET INSPECTION

Reference: **CAMSHAFT AND TAPPET REMOVAL AND INSTALLATION**

Cam Height

Use a micrometer to measure cam height "a". Replace camshaft if measured height is out of standard values.

Cam Height (IN)

Standard: 47.620 - 47.780 mm (1.8748 - 1.8811 in.)

Limit: 47.490 mm (1.8696 in.)

Cam Height (EX)

Standard: 46.543 - 46.703 mm (1.8324 - 1.8387 in.)

Limit: 46.420 mm (1.8275 in.)

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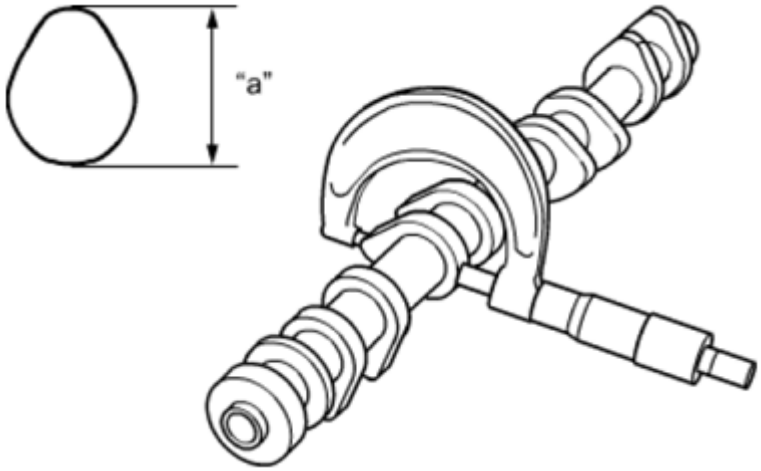


Fig. 57: Checking Cam Height
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Runout

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

Replace camshaft if measured camshaft runout exceeds limit.

CAUTION: Do not attempt to fix camshaft runout for the purpose of reuse.

Camshaft runout limit

0.015 mm (0.00059 in.)

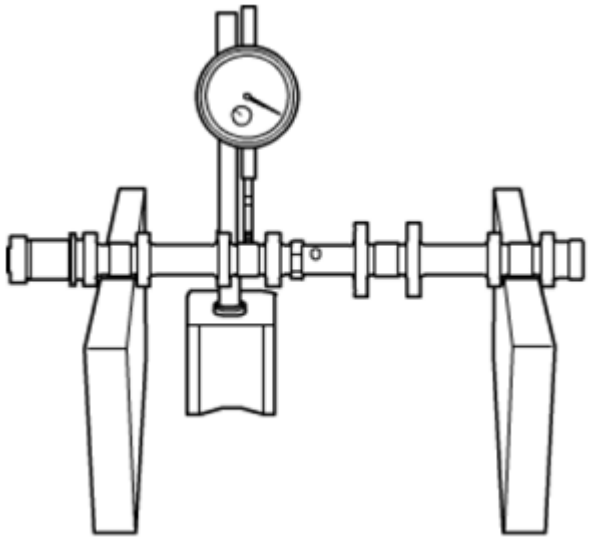


Fig. 58: Checking Camshaft Runout

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Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Journal

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

  Replace camshaft or cylinder head with camshaft housings if any defective conditions are found.

CAUTION: Do not attempt to fix faults in camshaft journal and camshaft housing for the purpose of reuse.

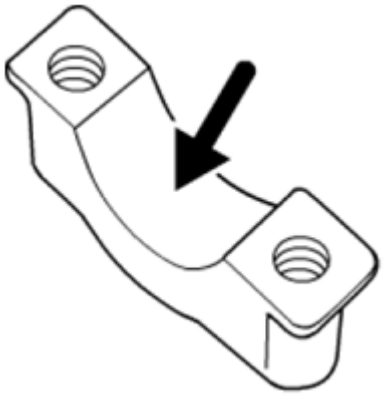


Fig. 59: Identifying Camshaft Journals Damage Area
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Journal Clearance

1. Clean camshaft housings and camshaft journals.
2. Remove all tappets.
3. Install lower bearing half and camshafts to cylinder head.
4. Place plastic gauge with the same width as the camshaft journal parallel to the camshaft, avoiding the oil hole.
5. Install camshaft housing referring to steps 5) to 6) in "Installation" under ***Camshaft and Tappet Removal and Installation*** .

CAUTION: Do not rotate camshaft while gauging plastic is installed.

6. Remove housings, and use scale (2) on plastic gauge envelope to measure plastic gauge (1) width at the widest point.

   Camshaft journal clearance (intake side of camshaft housing No. 1)

   Standard: 0.020 - 0.072 mm (0.00078 - 0.00283 in.)

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Limit: 0.10 mm (0.0039 in.)

Camshaft journal clearance (except intake side of camshaft housing No. 1)

Standard: 0.020 - 0.062 mm (0.00078 - 0.00244 in.)

Limit: 0.095 mm (0.00374 in.)

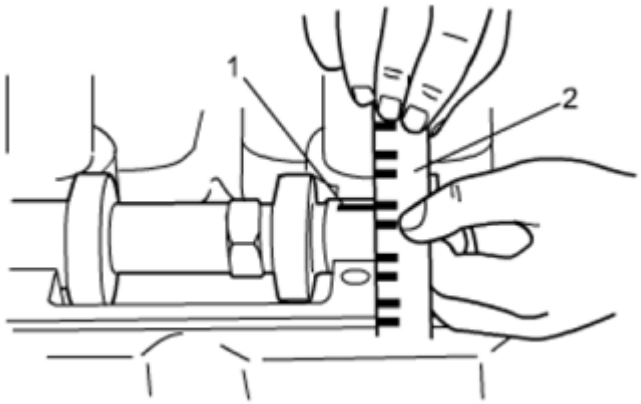


Fig. 60: Measuring Plastic Gauge Width Widest Point
Courtesy of SUZUKI OF AMERICA CORP.

If measured camshaft journal clearance exceeds limit, recheck camshaft journal clearance using the following procedures:

a. Install camshaft upper bearing half and camshaft housings without camshafts to cylinder head.
b. Tighten camshaft housing bolts referring to Step 6) in "Installation" under ***Camshaft and Tappet Removal and Installation*** .
c. For intake camshaft journal No. 1, measure journal outside diameter at positions shown in figure. Replace camshaft and recheck camshaft journal clearance if measured diameter is out of standard values.

   Replace camshaft bearings and recheck camshaft journal clearance if measured diameter is within standard values.

d. For all other camshaft journals, measure camshaft journal outside diameters and camshaft housing inside diameters.

   Replace corresponding camshaft or cylinder head and camshaft housings if measured diameters are out of standard values.

   Camshaft journal outside diameter

CAMSHAFT JOURNAL OUTSIDE DIAMETER SPECIFICATION

Item	Standard

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Intake camshaft journal No. 1 "a"	28.959 - 28.980 mm (1.1402 - 1.1409 in.)
Exhaust camshaft journal No. 1	26.959 - 26.980 mm (1.0614 - 1.0622 in.)
Others	25.959 - 25.980 mm (1.0220 - 1.0228 in.)

Camshaft housing inside diameter

CAMSHAFT HOUSING INSIDE DIAMETER SPECIFICATION

Item	
Camshaft housing No. 1 (intake)	32.000 - 32.025 mm (1.2599 - 1.2608 in.)
Camshaft housing No. 1 (exhaust)	27.000 - 27.021 mm (1.0630 - 1.0638 in.)
Others	26.000 - 26.021 mm (1.0237 - 1.0244 in.)

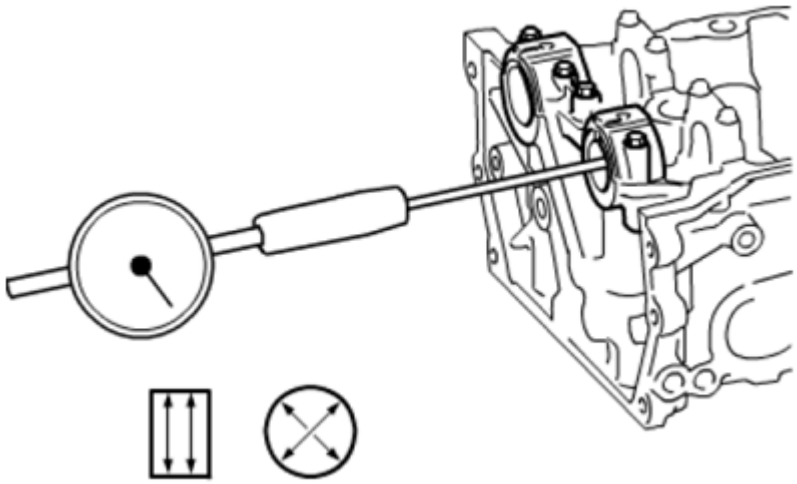


Fig. 61: Checking Camshaft Housing Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

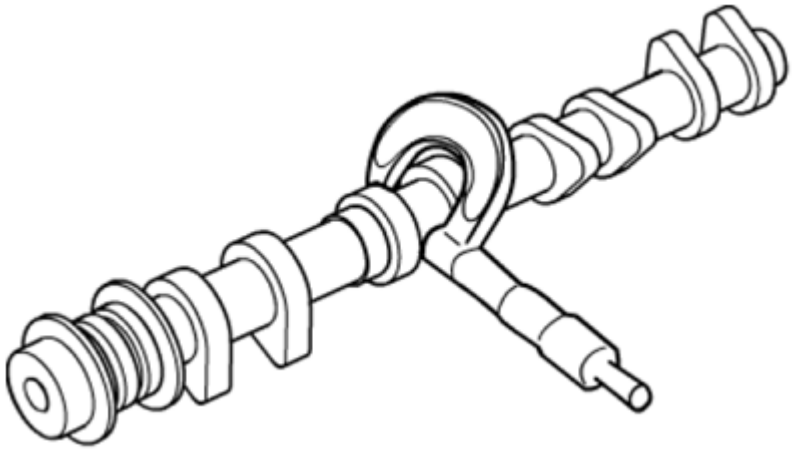


Fig. 62: Checking Camshaft Journal Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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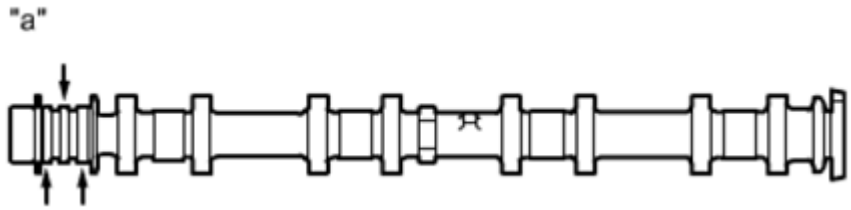


Fig. 63: [Identifying Camshaft]
Courtesy of SUZUKI OF AMERICA CORP.

7. Install intake and exhaust camshaft without tappet, and then measure intake and exhaust camshaft housing thrust clearance using a dial gauge.

   Replace camshaft or cylinder head and camshaft housings if measured clearance exceeds limit.

   Camshaft housing thrust clearance

   Standard: 0.10 - 0.35 mm (0.0039 - 0.0137 in.)

   Limit: 0.50 mm (0.019 in.)

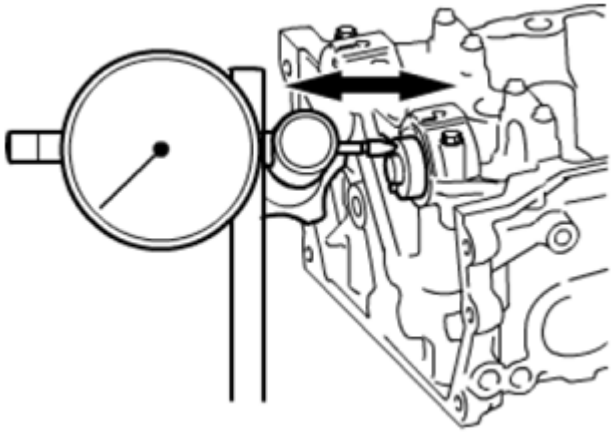


Fig. 64: Measuring Intake And Exhaust Camshaft Housing Thrust Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Wear of Tappet

Check tappet for pitting, scratches, or damage.

Replace tappet if any defective conditions are found.

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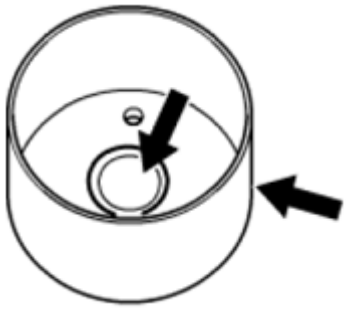


Fig. 65: Identifying Wear Of Tappet
Courtesy of SUZUKI OF AMERICA CORP.

Measure tappet bore of cylinder head inside diameter, and tappet outside diameter, and then determine cylinder head-to-tappet clearance. Replace tappet or cylinder head if clearance exceeds limit.

Cylinder head to tappet clearance

Standard: 0.025 - 0.066 mm (0.0010 - 0.0025 in.)

Limit: 0.10 mm (0.0039 in.)

Tappet outside diameter

Standard: 32.459 - 32.475 mm (1.2780 - 1.2785 in.)

Cylinder head tappet bore

Standard: 32.500 - 32.525 mm (1.2796 - 1.2805 in.)

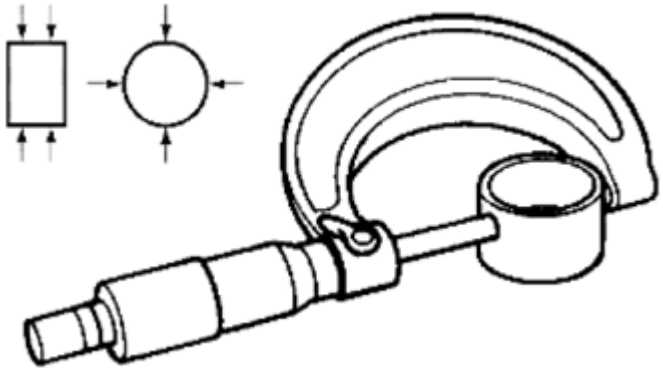


Fig. 66: Measuring Tappet Bore Of Tappet Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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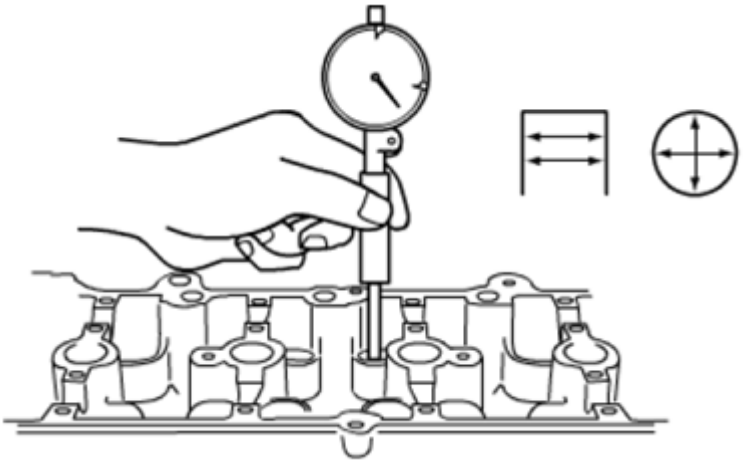


Fig. 67: Measuring Tappet Bore Of Cylinder Head Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

CMP actuator

- Check CMP actuator for wear or damage.

  Replace CMP actuator if any defective conditions are found.

- Install CMP actuator to intake camshaft and hold hexagonal section of intake camshaft stationary using wrench.

  Check that CMP actuator (1) cannot be turned by hand.

  Replace CMP actuator if it can be turned by hand.

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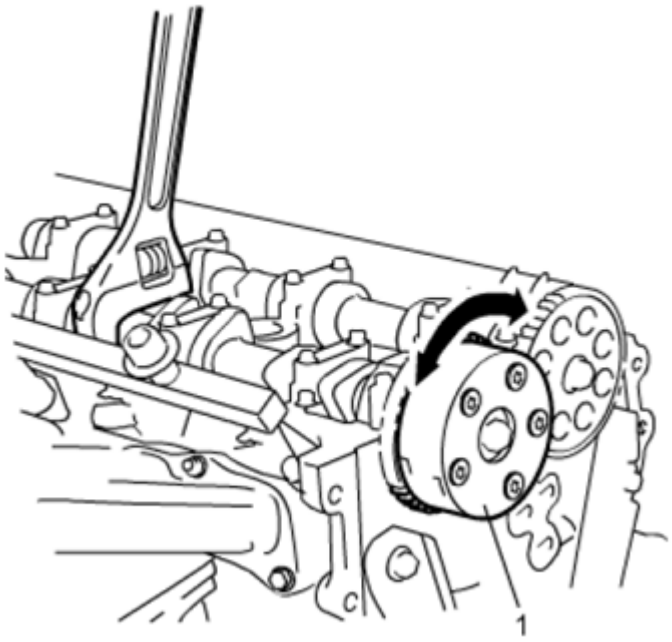


Fig. 68: Checking CMP Actuator
Courtesy of SUZUKI OF AMERICA CORP.

Exhaust Camshaft Timing Sprocket

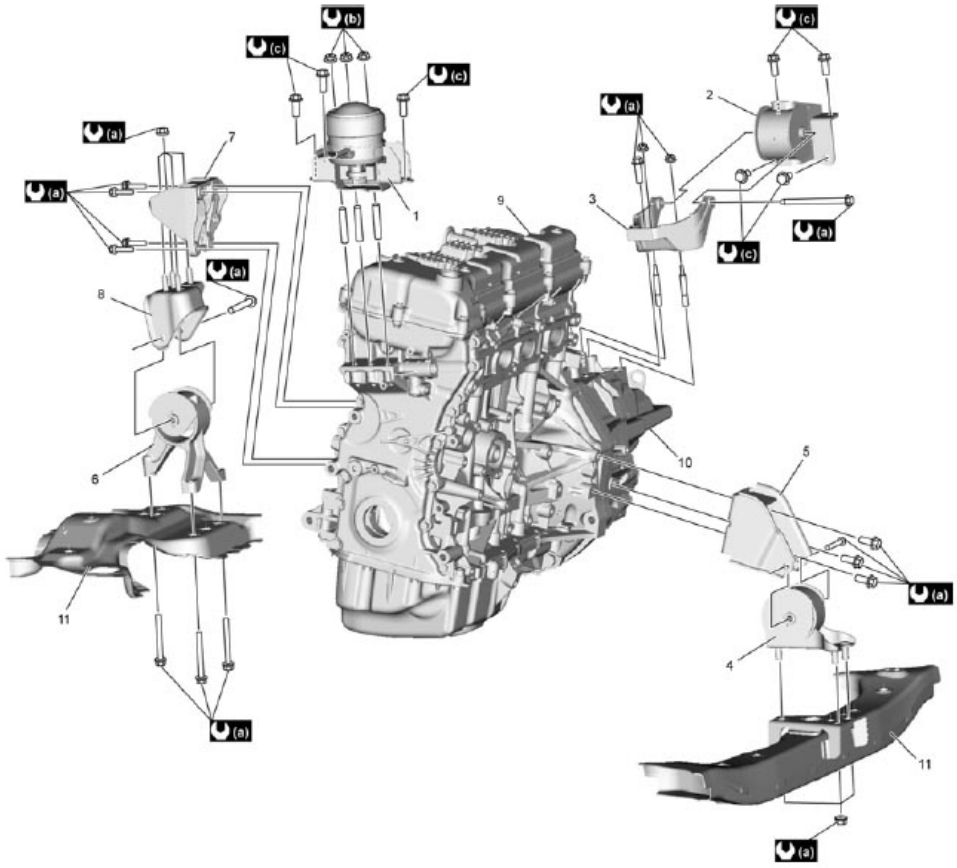
Check exhaust camshaft timing sprocket for wear and damage.

Replace exhaust camshaft timing sprocket if any defective conditions are found.

ENGINE MOUNTINGS COMPONENTS

M/T Model

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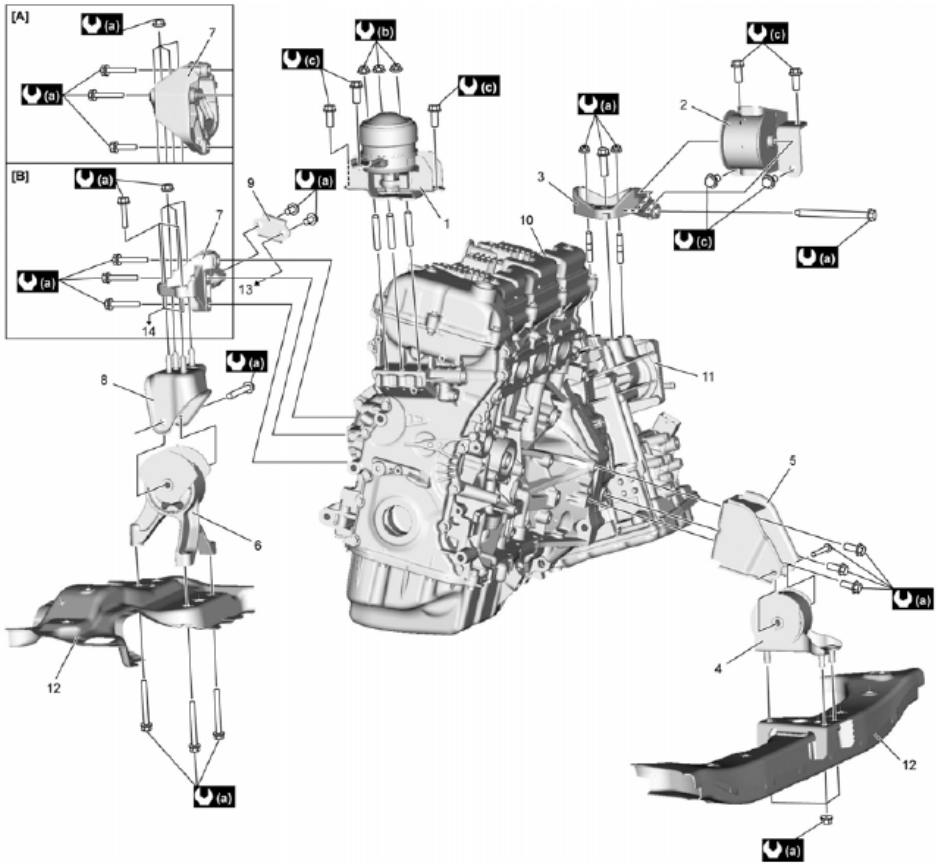


1.	Engine right mounting	6.	Engine rear mounting	11.	Suspension frame
2.	Engine left mounting	7.	Engine rear mounting bracket No.1	(a):	55 N·m (5.6 kgf-m, 40.5 lbf-ft)
3.	Engine left mounting bracket	8.	Engine rear mounting bracket No.2	(b):	65 N·m (6.6 kgf-m, 48.0 lbf-ft)
4.	Engine front mounting	9.	Engine assembly	(c):	93 N·m (9.5 kgf-m, 68.5 lbf-ft)
5.	Engine front mounting bracket	10.	Transaxle		

Fig. 69: Identifying Engine Mountings Components (M/T Model)
Courtesy of SUZUKI OF AMERICA CORP.

CVT Model

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[A]: 2WD model	6. Engine rear mounting	13. To CVT assembly
[B]: 4WD model	7. Engine rear mounting bracket No.1	14. To transfer
1. Engine right mounting	8. Engine rear mounting bracket No.2	(a): 55 N·m (5.6 kgf-m, 40.5 lbf-ft)
2. Engine left mounting	9. Engine rear mounting bracket stiffener	(b): 65 N·m (6.6 kgf-m, 48.0 lbf-ft)
3. Engine left mounting bracket	10. Engine assembly	(c): 93 N·m (9.5 kgf-m, 68.5 lbf-ft)
4. Engine front mounting	11. CVT assembly	
5. Engine front mounting bracket	12. Suspension frame	

Fig. 70: Identifying Engine Mountings Components (CVT Model)
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE ASSEMBLY REMOVAL AND INSTALLATION

Removal

1. Relieve fuel pressure, see **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative (-) and positive (+) cables at battery.

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3. Disconnect ECM connectors.
4. Remove ECM, battery, battery tray and battery bracket, see **BATTERY REMOVAL AND INSTALLATION** .
5. Remove right and left side engine under covers.
6. Remove right and left side front fender lower linings.
7. Remove front bumper and front bumper lower cover, see **FRONT BUMPER REMOVAL AND INSTALLATION** .
8. Remove engine cover.
9. Drain coolant, see **COOLING SYSTEM DRAINING** .
10. Drain the following oils and fluid if necessary.
    - Engine oil: **CVT FLUID CHANGE**
    - Manual transaxle oil (M/T model): **MANUAL TRANSAXLE OIL CHANGE**
    - CVT fluid (CVT model): **CVT FLUID CHANGE**
    - Transfer oil (4WD model): **TRANSFER OIL CHANGE**
11. Disconnect the following electric wires, connectors and clamp:
    - Connector (1) in main fuse box
    - Connector (2) in fuse box No. 1
    - Connector (3) in fuse box No. 2
    - Engine harness connector to main harness connector (4) (CVT model)
    - Battery ground cable (5)
    - Engine harness clamp (6)
    - Front height sensor connector (7)

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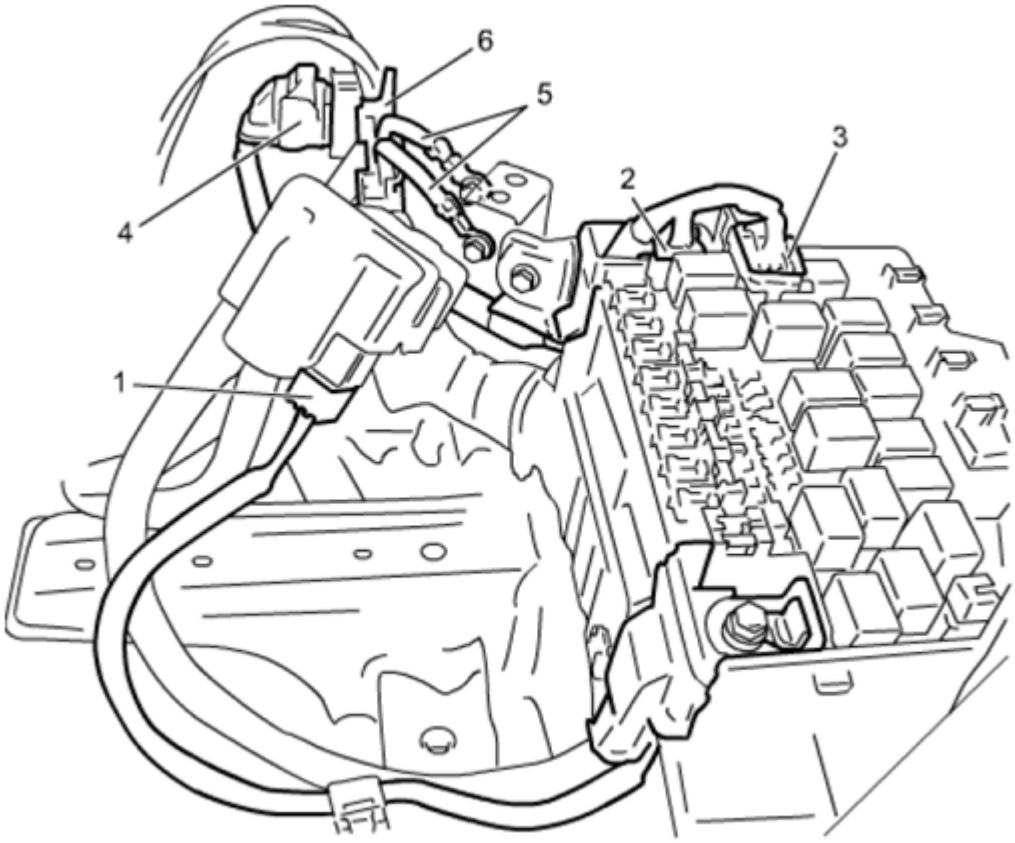


Fig. 71: Identifying Battery Ground Cable And Engine Harness Clamp
Courtesy of SUZUKI OF AMERICA CORP.

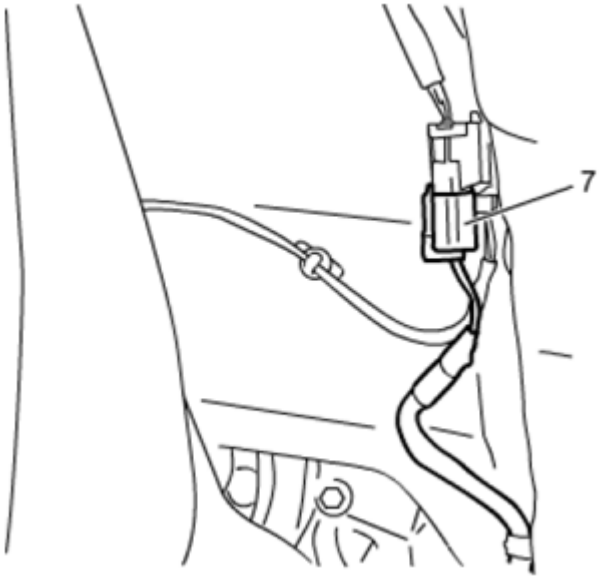


Fig. 72: Identifying Front Height Sensor Connector
Courtesy of SUZUKI OF AMERICA CORP.

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12. Disconnect the following hoses:
    - Brake booster hose (1)
    - Heater inlet and outlet hoses (2)
    - Fuel hose (3)
    - EVAP canister purge hose (4)
    - Radiator inlet hose (5)
    - CVT Fluid Cooler No. 1 Hose (6) (CVT model)
    - CVT Fluid Cooler No. 2 Hose (7) (CVT model)

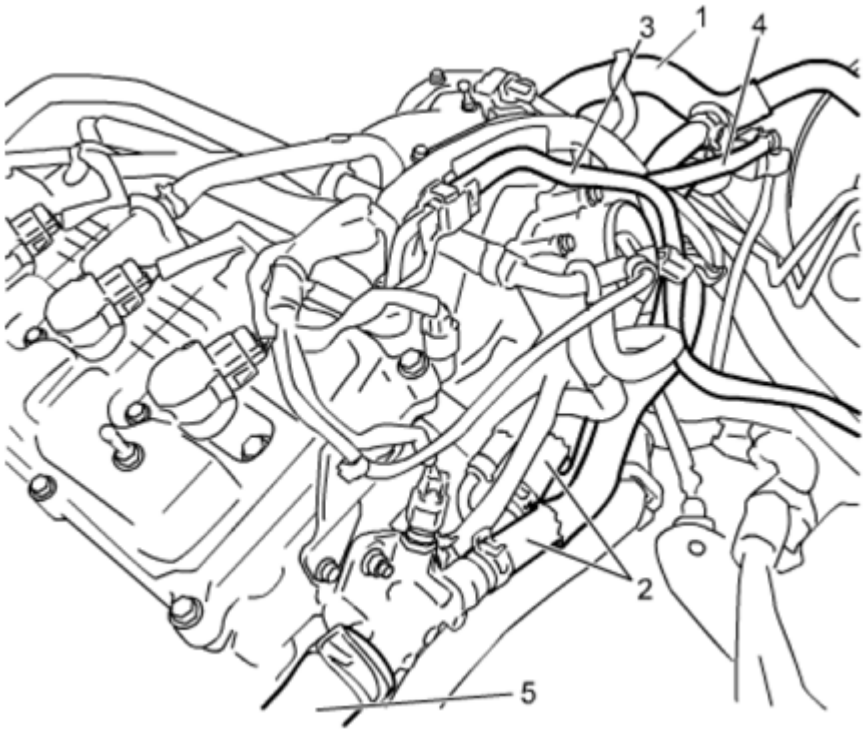


Fig. 73: Identifying Fuel Hose And EVAP Canister Purge Hose
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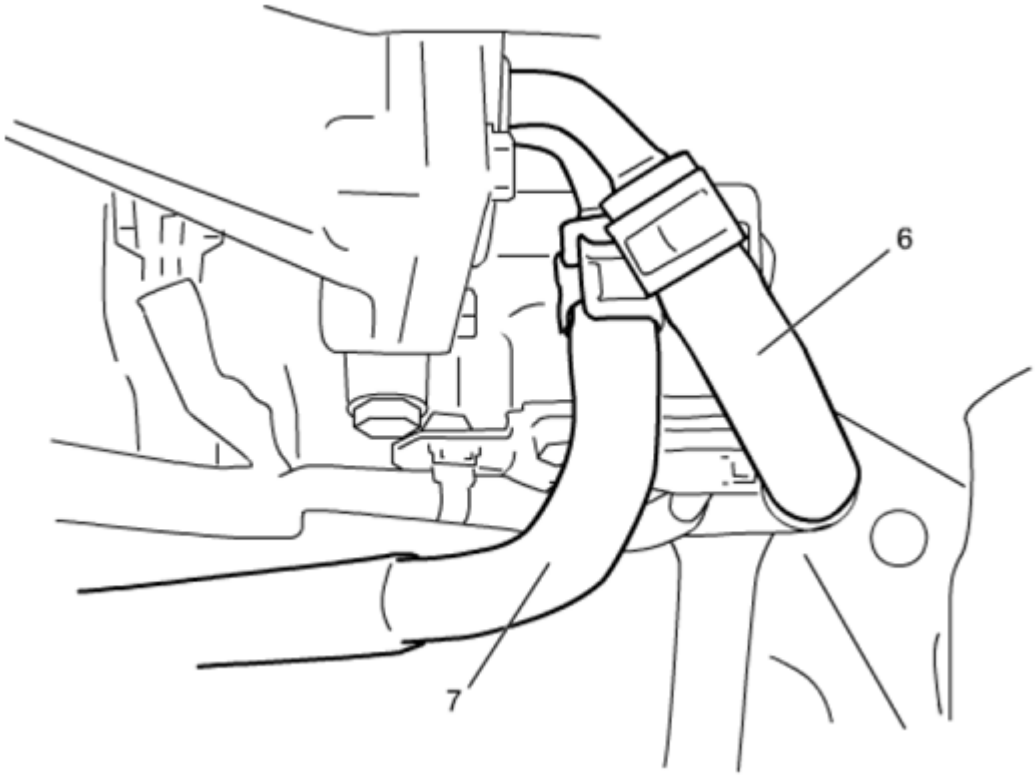


Fig. 74: Identifying CVT Fluid Cooler No. 1 And 2 Hose
Courtesy of SUZUKI OF AMERICA CORP.

13. Remove radiator outlet hose, thermostat cap and thermostat, see **THERMOSTAT REMOVAL AND INSTALLATION** .
14. Remove battery ground terminal bolt (1) after disconnecting the following cables:
    - Gear select control cable (2) (M/T model): **MANUAL TRANSAXLE UNIT COMPONENTS**
    - Gear shift control cable (3) (M/T model): **MANUAL TRANSAXLE UNIT COMPONENTS**
    - Battery ground terminal bolt (M/T model): **MANUAL TRANSAXLE UNIT COMPONENTS**
    - Select cable (4) (CVT model): **SELECT CABLE COMPONENTS**

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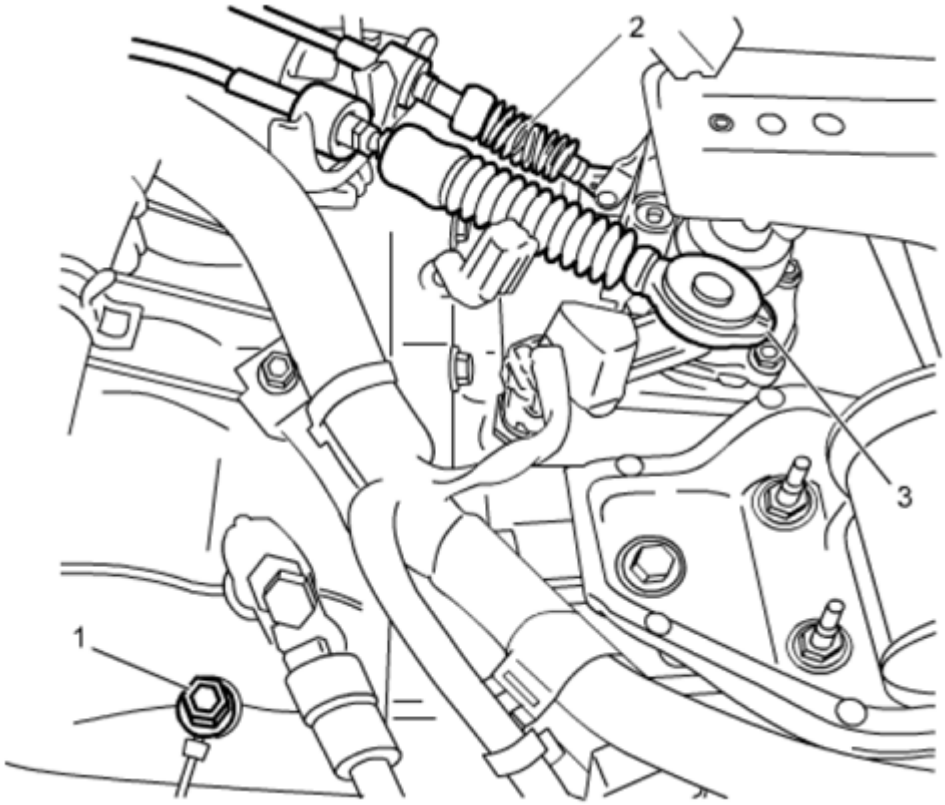


Fig. 75: Identifying Gear Select Control Cable (M/T Model)
Courtesy of SUZUKI OF AMERICA CORP.



Fig. 76: Identifying Select Cable (CVT Model)

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Courtesy of SUZUKI OF AMERICA CORP.

15. Remove accessory drive belt, see **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
16. With A/C hoses connected, remove A/C compressor from bracket, see **A/C COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .

CAUTION: Secure the A/C compressor to the body with a rope or the like so that it does not get damaged during removal and installation of engine assembly.

17. Remove front brake caliper and brake pads, see **FRONT BRAKE PAD REMOVAL AND INSTALLATION** .
18. Remove front wheel speed sensor harness clamp bolt, and then detach front speed sensor harness from strut bracket, see **FRONT WHEEL SPEED SENSOR REMOVAL AND INSTALLATION** .
19. Remove front strut nuts and bolts referring to steps 1) to 5) in "removal" under ***Front Strut Assembly Removal and Installation*** .
20. Remove floor tunnel front brace (1).

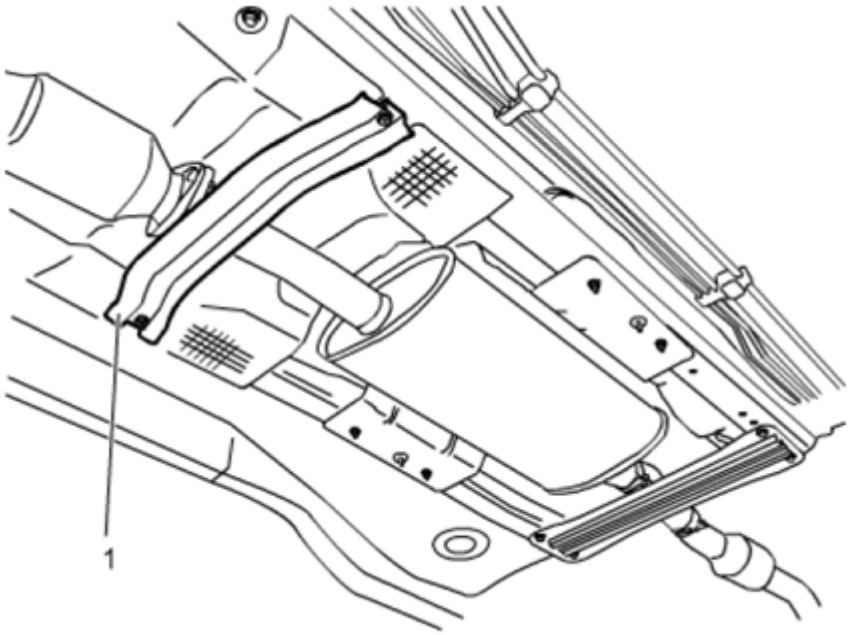


Fig. 77: Identifying Floor Tunnel Front Brace
Courtesy of SUZUKI OF AMERICA CORP.

21. Remove exhaust pipe No. 1 and heat protector panel No. 1, see **EXHAUST SYSTEM COMPONENTS** .
22. For 4WD model, remove propeller shaft assembly, see **PROPELLER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
23. Remove steering lower shaft referring to steps 4) to 7) in "removal" under ***Steering Column Removal and Installation*** .

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24. Remove P/S control module cover after turning over passenger side carpet, disconnect P/S control module connector (1) and remove ground bolt (2). Then, pull the harness (3) out to engine compartment.

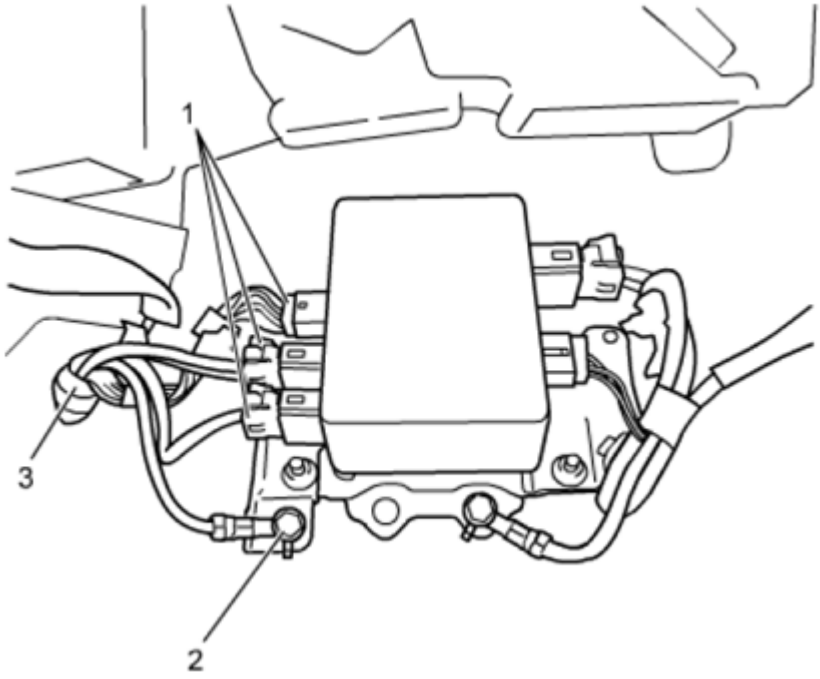


Fig. 78: Identifying P/S Control Module Connector
Courtesy of SUZUKI OF AMERICA CORP.

25. Disconnect ground cable (1) from suspension frame rear mounting bracket and body.



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Fig. 79: Identifying Ground Cable
Courtesy of SUZUKI OF AMERICA CORP.

26. Support suspension frame (1) and engine assembly (2) using engine lifter.

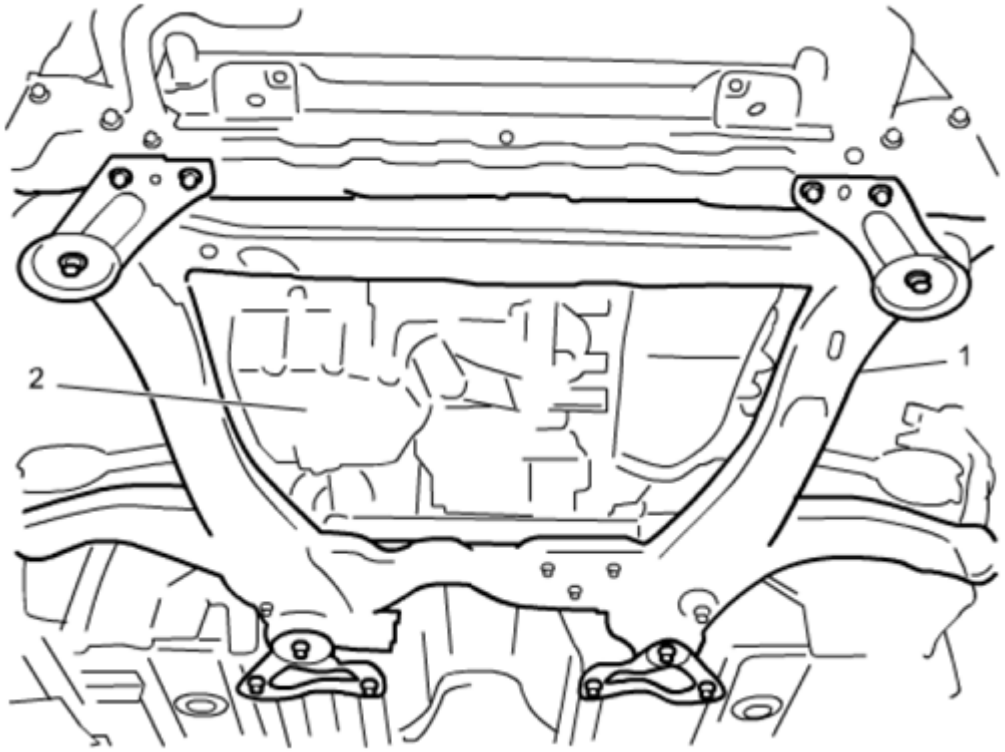


Fig. 80: Identifying Suspension Frame And Engine Assembly
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27. Remove suspension frame mounting brackets, see **FRONT SUSPENSION FRAME COMPONENTS** .
28. Remove engine left mounting bracket (1).

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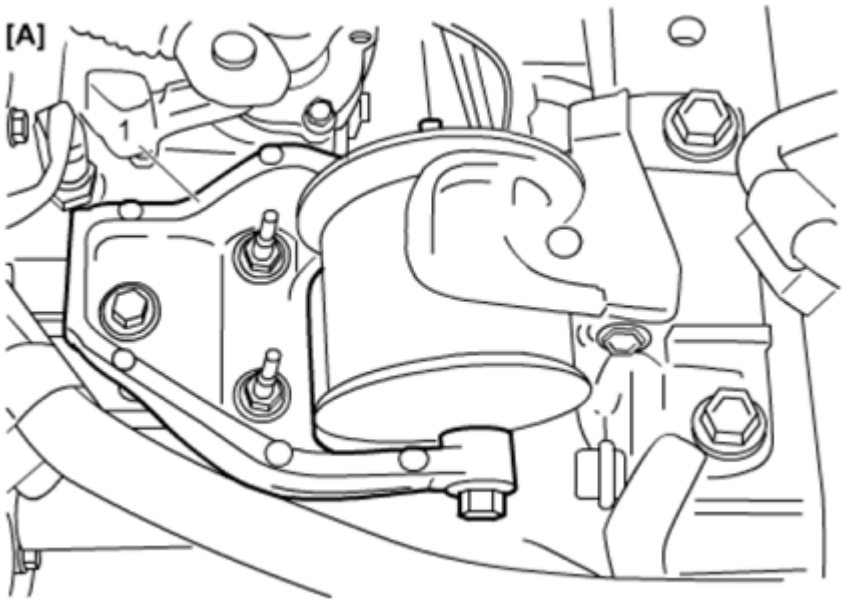
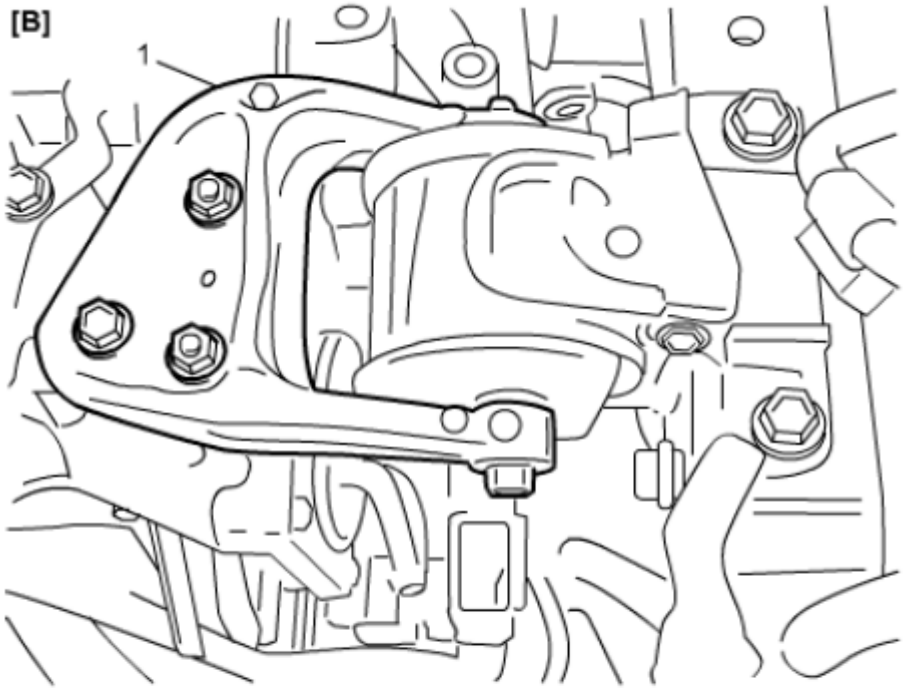


Fig. 81: Identifying Engine Left Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.



[A]:	M/T model
[B]:	CVT model

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Fig. 82: Identifying Engine Left Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

29. Remove engine right mounting bracket nuts (1), then loosen engine right mounting bolts (2).

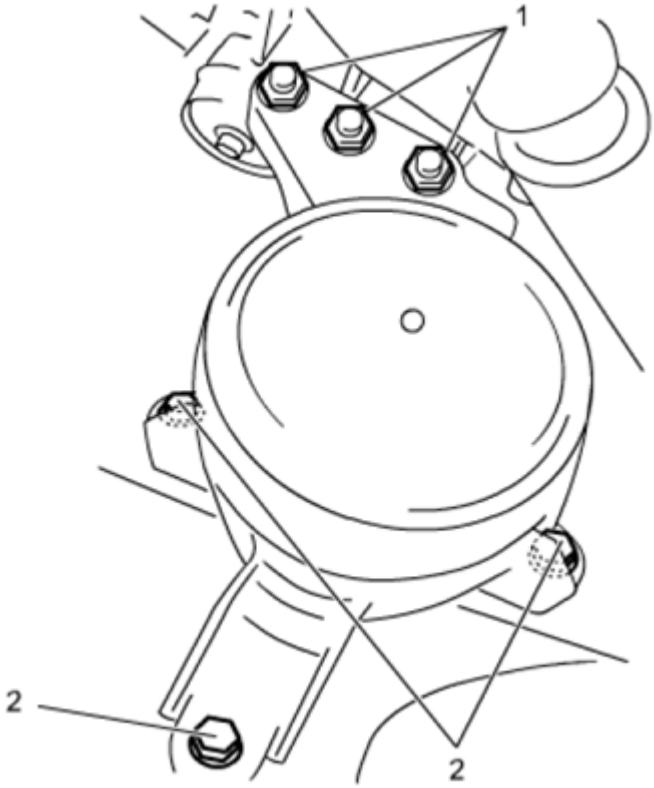


Fig. 83: Identifying Engine Right Mounting Bracket Nuts And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

30. Before lowering engine, make sure that all hoses, electric wires and cables are disconnected from engine.
31. Lower engine assembly with transaxle, transfer (4WD model), front drive shafts and suspension frame all together.

NOTE:

- **When removing engine assembly, CVT assembly, transfer (4WD model), front drive shafts or suspension frame from vehicle, maintain clearance with A/C compressor.**
- **Prior to removing engine rear mounting bracket No. 1 on 4WD model, it is necessary to remove transfer and disconnect engine rear mounting bracket No. 2.**

32. Remove front drive shaft assembly if necessary, see **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
33. For 4WD model, remove transfer if necessary, see **TRANSFER DISMOUNTING AND REMOUNTING** .

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34. Remove engine mounting bracket from engine assembly if necessary, see **ENGINE MOUNTINGS COMPONENTS**.
35. Remove transaxle if necessary.
    - M/T model: **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING**
    - CVT model: **CVT ASSEMBLY DISMOUNTING AND REMOUNTING**
36. For M/T model, remove clutch cover and clutch disc if necessary, see **CLUTCH COVER AND CLUTCH DISC REMOVAL AND INSTALLATION** .
37. For M/T model, remove flywheel if necessary, see **Flywheel/Drive Plate Removal and Installation**.

    For CVT model, remove drive plate if necessary, see **Flywheel/Drive Plate Removal and Installation**.

38. Remove engine harness from engine assembly if necessary.

Installation

1. Install engine harness to engine assembly if removed.
2. For M/T model, install flywheel if removed, see **Flywheel/Drive Plate Removal and Installation**.
3. For CVT model, install drive plate if removed, see **Flywheel/Drive Plate Removal and Installation**.
4. For M/T model, install clutch cover and clutch disc if removed, see **CLUTCH COVER AND CLUTCH DISC REMOVAL AND INSTALLATION** .
5. Install transaxle to engine if removed.
    - For M/T model: **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING**
    - For CVT model: **CVT ASSEMBLY DISMOUNTING AND REMOUNTING**
6. Install engine mounting bracket to engine assembly if removed, see **ENGINE MOUNTINGS COMPONENTS**.
7. For 4WD model, install transfer if removed, see **TRANSFER DISMOUNTING AND REMOUNTING** .
8. Install front drive shaft assembly if removed, see **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
9. Lift up engine assembly together with transaxle, transfer (4WD model), front drive shafts and suspension frame into engine compartment using engine lifter.

    NOTE: When removing engine chassis, CVT chassis, transfer (4WD model), front drive shafts or suspension frame from vehicle, maintain clearance with A/C compressor.

10. Tighten engine right mounting bracket bolts and nuts to specified torque, see **ENGINE MOUNTINGS COMPONENTS**.
11. Install left mounting bracket, then tighten left mounting bracket bolts and nuts to specified torque, see **ENGINE MOUNTINGS COMPONENTS**.
12. Install suspension frame mounting brackets, then tighten suspension frame mounting bracket bolts to specified torque, see **FRONT SUSPENSION FRAME COMPONENTS** .

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13. Connect ground cable to suspension frame mounting bracket and body, then tighten ground cable bolts (1) to specified torque.

    Tightening torque

    Ground cable bolt (a): 9.0 N.m (0.92 kg-m, 7.0 lbf-ft)

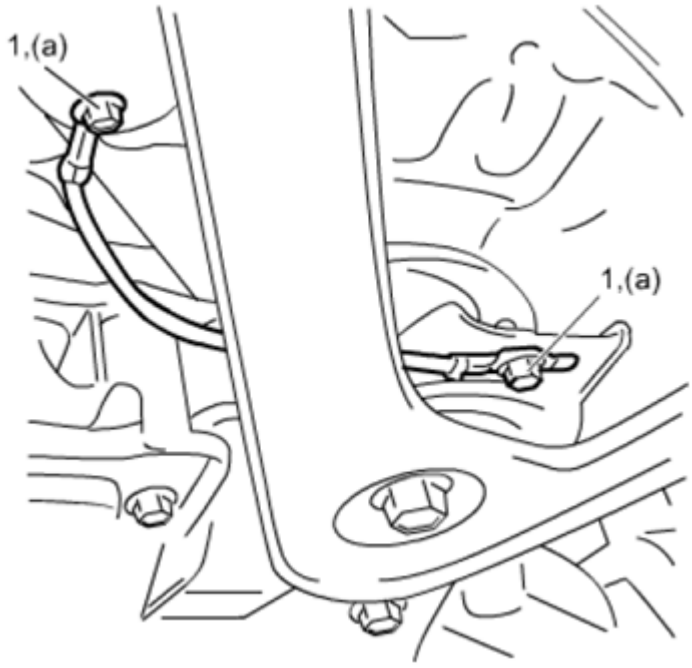


Fig. 84: Identifying Ground Cable Bolt
Courtesy of SUZUKI OF AMERICA CORP.

14. Insert EPS harness (3) into cabin, connect P/S control module connector (1), tighten ground bolt (2) to specified torque, and then install P/S control module cover.

    Tightening torque

    P/S control module ground bolt (a): 9.0 N.m (0.92 kg-m, 7.0 lbf-ft)

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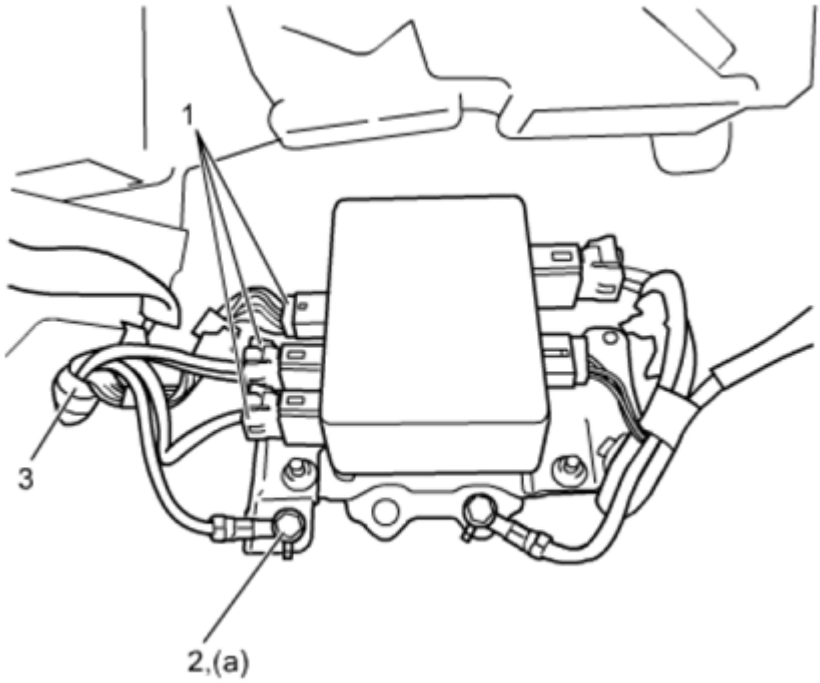


Fig. 85: Identifying P/S Control Module Connector And EPS Harness
Courtesy of SUZUKI OF AMERICA CORP.

15. Connect steering lower shaft to pinion shaft, then tighten lower joint bolt to specified torque, see **STEERING COLUMN REMOVAL AND INSTALLATION** .
16. For 4WD model, install propeller shaft assembly, see **PROPELLER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
17. Install exhaust pipe No. 1 and heat protector panel No. 1, see **EXHAUST SYSTEM COMPONENTS** .
18. Install floor tunnel front brace (1).

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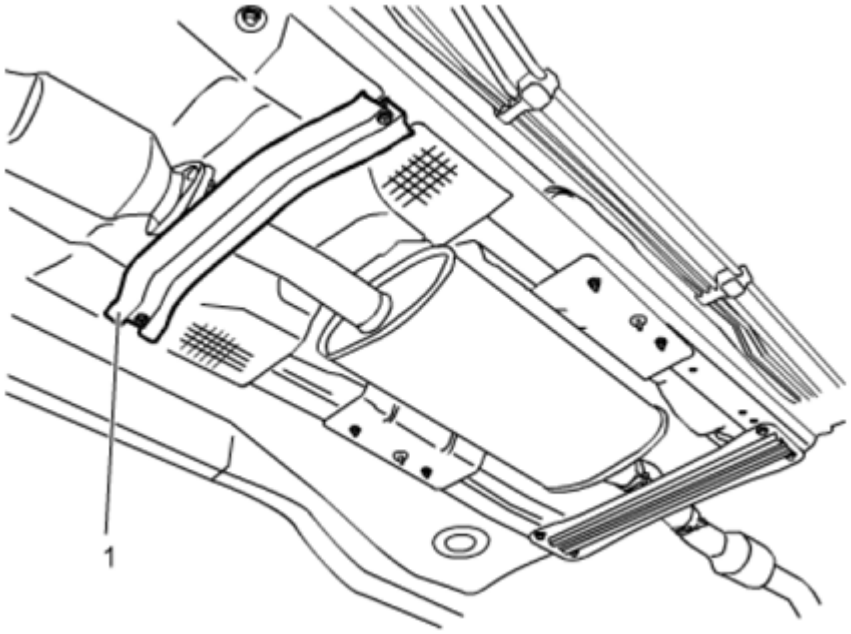


Fig. 86: Identifying Floor Tunnel Front Brace
Courtesy of SUZUKI OF AMERICA CORP.

19. Tighten front strut bolts and nuts to specified torque, see **FRONT STRUT ASSEMBLY REMOVAL AND INSTALLATION** .
20. Connect front wheel speed sensor harness to strut bracket, then tighten front wheel speed sensor harness clamp bolt, see **FRONT WHEEL SPEED SENSOR REMOVAL AND INSTALLATION** .
21. Install brake pads and caliper, see **FRONT BRAKE PAD REMOVAL AND INSTALLATION** .
22. Install A/C compressor to bracket, see **A/C COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
23. Install accessory drive belt, see **ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
24. For M/T model, connect gear select control cable, gear shift control cable, then tighten battery ground terminal bolt to specified torque, see **MANUAL TRANSAXLE UNIT COMPONENTS** .
25. For CVT model, connect select cable, see **MANUAL TRANSAXLE UNIT COMPONENTS** .
26. Install thermostat, thermostat cap and radiator outlet hose, see **MANUAL TRANSAXLE UNIT COMPONENTS** .
27. Install engine harness clamps.
28. Install all other removed electric wires, connectors and hoses to original locations.
29. Tighten battery ground terminal bolts (1) to specified torque.

Tightening torque

Battery ground terminal bolts (a): 9.0 N.m (0.92 kg-m, 7.0 lbf-ft)

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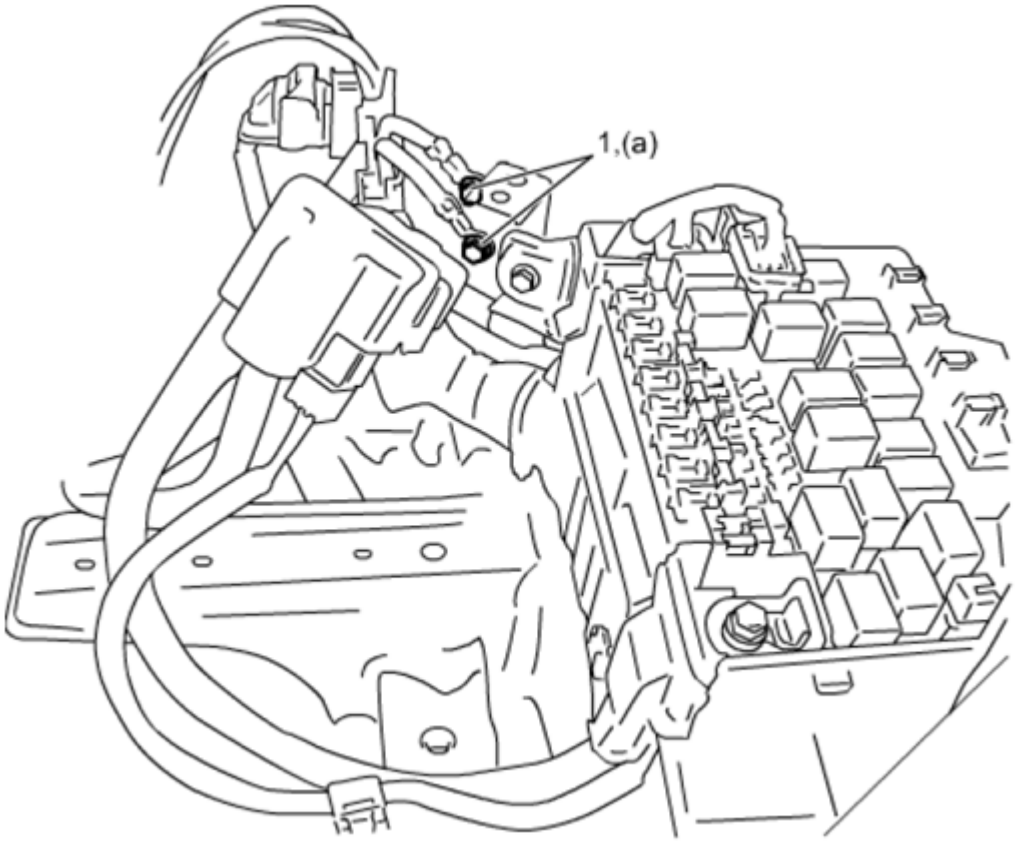


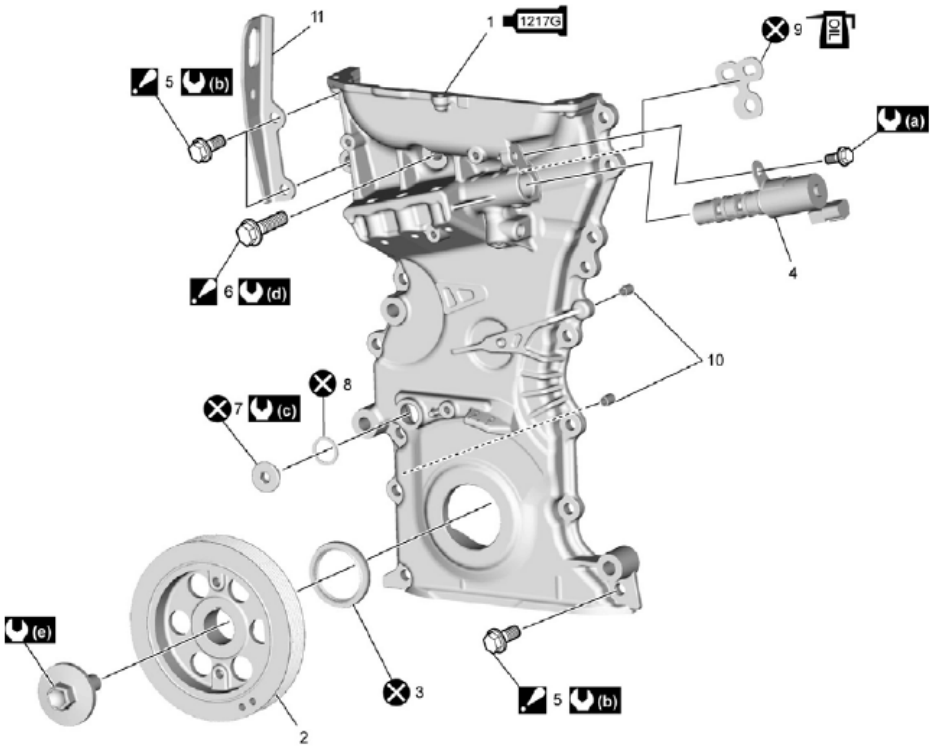
Fig. 87: Identifying Battery Ground Terminal Bolts
Courtesy of SUZUKI OF AMERICA CORP.

30. Install air cleaner assembly, see **MANUAL TRANSAXLE UNIT COMPONENTS** .
31. Refill oils and fluid.
    - Engine oil: **MANUAL TRANSAXLE UNIT COMPONENTS** .
    - Manual transmission oil (M/T model): **MANUAL TRANSAXLE UNIT COMPONENTS** .
    - CVT fluid (CVT model): **MANUAL TRANSAXLE UNIT COMPONENTS** .
    - Transfer oil (4WD model): **TRANSFER OIL CHANGE** .
32. Refill cooling system with coolant, see **COOLING SYSTEM REFILLING** .
33. Install right and left side engine under covers.
34. Install battery bracket, battery tray, battery and ECM, see **BATTERY REMOVAL AND INSTALLATION** .
35. Connect ECM connectors.
36. Connect positive (+) cables and negative (-) at battery.
37. Check any leakage of fuel, coolant, oil and exhaust.
    - Fuel leak: **FUEL LEAKAGE CHECK PROCEDURE**
    - Coolant leak: **ENGINE COOLING SYSTEM INSPECTION**
38. Install engine cover.

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39. Install front bumper and front bumper lower cover, see **FRONT BUMPER REMOVAL AND INSTALLATION** .
40. Install right and left side front fender lower linings.

TIMING CHAIN COVER COMPONENTS



1217G 1. Timing chain cover : Apply sealant 99000-31260 referring to *Timing Chain Cover Removal and Installation*.	7. Timing chain cover plug	(b): 25 N·m (2.5 kgf-m, 18.5 lbf-ft)
2. Crankshaft pulley	8. Timing chain cover plug gasket	(c): 27 N·m (2.8 kgf-m, 20.0 lbf-ft)
3. Oil seal	9. Gasket	(d): 55 N·m (5.6 kgf-m, 40.5 lbf-ft)
4. Oil control valve	10. Dowel pin	(e): 150 N·m (15.3 kgf-m 111.0 lbf-ft)
5. Timing chain cover bolt (M8) : For tightening order, refer to *Timing Chain Cover Removal and Installation*.	11. Engine hook	: Do not reuse.
6. Timing chain cover bolt (M10) : For tightening order, refer to *Timing Chain Cover Removal and Installation*.	(a): 11 N·m (1.1 kgf-m, 8.5 lbf-ft)	OIL : Apply engine oil.

Fig. 88: Identifying Timing Chain Cover Components
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN COVER REMOVAL AND INSTALLATION

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Reference: **TIMING CHAIN COVER COMPONENTS**

CAUTION:
- **Keep working table, tools and hands clean while overhauling.**
- **Take special care when handling aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Always keep them clean.**

Removal

1. Remove engine assembly from vehicle, see **Engine Assembly Removal and Installation**.
2. Remove crankshaft pulley bolt.

   To lock crankshaft pulley (1), use special tool as shown in the following figure.

CAUTION:
- **Use special tool to prevent unnecessary load on timing chain, sprockets and any other related parts.**
- **Use specified bolts (2) to install special tool to crankshaft pulley. Bolt size: M8**

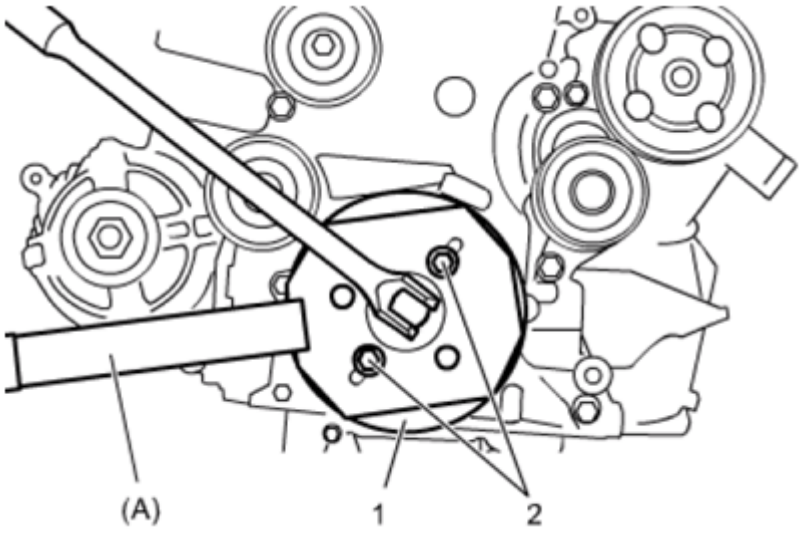
  Pitch: 1.25 mm (0.0492 in.)

  Length: 25 mm (0.98 in.)

  Strength: 7T

Special Tool

A. **09917-68221**



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

3. Remove crankshaft pulley (1).

   Use special tools as shown in figure if it is hard to remove.

   Special Tool

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

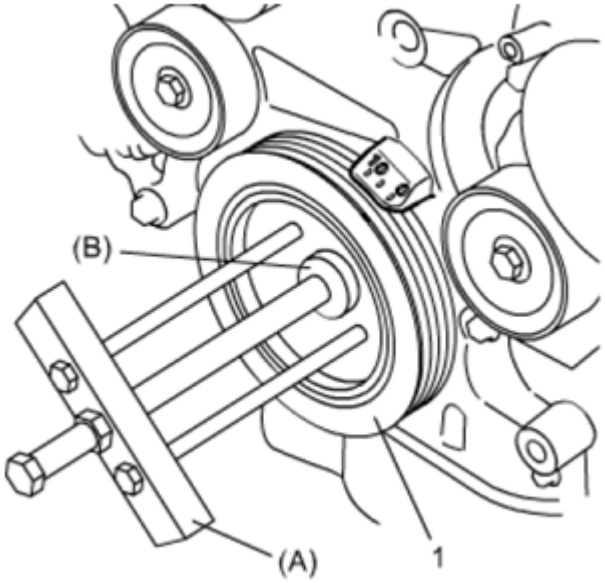


Fig. 90: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
5. Remove oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
6. Remove tensioner pulley and idler pulley, see **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
7. Remove timing chain cover bolts, then remove timing chain cover with engine hook.
8. Remove crankshaft oil seal from timing chain cover using flat-end screwdriver or the like, if necessary.
9. Remove oil control valve from timing chain cover if necessary, see **OCV Removal and Installation**.

Installation

Reference: **TIMING CHAIN COVER INSPECTION**

1. Install oil control valve if removed, see **OCV Removal and Installation**.

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2. Clean mating surface of timing chain cover, cylinder block and cylinder head by removing old sealant and oil.
3. Check oil seal (1) for any damage.

   Replace oil seal if any abnormalities are found.

   NOTE: When installing new oil seal, press it into timing chain cover (2) using special tool as shown in figure.

   Special Tool

   A. **09913-75510**

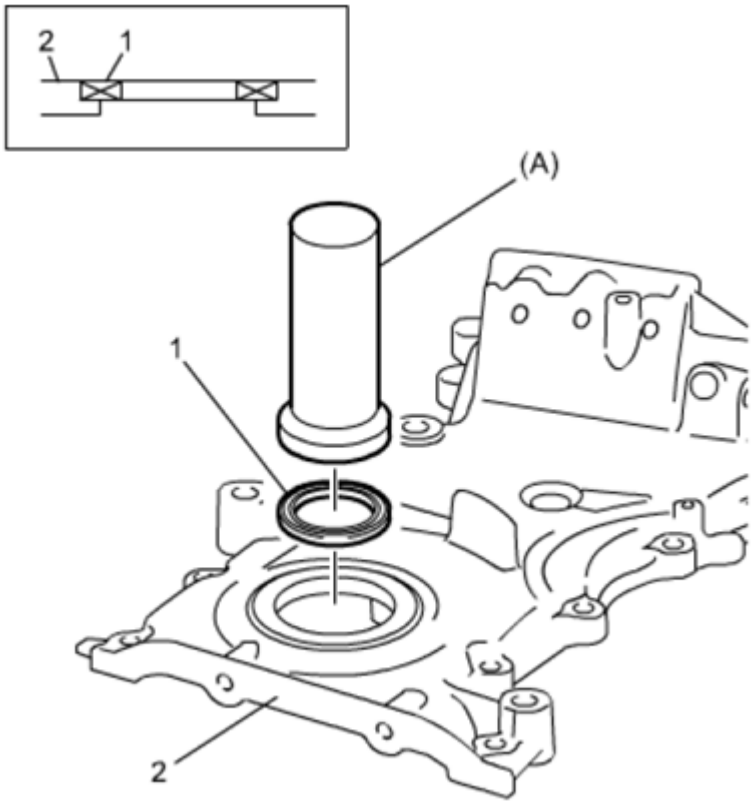


Fig. 91: Identifying Oil Seal With Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

4. Install dowel pins (1) to cylinder block.

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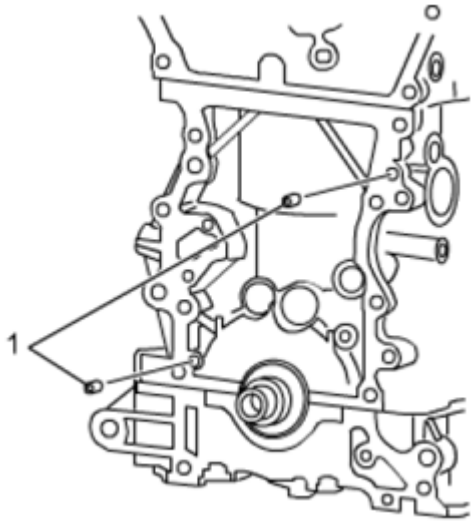


Fig. 92: Identifying Dowel Pins
Courtesy of SUZUKI OF AMERICA CORP.

5. Apply sealant "A" as follows:
   a. Fill sealant "A" to mating clearance of cylinder block and cylinder head.
   b. Apply sealant "A" to mating surface of timing chain cover as specified.

NOTE:

- **Before applying sealant, make sure mating surfaces are clean and dry.**
- **Install timing chain cover within 2 minutes after applying sealant.**
- **Wipe off excessive sealant of upper and lower end of the cover.**

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

Sealant bead size for timing chain cover

Width "a": 3 mm (0.11 in.)

Height "b": 2 mm (0.07 in.)

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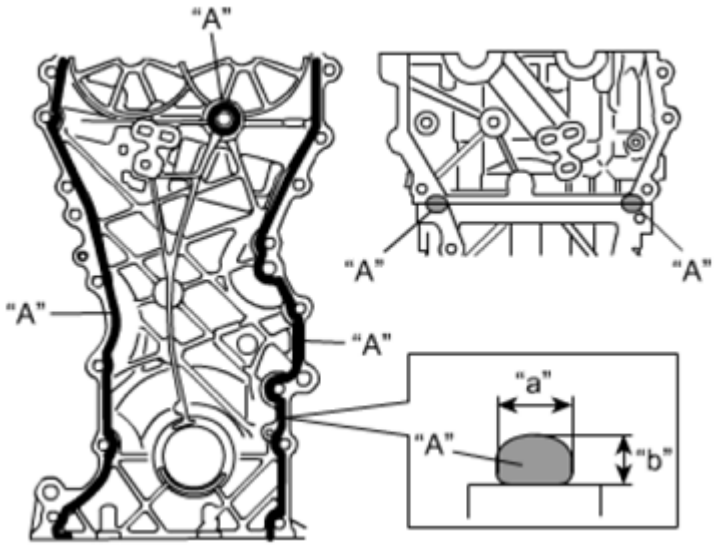


Fig. 93: Identifying Sealant Applying Area
Courtesy of SUZUKI OF AMERICA CORP.

6. Apply engine oil to oil seal lip, and then install timing chain cover with engine hook. Tighten timing chain cover bolts to specified torque in numerical order ("1" - "17") evenly and gradually.

NOTE: Before installing timing chain cover, check that dowel pins are securely fitted.

Tightening torque

Timing chain cover bolt* (M8 bolt) (a): 25 N.m (2.5 kg-m, 18.5 lbf-ft)

Timing chain cover bolt* (M10 bolt) (b): 55 N.m (5.6 kg-m, 40.5 lbf-ft)

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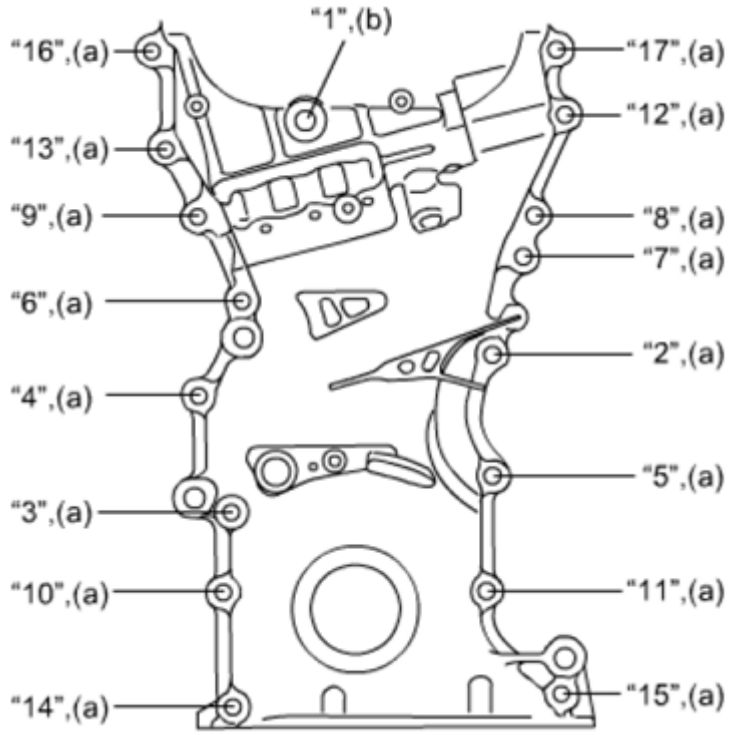


Fig. 94: Identifying Timing Chain Cover Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

7. Install tensioner pulley and idler pulley, see **TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
8. Install cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
9. Install oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
10. Install crankshaft pulley (1) and tighten crankshaft pulley bolt to specified torque.

    To lock crankshaft pulley, use special tool as shown in figure.

CAUTION:

- **Use special tool to prevent unnecessary load on timing chain, sprockets and any other related parts.**
- **Use specified bolts (2) to install special tool to crankshaft pulley.**

  Bolt size: M8

  Pitch: 1.25 mm (0.0492 in.)

  Length: 25 mm (0.98 in.)

  Strength: 7T

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Special Tool

A. **09917-68221**

Tightening torque

Crankshaft pulley bolt (a): 150 N.m (15.3 kg-m, 111.0 lbf-ft)

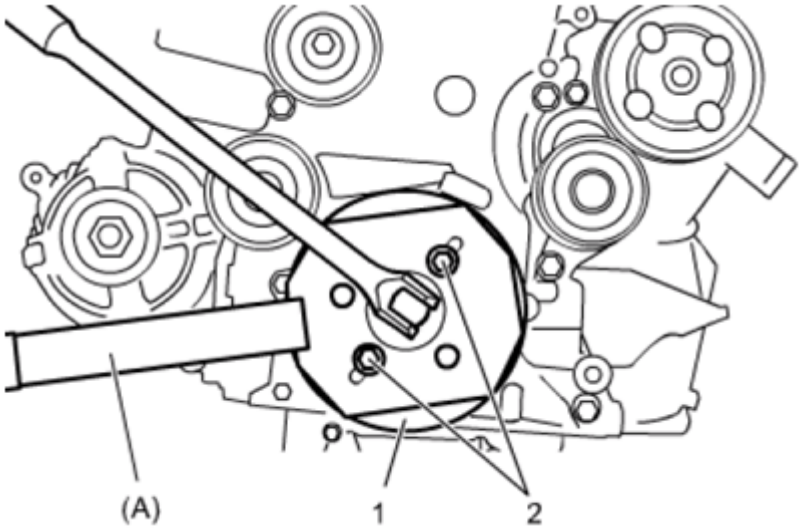


Fig. 95: Removing Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

11. 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 any damage. Replace oil seal if any abnormalities are found.

Timing Chain Cover

Inspect oil passage (1) for driving CMP actuator and strainer (2).

Clean passage and strainer if clog or foreign matter exists.

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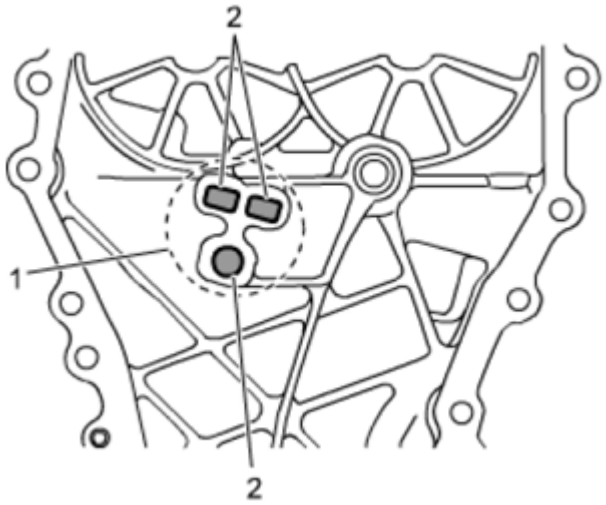


Fig. 96: Identifying Oil Passage For Driving CMP Actuator And Strainer
Courtesy of SUZUKI OF AMERICA CORP.

OCV REMOVAL AND INSTALLATION

Reference: **TIMING CHAIN COVER COMPONENTS**

Removal

Remove OCV (2) and O-ring (3) from timing chain cover (1).

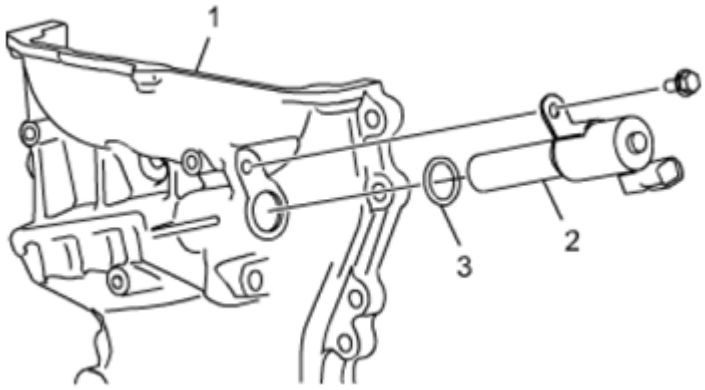


Fig. 97: Identifying OCV, O-Ring And Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure noting the following point:

- Tighten OCV bolt to specified torque.

  Tightening torque

OCV bolt: 11 N.m (1.1 kg-m, 8.5 lbf-ft)

FLYWHEEL/DRIVE PLATE REMOVAL AND INSTALLATION

Removal

1. Remove transmission assembly.
   - M/T model: **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** .
   - CVT model: **CVT ASSEMBLY DISMOUNTING AND REMOUNTING** .
2. Wedge a special tool in ring gear teeth to lock flywheel or drive plate as shown in figure.

   Special Tool

   A. **09924-17811**

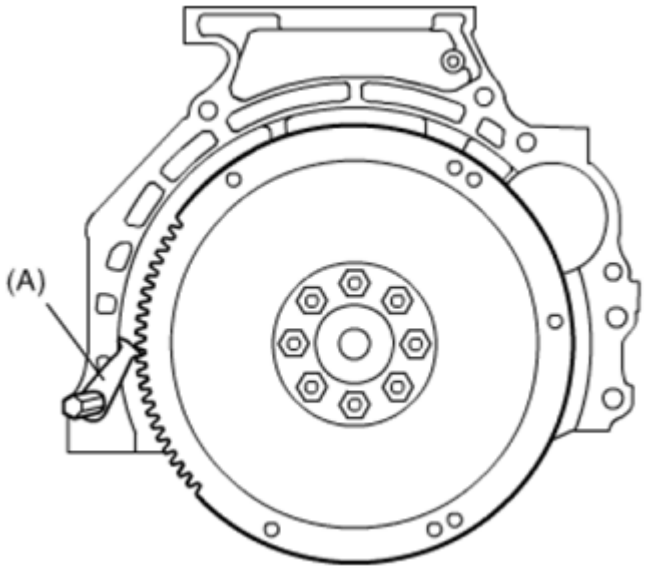


Fig. 98: Identifying Special Tool In Ring Gear Teeth
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove flywheel or drive plate from engine assembly.

Installation

Reverse removal procedure noting the following points:

- Install new flywheel bolts or drive plate bolts.
- Wedge a special tool in ring gear teeth to lock flywheel or drive plate as shown in figure.

  Special Tool

  A. **09924-17811**

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- Tighten flywheel bolts or drive plate bolts to specified torque.

  Tightening torque

  Flywheel bolt (a): 70 N.m (7.1 kg-m, 52.0 lbf-ft)

  Drive plate bolt (a): 70 N.m (7.1 kg-m, 52.0 lbf-ft)

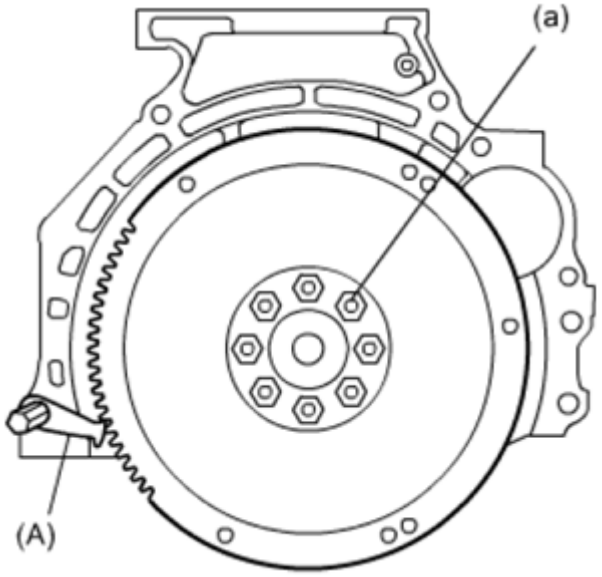


Fig. 99: Identifying Flywheel Bolt
Courtesy of SUZUKI OF AMERICA CORP.

FLYWHEEL/DRIVE PLATE INSPECTION

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

Visual Inspection

- Check ring gear of flywheel for M/T model or drive plate for CVT model, for cracking, wear or any damage.

  Replace flywheel for M/T model or drive plate for CVT model if defective condition is found, see **Flywheel/Drive Plate Removal and Installation**.

Flywheel/Drive Plate Face Runout

- Check flywheel for M/T model or drive plate for CVT model for runout using dial gauge and "V" blocks. Replace flywheel for M/T model or drive plate for CVT model if measured runout exceeds the limit, see **Flywheel/Drive Plate Removal and Installation**.

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Flywheel/drive plate face runout

Limit: 0.2 mm (0.0078 in.)

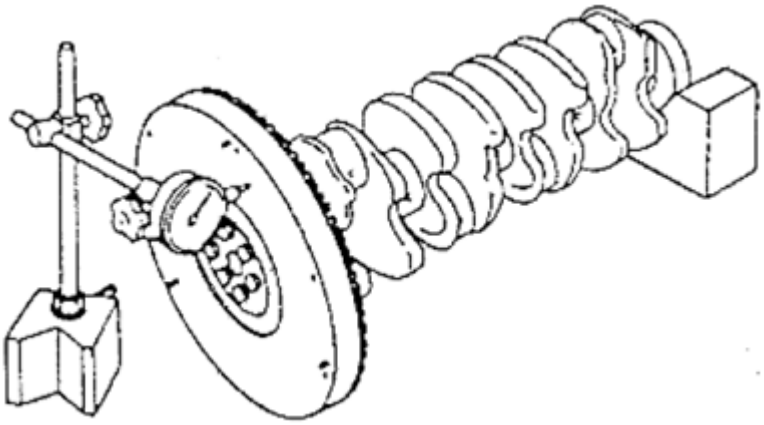
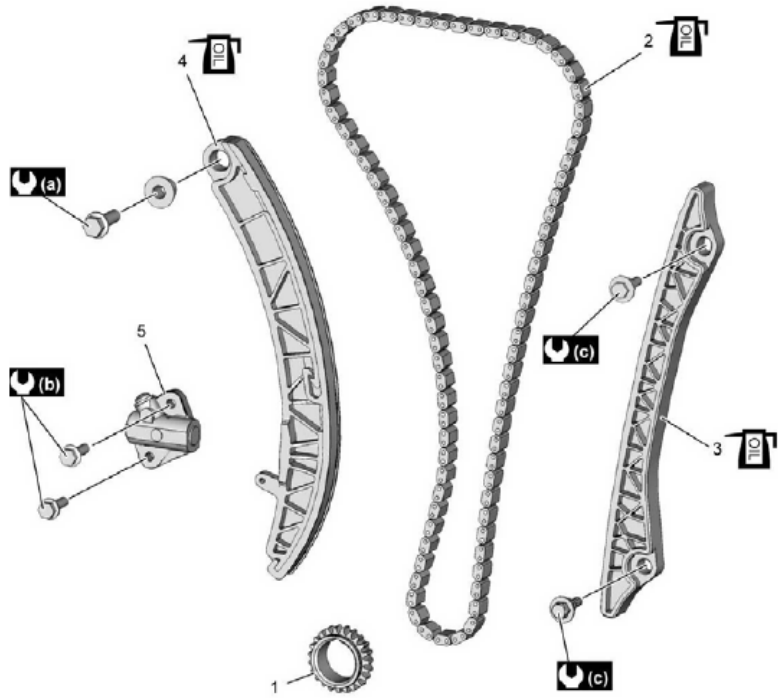


Fig. 100: Checking Flywheel/Drive Plate Face Runout
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TIMING CHAIN AND CHAIN TENSIONER COMPONENTS

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1. Crankshaft timing sprocket	4. Timing chain tensioner	(b): 11 N·m (1.1 kgf-m, 8.5 lbf-ft)
2. Timing chain	5. Timing chain tensioner adjuster	(c): 9 N·m (0.92 kgf-m, 7.0 lbf-ft)
3. Timing chain guide	(a): 25 N·m (2.5 kgf-m, 18.5 lbf-ft)	OIL: Apply engine oil to sliding surface.

Fig. 101: Identifying Timing Chain And Chain Tensioner Components
Courtesy of SUZUKI OF AMERICA CORP.

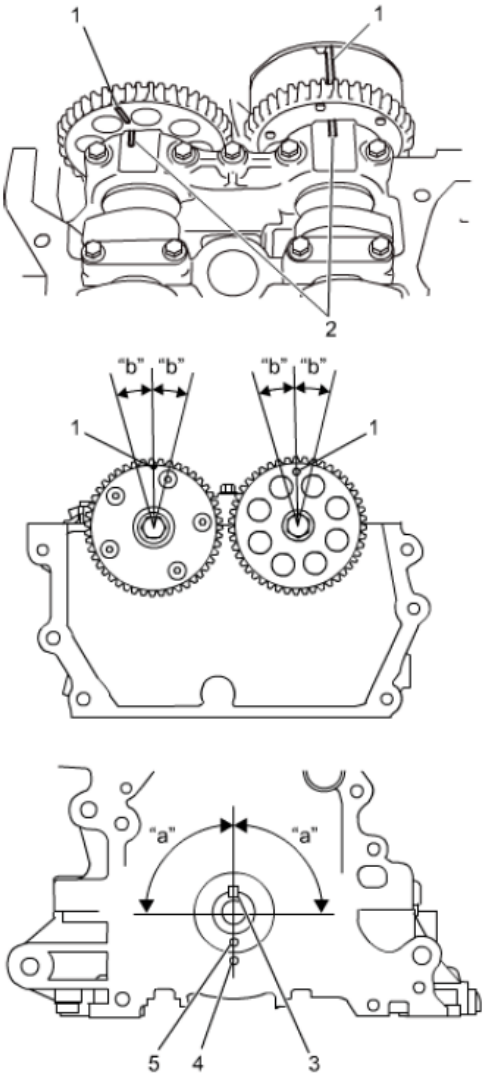
TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION

Reference: **TIMING CHAIN AND CHAIN TENSIONER COMPONENTS**

Removal

CAUTION: After timing chain is removed, never turn crankshaft and camshafts independently more than specified range ("a" and "b") as shown in figure. If either of those shafts is turned, interference may occur between pistons and valves and valves themselves, and parts related to piston and valves may be damaged.

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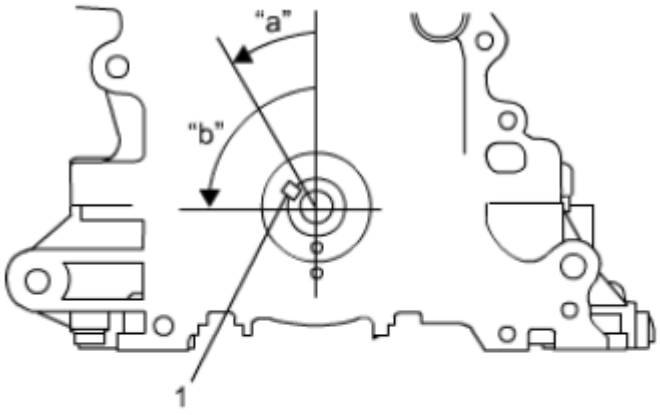


1.	Timing marks on camshaft timing sprockets
2.	Matchmark on camshaft housing No.1
3.	Key
4.	Matchmark on lower crankcase
5.	Timing mark on crankshaft timing sprocket
"a":	90°
"b":	15°

Fig. 102: Identifying Timing Marks On Camshaft Timing
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: If it is necessary to rotate the camshaft after removing timing chain, turn crankshaft counterclockwise and position the key (1) within an angle of 30 to

90° from TDC before rotating the camshaft as shown in the following figure and keep the valves from coming in contact with the pistons.



"a":	30°
"b":	90°
1.	Key

Fig. 103: Rotating Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

1. Remove timing chain cover.
2. Align camshafts and crankshaft by turning the crankshaft at specific position as follows:
   a. Align timing marks on CMP actuator (1) and timing mark (2) on exhaust camshaft timing sprocket with matchmark (3) on camshaft housing No. 1.

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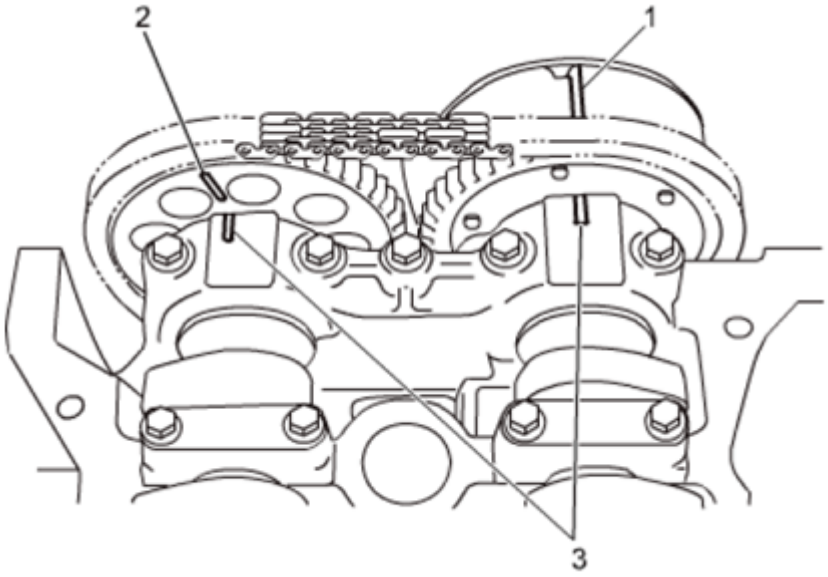


Fig. 104: Aligning Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

b. Align timing mark (1) on crankshaft timing sprocket with matchmark (2) on lower crankcase.

3. Remove timing chain tensioner adjuster (3).
4. Remove timing chain tensioner (4).
5. Remove timing chain guide (5).
6. Remove timing chain (6) and crankshaft timing sprocket (7).

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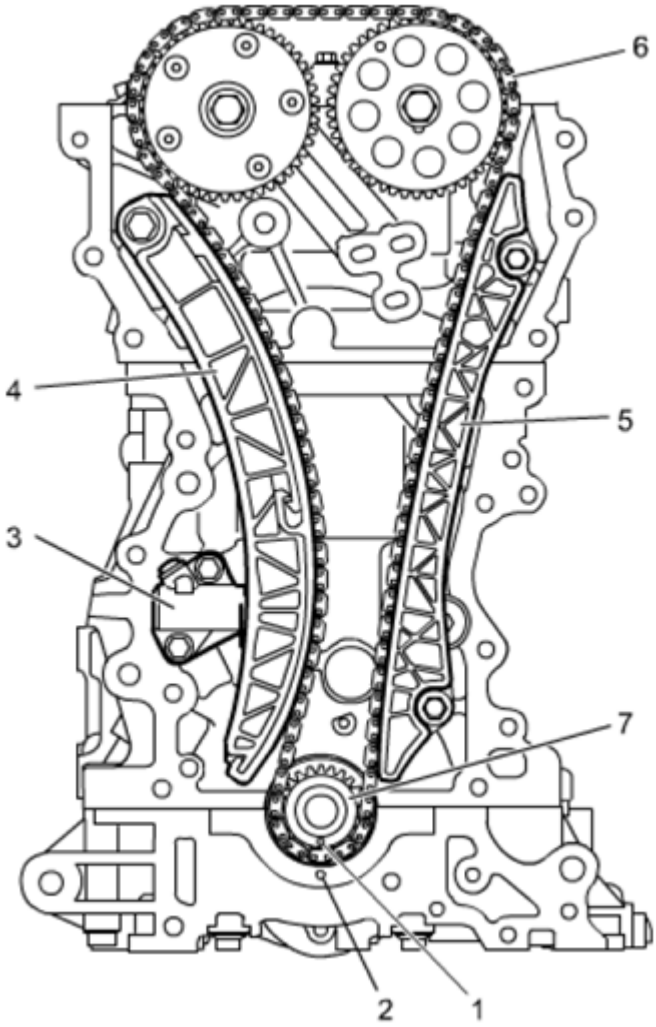


Fig. 105: Identifying Timing Chain And Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **TIMING CHAIN AND CHAIN TENSIONER INSPECTION**

1. Turn camshaft position key slot (1) within specified range (30 - 90°) (2) in counterclockwise direction from top as shown in figure.
2. Align timing mark (3) on CMP actuator with matchmark (4) on camshaft housing No. 1.
3. Align timing mark (5) on exhaust camshaft timing sprocket with matchmark (4) on camshaft housing No. 1.
4. Install key (6) to key slot (1) of crankshaft.
    a. Align key slot of crankshaft timing sprocket (7) with key, and then Install crankshaft timing sprocket to crankshaft.
    b. Align timing mark (8) on crankshaft timing sprocket with matchmark (9) on lower crankcase.

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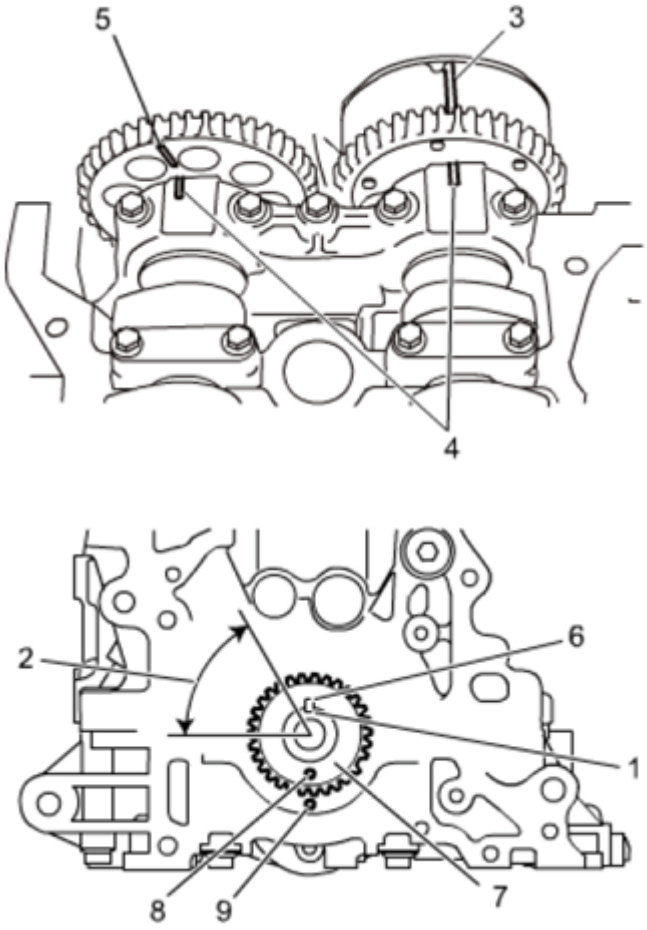


Fig. 106: Aligning Timing Mark On Crankshaft Timing Sprocket With Lower Crankcase
Courtesy of SUZUKI OF AMERICA CORP.

5. Install timing chain while aligning two blue plates (2) with timing marks (1) on CMP actuator and exhaust camshaft timing sprockets.

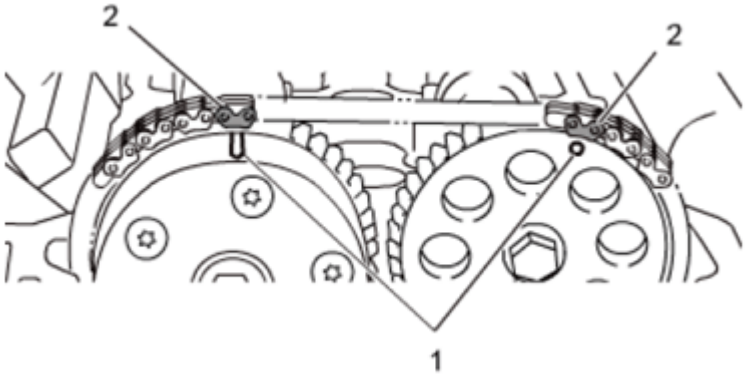


Fig. 107: Aligning Blue Plates With Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

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6. Install timing chain while aligning blue plate (2) with timing mark (1) on crankshaft timing sprocket.

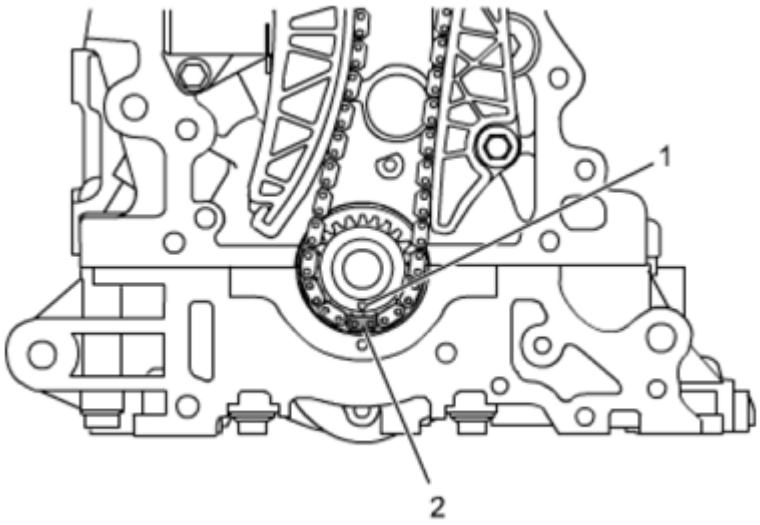


Fig. 108: Aligning Blue Plate With Timing Mark On Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install timing chain guide (1) and tighten timing chain guide bolts (2) to specified torque.

   Tightening torque

   Timing chain guide bolt (a): 9.0 N.m (0.92 kg-m, 7.0 lbf-ft)

8. Apply engine oil to sliding surface of timing chain guide.
9. Attach spacer (4) to timing chain tensioner (3).
10. Install timing chain tensioner (3) and tighten timing chain tensioner bolt (5) to specified torque.

    Tightening torque

    Timing chain tensioner bolt (b): 25 N.m (2.5 kg-m, 18.5 lbf-ft)

11. Apply engine oil to sliding surface of timing chain tensioner.
12. Make sure that all blue plates (6) are aligned with timing marks (7) on corresponding timing sprockets.

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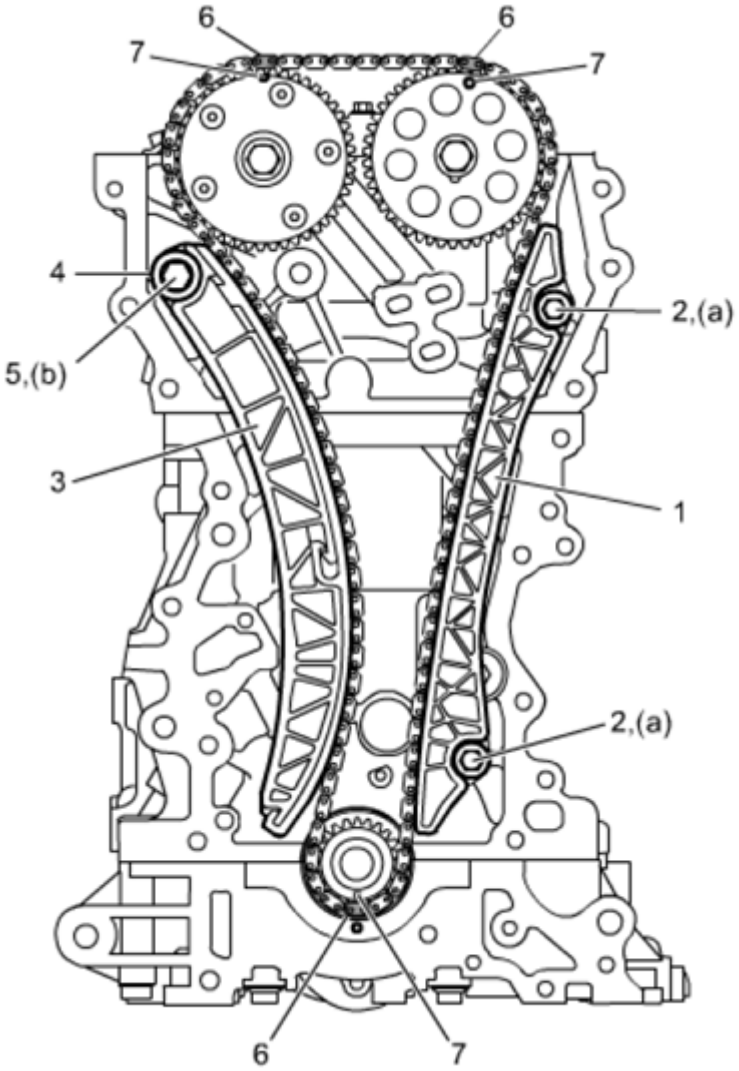
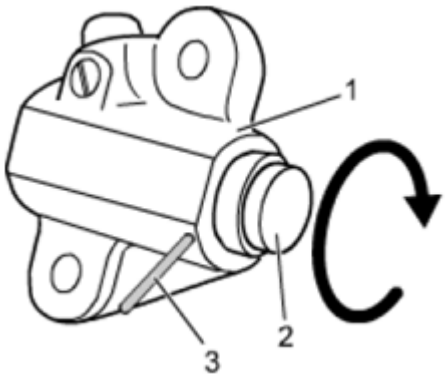


Fig. 109: Aligning Timing Marks On Corresponding Timing Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

13. Screw in plunger (2) of timing chain tensioner adjuster (1) clockwise and install a retainer (3) (1.4 mm (0.055 in.) diameter wire or the like) to hold plunger in place.



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Fig. 110: Identifying Plunger Of Timing Chain Tensioner Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

14. Install timing chain tensioner adjuster (1) with a retainer.

    Tighten timing chain tensioner adjuster bolts (2) to specified torque, and then remove a retainer from timing chain tensioner adjuster.

    Tightening torque

    Timing chain tensioner adjuster bolt (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)

15. Apply engine oil to timing chain, turn crankshaft clockwise 720°, and confirm that the following conditions have been met:
    - Timing mark (4) on CMP actuator is aligned with matchmark (3) on camshaft housing No. 1.
    - Timing mark (5) on exhaust camshaft timing sprocket is aligned with matchmark (3) on camshaft housing No. 1.
    - Timing mark (6) on crankshaft timing sprocket is aligned with matchmark (7) on lower crankcase.

    NOTE:
    - **Be sure to turn crankshaft 720°. If it is turned only 360°, the timing marks on CMP actuator and exhaust camshaft timing sprockets will not meet matchmark on camshaft housing No. 1.**
    - **After turning crankshaft 720°, the painted links of the timing chain will not be aligned with the timing marks on the CMP actuator and the exhaust timing sprocket, but this is normal.**

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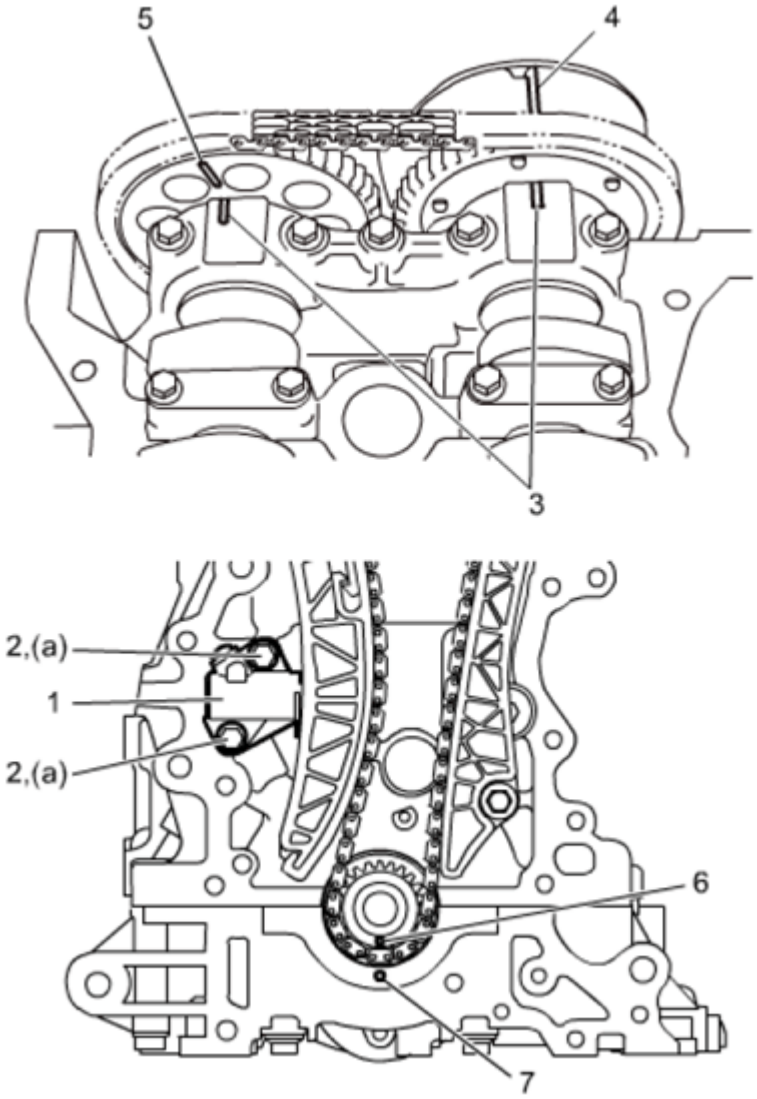


Fig. 111: Identifying Timing Mark On Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

16. Install timing chain cover, see **Timing Chain Cover Removal and Installation**.
17. Install cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
18. Install oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
19. Install engine assembly, see **Engine Assembly Removal and Installation**.

TIMING CHAIN AND CHAIN TENSIONER INSPECTION

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

Timing Chain Guide

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Check sliding surface of timing chain guide (1) for wear or damage.

Replace timing chain guide if any abnormalities are found.

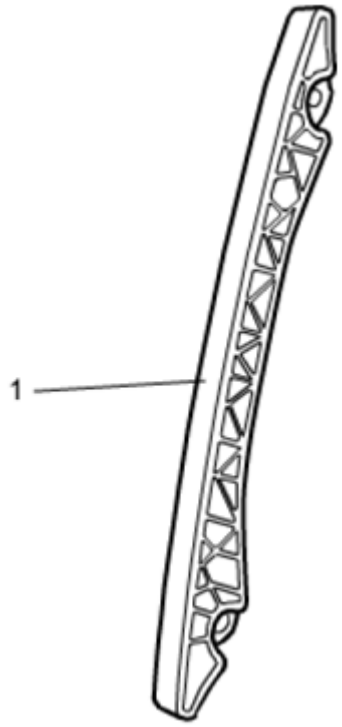


Fig. 112: Identifying Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner

Check sliding surface of timing chain tensioner (1) for wear or damage.

Replace timing chain tensioner if any abnormalities are found.

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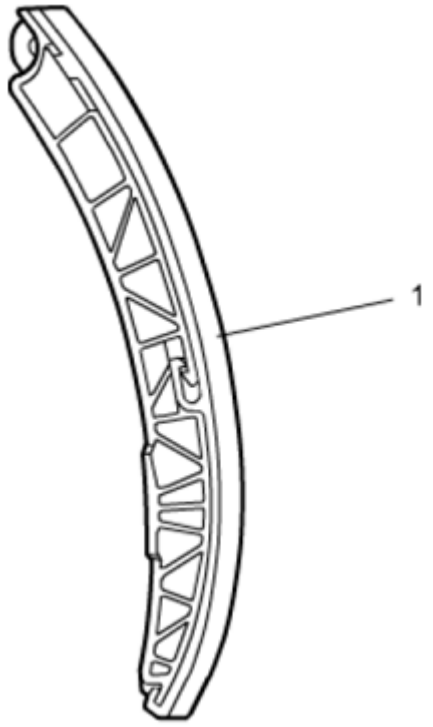


Fig. 113: Identifying Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Timing Sprocket

Check sprocket teeth for wear or damage.

Replace crankshaft timing sprocket if any abnormalities are found.

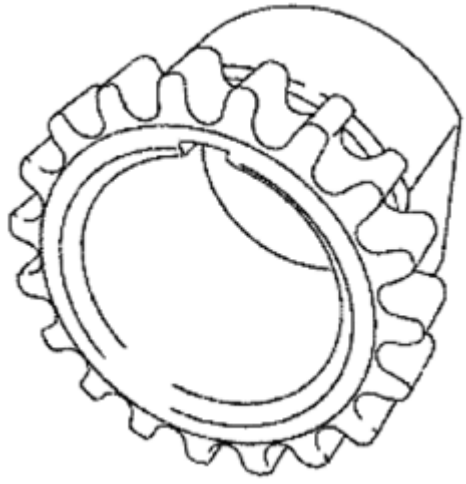


Fig. 114: Identifying Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

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Timing Chain

Check timing chain for wear or damage.

Replace timing chain if any abnormalities are found.

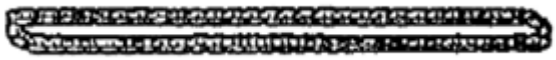


Fig. 115: Identifying Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner Adjuster

Check that tooth surface (1) are free from damage.

Replace timing chain tensioner adjuster if any abnormalities are found.

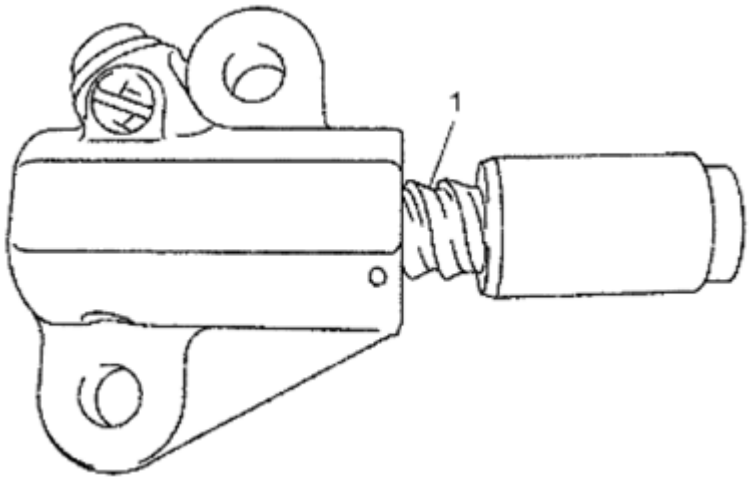
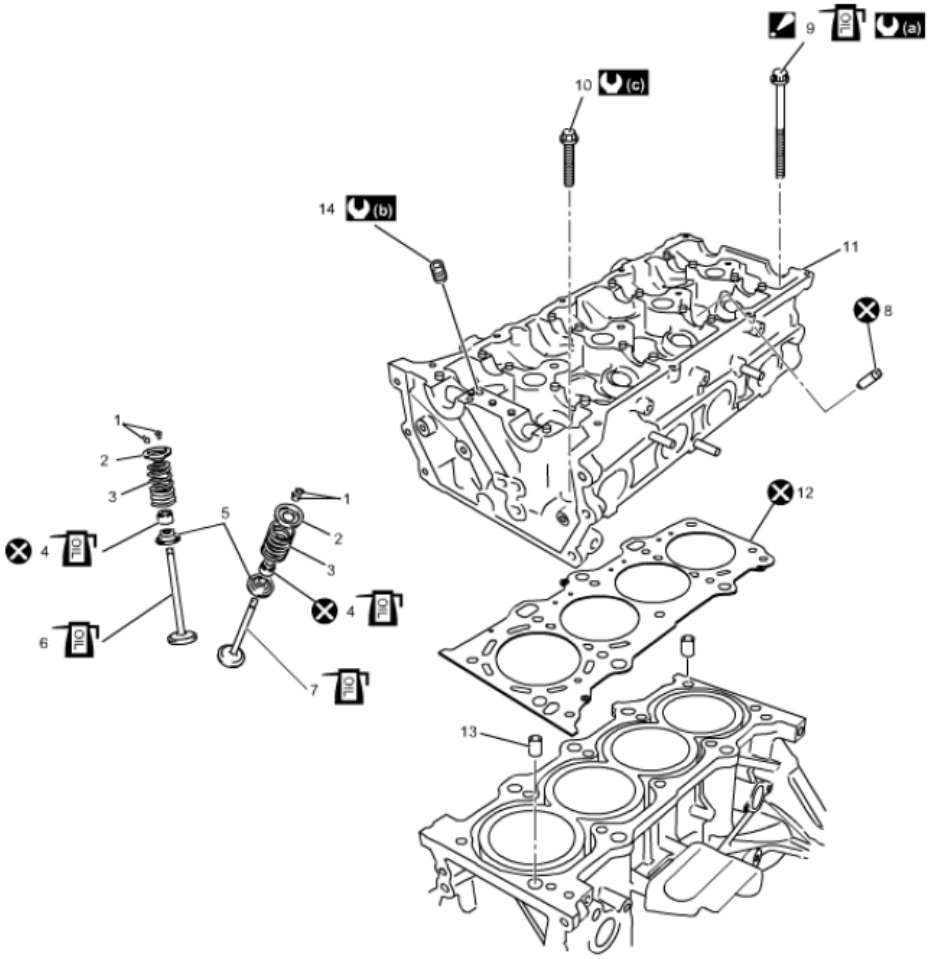


Fig. 116: Identifying Timing Chain Tensioner Adjuster Damage Area
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND CYLINDER HEAD COMPONENTS

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1. Valve cotters	7. OIL Exhaust valve: Apply engine oil to sliding surface.	13. Dowel pin
2. Valve spring retainer	8. Valve guide	14. Venturi plug
3. Valve spring	9. OIL Cylinder head bolt No.1 : Check cylinder head bolt No.1 for deformation to reuse. ☞ : Apply engine oil to bolt thread. : For tightening order, refer to ***Valve and Cylinder Head Removal and Installation***.	(a): 20 N·m → 40 N·m → +60° → +80° (2.0 kgf-m → 4.1 kgf-m → +60° → +80°, 15.0 lbf-ft → 29.5 lbf-ft → +60° → +80°)
4. OIL Valve stem seal : Apply engine oil to valve stem seal lip.	10. Cylinder head bolt No.2	(b): 3.5 N·m (0.37 kgf-m, 2.5 lbf-ft)
5. Valve spring seat	11. Cylinder head	(c): 25 N·m (2.5 kgf-m, 18.5 lbf-ft)
6. OIL Intake valve : Apply engine oil to sliding surface.	12. Cylinder head gasket	: Do not reuse.

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Fig. 117: Identifying Valve And Cylinder Head Components
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION

Reference: **VALVE AND CYLINDER HEAD COMPONENTS**

Removal

1. Remove timing chain, see **Timing Chain and Chain Tensioner Removal and Installation**.
2. Remove spark plugs, see **SPARK PLUG REMOVAL AND INSTALLATION** .
3. Remove intake camshaft and exhaust camshaft, see **Camshaft and Tappet Removal and Installation**.
4. Remove camshaft bearings.
5. Remove heater outlet pipe bolt (1) from cylinder head (2).

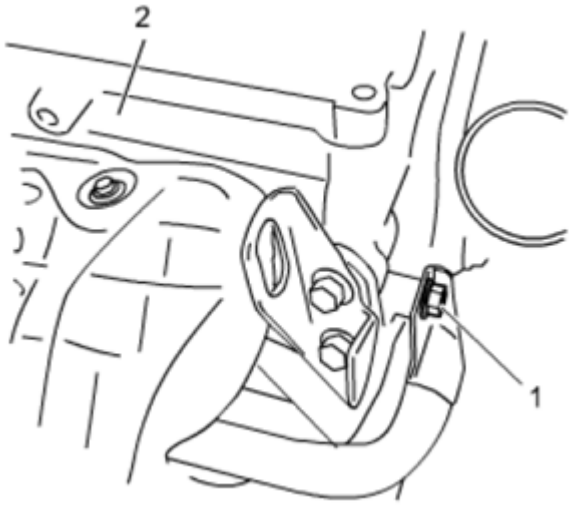


Fig. 118: Identifying Heater Outlet Pipe Bolt And Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove cylinder head bolt No. 2 (1).
7. Loosen cylinder head bolts No. 1 (2) in numerical order ("1" - "10") evenly and gradually.

NOTE: Use 12-point socket wrench for cylinder head bolts No. 1.

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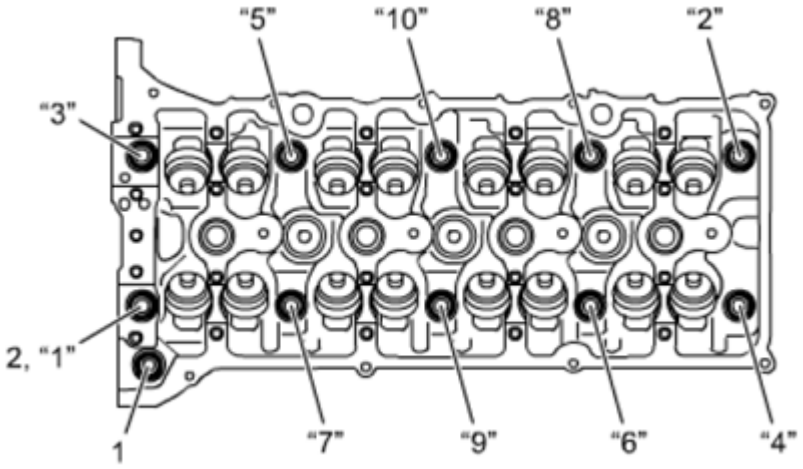


Fig. 119: Identifying Cylinder Head Bolts
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove cylinder head with gasket, intake manifold and exhaust manifold from cylinder block.
9. Remove following components of cylinder head if necessary.
   - Intake manifold: **Intake Manifold Removal and Installation**.
   - Exhaust manifold: **EXHAUST MANIFOLD REMOVAL AND INSTALLATION** .
   - Fuel injector: **FUEL INJECTOR REMOVAL AND INSTALLATION** .
   - Water outlet cap: **COOLING SYSTEM COMPONENTS** .
   - Oil venturi plug: **VALVE AND CYLINDER HEAD DISASSEMBLY AND REASSEMBLY**.

Installation

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

Reference: **CYLINDER HEAD INSPECTION**

Reference: **CYLINDER HEAD BOLT NO. 1 INSPECTION**

CAUTION: Check them for deformation if cylinder head bolts No. 1 are reused, see Cylinder Head Bolt No. 1 Inspection.

1. Clean mating surface of cylinder head and cylinder block removing old gasket, dust and oil.
2. Install dowel pins (1) to cylinder block.
3. Install new cylinder head gasket (2) to cylinder block.

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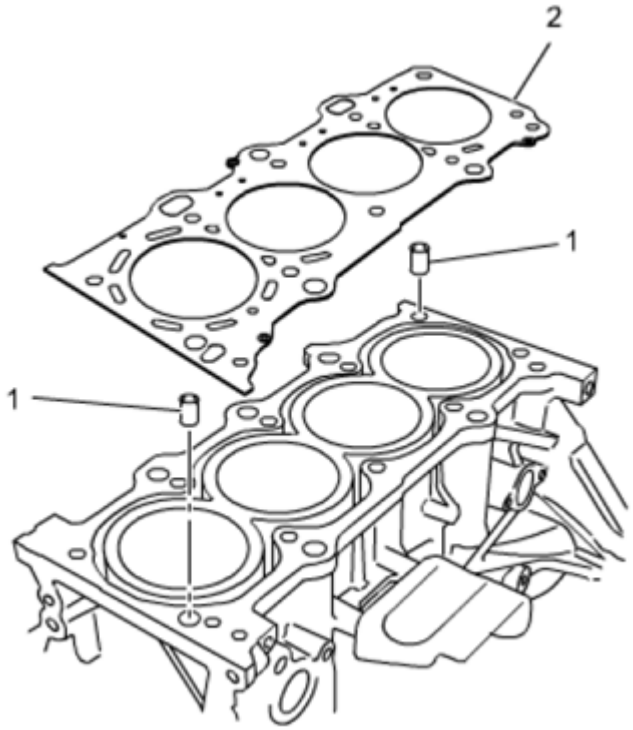
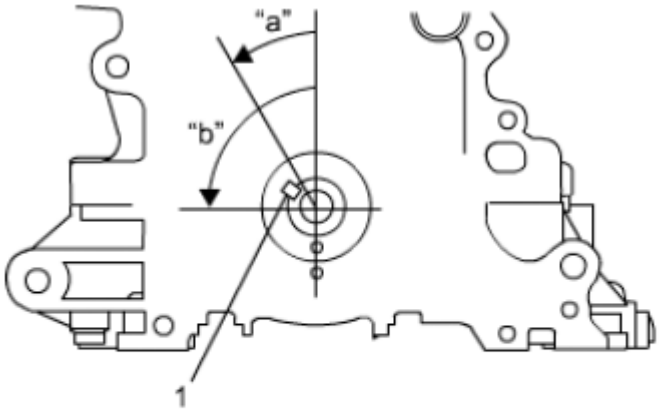


Fig. 120: Identifying Cylinder Head Gasket And Dowel Pins
Courtesy of SUZUKI OF AMERICA CORP.

4. Install cylinder head to cylinder block as follows:

NOTE: Before Installing the cylinder head to the cylinder block, turn crankshaft counterclockwise and position the key (1) within an angle of 30 to 90° from TDC before rotating the camshaft as shown in the following figure and keep the valves from coming in contact with the pistons.

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"a":	30°
"b":	90°

Fig. 121: Identifying Crankshaft Key Position
Courtesy of SUZUKI OF AMERICA CORP.

a. Install cylinder head to cylinder block.
b. Apply engine oil to cylinder head bolts No. 1 threads.
c. c) Tighten cylinder head bolts No. 1 to 20 N.m (2.0 kgf-m, 15.0 lbf-ft) in numerical order ("1" - "10") evenly and gradually.

NOTE: Use 12-point socket wrench for cylinder head bolts No. 1.

d. Retighten them to 40 N.m (4.1 kgf-m, 29.5 lbf-ft) in the same manner as in Step c).
e. Retighten them to 60° in the same manner as in Step c).
f. Retighten them to 80° in the same manner as in Step c).

Tightening torque

Cylinder head bolt No. 1* (a): 20 N.m --> 40 N.m --> +60° --> +80° (2.0 kgf-m --> 4.1 kgf-m --> +60° --> +80°, 15.0 lbf-ft --> 29.5 lbf-ft --> +60° --> +80°)

g. Tighten cylinder head bolt No. 2 (2) to specified torque.

Tightening torque

Cylinder head bolt No. 2 (b): 25 N.m (2.5 kg-m, 18.5 lbf-ft)

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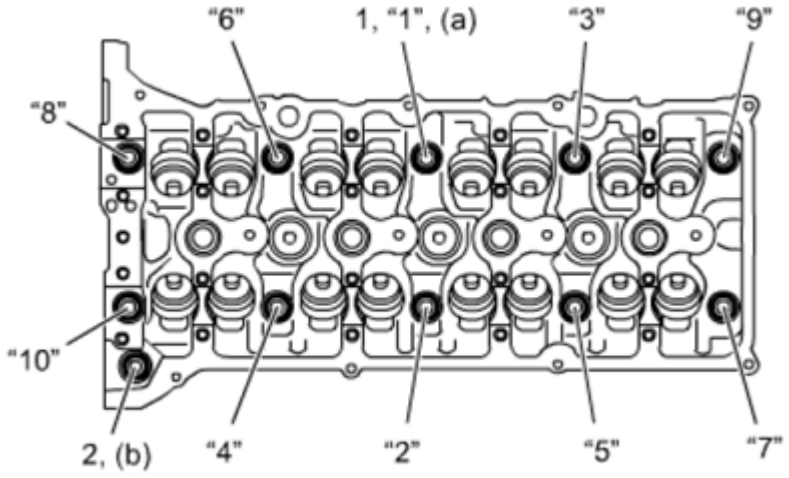


Fig. 122: Tightening Cylinder Head Bolt Specified Torque
Courtesy of SUZUKI OF AMERICA CORP.

5. Install oil venturi plug if removed, see **Valve and Cylinder Head Disassembly and Reassembly**.
6. Install intake camshaft and exhaust camshaft, see **Camshaft and Tappet Removal and Installation**.
7. Install timing chain, see **Timing Chain and Chain Tensioner Removal and Installation**.
8. Install timing chain cover, see **Timing Chain Cover Removal and Installation**.
9. Install cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
10. Install oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
11. Install water outlet cap if removed, see **COOLING SYSTEM COMPONENTS** .
12. Install heater outlet pipe bolt to cylinder head, see **COOLING SYSTEM COMPONENTS** .
13. Install spark plugs, see **SPARK PLUG REMOVAL AND INSTALLATION** .
14. Install exhaust manifold if removed, see **EXHAUST MANIFOLD REMOVAL AND INSTALLATION** .
15. Install intake manifold if removed, see **Intake Manifold Removal and Installation**.
16. Install fuel injectors if removed, see **FUEL INJECTOR REMOVAL AND INSTALLATION** .
17. Install engine assembly, see **Engine Assembly Removal and Installation**.

VALVE AND CYLINDER HEAD DISASSEMBLY AND REASSEMBLY

Disassembly

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

NOTE: **Parts must go back in the position where they were. Keep them in the following order:**

- **Valve cotter**
- **Valve spring retainer**

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- **Valve spring**
- **Valve spring seat**
- **Intake valve**
- **Exhaust valve**
- **Tappet**

1. Remove oil venturi plug (1).

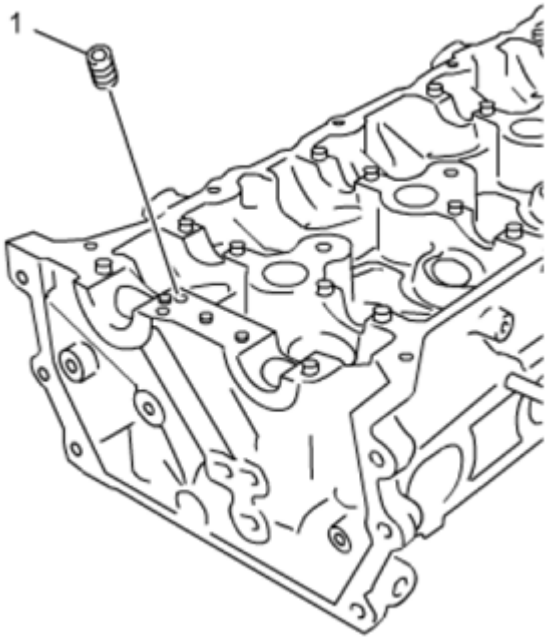


Fig. 123: Identifying Oil Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove tappets from cylinder head.
3. Use special tools (A) and (B) to compress valve spring and use special tool (C) to remove valve cotters (1).

CAUTION: When compressing the valve spring, be careful not to damage inner side of the tappet installing hole.

Special Tool

A. **09916-14510**
B. **09916-14522**
C. **09916-84511**

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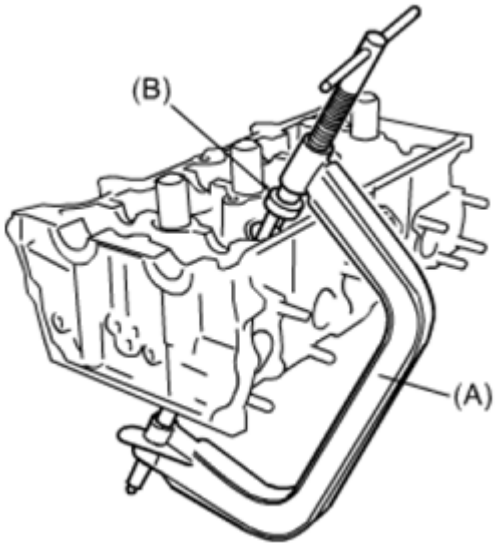


Fig. 124: Compressing Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

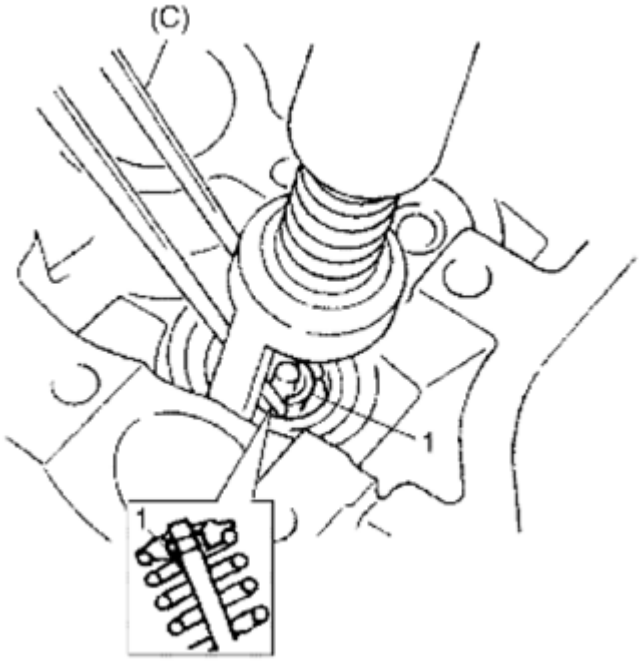


Fig. 125: Removing Valve Cotters
Courtesy of SUZUKI OF AMERICA CORP.

4. Release special tools (A) and (B), and remove spring retainer and valve spring.
5. Remove valve.
6. Remove valve stem seal (1) and valve spring seat (2).

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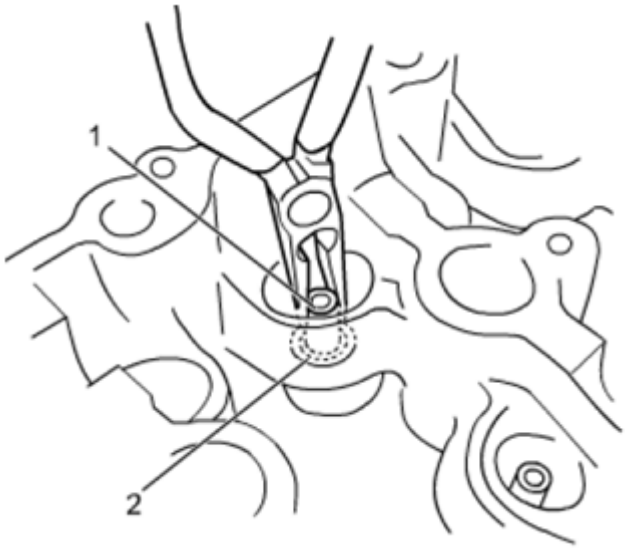


Fig. 126: Removing Valve Stem Seal And Valve Spring Seat
Courtesy of SUZUKI OF AMERICA CORP.

7. Use special tool to remove valve guide from combustion chamber side to valve spring side.

NOTE: Heating cylinder head 80 to 100°C (176 to 212°F) may facilitate valve guide removal.

Special Tool

A. **09916-44910**

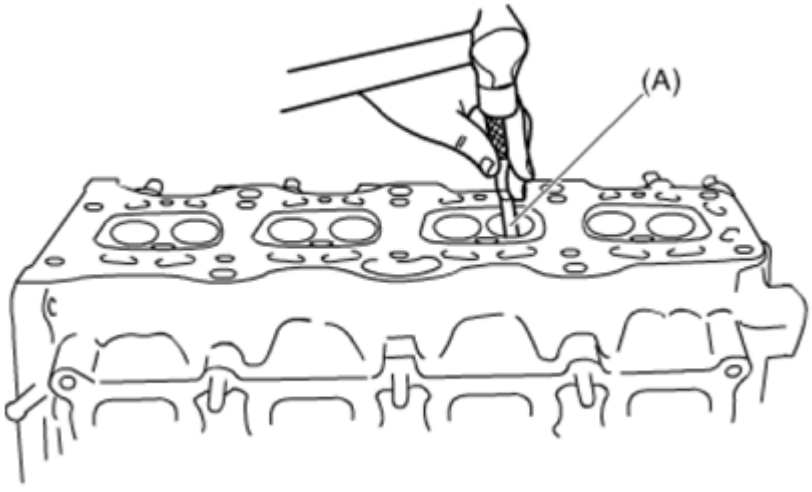


Fig. 127: Removing Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

Reassembly

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Reference: **VALVE AND VALVE GUIDE INSPECTION**

Reference: **CYLINDER HEAD INSPECTION**

Reference: **VALVE SPRING INSPECTION**

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

   CAUTION: Clean away shavings from reamed hole.

   Special Tool

   A. **09916-37320**
   B. **09916-34542**

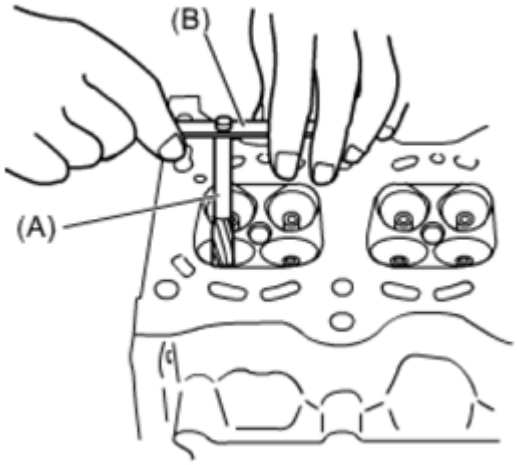


Fig. 128: Reaming Guide Hole With Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

2. Use special tools to install valve guide to cylinder head as follows.

   Special Tool

   A. **09916-58210**
   B. **09916-56510**

NOTE:

- **Never reuse valve guide.**

  Install new oversized valve guide.

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- **Intake and exhaust valve guides are identical.**

a. Uniformly heat cylinder head to a temperature of 80 to 100°C (176 to 212°F) so that it will not be distorted, and drive new valve guide into guide hole with special tools.
b. Install new valve guide until special tool contacts cylinder head.

After installation, make sure that valve guide protrudes from cylinder head by specified dimension "a".

CAUTION: The same special tool (B) is used to install intake valve guide and exhaust valve guide but the direction in which it is applied differs.

- **For intake valve guide**

  The side (2) should be directed to valve guide.

- **For exhaust valve guide**

  The side (1) should be directed to valve guide.

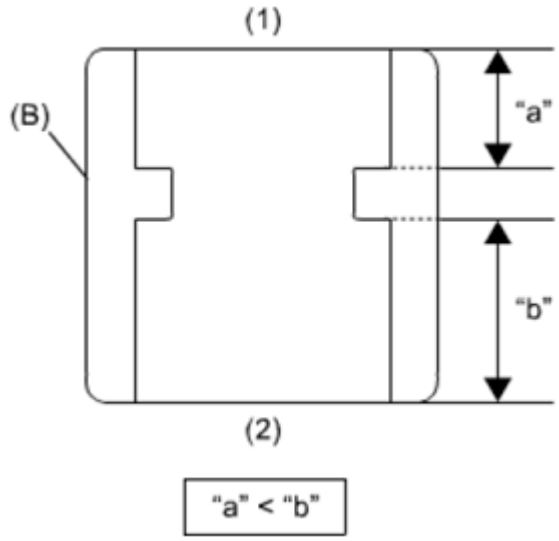


Fig. 129: Identifying Intake And Exhaust Valve Guide Dimension
Courtesy of SUZUKI OF AMERICA CORP.

Valve guide protrusion "a"

IN: 16.3 - 16.7 mm (0.642 - 0.657 in.)

EX: 12.3 - 12.7 mm (0.485 - 0.500 in.)

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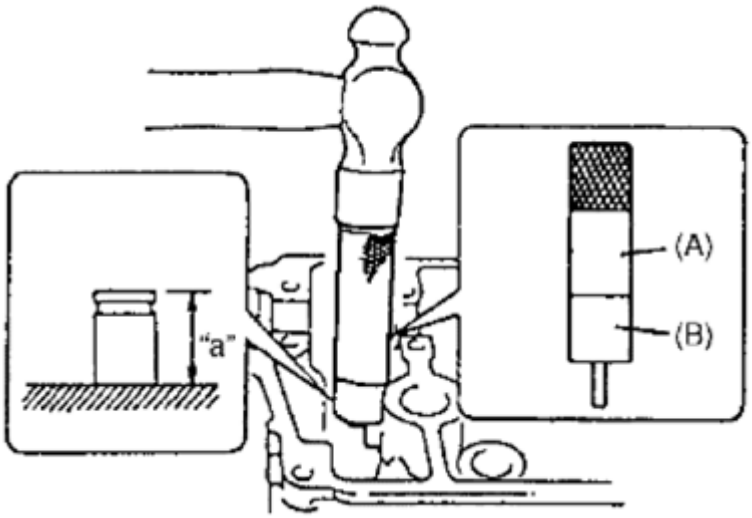


Fig. 130: Tapping Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

3. Ream valve guide bore with special tool.

CAUTION: Clean away shavings from reamed hole.

Special Tool

A. **09916-34550**
B. **09916-34542**

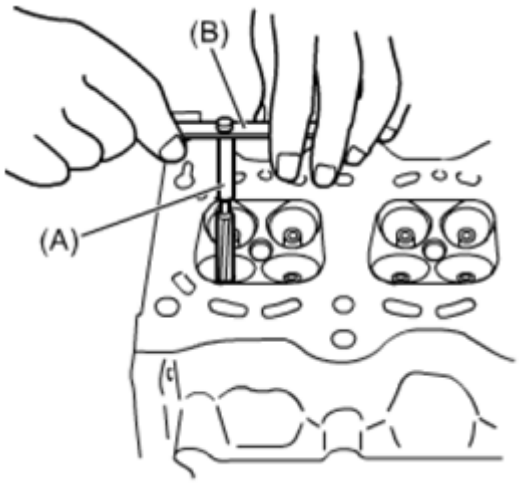


Fig. 131: Reaming Valve Guide Bore With Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

4. Install valve spring seat to cylinder head.

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5. Install new valve stem seal (1) to valve guide.

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

   After installation, check that valve stem seal is properly fixed to valve guide.

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

   Special Tool

   A. **09917-98221**
   B. **09916-58210**

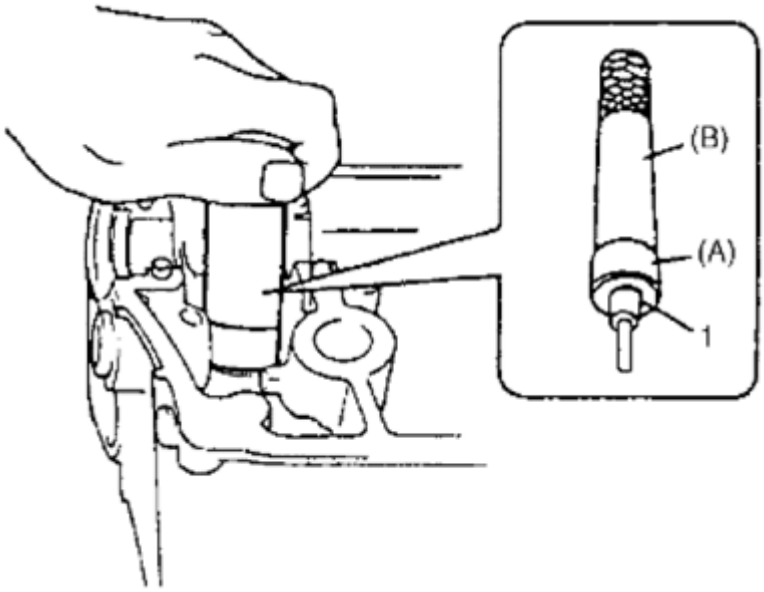


Fig. 132: Installing Valve Spring Seat To Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

6. Apply engine oil to valve stem, then install valve to valve guide.
7. Install valve spring and valve spring retainer.

   NOTE: Valve spring does not have specific direction for installation.

8. Use special tools to compress valve spring and fit two valve cotters (1) into groove in valve stem.

   CAUTION: When compressing the valve spring, be careful not to damage inside surface of the tappet installing hole.

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Special Tool

A. **09916-14510**
B. **09916-14522**
C. **09916-84511**

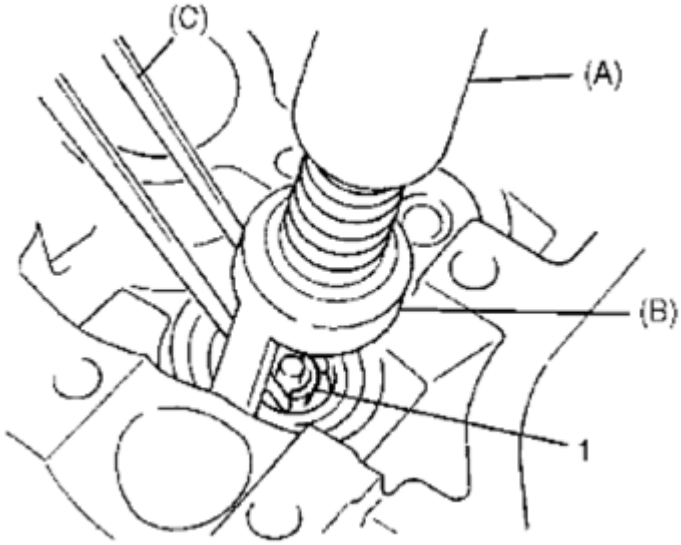


Fig. 133: Compressing Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

9. Install venturi plug (1).

Tightening torque

Venturi plug (a): 3.5 N.m (0.36 kg-m, 2.5 lbf-ft)

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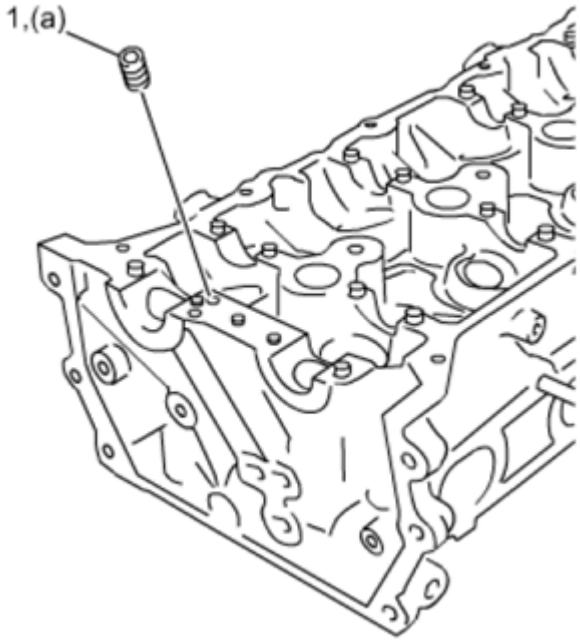


Fig. 134: Identifying Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND VALVE GUIDE INSPECTION

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

Valve Guide

Valve stem-to-guide clearance

- Take diameter readings on valve stems and guides with a micrometer and bore gauge to check system-to-guide clearance.
- Be sure to take reading at more than one place along the length of each stem and guide.
- Replace valve and valve guide if clearance exceeds limit.

Valve stem outside diameter

IN: 5.465 - 5.480 mm (0.2152 - 0.2157 in.)

EX: 5.440 - 5.455 mm (0.2142 - 0.2147 in.)

Valve guide inside diameter

IN & EX: 5.500 - 5.512 mm (0.2166 - 0.2170 in.)

Stem-to-guide clearance

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Standard

IN: 0.020 - 0.047 mm (0.0007 - 0.0018 in.)

EX: 0.045 - 0.072 mm (0.0017 - 0.0028 in.)

Limit

IN: 0.070 mm (0.0027 in.)

EX: 0.090 mm (0.0035 in.)



Fig. 135: Checking Valve Stem Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

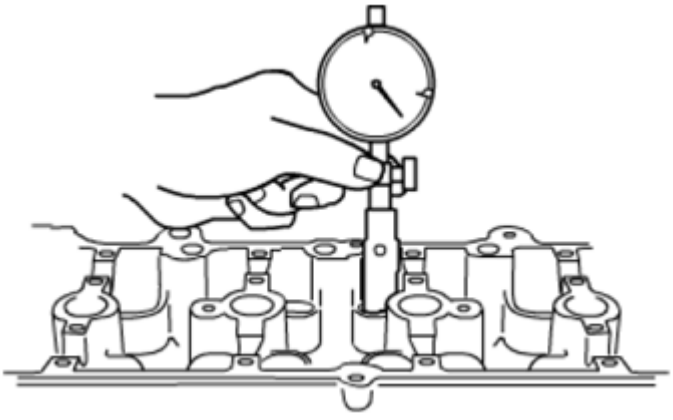


Fig. 136: Checking Valve Guide Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Valve stem end deflection

Check valve stem end deflection using a dial gauge.

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

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Replace valve and valve guide if deflection exceeds the limit.

Valve stem end deflection limit

In: 0.14 mm (0.0055 in.)

Ex: 0.18 mm (0.0070 in.)

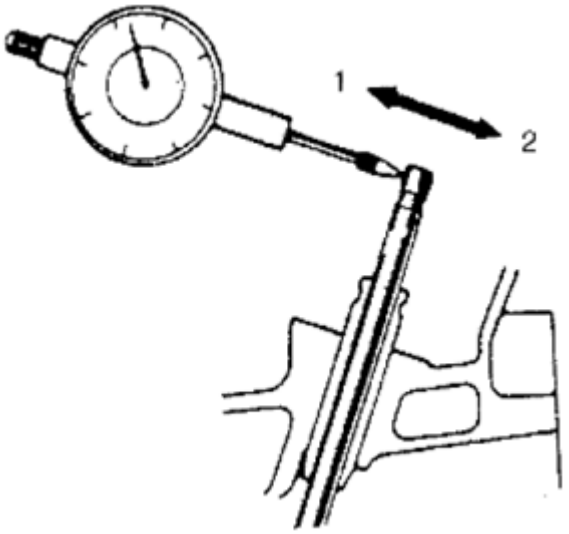


Fig. 137: Measuring End Deflection
Courtesy of SUZUKI OF AMERICA CORP.

Valve

Visual inspection

- Remove all carbon deposits from each valve (1).
- Check each valve for wear, burn or distortion at its face and stem end and replace if necessary.
- Measure valve protrusion length "a".

  Replace valve and/or cylinder head if measured length is out of standard value.

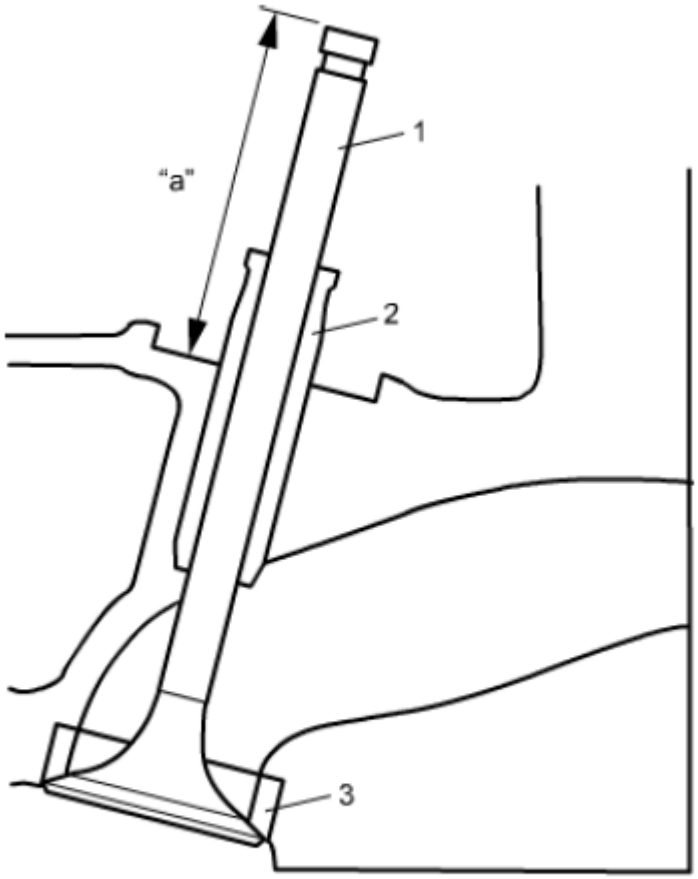
  Valve protrusion length "a"

  Standard

  IN: 44.00 - 44.60 mm (1.733 - 1.755 in.)

  EX: 42.85 - 43.45 mm (1.687 - 1.710 in.)

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2. Valve guide	3. Valve seat

Fig. 138: Measuring Valve Protrusion Length
Courtesy of SUZUKI OF AMERICA CORP.

Valve head radial runout

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

To check runout, rotate valve slowly.

Replace valve if runout exceeds the limit.

Valve head radial runout

Standard

IN: 0.000 - 0.045 mm (0.0000 - 0.0017 in.)

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EX: 0.000 - 0.030 mm (0.0000 - 0.0011 in.)

Limit

IN: 0.090 mm (0.0035 in.)

EX: 0.060 mm (0.0023 in.)

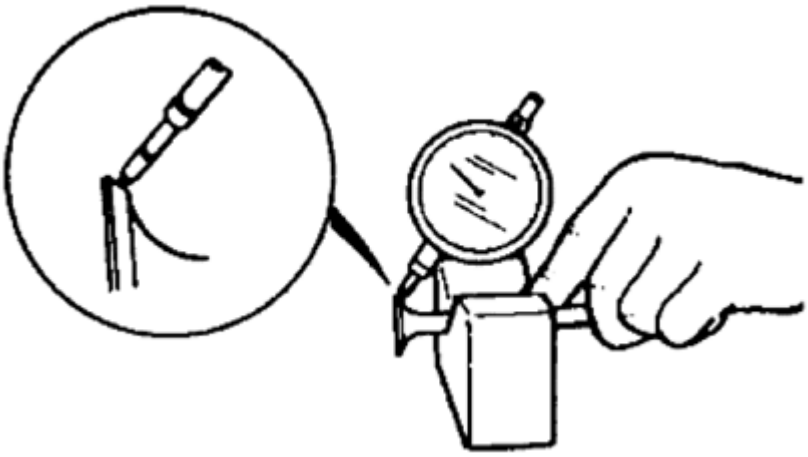


Fig. 139: Checking Valve Head Radial Runout
Courtesy of SUZUKI OF AMERICA CORP.

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 rotating and tapping seat with valve. Must use a valve lapper (tool use in valve lapping).

Pattern produced on seating surface 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

IN: 1.05 - 1.35 mm (0.0414 - 0.531 in.)

EX: 1.12 - 1.42 mm (0.0441 - 0.0559 in.)

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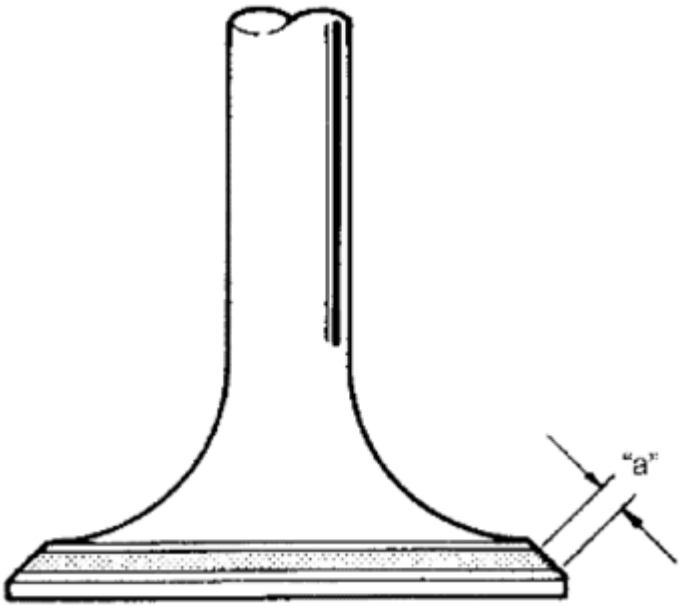


Fig. 140: Identifying Standard Seating Width
Courtesy of SUZUKI OF AMERICA CORP.

Valve seat repair

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

1. **Intake valve seat:**

   Use valve seat cutters to make three cuts as illustrated in figure. Must use three separate cutters: the 1st for making 22° 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 intake valve seat

   "a": 1.05 - 1.35 mm (0.0414 - 0.0531 in.)

2. **Exhaust valve seat:**

   Use valve seat cutters to make three cuts as illustrated in the figure. Three cutters must be used: the 1st for making 22° angle, the 2nd for making 65° angle, and 3rd for making 45° angle. Must make the 3rd cut (45°) to produce desired seat width.

   Seat width for exhaust valve seat

   "b": 1.12 - 1.42 mm (0.0441 - 0.559 in.)

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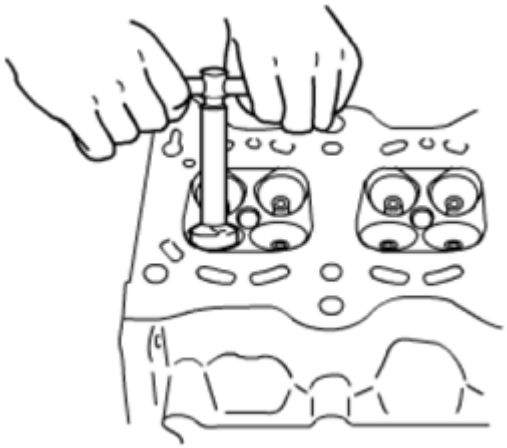
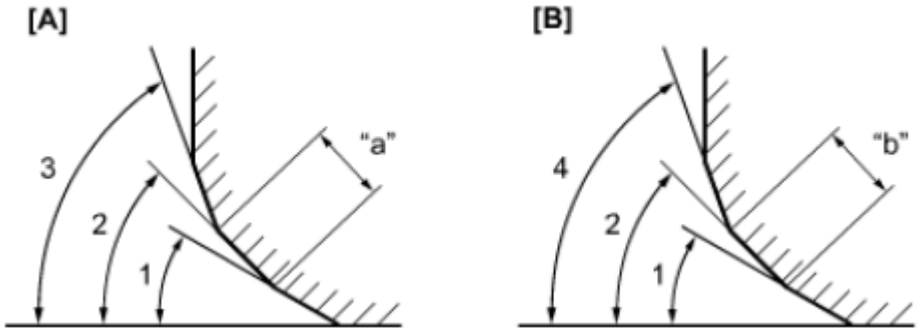


Fig. 141: Reaming Exhaust Valve Seat
Courtesy of SUZUKI OF AMERICA CORP.



[A]: Intake	1. 22°	3. 60°
[B]: Exhaust	2. 45°	4. 65°

Fig. 142: Identifying Exhaust Valve Seat Angle
Courtesy of SUZUKI OF AMERICA CORP.

3. **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.

Venturi Plug Inspection

Check that venturi plug passage is not clogged.

Clean or replace venturi plug if venturi plug passage is clogged.

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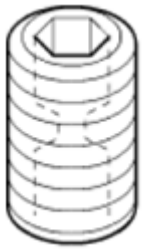


Fig. 143: Identifying Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD INSPECTION

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

Combustion Chamber

- Remove all carbon deposits from each combustion chamber.

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

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

Cylinder Head Flatness

Use a straightedge (1) and feeler gauge (2) to check flatness of gasket surface at a total of 6 locations. If any measured value exceeds its limit, correct gasket surface with a surface plate and abrasive paper #400 (Waterproof silicon carbide abrasive paper) by placing abrasive paper on and over surface plate and rubbing gasket surface against paper to grind off high spots.

Replace cylinder head if it is impossible to correct cylinder head distortion.

NOTE: Distorted mating surface of cylinder head and cylinder head gasket causes combustion gas and/or check cooling system for leakage, overheating and reduced power output.

Distortion of mating surface of cylinder head and cylinder head gasket

Limit: 0.03 mm (0.0011 in.)

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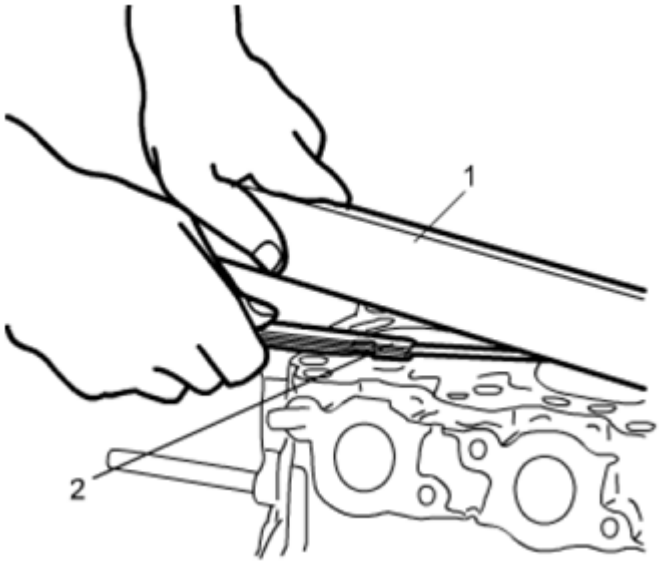


Fig. 144: Distortion Of Mating Surface Of Cylinder Head And Cylinder Head Gasket
Courtesy of SUZUKI OF AMERICA CORP.

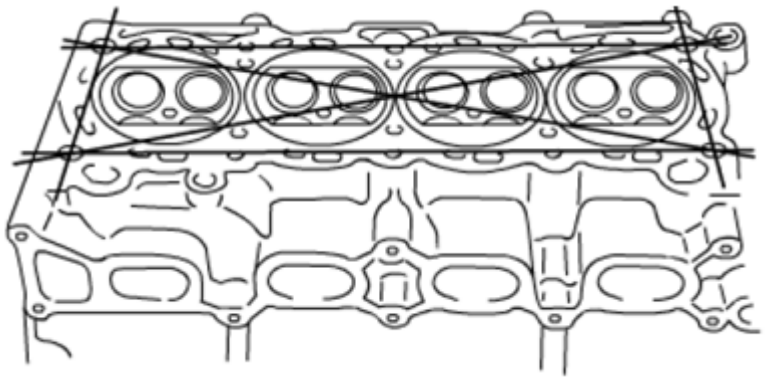


Fig. 145: Inspecting Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

Manifold Seating Surface Flatness

Use straightedge (1) and feeler gauge (2) to check flatness of manifold seating surface.

Correct seating surface or replace cylinder head if measured value exceeds its limit.

Distortion of seating face of intake manifold and exhaust manifold on cylinder head

Limit: 0.05 mm (0.0019 in.)

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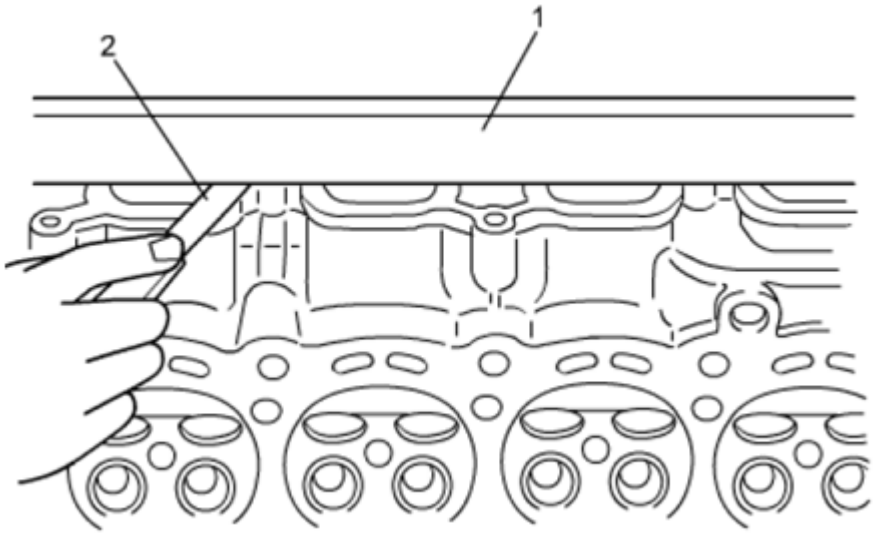


Fig. 146: Distortion Of Seating Face Of Intake Manifold And Exhaust Manifold On Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

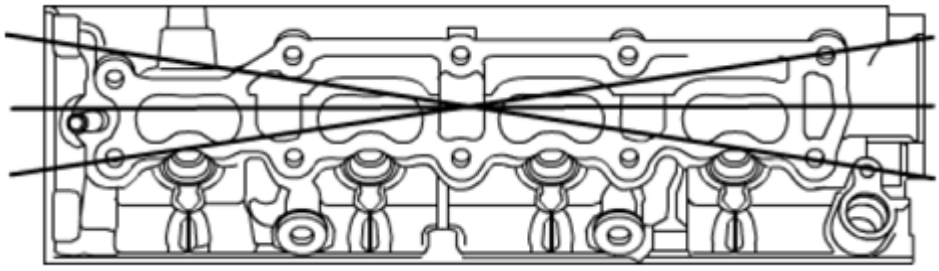


Fig. 147: Inspecting Intake And Exhaust Manifold
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD BOLT NO. 1 INSPECTION

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

NOTE: If cylinder head bolt No. 1 (1) is reused, check thread diameter for deformation as follows and replace it with a new one if thread diameter difference exceeds the limit:

Use a micrometer (3) to measure the thread diameter of each cylinder head bolt No. 1 "A" at "a" and "B" at "b".

Then calculate difference in diameters (A - B).

Replace cylinder head bolt No. 1 with new bolt if it exceeds limit.

Cylinder head bolt No. 1 diameter measurement points

"a": 95.0 mm (3.74 in.)

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"b": 130.0 mm (5.11 in.)

Cylinder head bolt No. 1 diameter difference (deformation)

Limit (A - B): 0.25 mm (0.0098 in.)

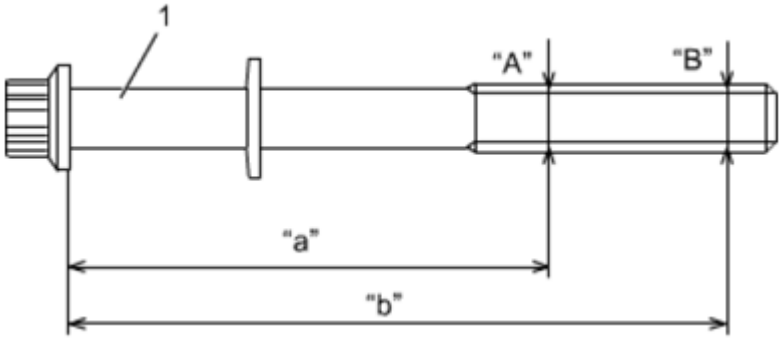
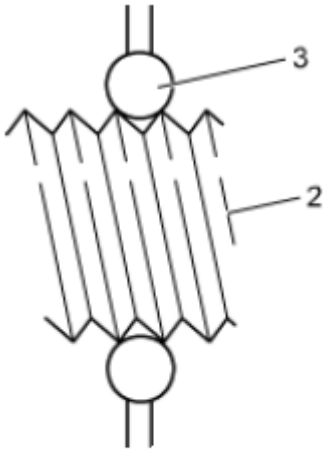


Fig. 148: Measuring Thread Diameter Of Cylinder Head Bolt
Courtesy of SUZUKI OF AMERICA CORP.



2. Thread

Fig. 149: Identifying Cylinder Head Bolt Thread
Courtesy of SUZUKI OF AMERICA CORP.

VALVE SPRING INSPECTION

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

Valve Spring Free Length and Preload

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- Check each valve spring for breakage or weakening.
- Measure valve spring free length and preload.

  Replace valve spring if measured value is less than limit.

NOTE: 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 "a"

Standard: 51.34 mm (2.021 in.)

Limit: 50.34 mm (1.981 in.)

Valve spring preload when compressed to 41.0 mm (1.61 in.)

Standard: 170 - 196 N (17.4 kgf - 19.9 kgf, 125.5 lbf - 144.0 lbf)

Limit: 165 N (16.9 kgf, 37.1 lbf)

Valve spring preload when compressed to 31.2 mm (1.22 in.)

Standard: 379 - 437 N (38.7 - 44.5 kgf, 279.5 - 322.0 lbf)

Limit: 375 N (38.2 kgf, 277.0 lbf)

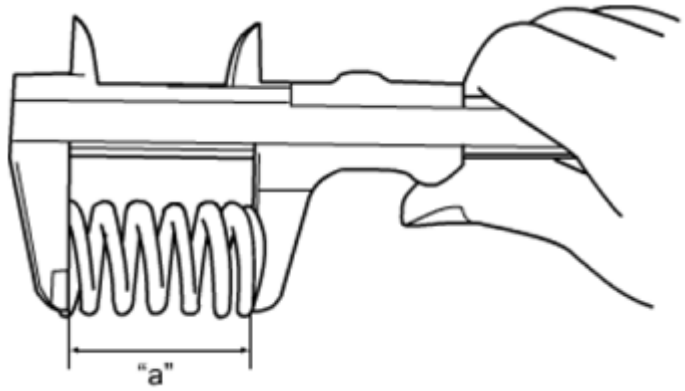


Fig. 150: Measuring Valve Spring Free Length
Courtesy of SUZUKI OF AMERICA CORP.

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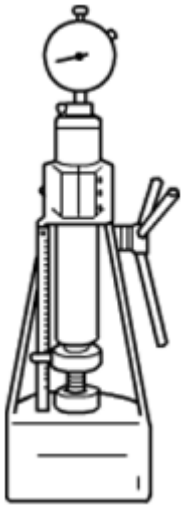


Fig. 151: Measuring Valve Spring Preload
Courtesy of SUZUKI OF AMERICA CORP.

Spring Squareness

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

Valve spring squareness

Limit: 2.2 mm (0.086 in.)

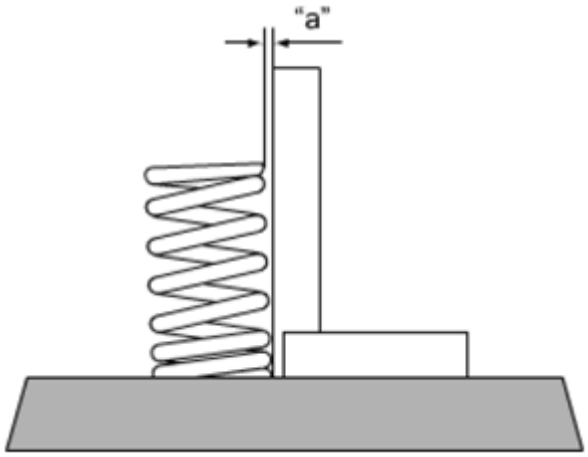
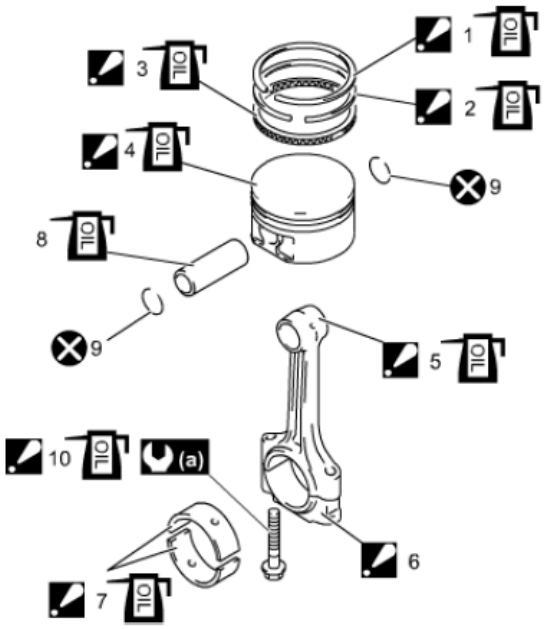


Fig. 152: Identifying Clearance Between End Of Valve Spring And Square
Courtesy of SUZUKI OF AMERICA CORP.

PISTON, PISTON RING AND CONNECTING ROD COMPONENTS

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1. 1st ring : For assembly, refer to ***Piston, Piston Ring and Connecting Rod Disassembly and Reassembly***. : Apply engine oil to sliding surface.	5. Connecting rod : Do not apply engine oil to mating surface between connecting rod bearing and connecting rod. : Apply engine oil to sliding surface.	9. Piston pin circlip
2. 2nd ring : For assembly, refer to ***Piston, Piston Ring and Connecting Rod Disassembly and Reassembly***. : Apply engine oil to sliding surface.	6. Connecting rod bearing cap : To install connecting rod cap, direct arrow on it to crank pulley. : Do not apply engine oil to mating surface between connecting rod bearing and connecting rod cap.	10. Connecting rod bearing cap bolt : Check connecting rod bearing cap bolt for deformation to reuse. : Apply engine oil to bolt thread and seat. : For tightening order, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation***.
3. Oil ring : For assembly, refer to ***Piston, Piston Ring and Connecting Rod Disassembly and Reassembly***. : Apply engine oil to sliding surface.	7. Connecting rod bearing : For applying engine oil, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation***.	(a): 15 N·m → +45° → +45° (1.5 kgf-m → +45° → +45°, 11.0 lbf-ft → +45° → +45°)
4. Piston : For assembly, refer to ***Piston, Piston Ring and Connecting Rod Removal and Installation***. : Apply engine oil to sliding surface.	8. Piston pin : Apply engine oil to sliding surface.	: Do not reuse.

Fig. 153: Identifying Piston, Piston Ring And Connecting Rod Components

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Courtesy of SUZUKI OF AMERICA CORP.

PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION

CAUTION: Parts must go back in the position where they were. Keep them in the following order:

- **Connecting rod**
- **Connecting rod bearing**
- **Connecting rod bearing cap**
- **Piston**

Removal

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

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. Remove oil pump, see **OIL PUMP ASSEMBLY REMOVAL AND INSTALLATION** .
4. Mark cylinder number on all pistons, connecting rods and connecting rod bearing caps using silver pencil or quick drying paint.
5. Remove connecting rod bearing caps.
6. Remove carbon deposits from tops of cylinder bores before removing pistons from cylinder.
7. Push piston and connecting rod assembly out through the top of cylinder bore.
8. 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**

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

CAUTION:

- **Apply engine oil to the following parts:**
  - **Crankshaft pin**
  - **Connecting rod bearing**
  - **Piston**
  - **Piston ring**
  - **Cylinder wall**
- **Install the following parts in the position where they were:**
  - **Connecting rod**
  - **Connecting rod bearing**
  - **Connecting rod bearing cap**

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- **Piston**

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

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

2. Install connecting rod bearing to connecting rod or bearing cap as follows:
   a. Fit tab (1) of connecting rod bearing to groove (2) of connecting rod or bearing cap.
   b. Press bearing end (3) until it fully seats in connecting rod or bearing cap.

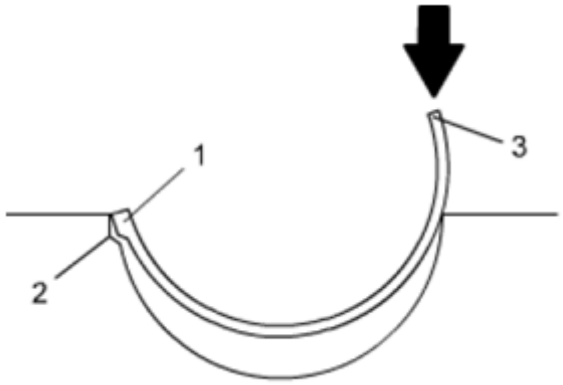
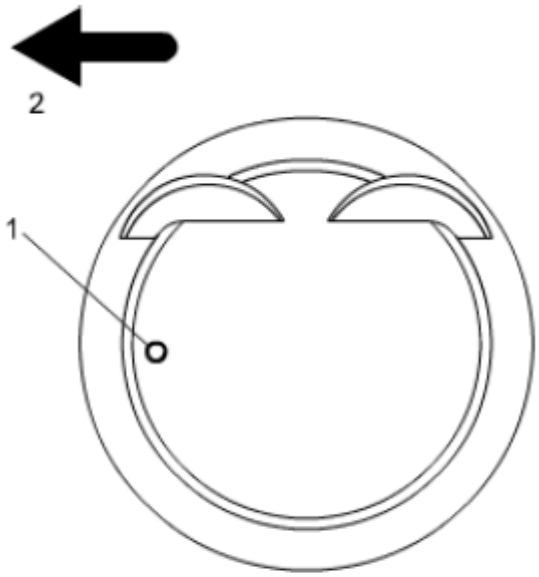


Fig. 154: Identifying Connecting Rod Bearing Installation Position
Courtesy of SUZUKI OF AMERICA CORP.

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

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2: Crankshaft pulley side

Fig. 155: Identifying Piston Mark
Courtesy of SUZUKI OF AMERICA CORP.

4. Install piston and connecting rod assembly into cylinder bore. Use special tool to compress rings. Guide connecting rod into place on crankshaft.

   Tap piston head with a hammer handle to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered in cylinder bore.

   Special Tool

   A. **09916-77310**

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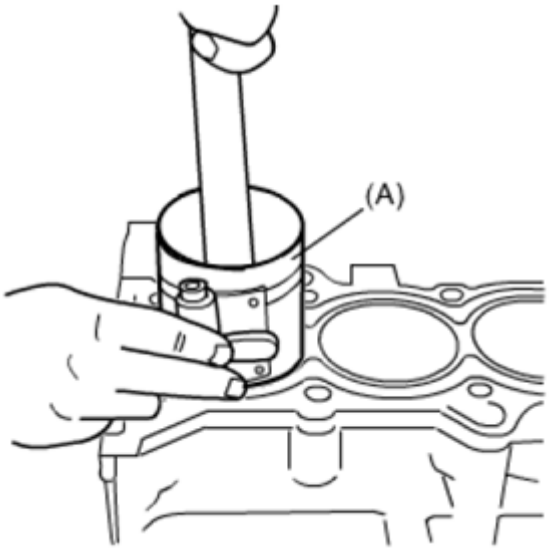


Fig. 156: Installing Piston And Connecting Rod Assembly Into Cylinder Bore
Courtesy of SUZUKI OF AMERICA CORP.

5. Install connecting rod bearing cap (1) as follows:

NOTE:

- **Before installing connecting rod bearing cap, check the cap bolts for deformation. Refer to "CONNECTING ROD BOLT DEFORMATION" under *Piston Pins and Connecting Rods Inspection* .**
- **Tighten connecting rod bearing cap bolt (3) gradually.**

a. Direct arrow mark (2) on connecting rod bearing cap (1) to crankshaft pulley side.
b. Apply engine oil to bolt thread and seat of connecting rod bearing cap bolt.
c. c) Tighten all connecting rod bearing cap bolts to 15 N.m (1.5 kgf-m, 11.0 lbf-ft) evenly and gradually.
d. Retighten them to 45° in the same manner as in Step c).
e. Retighten them to 45° in the same manner as in Step c).

Tightening torque

Connecting rod bolt* (a): 15 N.m --> +45° --> +45° (1.5 kgf-m --> +45° --> +45°, 11.0 lbf-ft --> +45° --> +45°

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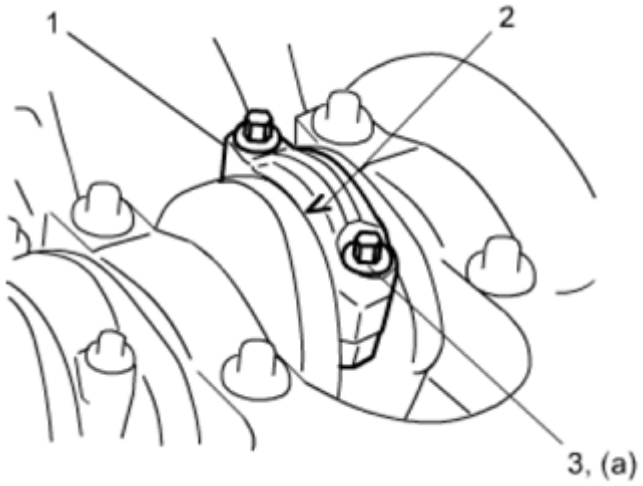


Fig. 157: Identifying Connecting Rod Bearing Cap Installation Position
Courtesy of SUZUKI OF AMERICA CORP.

6. Install oil pump, see **OIL PUMP ASSEMBLY REMOVAL AND INSTALLATION** .
7. Install cylinder head, see **Valve and Cylinder Head Removal and Installation**.
8. Install engine assembly, see **Engine Assembly Removal and Installation**.

PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY

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

CAUTION: Parts must be reassembled in the position where they were. Keep the following as a group for each cylinder:

- **Piston**
- **Piston pin**
- **Piston ring**
- **Connecting rod**
- **Connecting rod bearing**
- **Connecting rod bearing cap**

Disassembly

1. Use a piston ring expander to remove 1st and 2nd rings and oil ring from piston.
2. Remove piston pin from connecting rod as follows.
   a. Remove piston pin circlips (1), as shown.

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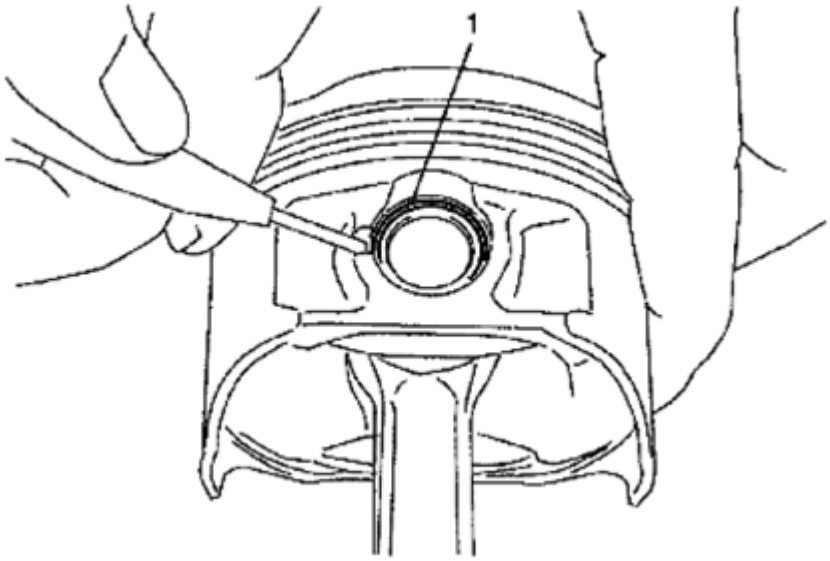


Fig. 158: Removing Piston Pin From Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

b. Remove piston pin.

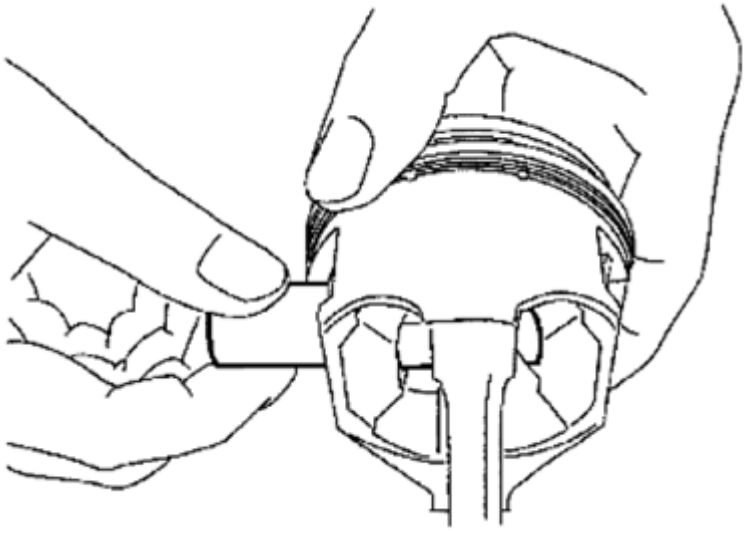


Fig. 159: Removing Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

Reassembly

Reference: **CYLINDER, PISTON AND PISTON RING INSPECTION**

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

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

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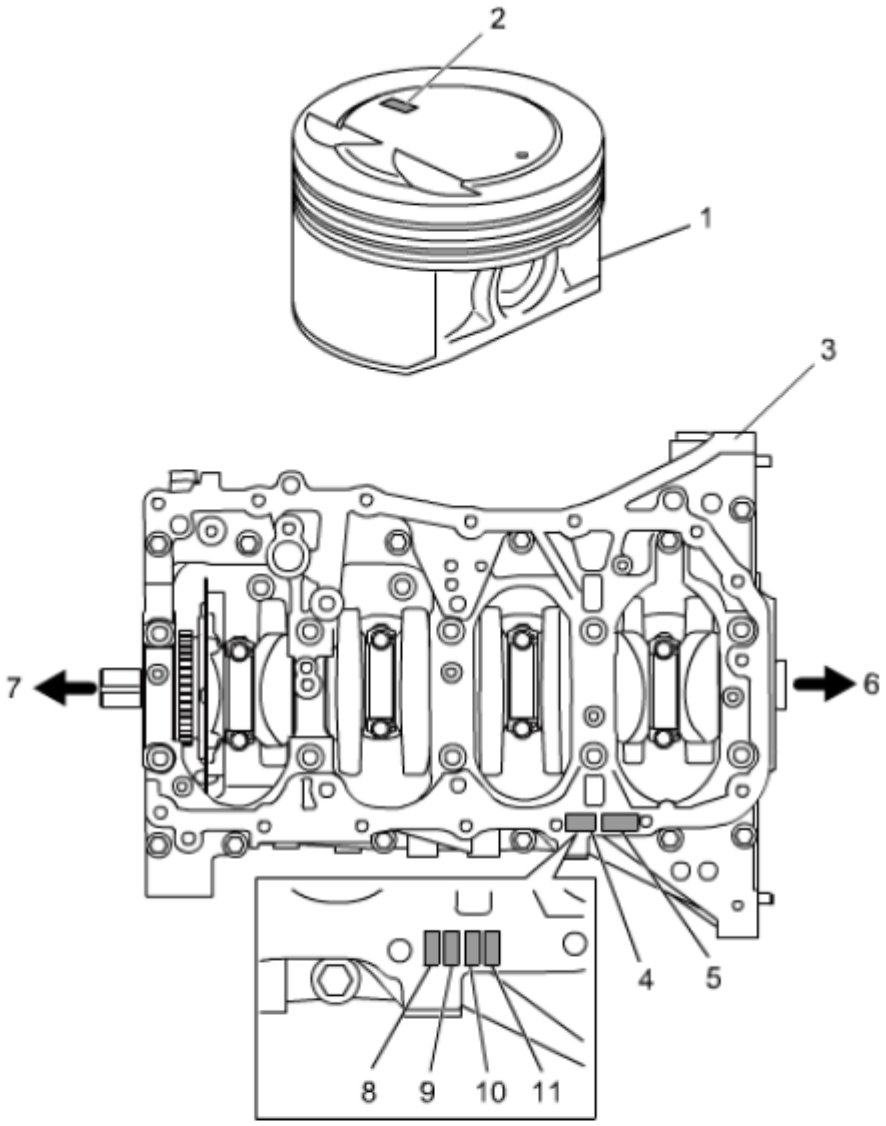
CAUTION:

- **Apply engine oil to the following parts:**
  - **Piston pin hole**
  - **Piston pin**
  - **Connecting rod small-end bore**
- **Reassemble the following parts in the position where they were:**
  - **Piston**
  - **Piston pin**
  - **Piston ring**
  - **Connecting rod**
  - **Connecting rod bearing**
  - **Connecting rod bearing cap**

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

1. To replace piston, select proper piston using the following procedures:
   a. Check stamped number (2) on piston (1) as shown in figure.
   b. Check stamped number (4) on lower crankcase (3) as shown in figure.

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5.	Stamped alphabet	9.	Cylinder No.2
6.	Transaxle side	10.	Cylinder No.3
7.	Crankshaft pulley side	11.	Cylinder No.4
8.	Cylinder No.1		

Fig. 160: Identifying Stamped Number On Piston
Courtesy of SUZUKI OF AMERICA CORP.

c. Stamped number on piston and stamped number on lower crankcase correspond with each other.

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Select proper piston referring the following table.

Piston selection table

PISTON SELECTION CHART

	Stamped number on lower crankcase	
	1	**2**
Stamped number on piston	1	2

2. Use a suitable tool to remove carbon deposit from piston head and ring grooves.
3. Assemble piston pin, piston (1) and connecting rod (2) as follows.
   a. Apply engine oil to piston pin, piston pin hole in piston and connecting rod.
   b. Fit connecting rod to piston.

NOTE: Be sure to position front mark (4) on piston and oil hole (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 circlip end gap comes within the range indicated by arrow (6).

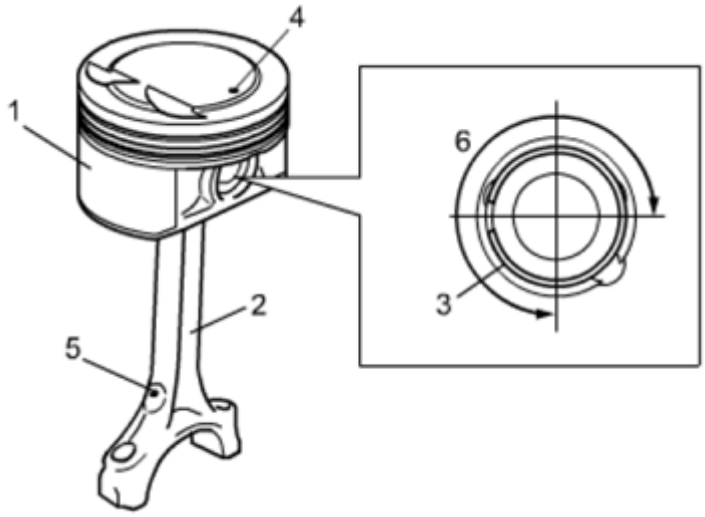


Fig. 161: Inserting Piston Pin To Piston And Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

4. Install piston rings to piston noting the following points:
   - As indicated in figure, 1st and 2nd rings have discrimination mark (1) respectively. When installing these piston rings to piston, direct discrimination mark side of each ring toward top of piston.

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- 1st ring (2) differs from 2nd ring (3) in thickness, shape and color of surface contacting cylinder wall.

  Refer to the figure to distinguish 1st ring from 2nd ring.

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

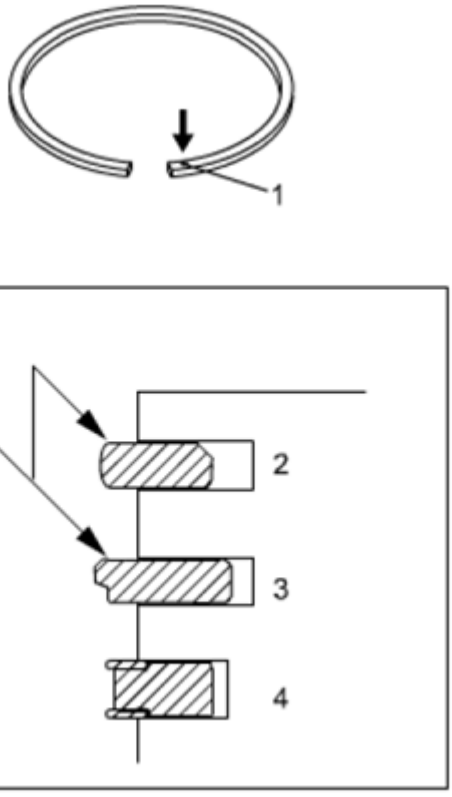
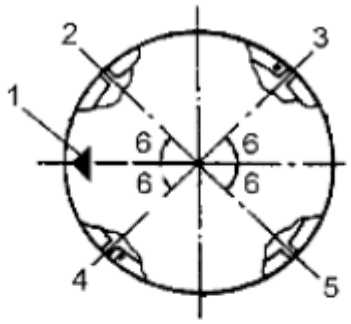


Fig. 162: Identifying Piston Ring Position
Courtesy of SUZUKI OF AMERICA CORP.

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

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1. Front mark	4. 2nd ring end gap and oil ring spacer gap
2. Oil ring upper rail gap	5. Oil ring lower rail gap
3. 1st ring end gap	6. 45°

Fig. 163: Identifying Piston Ring Gap
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER, PISTON AND PISTON RING INSPECTION

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

Cylinder

Visual inspection

Check cylinder walls for scratches, roughness or ridges which indicate excessive wear.

Replace cylinder block, piston rings and/or pistons if cylinder wall is too rough, deeply scratched or ridged.

Cylinder bore diameter, taper and out-of-round

Use cylinder gauge to measure cylinder bore in thrust and axial direction.

Replace cylinder block if any of the following conditions are discovered:

- Cylinder bore exceeds limit.
- Difference of measurements at two positions ([1] and [2]) exceeds taper limit.
- Difference between thrust [4] and axial [3] measurements exceeds roundness limit.

CAUTION: Replace cylinder block if any abnormality is found on cylinder inside

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wall.

NOTE: There are two sizes for cylinder bore, to keep clearance between piston and cylinder properly.
To distinguish standard value, refer to PISTON, PISTON RING AND CONNECTING ROD DISASSEMBLY AND REASSEMBLY.

Cylinder bore diameter

Standard

CYLINDER BORE DIAMETER SPECIFICATION

Stamped number on lower crankcase	1	92.0101 - 92.0200 mm (3.62245 - 3.62283 in.)
	2	92.0000 - 92.0100 mm (3.62205 - 3.62244 in.)

Cylinder bore diameter

Limit: 92.050 mm (3.6240 in.)

Cylinder bore roundness ([3] - [4])

Limit: 0.020 mm (0.00078 in.)

Cylinder bore taper ([1] - [2])

Limit: 0.013 mm (0.00051 in.)

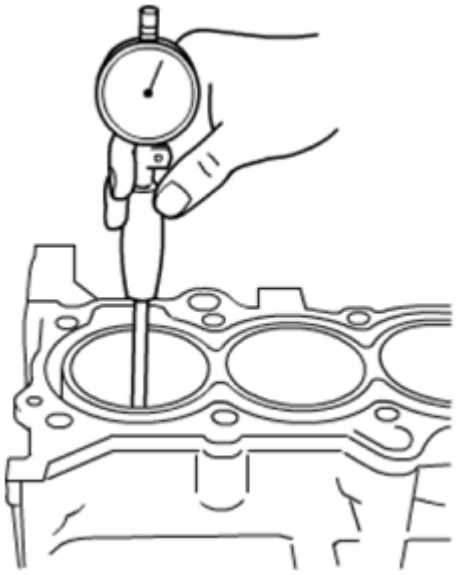
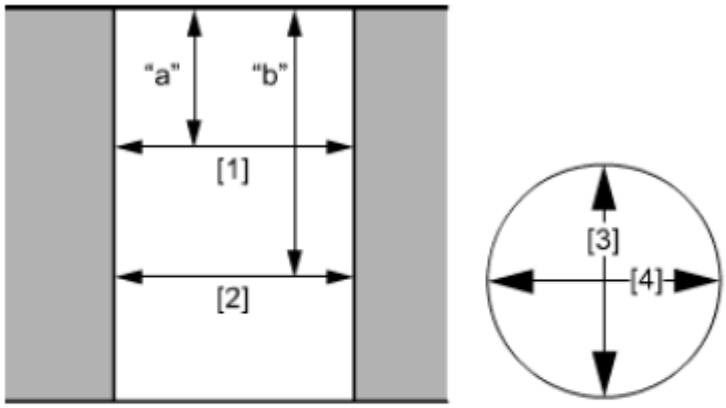


Fig. 164: Measuring Cylinder Bore Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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"a":	50 mm (1.96 in.)
"b":	100 mm (3.93 in.)

Fig. 165: Identifying Cylinder Bore Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Piston

NOTE: Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance.

Visual inspection

Inspect piston for cracks or other damages.

Replace piston if any abnormalities are found.

Piston diameter

As indicated in figure, piston diameter should be measured at specified position "a" 11.4 mm (0.448 in) from piston skirt end in the direction perpendicular to piston pin.

Replace piston if measured diameter is less than its limit.

New piston diameter standard size

PISTON DIAMETER SPECIFICATION

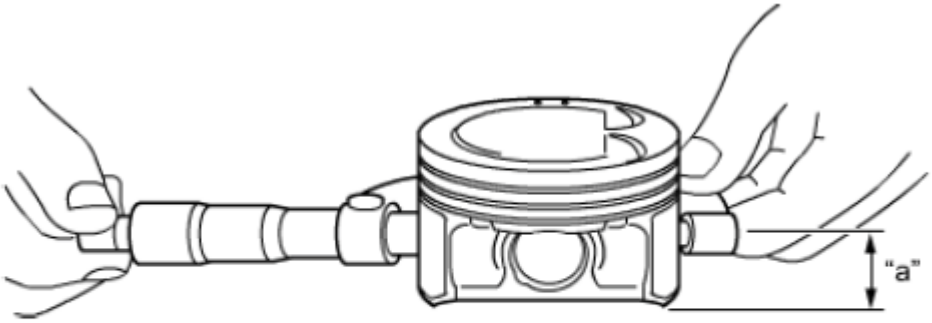
Stamped number on piston	1	91.950 - 91.960 mm (3.6200 - 3.6204 in.)
	2	91.940 - 91.950 mm (3.6196 - 3.6200 in.)

Piston diameter limit size

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PISTON DIAMETER SIZE SPECIFICATION

Stamped number on piston	1	91.940 mm (3.6196 in.)
	2	91.930 mm (3.6192 in.)



"a": 11.4 mm (0.449 in.)

Fig. 166: 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 its standard value.

Replace piston if it is out of limit.

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

Piston clearance

Limit: 0.12 mm (0.0047 in.)

Ring groove clearance

1. Before checking, piston grooves must be clean, dry and free from carbon deposits.
2. Fit new piston ring (1) into piston groove.
3. Use feeler gauge (2) to measure clearance between ring and ring land.

   Replace piston if clearance is out of limit.

   Ring groove clearance

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RING GROOVE CLEARANCE SPECIFICATION

	Standard	Limit
1st ring	0.04 - 0.08 mm (0.0015 - 0.0031 in.)	0.13 mm (0.0051 in.)
2nd ring	0.03 - 0.07 mm (0.0011 - 0.0027 in.)	0.11 mm (0.0433 in.)
Oil ring	0.035 - 0.175 mm (0.0014 - 0.0068 in.)	-

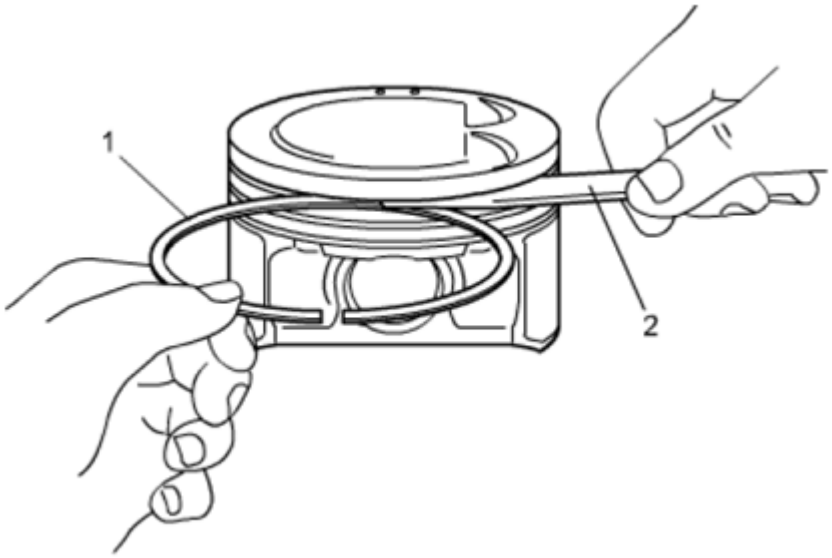


Fig. 167: Measuring Clearance Between Ring And Ring Land
Courtesy of SUZUKI OF AMERICA CORP.

Piston Ring

Piston ring end gap

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

Replace piston ring if measured gap exceeds limit.

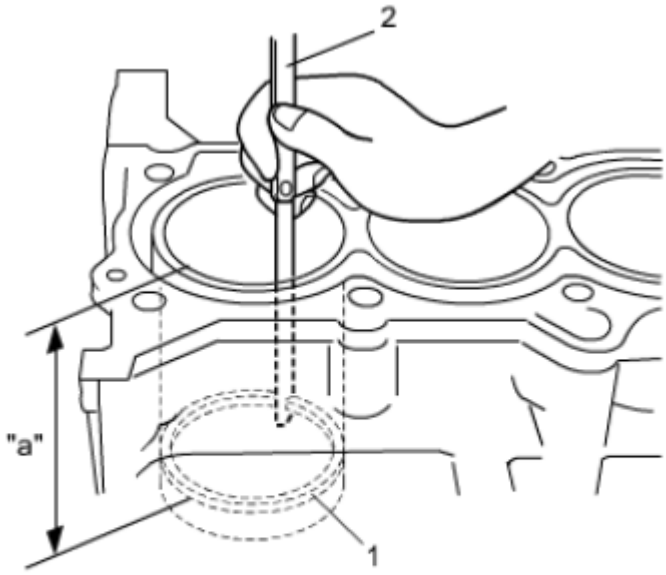
NOTE: Remove carbon deposit from top of cylinder bore before inserting piston ring.

Piston ring end gap

PISTON RING END GAP SPECIFICATION

Item	Standard	Limit
1st ring	0.20 - 0.33 mm (0.0078 - 0.0129 in.)	0.7 mm (0.0275 in.)
2nd ring	0.32 - 0.48 mm (0.0126 - 0.0188 in.)	0.7 mm (0.0275 in.)
Oil ring	0.20 - 0.50 mm (0.0078 - 0.0196 in.)	1.8 mm (0.0708 in.)

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"a". 120 mm (4.724 in.)

Fig. 168: 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 pin hole in piston for wear or damage, paying particular attention to condition of small-end bore bushing.

Replace piston pin, connecting rod and/or piston if piston pin, connecting rod small-end bore or piston pin hole in piston is badly worn or damaged.

Piston pin clearance

Check piston pin clearance in connecting rod 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: 0.003 - 0.017 mm (0.0002 - 0.0006 in.)

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Limit: 0.040 mm (0.0015 in.)

Piston pin clearance in piston

Standard: 0.010 - 0.016 mm (0.00039 - 0.00062 in.)

Limit: 0.05 mm (0.0019 in.)

Small-end bore

21.003 - 21.011 mm (0.82689 - 0.83720 in.)

Piston pin outside diameter

20.994 - 21.000 mm (0.82654 - 0.82677 in.)

Diameter of piston pin hole in piston

21.007 - 21.013 mm (0.82705 - 0.82728 in.)

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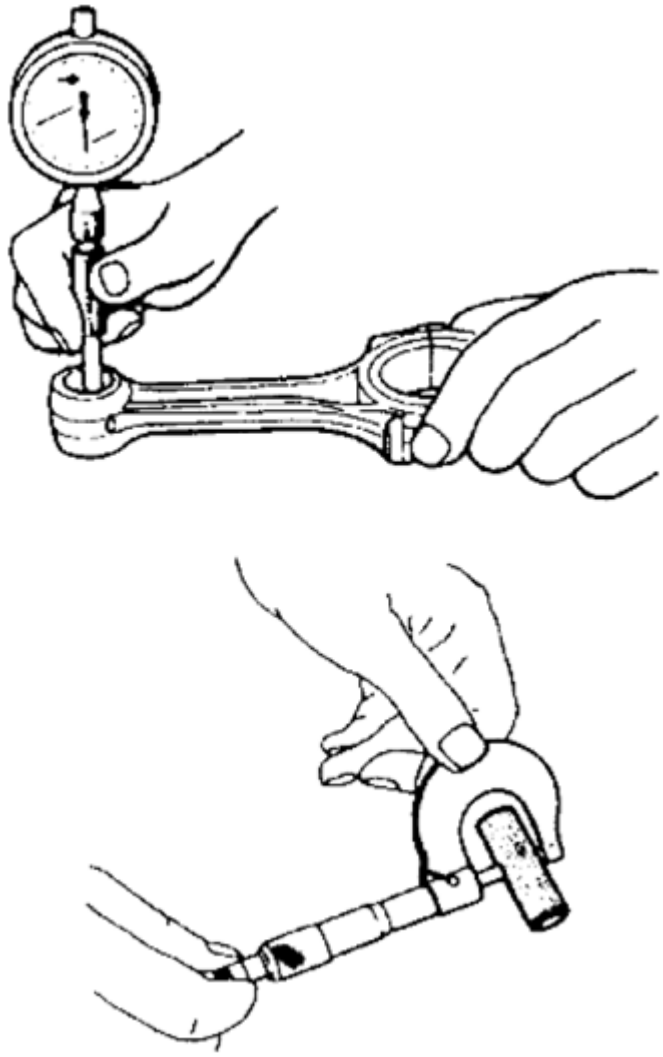


Fig. 169: Checking Piston Pin Clearance In Connecting Rod Small-End And Piston
Courtesy of SUZUKI OF AMERICA CORP.

Connecting Rod

Big-end side clearance

Check big-end side clearance of connecting rod, with rod fitted and connected to its crankshaft pin in the normal manner.

Replace connecting rod if measured clearance exceeds standard value.

Big-end side clearance

Standard: 0.25 - 0.40 mm (0.0098 - 0.0157 in.)

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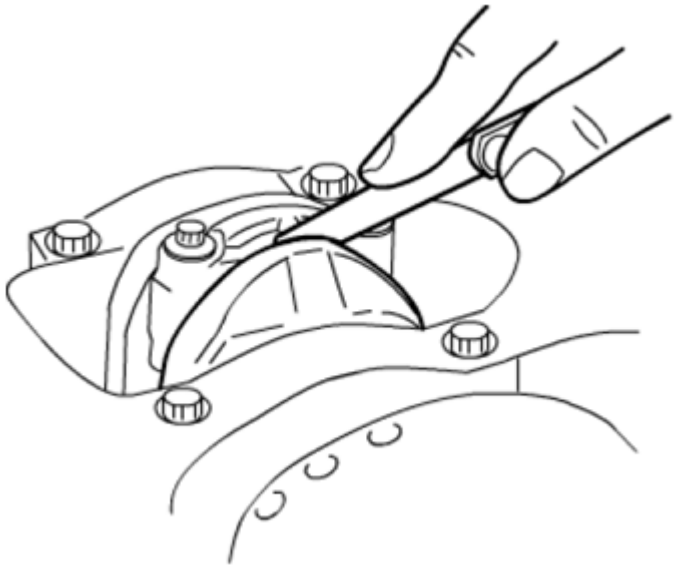


Fig. 170: Checking Big-End Side Clearance Of Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

Connecting rod alignment

Mount connecting rod on aligner to check for bow and twist.

Replace it if measured value exceeds the limit.

Connecting rod alignment

Limit on bow: 0.05 mm (0.0019 in.)

Limit on twist: 0.10 mm (0.0039 in.)

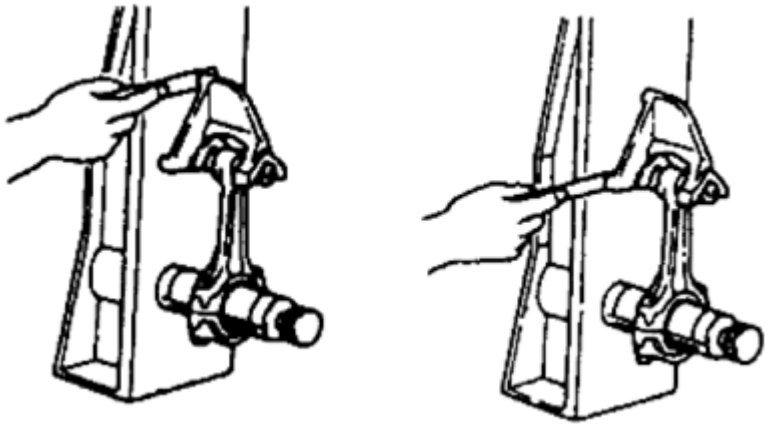


Fig. 171: Checking Connecting Rod Alignment
Courtesy of SUZUKI OF AMERICA CORP.

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Connecting rod bolt deformation

Use micrometer (3) to measure each thread, diameter of connecting rod bolt (1) "A" at "a" and "B" at "b".

Calculate difference in diameters ("A" - "B").

Replace connected rod bolt if it exceeds limit.

Connecting rod bolt measurement points

"a": 28.5 mm (1.12 in.)

"b": 42.0 mm (1.65 in.)

Connecting rod bolt diameter difference

Limit ("A" - "B"): 0.05 mm (0.0019 in.)

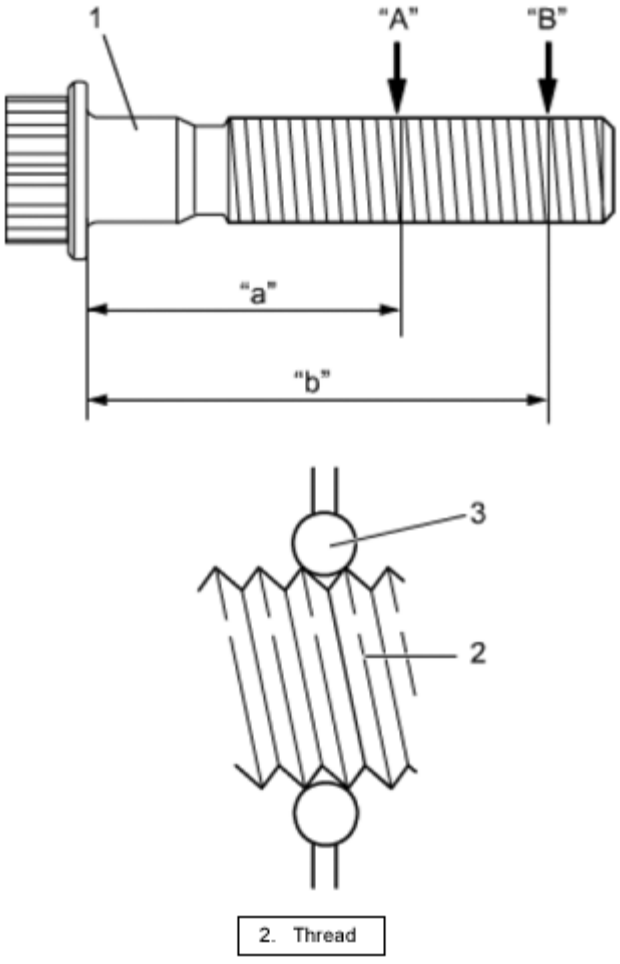


Fig. 172: Measuring Thread Diameter Of Connecting Rod Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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CRANKSHAFT PIN AND CONNECTING ROD BEARINGS INSPECTION

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

Crankshaft Pin Diameter

- Use micrometer to measure crankshaft pin diameter at several points and calculate taper and out-of-round conditions.

  Replace crankshaft or regrind crankshaft pin to undersize and use undersize bearing if calculated taper and/or out-of-round is out of their service limit.

CAUTION: If crankshaft pin is reground, new undersize bearings must be installed and bearing clearance must be checked.

Crankshaft pin diameter

Standard: 49.982 - 50.000 mm (1.9678 - 1.9685 in.)

Crankshaft pin taper ([a] - [b]) and out-of-round ([1] -[2])

Limit: 0.01 mm (0.0003 in.)

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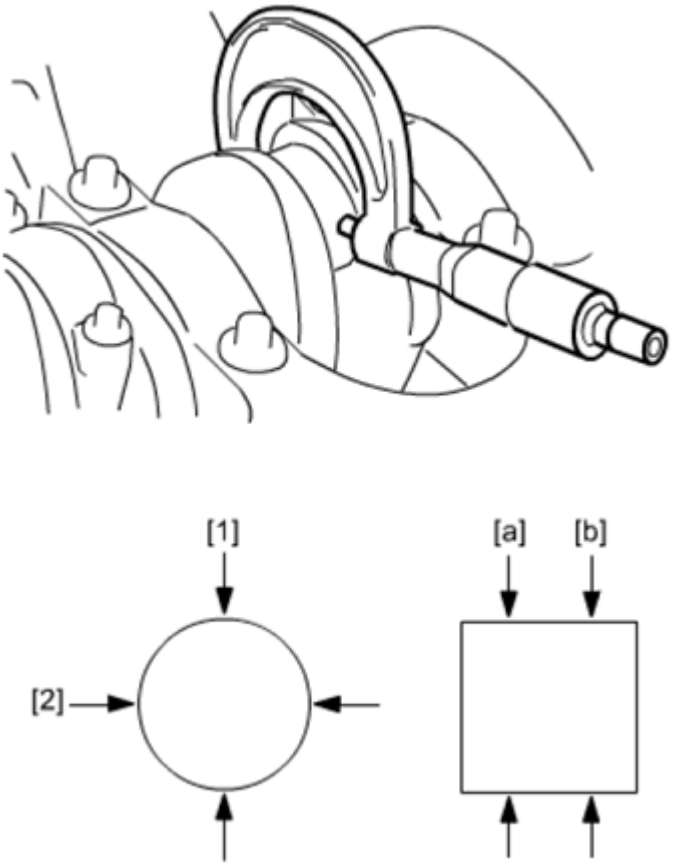


Fig. 173: Measuring Crankshaft Pin Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Connecting Rod Bearing General Information

- Service connecting rod bearings are available in five standard sizes and 0.25 mm (0.0098 in) undersize bearing. The difference of those sizes is thickness.
- Specified colors for identification of sizes are painted at specified location (1) as shown in figure.

BEARING THICKNESS SPECIFICATION

	Painted color	Bearing thickness
Standard size	Blue	1.494 - 1.497 mm (0.05882 - 0.05893 in.)
	Yellow	1.491 - 1.494 mm (0.05870 - 0.05881 in.)
	Colorless	1.488 - 1.491 mm (0.05859 - 0.05870 in.)
	Black	1.485 - 1.488 mm (0.05847 - 0.05858 in.)
	Green	1.482 - 1.485 mm (0.05835 - 0.05846 in.)
0.25 mm (0.0098 in) undersize	Red	1.605 - 1.615 mm (0.06319 - 0.06358 in.)

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Fig. 174: Identifying Connecting Rod Bearing Mark Location
Courtesy of SUZUKI OF AMERICA CORP.

Connecting Rod Bearing Visual Inspection

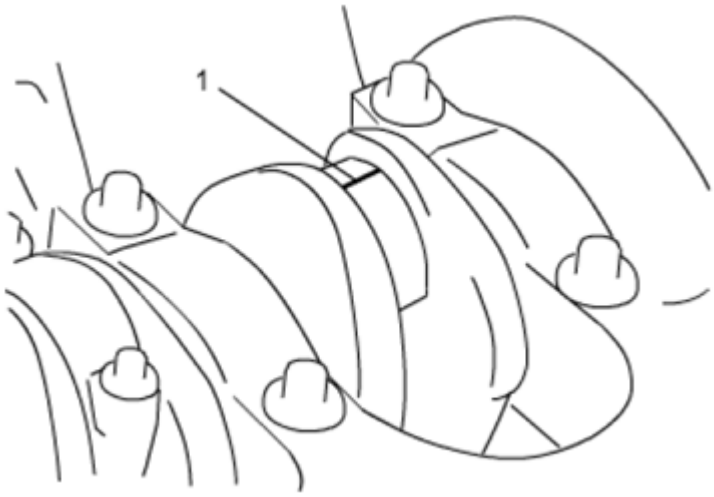
Check bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Replace connecting rod bearings if any abnormalities are found.

Connecting Rod Bearing Clearance

CAUTION: Do not rotate crankshaft while gauging plastic is installed.

NOTE: After checking connecting rod bearing clearance, check connecting rod bolt for deformation by referring to "CONNECTING ROD BOLT DEFORMATION" under *Piston Pins and Connecting Rods Inspection* .

1. Clean connecting rod bearings and crankshaft pin.
2. Place plastic gauge (1) with the same width as the crankshaft pin, so that it fits over the bearing, parallel to the crankshaft, avoiding the oil hole.



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Fig. 175: Identifying Plastic Gauge
Courtesy of SUZUKI OF AMERICA CORP.

3. Install connecting rod bearings and its cap.
4. After three minutes elapsed, remove cap and use a scale (2) on plastic gauge envelope to measure plastic gauge (1) width at the widest point.

Connecting rod bearing clearance

Standard: 0.045 - 0.063 mm (0.0017 - 0.0024 in.)

Limit: 0.065 mm (0.0025 in.)

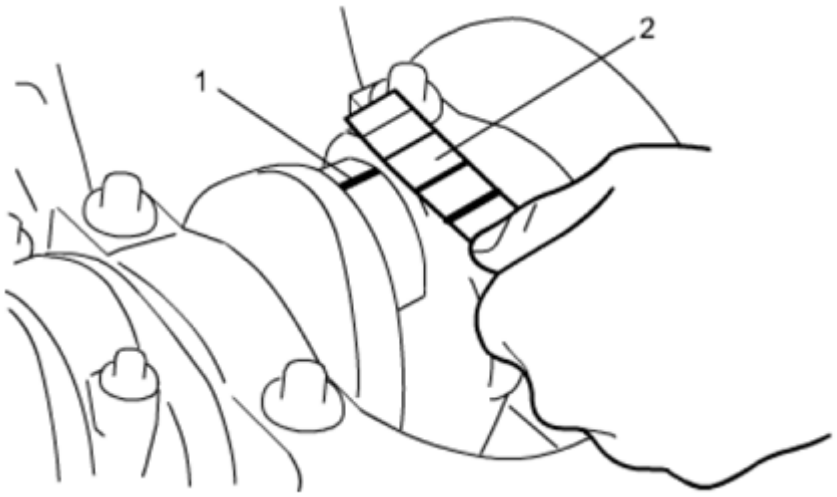


Fig. 176: Measuring Plastic Gauge Width Widest Point
Courtesy of SUZUKI OF AMERICA CORP.

If measured oil clearance is less than standard value or more than service limit, replace connecting rod bearings with new ones referring to **SELECTION OF CONNECTING ROD BEARINGS**, and recheck oil clearance.

Depending on measured oil clearance with new bearing, select other bearings using the following procedures and recheck oil clearance:

- More than standard:

  Replace bearings with one size thicker or regrind crankshaft pin to under size and use 0.25 mm (0.0098 in) undersize bearings.

- Less than standard:

  Replace bearings with one size thinner or regrind crankshaft pin to under size and use 0.25 mm (0.0098 in) undersize bearings.

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Selection of Connecting Rod Bearings

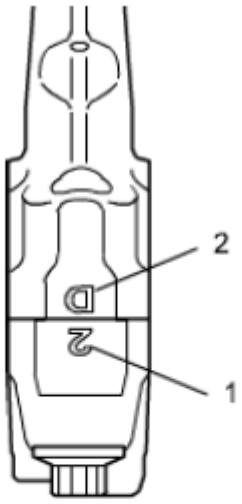
Standard size

1. Check connecting rod big-end inside diameter using the following procedures:
   - There is stamped number (any of "1", "2" or "3") on each connecting rod and it cap as shown in figure.
   - That number represent connecting rod big-end inside diameter as follows.

   Connecting rod big-end inside diameter

   CONNECTING ROD BIG-END INSIDE DIAMETER SPECIFICATION

Stamped number	Connecting rod big-end inside diameter
1	53.0000 - 53.0060 mm (2.08662 - 2.08685 in.)
2	53.0061 - 53.0120 mm (2.08686 - 2.08708 in.)
3	53.0121 - 53.0180 mm (2.08709 - 2.08732 in.)



1.	Connecting rod big-end inside diameter number
2.	Weight indication mark

Fig. 177: Identifying Stamped Number On Connecting Rod Cap
Courtesy of SUZUKI OF AMERICA CORP.

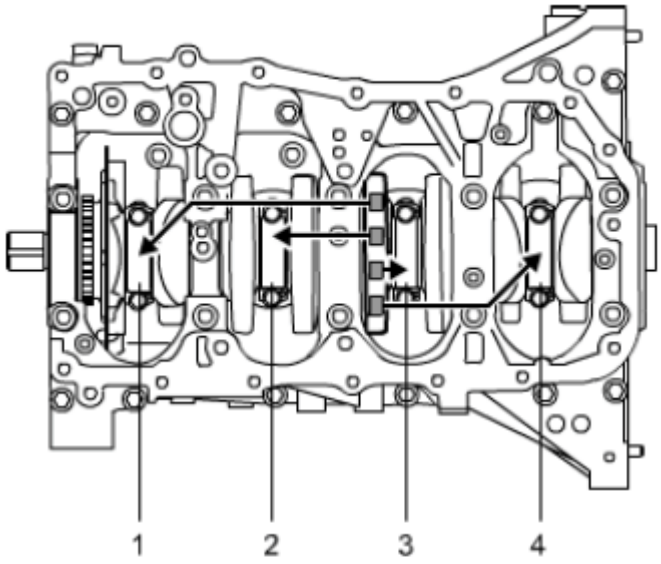
2. Check crankshaft pin diameter using the following procedures:
   - There are four stamped alphabets (any of "A", "B" or "C") on crank web No. 5 as shown in figure.
   - Those alphabets represent crankshaft pin diameter as follows:

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Crankshaft pin diameter

CRANKSHAFT PIN DIAMETER SPECIFICATION

Stamped alphabet	Crankshaft pin diameter
A	49.9940 - 50.0000 mm (1.96827 - 1.96850 in.)
B	49.9880 - 49.9939 mm (1.96804 - 1.96826 in.)
C	49.9820 - 49.9879 mm (1.96780 - 1.96802 in.)



1.	Crankshaft pin No.1
2.	Crankshaft pin No.2
3.	Crankshaft pin No.3
4.	Crankshaft pin No.4

Fig. 178: Identifying Crankshaft Pin
Courtesy of SUZUKI OF AMERICA CORP.

3. Determine new standard bearings to be installed to connecting rod big-end from numbers stamped on connecting rods and the caps and alphabets stamped on crank web No. 5 using the following table:

Connecting rod bearing cross-reference selection table

CONNECTING ROD BEARING CROSS-REFERENCE SELECTION CHART

	Stamped number for connecting rod big-end inside diameter		

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		1 or A	2 or B	3 or C
Stamped alphabet for crankshaft pin outside diameter	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue

Undersize

1. Determine target diameter of crankshaft pin for regrinding according to the following procedure.
   a. Assemble connecting rod, connecting rod cap and undersize bearings (0.25 mm (0.0098 in.)), referring to step 2) to 5) of "Installation" under ***Piston, Piston Ring and Connecting Rod Removal and Installation*** .
   b. Use a bore gauge to measure connecting rod bearing inside diameter "a".
   c. Calculate target diameter using the following formula:

      Formula for target diameter of crankshaft pin

      A = B - 0.054 mm (0.0021 in.)

      A: Target diameter of crankshaft pin B: Measured connecting rod bearing inside diameter "a" .

2. Grind crankshaft pin to target diameter.
3. Check connecting rod bearing oil clearance.

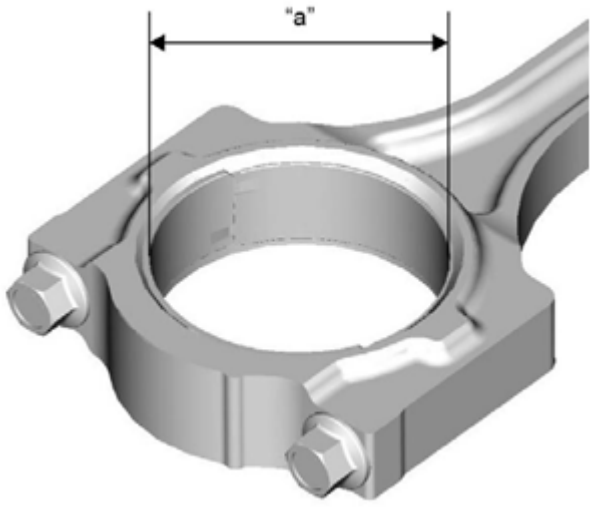
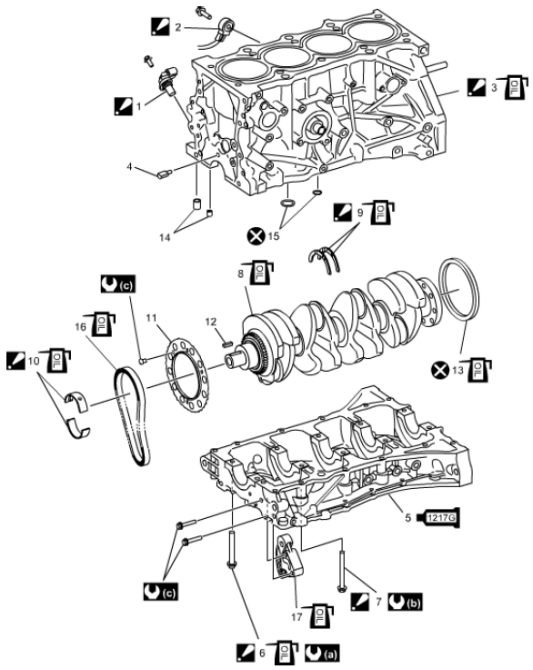


Fig. 179: Measuring Connecting Rod Bearing Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

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1. CKP sensor : For removal and installation, refer to ***CKP Sensor Removal and Installation***.	8. Crankshaft : Apply engine oil to sliding surface	15. O-ring
2. Knock sensor : For removal and installation, refer to ***Knock Sensor Removal and Installation***.	9. Thrust bearing : Install thrust bearing with oil grooves facing out.: Apply engine oil to sliding surface.	16. Oil pump chain : Apply engine oil to sliding surface.
3. Cylinder block : Do not apply engine oil to main bearing seating face. : Apply engine oil to sliding surface	10. Main bearing : For applying engine oil, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation***.	17. Oil pump chain adjuster : Apply engine oil to sliding surface.
4. Timing chain oil jet	11. Sensor plate	(a): 50 N·m → 0 N·m → 20 N·m → 35 N·m → +40° → +40° (5.1 kgf-m → 0 kgf-m → 2.0 kgf-m → 3.6 kgf-m → +40° → +40°, 37.0 lbf-ft → 0 lbf-ft → 15.0 lbf-ft → 26.0 lbf-ft → +40° → +40°)
5. Lower crankcase : Apply sealant 99000-31260 referring to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation***.	12. Crankshaft timing sprocket key	(b): 25 N·m (2.5 kgf-m, 18.5 lbf-ft)
6. Crankcase bolt No.1 : Check crankcase bolt No.1 for deformation to reuse. : Apply engine oil to bolt thread and seat.: For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation***.	13. Rear oil seal : Apply engine oil to oil seal lip.	(c): 11 N·m (1.1 kgf-m, 8.5 lbf-ft)
7. Crankcase bolt No.2 : For tightening order, refer to ***Main Bearings, Crankshaft and Cylinder Block Removal and Installation***.	14. Dowel pin	: Do not reuse.

Fig. 180: Identifying Main Bearing, Crankshaft And Cylinder Block Components
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION

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

CAUTION: Parts must go back in the position where they were. Keep them in the following order:

- **Main bearing**
- **Thrust bearing**

Removal

1. Remove engine assembly, see **Engine Assembly Removal and Installation**.
2. Remove flywheel for M/T model or drive plate for CVT model, see **Flywheel/Drive Plate Removal and Installation**.
3. Remove generator, see **GENERATOR REMOVAL AND INSTALLATION** .
4. Remove water pump, see **WATER PUMP REMOVAL AND INSTALLATION** .
5. Remove engine front mounting bracket (1).

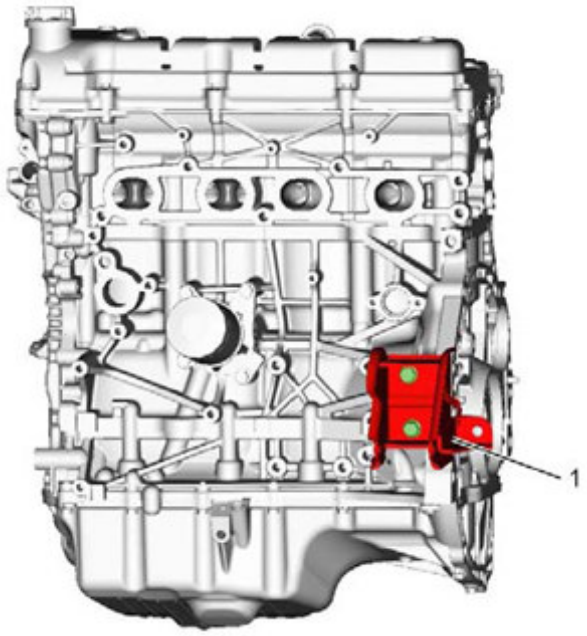


Fig. 181: Identifying Engine Front Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove piston and connecting rod, see **Piston, Piston Ring and Connecting Rod Removal and Installation**.
7. Remove oil pump chain adjuster (1) from lower crankcase.

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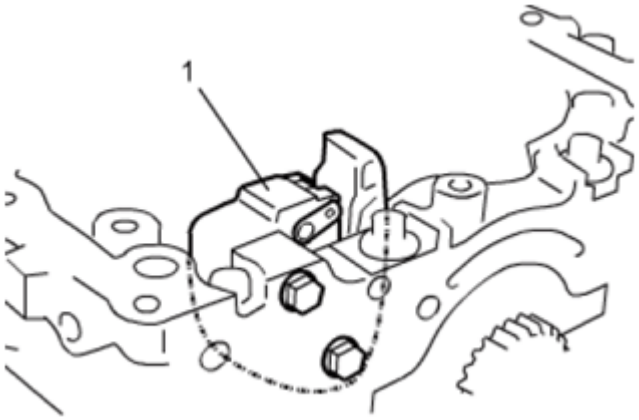


Fig. 182: Identifying Oil Pump Chain Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove CKP sensor, see **CKP SENSOR REMOVAL AND INSTALLATION** .
9. Loosen crankcase bolt No. 2s in numerical order ("1" - "12") evenly and gradually.

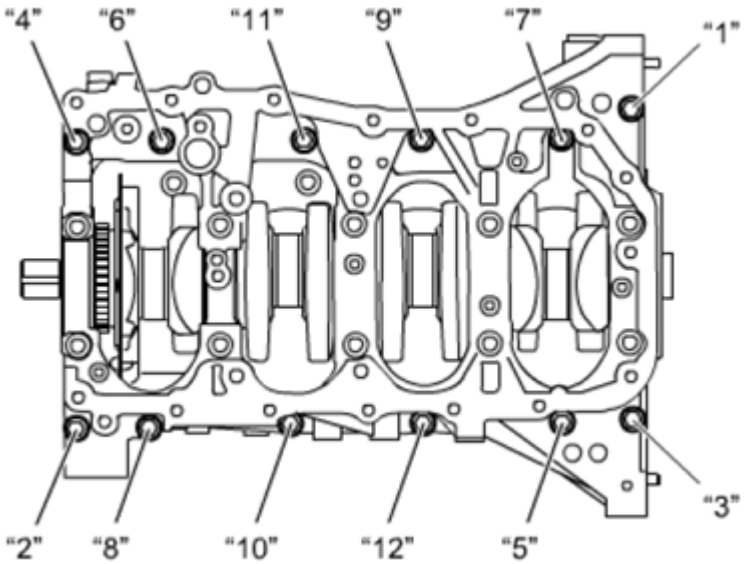


Fig. 183: Identifying Crankcase Bolt
Courtesy of SUZUKI OF AMERICA CORP.

10. Loosen crankcase bolt No. 1s in numerical order ("1" - "10") evenly and gradually, and then remove lower crankcase and rear oil seal.

NOTE: Use 12-point socket wrench for crankcase bolt No. 1s.

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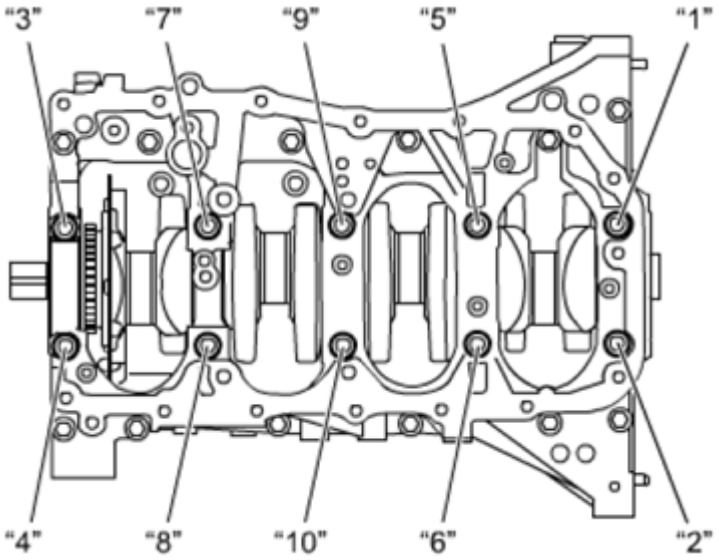


Fig. 184: Identifying Crankcase Bolt
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove crankshaft and oil pump chain from cylinder block.
12. Remove sensor plate (2) from crankshaft (1), if necessary.

NOTE: Use T-30 security TORX® to loosen sensor plate screws (3).

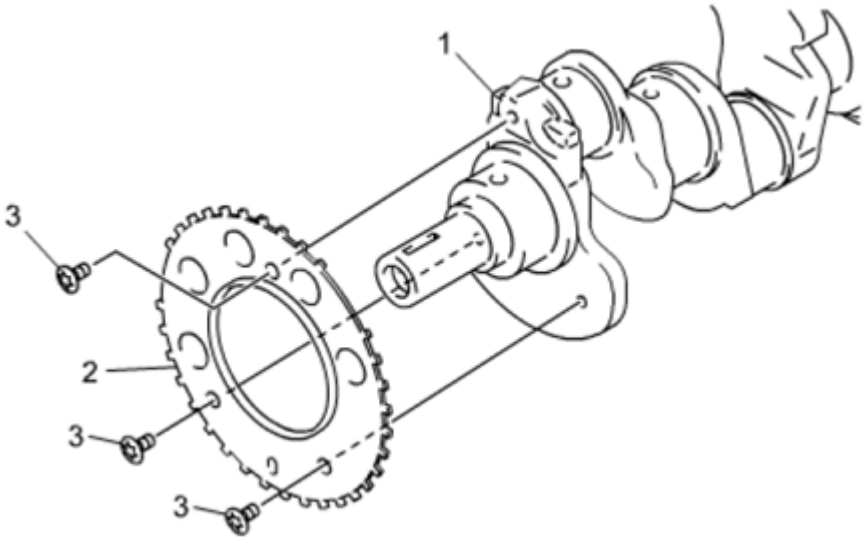


Fig. 185: Identifying Sensor Plate And Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **CRANKSHAFT INSPECTION**

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Reference: **MAIN BEARINGS INSPECTION**

Reference: **SENSOR PLATE INSPECTION**

Reference: **FLYWHEEL/DRIVE PLATE INSPECTION**

Reference: **CYLINDER BLOCK INSPECTION**

Reference: **OIL PUMP DRIVE SPROCKET INSPECTION**

Reference: **OIL PUMP CHAIN AND OIL PUMP CHAIN ADJUSTER INSPECTION**

CAUTION:
- **Apply engine oil to the following parts:**
  - **Crankshaft journal**
  - **Main bearing**
  - **Thrust bearing**
  - **Oil pump chain adjuster**
- **Do not apply engine oil to the following spots:**
  - **Contact surfaces between main bearing and cylinder block**
  - **Contact surfaces between main bearing and lower crankcase**
  - **Contact surfaces between connecting rod bearing and connecting rod**
  - **Contact surfaces between connecting rod bearing and connecting rod cap**
- **Install the following parts in the position where they were:**
  - **Main bearing**
  - **Thrust bearing**

1. Install sensor plate (1) using the following procedure:
   a. Attach spring pin (2) to crankshaft (3).

NOTE: **Use spring pin of genuine SUZUKI part (09205-05006).**

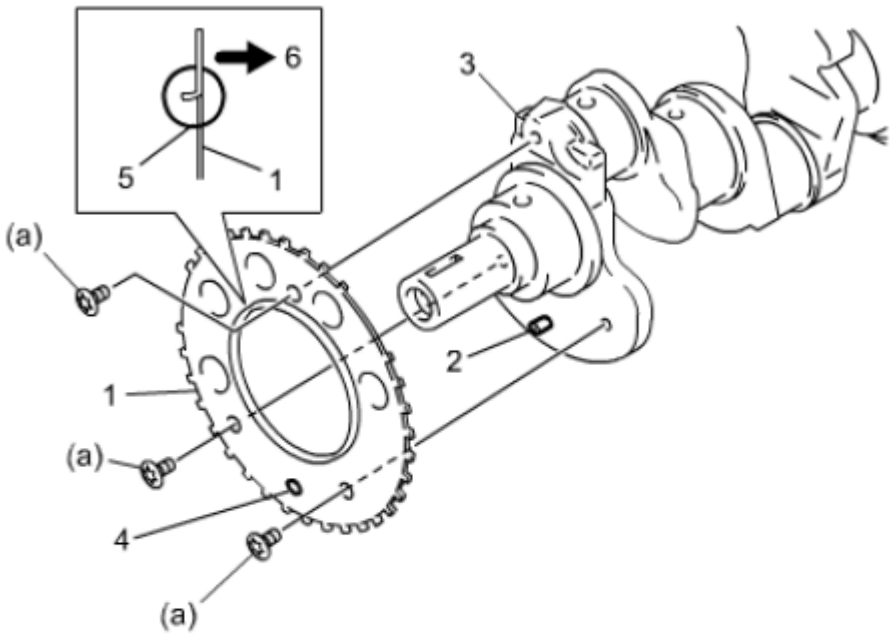
   b. Install sensor plate to crankshaft.

CAUTION:
- **Align spring pin hole (4) on sensor plate with spring pin on crankshaft.**
- **Inside edge (5) of sensor plate is bent. Install sensor plate properly.**

Tightening torque

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Sensor plate screw (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)



6. Crankshaft side

Fig. 186: Identifying Spring Pin And Crankshaft With Sensor Plate Screw
Courtesy of SUZUKI OF AMERICA CORP.

c. Detach spring pin from crankshaft.

2. Install main bearings to cylinder block or lower crankcase using the following procedures:

NOTE:
- **Install main bearing halves with oil groove to cylinder block.**
- **Install other main bearing halves to lower crankcase.**

a. Fit the tab (1) on each bearing into recess (2) in cylinder block or lower crankcase.
b. Press bearing end (3) until it is firmly seated on the cylinder block or lower crankcase.
c. Apply engine oil to sliding surface (4) of main bearing halves.

CAUTION: Do not apply engine oil between bearing halves (5) and cylinder block or lower crankcase (5).

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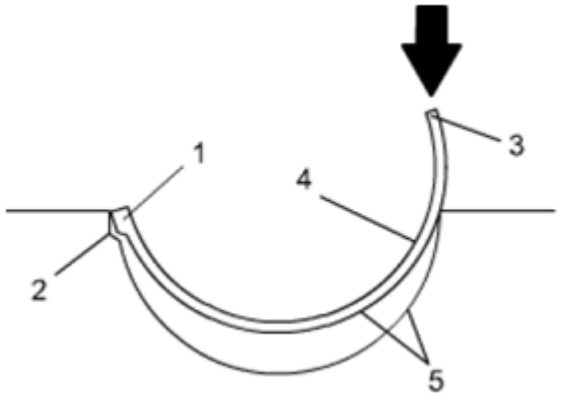


Fig. 187: Identifying Bearing Installation Position
Courtesy of SUZUKI OF AMERICA CORP.

3. Install new O-rings (1) to cylinder block (3).
4. Install dowel pins (2) to cylinder block (3).

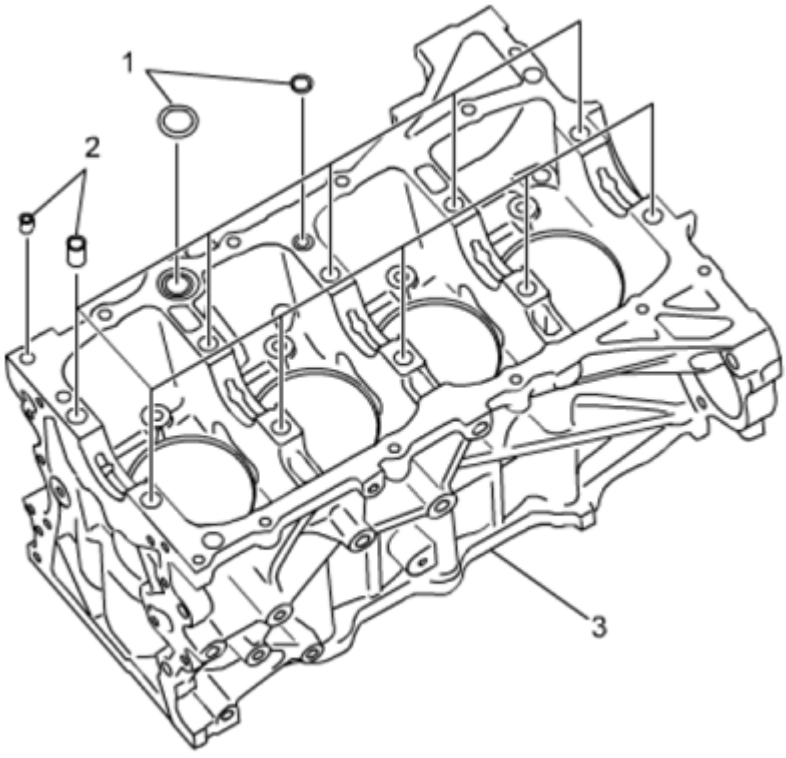


Fig. 188: Identifying Dowel Pins And Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

5. Apply engine oil to thrust bearings (1) and install them to cylinder block journal No. 3, with oil grooves (2) facing outward.

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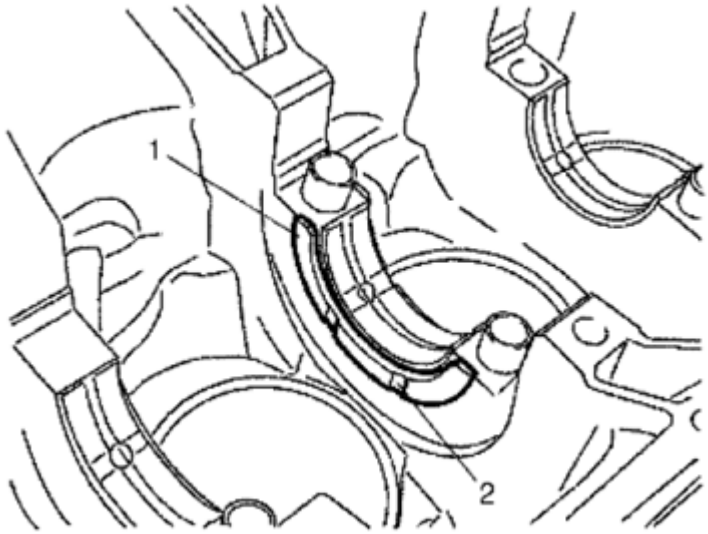


Fig. 189: Identifying Thrust Bearings
Courtesy of SUZUKI OF AMERICA CORP.

6. Apply engine oil to sliding surface of main bearings and crankshaft.
7. Install crankshaft to cylinder block, with oil pump chain installed to oil pump drive sprocket on crankshaft.
8. Apply sealant to mating surface of lower crankcase (1) as shown in figure.

NOTE:

- **Before applying sealant, make sure mating surfaces are clean and dry.**
- **Install lower crankcase within 10 minutes after applying sealant.**

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

Sealant bead size for lower crankcase

Width "a": 3 mm (0.11 in.)

Height "b": 2 mm (0.07 in.)

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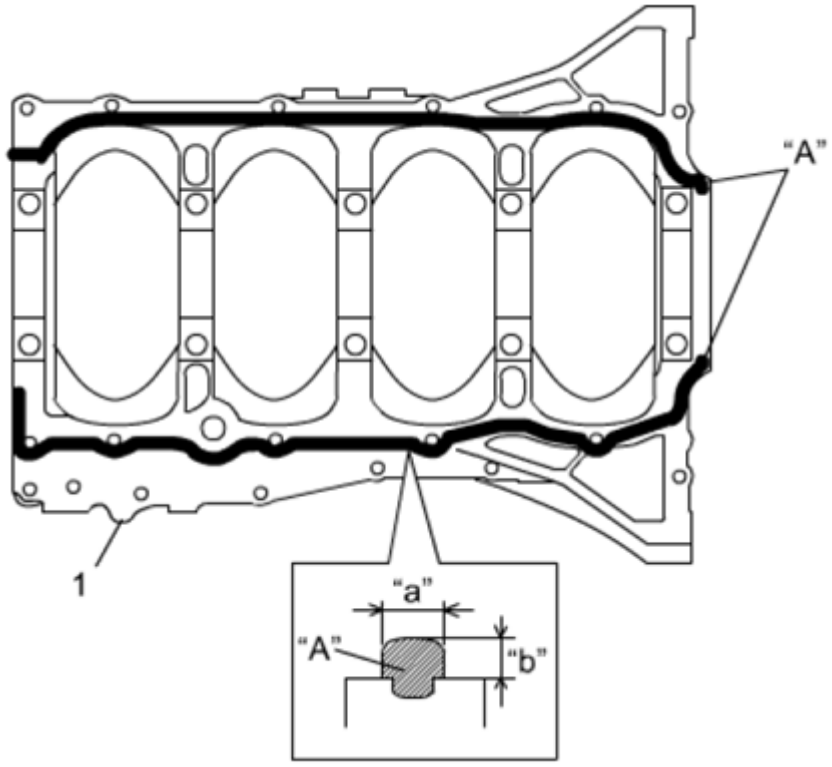


Fig. 190: Identifying Sealant Applying Area
Courtesy of SUZUKI OF AMERICA CORP.

9. Install lower crankcase to cylinder block and tighten crankcase bolt No. 1s using the following procedures:

NOTE:

- **If crankcase bolt No. 1 are reused, check them for deformation by referring to "CRANKCASE BOLT NO. 1 INSPECTION" under *Main Bearings Inspection* .**
- **Use 12-point socket wrench for crankcase bolt No. 1s.**

a. a) Apply engine oil to bolt threads and seats of crankcase bolt No. 1 and tighten bolt to 50 N.m (5.1 kgf-m, 37.0 lbf-ft) in numerical order ("1" - "10") evenly and gradually.
b. Loosen all bolts in reverse numerical order until loosening torque becomes 0.
c. Retighten them to 20 N.m (2.0 kgf-m, 15.0 lbf-ft) in the same manner as in Step a).
d. Retighten them to 35 N.m (3.6 kgf-m, 26.0 lbf-ft) in the same manner as in Step a).
e. Retighten them to 40° in the same manner as in Step a).
f. Retighten them to 40° in the same manner as in Step a).

Tightening torque

Crankcase bolt No. 1* (a): 50 N.m --> 0 N.m --> 20 N.m --> 35 N.m --> 40° --> 40° (5.1 kgf-m --> 0 kgf-m --> 2.0 kgf-m --> 3.6 kgf-m --> 40° --> 40°, 37.0 lbf-ft --> 0 lbf-ft --> 15.0 lbf-ft -->

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26.0 lbf-ft --> 40° --> 40°)

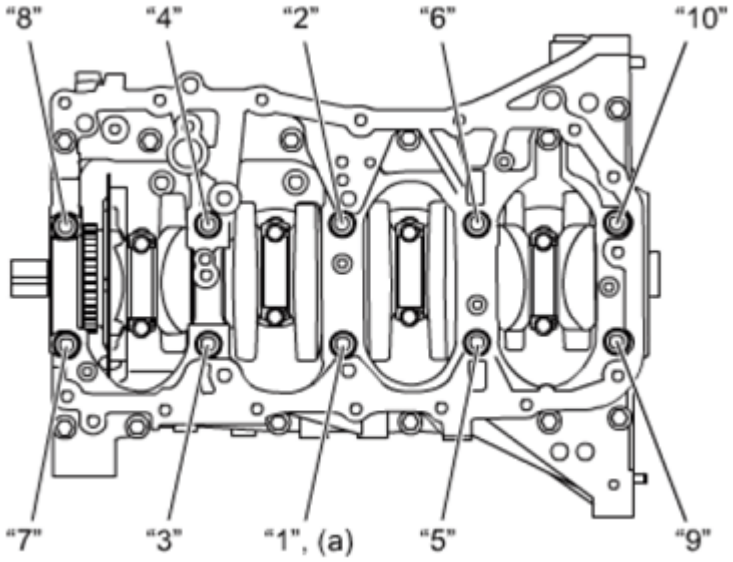


Fig. 191: Identifying Crankcase Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Tighten crankcase bolt No. 2s in numerical order ("1" - "12") evenly and gradually.

Tightening torque

Crankcase bolt No. 2* (a): 25 N.m (2.5 kg-m, 18.5 lbf-ft)

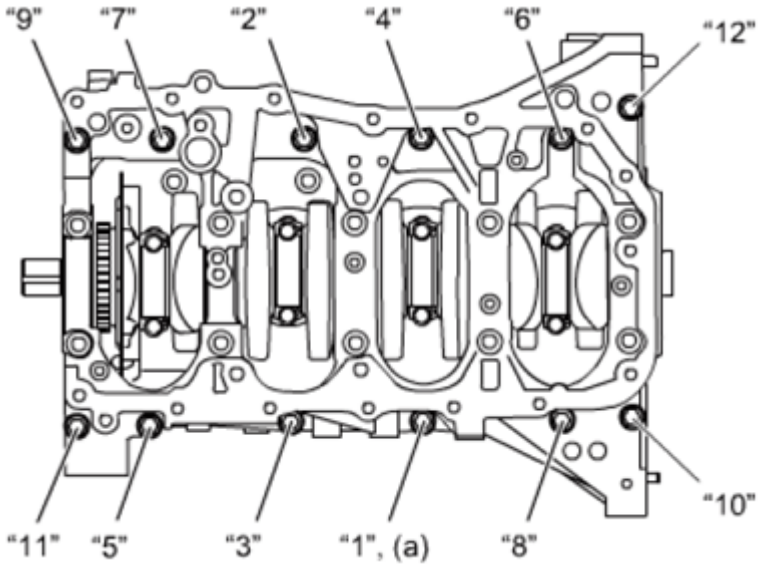


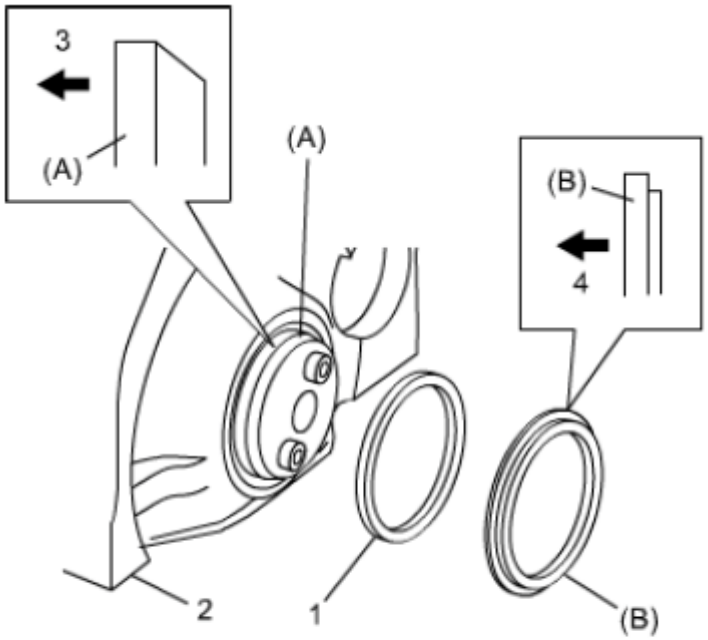
Fig. 192: Identifying Crankcase Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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11. Check that crankshaft rotates smoothly when turning it by hand.
12. Apply engine oil to new rear oil seal (1) and install it to cylinder block (2) using special tools.

Special Tool

A. **09911-97710**
B. **09911-97811**



3. Crankshaft side	4. Oil seal side

Fig. 193: Identifying Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

13. Install pistons and connecting rods, see **Piston, Piston Ring and Connecting Rod Removal and Installation**.
14. Install oil pump chain adjuster (1).

Tightening torque

Oil pump chain adjuster bolt (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)

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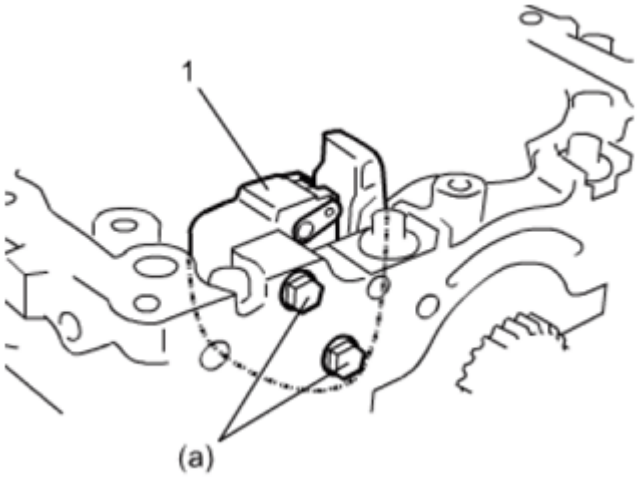


Fig. 194: Identifying Oil Pump Chain Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

15. Install cylinder head, see **Valve and Cylinder Head Removal and Installation**.
16. Install timing chain cover, see **Timing Chain Cover Removal and Installation**.
17. Install cylinder head cover, see **CYLINDER HEAD COVER REMOVAL AND INSTALLATION**.
18. Install oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
19. Install CKP sensor, see **CKP SENSOR REMOVAL AND INSTALLATION** .
20. Install flywheel for M/T model, or drive plate for CVT model, see **Flywheel/Drive Plate Removal and Installation**.
21. Install engine front mounting bracket (1).

Tightening torque

Engine front mounting bracket bolt (a): 55 N.m (5.6 kg-m, 40.5 lbf-ft)

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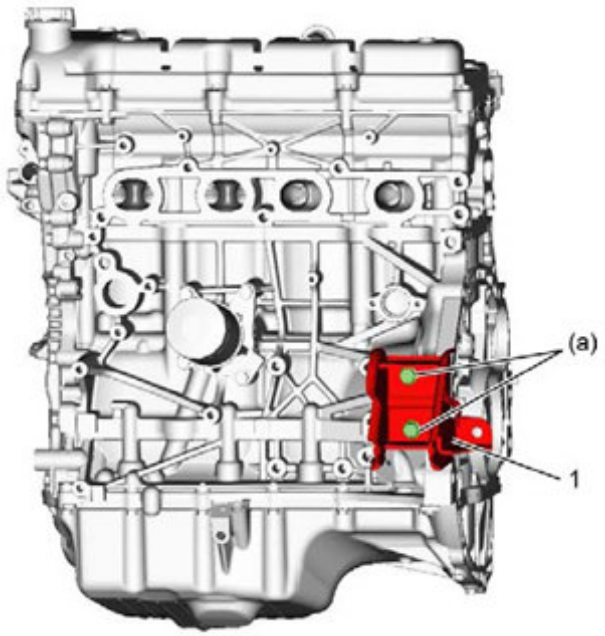


Fig. 195: Identifying Engine Front Mounting Bracket Bolt
Courtesy of SUZUKI OF AMERICA CORP.

22. Install water pump, see **WATER PUMP REMOVAL AND INSTALLATION** .
23. Install generator, see **GENERATOR REMOVAL AND INSTALLATION** .
24. Install engine assembly, see **Engine Assembly Removal and Installation**.

CRANKSHAFT INSPECTION

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

Crankshaft Runout

Use dial gauge to measure runout at center journal. Rotate crankshaft slowly.

Replace crankshaft if runout exceeds the limit.

Crankshaft runout

Limit: 0.02 mm (0.0007 in.)

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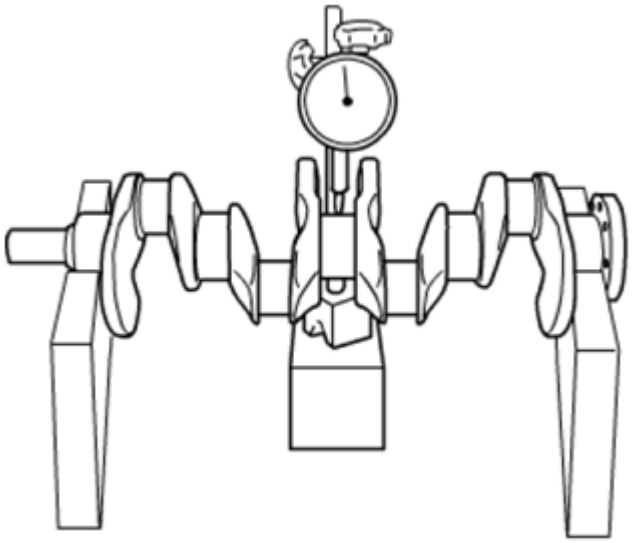


Fig. 196: Measuring Runout Center Journal
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Thrust Play

1. Assemble crankshaft, main bearings, thrust bearings and lower crankcase without applying sealant, see **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**.
2. Use dial gauge (1) to measure crankshaft thrust play (2) as shown in figure below.

   Replace thrust bearing with new one (standard size or over size) to obtain standard thrust play if measured thrust play is out of standard value.

   Recheck crankshaft thrust play.

   Crankshaft thrust play

   Standard: 0.10 - 0.35 mm (0.0039 - 0.0137 in.)

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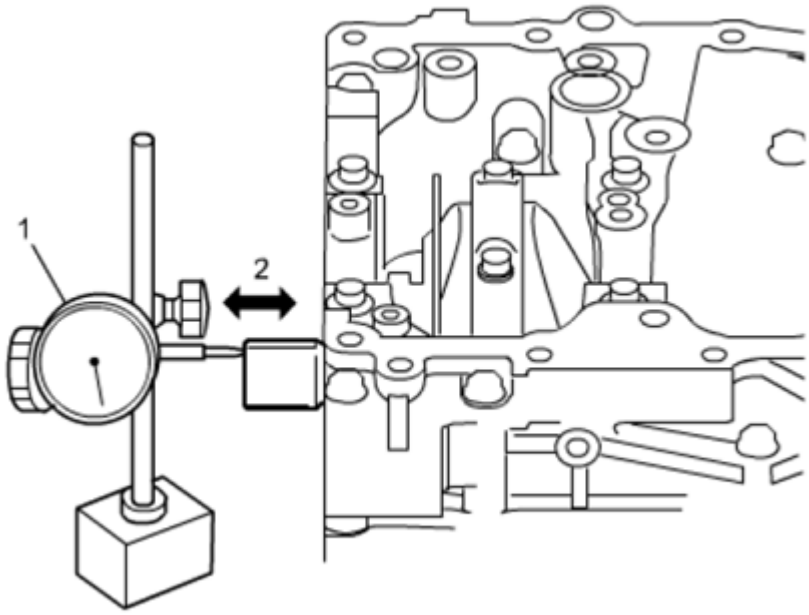


Fig. 197: Measuring Crankshaft Thrust Play
Courtesy of SUZUKI OF AMERICA CORP.

Thrust bearing thickness

Standard size: 2.470 - 2.520 mm (0.973 - 0.9921 in.)

Oversize (0.125 mm, 0.00492 in.): 2.533 - 2.583 mm (0.0998 - 0.1016 in.)

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.

Regrind or replace crankshaft if any one of journals is badly damaged or uneven wear exceeds its limit.

Crankshaft journal outside diameter

Standard: 51.982- 52.000 mm (2.0466 - 2.0472 in)

Limit: 51.972 mm (2.0461 in.)

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

Limit: 0.01 mm (0.0003 in.)

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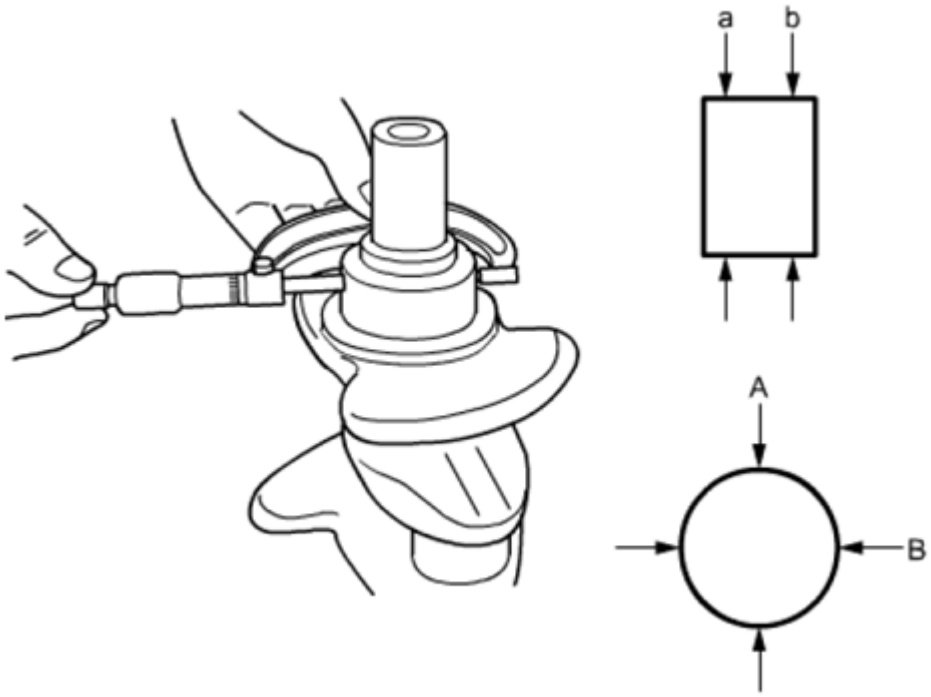


Fig. 198: Checking Crankshaft Journal Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER BLOCK INSPECTION

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

Distortion of Gasket Surface

Use straightedge and feeler gauge to check gasket surface for distortion and repair it, if flatness exceeds the limit.

Replace cylinder block if repair is not possible.

Cylinder block flatness

Limit: 0.03 mm (0.001 in.)

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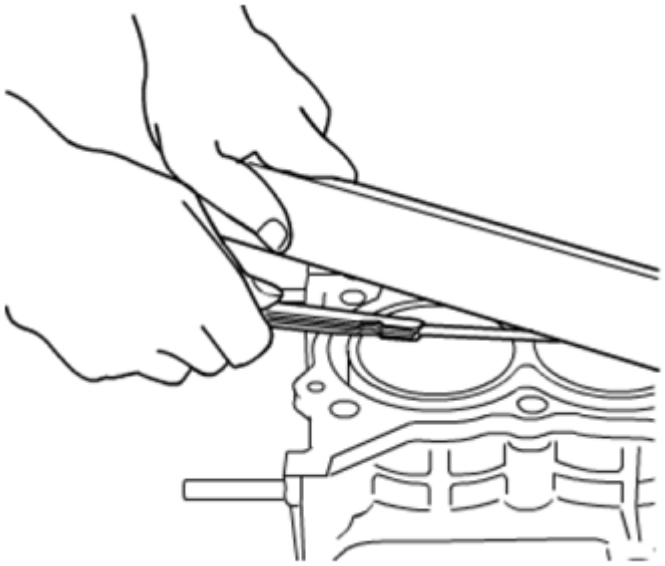


Fig. 199: Checking Gasket Surface For Distortion
Courtesy of SUZUKI OF AMERICA CORP.

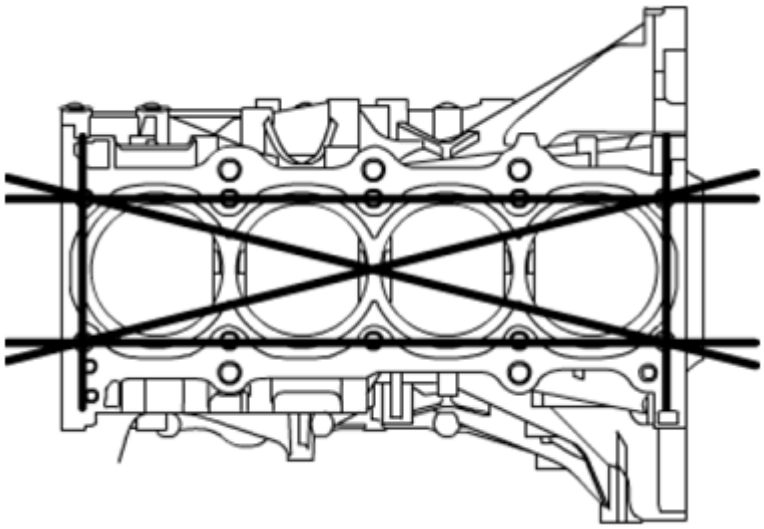


Fig. 200: Inspecting Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS INSPECTION

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

Visual Inspection

Check bearings for pitting, scratches, wear or damage.

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Replace both upper and lower halves if any defective condition is found. Never replace either half without replacing the other half.

Main Bearing Clearance

CAUTION: Do not rotate crankshaft while gauging plastic is installed.

NOTE: After checking main bearing clearance, check crankcase bolt No. 1 for deformation, see MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION.

1. Remove lower crankcase.
2. Clean bearings and crankshaft journals.
3. Place plastic gauge (1) with the same width as the bearing, parallel to the crankshaft, avoiding oil hole.

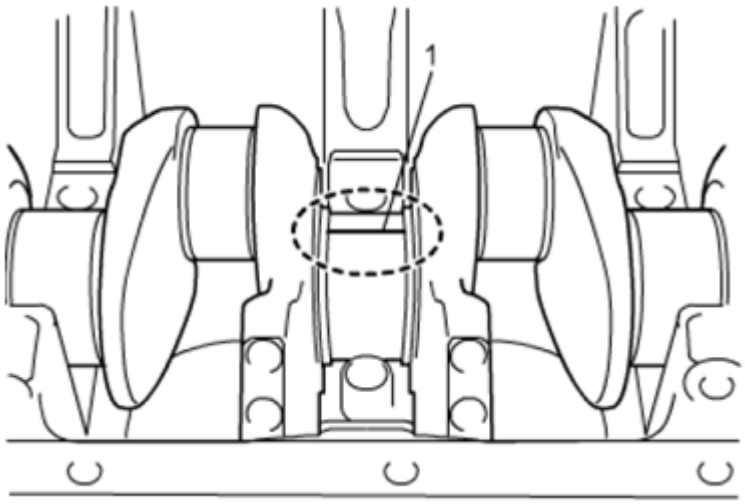


Fig. 201: Identifying Plastic Gauge
Courtesy of SUZUKI OF AMERICA CORP.

4. Without applying sealant install lower crankcase, see **MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION**.
5. After three minutes, remove lower crankcase and use scale (2) on plastic gauge envelope (1) to measure plastic gauge width at the widest point.

NOTE: If either of the following conditions exists for the crankshaft journal and the cylinder block journal together, different standard values are applied.

- **Stamped number for crankshaft journal diameter is "4", and stamped alphabet for cylinder block journal inside diameter is "A".**

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Standard: 0.019 - 0.031 mm (0.00075 - 0.00122 in.)

- **Stamped number for crankshaft journal diameter is "9", and stamped alphabet for cylinder block journal inside diameter is "F".**

  Standard: 0.025 - 0.037 mm (0.0010 - 0.0014 in.)

For more information about stamped number and stamped alphabet.

Main bearing clearance

Standard: 0.022 - 0.034 mm (0.00087 - 0.00133 in.)

Limit: 0.050 mm (0.00196 in.)

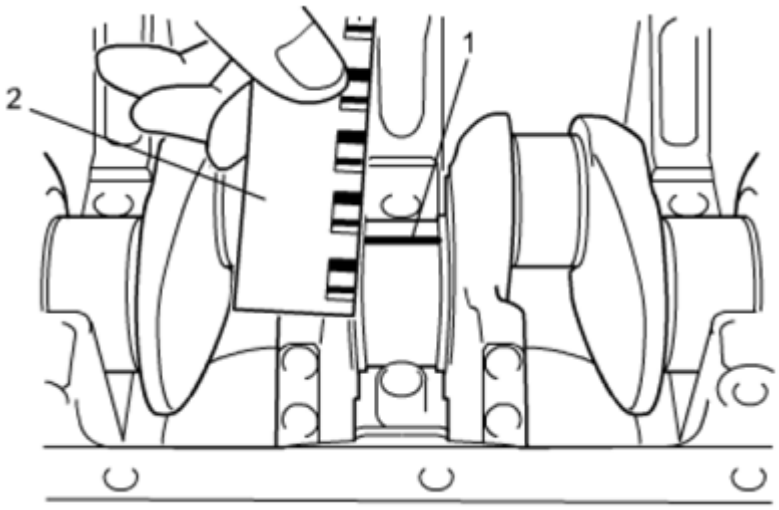


Fig. 202: Measuring Plastic Gauge Width Widest Point
Courtesy of SUZUKI OF AMERICA CORP.

If measured clearance is less than standard or more than service limit, replace main bearings with new ones referring to **SELECTION OF MAIN BEARINGS** and recheck main bearing clearance.

If measured clearance with new bearings is out of standard, select other bearing using the following procedures and recheck main bearing clearance:

- More than standard:

  Replace bearing with one size thicker or regrind crankshaft journal to undersize and use 0.25 mm undersize bearing (0.0098 in).

- Less than standard:

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Replace bearing with one size thinner or regrind crankshaft journal to undersize and use 0.25 mm undersize bearing (0.0098 in).

Selection of Main Bearings

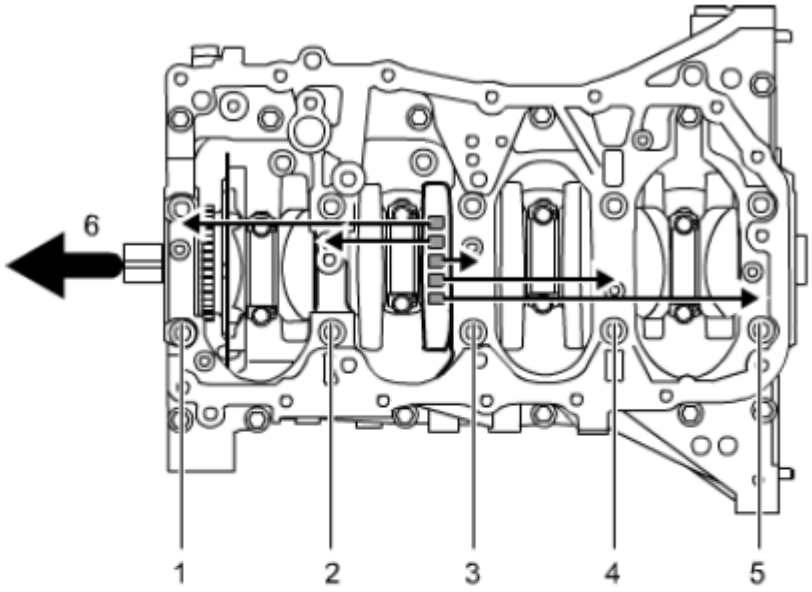
Standard size bearing

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

- Bearing is in defective condition.
- Bearing clearance is out of specification.
- Crankshaft or cylinder block is replaced.

1. Check crankshaft journal diameter using the following procedures:
    - There are five stamped numbers (any of "4" through "9") on crank web No. 4 as shown in figure.
    - Those numbers represent crankshaft journal diameter as follows:

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1.	Crankshaft journal No.1
2.	Crankshaft journal No.2
3.	Crankshaft journal No.3
4.	Crankshaft journal No.4
5.	Crankshaft journal No.5
6.	Crankshaft pulley side

Fig. 203: Identifying Crankshaft Journal
Courtesy of SUZUKI OF AMERICA CORP.

- Determine crankshaft journal diameter for journals No. 1 through No. 5 using stamped numbers and following table.

Crankshaft journal diameter

CRANKSHAFT JOURNAL DIAMETER SPECIFICATION

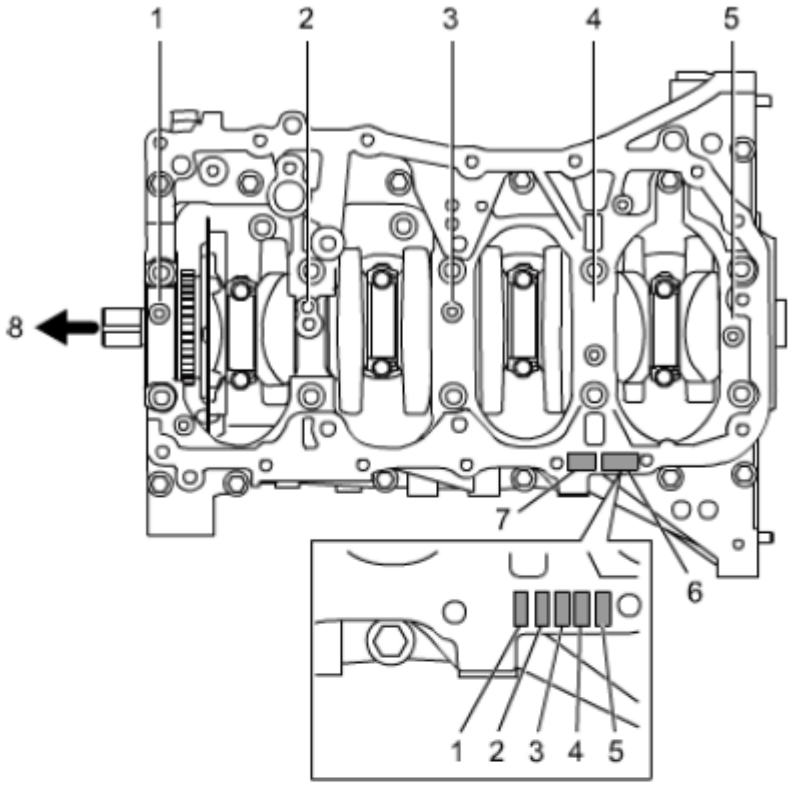
Stamped numbers	Journal diameter
4	51.997 - 52.000 mm (2.04712 - 2.04724 in.)
5	51.994 - 51.997 mm (2.04700 - 2.04712 in.)
6	51.991 - 51.994 mm (2.04688 - 2.04700 in.)
7	51.988 - 51.991 mm (2.04677 - 2.04688 in.)
8	51.985 - 51.988 mm (2.04665 - 2.04677 in.)

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9	51.982 - 51.985 mm (2.04654 - 2.04665 in.)

2. Check cylinder block journal inside diameter using the following procedures:
   - There are five stamped alphabets (6) (any of "A" through "F") on Lower crankcase as shown in figure.
   - Those alphabets represent cylinder block journal inside diameter as follows:

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1.	Cylinder block journal No.1
2.	Cylinder block journal No.2
3.	Cylinder block journal No.3
4.	Cylinder block journal No.4
5.	Cylinder block journal No.5
7.	Stamped numbers for bore
8.	Crankshaft pulley side

Fig. 204: Identifying Cylinder Block Journal
Courtesy of SUZUKI OF AMERICA CORP.

- Determine cylinder block journal inside diameter for journals No. 1 through No. 5 using stamped

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alphabets and following table.

CYLINDER BLOCK JOURNAL INSIDE DIAMETER SPECIFICATION

Stamped number	Cylinder block journal inside diameter
A	56.000 - 56.003 mm (2.20473 - 2.20484 in.)
B	56.003 - 56.006 mm (2.20484 - 2.20496 in.)
C	56.006 - 56.009 mm (2.20496 - 2.20507 in.)
D	56.009 - 56.012 mm (2.20507 - 2.20519 in.)
E	56.012 - 56.015 mm (2.20519 - 2.20531 in.)
F	56.015 - 56.018 mm (2.20531 - 2.20543 in.)

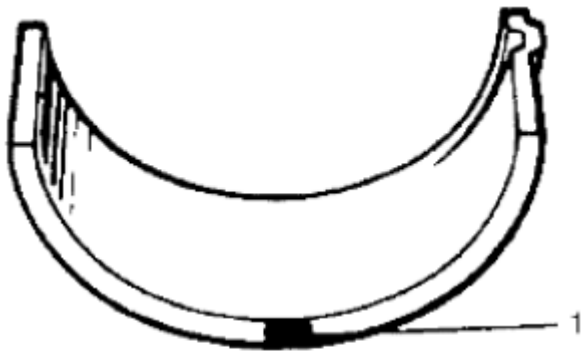
3. There are 5 kinds of standard bearings differing in thickness. To distinguish them, each bearing is painted in the following colors at the position as shown in figure.

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

   Standard size crankshaft main bearing thickness

   CRANKSHAFT MAIN BEARING THICKNESS SPECIFICATION

Painted color	Bearing thickness
Blue	2.011 - 2.014 mm (0.07917 - 0.07929 in)
Yellow	2.008 - 2.011 mm (0.07905 - 0.07917 in)
Colorless	2.005 - 2.008 mm (0.07893 - 0.07905 in)
Black	2.002 - 2.005 mm (0.07881 - 0.07893 in)
Green	1.999 - 2.002 mm (0.07870 - 0.07881 in)



1. Paint

Fig. 205: Identifying Crankshaft Main Bearing Mark Location
Courtesy of SUZUKI OF AMERICA CORP.

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4. Select new standard crankshaft bearings using stamped numbers for crankshaft journal diameter, stamped alphabets for cylinder block journal inside diameter and following table:

Main bearing cross - reference selection table (standard size)

MAIN BEARING SPECIFICATION

			Stamped number on crank web No. 4					
			4	5	6	7	8	9
Stamped alphabets on lower crankcase	A	Upper	Green	Green	Green	Black	Black	Colorless
		Lower	Green	Green	Black	Black	Colorless	Colorless
	B	Upper	Green	Green	Black	Black	Colorless	Colorless
		Lower	Green	Black	Black	Colorless	Colorless	Yellow
	C	Upper	Green	Black	Black	Colorless	Colorless	Yellow
		Lower	Black	Black	Colorless	Colorless	Yellow	Yellow
	D	Upper	Black	Black	Colorless	Colorless	Yellow	Yellow
		Lower	Black	Colorless	Colorless	Yellow	Yellow	Blue
	E	Upper	Black	Colorless	Colorless	Yellow	Yellow	Blue
		Lower	Colorless	Colorless	Yellow	Yellow	Blue	Blue
	F	Upper	Colorless	Colorless	Yellow	Yellow	Blue	Blue
		Lower	Colorless	Yellow	Yellow	Blue	Blue	Blue

Undersize bearing (0.25 mm (0.0098 in.))

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

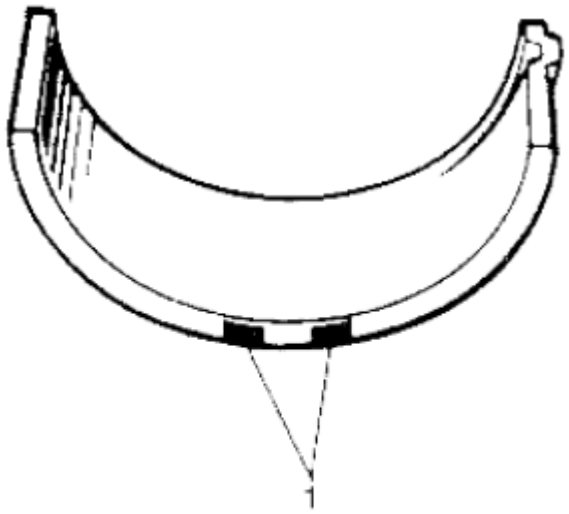
To distinguish them, each bearing is painted in the following colors at the position as shown in figure. Each color represents the following thickness at the center of bearing.

Undersize of crankshaft main bearing thickness

CRANKSHAFT MAIN BEARING THICKNESS SPECIFICATION

Painted color	Bearing thickness
Red & Blue	2.136 - 2.139 mm (0.08409 - 0.08421 in.)
Red & Yellow	2.133 - 2.136 mm (0.08397 - 0.08409 in.)
Red	2.130 - 2.133 mm (0.08385 - 0.08397 in.)
Red & Black	2.127 - 2.130 mm (0.08374 - 0.08385 in.)
Red & Green	2.124 - 2.127 mm (0.08363 - 0.08374 in.)

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1. Paint

Fig. 206: Identifying Crankshaft Main Bearing Mark Location
Courtesy of SUZUKI OF AMERICA CORP.

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

     Finished crankshaft journal diameter

     51.732 - 51.750 mm (2.0367 - 2.0374 in.)

  b. Use micrometer to measure reground journal diameter, see **CRANKSHAFT INSPECTION**.
  c. Use measured journal diameter above and alphabets on cylinder block to select an undersize bearing by referring to the following table:

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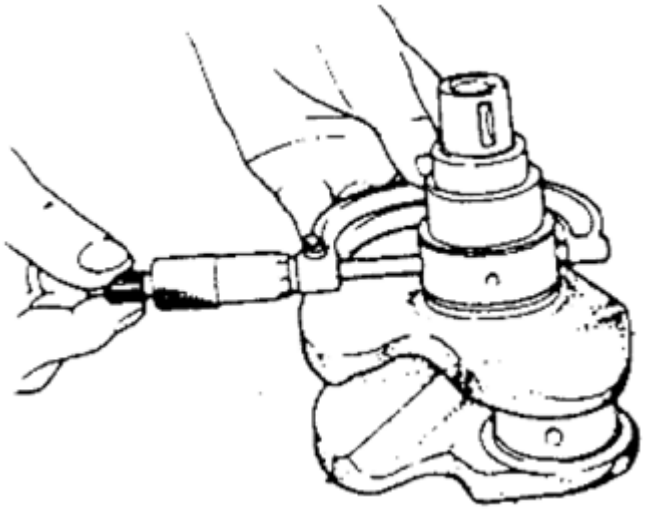


Fig. 207: Measuring Crankshaft Journal Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Main bearing cross - reference table (under size)

MAIN BEARING SPECIFICATION

			Measured journal diameter					
			51.7470 - 51.7499 mm (2.03728 - 2.03739 in.)	**51.7440 - 51.7469 mm (2.03717 - 2.03727 in.)**	**51.7410 - 51.7439 mm (2.03705 - 2.03716 in.)**	**51.7380 - 51.7409 mm (2.03693 - 2.03704 in.)**	**51.7350 - 51.7379 mm (2.03682 - 2.03692 in.)**	**51.7320 - 51.7349 mm (2.03670 - 2.03680 in.)**
Stamped alphabet on lower crankcase	A	Upper	Red & Green	Red & Green	Red & Green	Red & Black	Red & Black	Red
		Lower	Red & Green	Red & Green	Red & Black	Red & Black	Red	Red
	B	Upper	Red & Green	Red & Green	Red & Black	Red & Black	Red	Red
		Lower	Red & Green	Red & Black	Red & Black	Red	Red	Red & Yellow
	C	Upper	Red & Green	Red & Black	Red & Black	Red	Red	Red & Yellow
		Lower	Red & Black	Red & Black	Red	Red	Red & Yellow	Red & Yellow
	D	Upper	Red & Black	Red & Black	Red	Red	Red & Yellow	Red & Yellow
		Lower	Red & Black	Red	Red	Red & Yellow	Red & Yellow	Red & Blue
	E	Upper	Red & Black	Red	Red	Red & Yellow	Red & Yellow	Red & Blue
					Red &	Red &		

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		Lower	Red	Red	Yellow	Yellow	Red & Blue	Red & Blue
	F	Upper	Red	Red	Red & Yellow	Red & Yellow	Red & Blue	Red & Blue
		Lower	Red	Red & Yellow	Red & Yellow	Red & Blue	Red & Blue	Red & Blue

d. Install selected main bearings and measure bearing clearance.

   If measured clearance is more than standard, replace bearings with one size thicker and recheck bearing clearance.

   If measured clearance is less than standard, replace bearings with one size thinner and recheck bearing clearance.

Crankcase Bolt No. 1 Inspection

Measure each thread diameter at specified points on crankcase bolt No. 1 (1) using micrometer (2).

Calculate difference in diameters ("A" - "B").

Replace with new one if it exceeds limit.

Crankcase bolt diameter measurement points

"a": 61.0 mm (2.40 in.)

"b": 98.0 mm (3.85 in.)

Crankcase cap bolt diameter difference

Limit ("A" - "B"): 0.13 mm (0.0051 in.)

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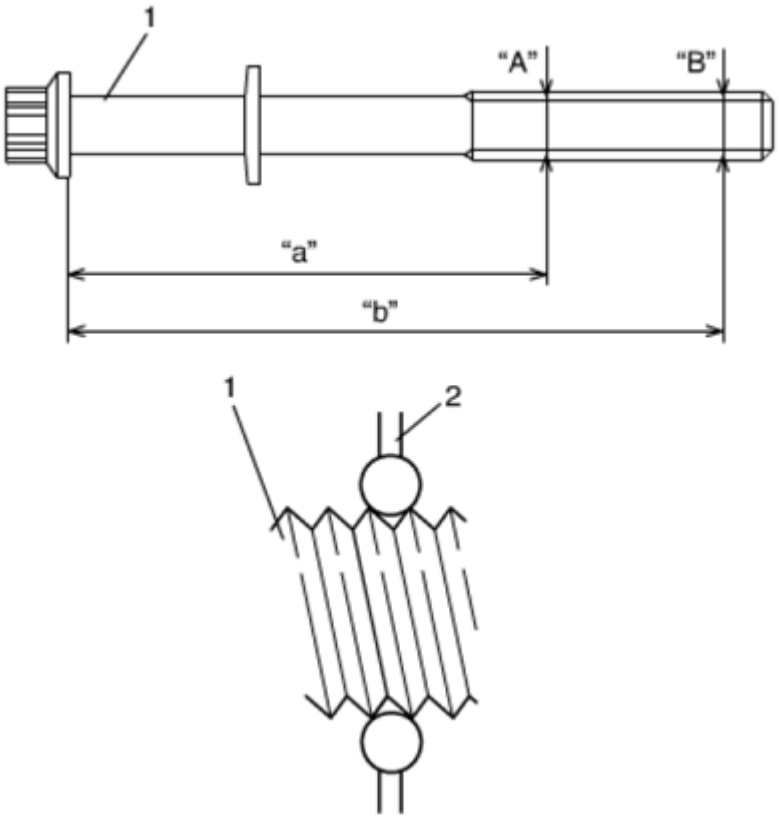


Fig. 208: Measuring Thread Diameter Specified Points On Crankcase Bolt
Courtesy of SUZUKI OF AMERICA CORP.

SENSOR PLATE INSPECTION

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

Check sensor plate (1) for cracks or damage.

Replace it if any defective conditions are found.

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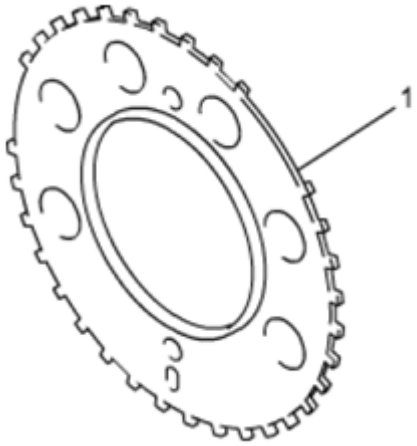


Fig. 209: Identifying Sensor Plate
Courtesy of SUZUKI OF AMERICA CORP.

OIL PUMP DRIVE SPROCKET INSPECTION

Check oil pump drive sprocket (2) for cracks or any damage.

Replace crankshaft (1) if defective conditions are found.

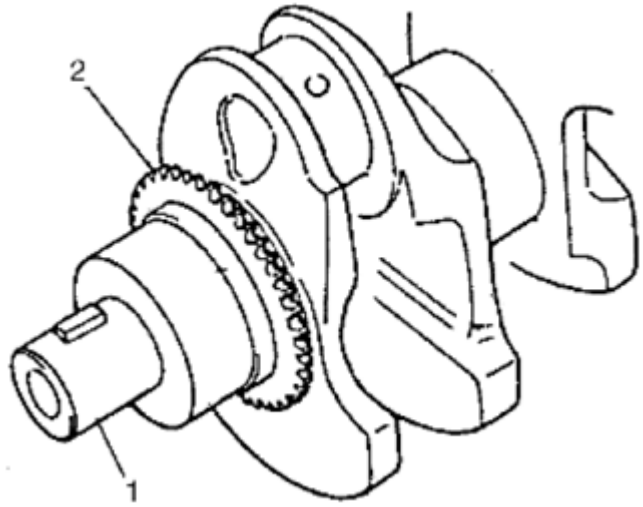


Fig. 210: Identifying Oil Pump Drive Sprocket And Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

OIL PUMP CHAIN AND OIL PUMP CHAIN ADJUSTER INSPECTION

Oil Pump Chain

Check oil pump chain for wear or any damage.

Replace oil pump chain if faulty condition is found.

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Fig. 211: Identifying Oil Pump Chain
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pump Chain Adjuster

Check oil pump chain adjuster according to the following procedures.

- Check latch (1), teeth (2), plunger (3) or tensioner (4) for cracks, wear or any damage.
- Check that plunger (3) moves in direction [b] and does not move in direction [a] when latch (1) engages with plunger teeth (2).

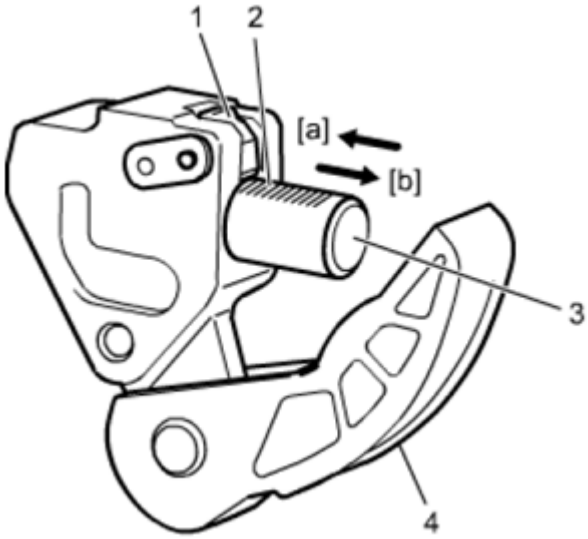


Fig. 212: Checking Oil Pump Chain Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

- Check that plunger (2) moves in direction [b] freely and smoothly when latch (1) is raised up in direction [a].
- Check that tensioner (3) moves in direction [c] freely and smoothly.

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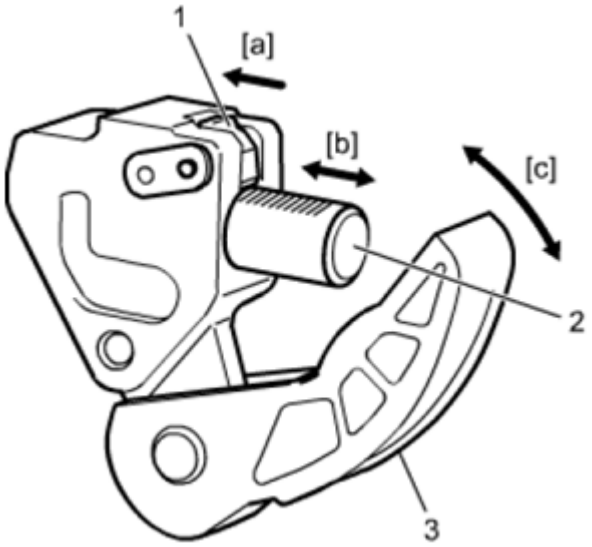


Fig. 213: Checking Plunger
Courtesy of SUZUKI OF AMERICA CORP.

Replace oil pump chain adjuster if defective conditions are found.

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
Throttle body bolt	12	1.2	9.0
Cylinder block heater bolt	11	1.1	8.5
PCV valve	2.5	0.25	2.0
Cylinder head cover bolt*	3.0 N.m --> 5.0 N.m --> 7.5 N.m (0.31 kgf-m --> 0.51 kgf-m --> 0.76 kgf-m, 2.5 lbf-ft --> 4.0 lbf-ft --> 5.5 lbf-ft)		
Special tool fixing bolt	8	0.82	6.0
CMP actuator bolt	60	6.1	44.5
Camshaft housing bolt*	11	1.1	8.5
Exhaust camshaft timing sprocket bolt	60	6.1	44.5
Timing chain cover plug	27	2.8	20.0
Ground cable bolt	9.0	0.92	7.0
P/S control module	9.0	0.92	7.0

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ground bolt			
Battery ground terminal bolts	9.0	0.92	7.0
Timing chain cover bolt* (M8 bolt)	25	2.5	18.5
Timing chain cover bolt* (M10 bolt)	55	5.6	40.5
Crankshaft pulley bolt	150	15.3	111.0
OCV bolt	11	1.1	8.5
Flywheel bolt	70	7.1	52.0
Drive plate bolt	70	7.1	52.0
Timing chain guide bolt	9.0	0.92	7.0
Timing chain tensioner bolt	25	2.5	18.5
Timing chain tensioner adjuster bolt	11	1.1	8.5
Cylinder head bolt No. 1*	20 N.m --> 40 N.m --> +60° --> +80° (2.0 kgf-m --> 4.1 kgf-m --> +60° --> +80°, 15.0 lbf-ft --> 29.5 lbf-ft --> +60° --> +80°)		
Cylinder head bolt No. 2	25	2.5	18.5
Venturi plug	3.5	0.36	2.5
Connecting rod bolt*	15 N.m --> +45° --> +45° (1.5 kgf-m --> +45° --> +45°, 11.0 lbf-ft --> +45° --> +45°		
Sensor plate screw	11	1.1	8.5
Crankcase bolt No. 1*	50 N.m --> 0 N.m --> 20 N.m --> 35 N.m --> 40° --> 40° (5.1 kgf-m --> 0 kgf-m --> 2.0 kgf-m --> 3.6 kgf-m --> 40° --> 40°, 37.0 lbf-ft --> 0 lbf-ft --> 15.0 lbf-ft --> 26.0 lbf-ft --> 40° --> 40°)		
Crankcase bolt No. 2*	25	2.5	18.5
Oil pump chain adjuster bolt	11	1.1	8.5
Engine front mounting bracket bolt	55	5.6	40.5

NOTE: **The specified tightening torque is described in the following.**
AIR CLEANER COMPONENTS
THROTTLE BODY AND INTAKE MANIFOLD COMPONENTS
CYLINDER HEAD COVER COMPONENTS
CAMSHAFT AND TAPPET COMPONENTS
ENGINE MOUNTINGS COMPONENTS
TIMING CHAIN COVER COMPONENTS
TIMING CHAIN AND CHAIN TENSIONER COMPONENTS
VALVE AND CYLINDER HEAD COMPONENTS
PISTON, PISTON RING AND CONNECTING ROD COMPONENTS
MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

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Reference:

For the tightening torque of fastener not specified in this section, refer to **FASTENERS INFORMATION** .

SPECIAL TOOLS AND EQUIPMENT

RECOMMENDED SERVICE MATERIAL

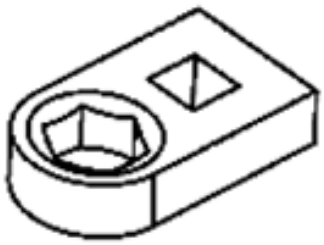
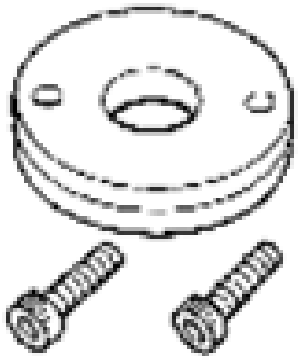
SPECIAL TOOLS SPECIFICATION

Material	SUZUKI recommended product or Specification		Note
Sealant	SUZUKI Bond No. 1217G	P/No.: 99000-31260	**Cylinder Head Cover Removal and InstallationTiming Chain Cover Removal and InstallationMain Bearings, Crankshaft and Cylinder Block Removal and Installation**

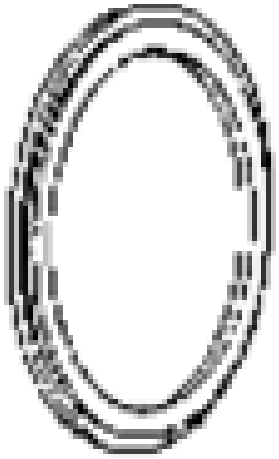
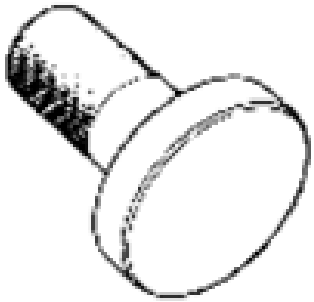
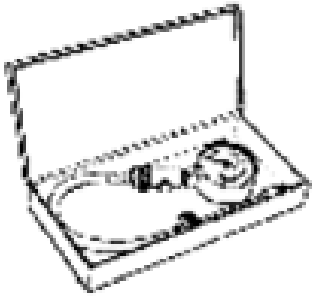
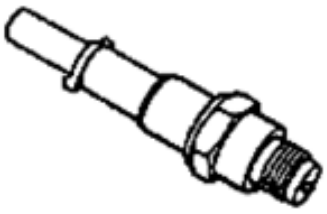
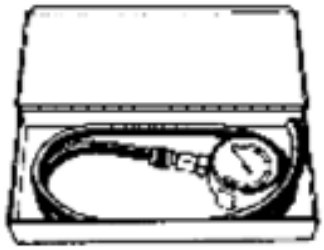
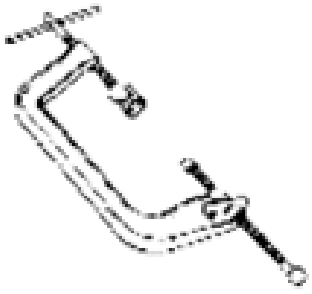
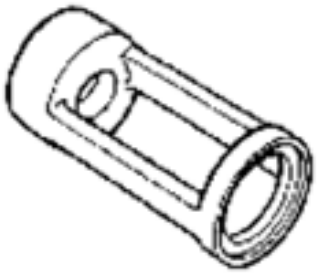
NOTE: **Required service material is also described in the following.**
CYLINDER HEAD COVER COMPONENTS
CAMSHAFT AND TAPPET COMPONENTS
TIMING CHAIN COVER COMPONENTS
TIMING CHAIN AND CHAIN TENSIONER COMPONENTS
VALVE AND CYLINDER HEAD COMPONENTS
PISTON, PISTON RING AND CONNECTING ROD COMPONENTS
MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

SPECIAL TOOL

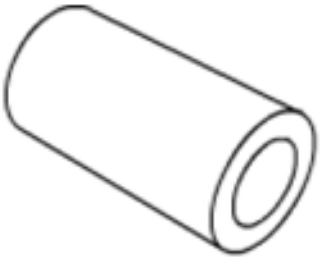
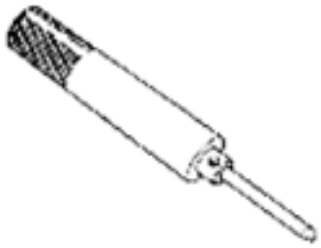
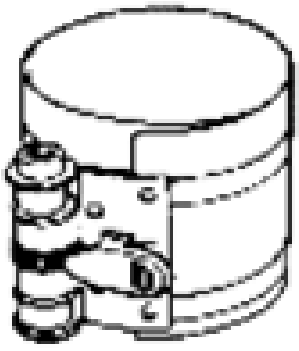
SPECIAL TOOL SPECIFICATION

09911-05120 Box end wrench (14 mm) 	09911-97710 Oil seal guide 
09911-97811	09913-75510

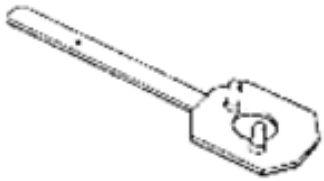
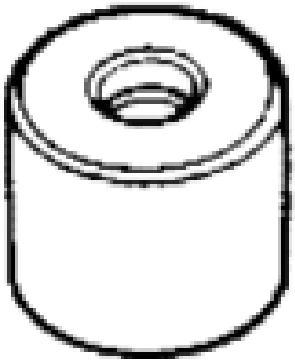
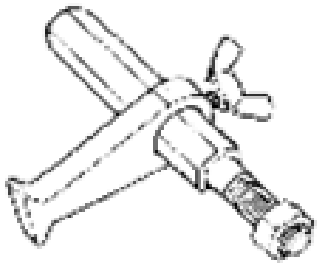
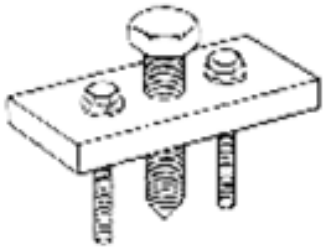
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Oil seal installer 	Bearing installer 
09915-64512 Compression gauge 	09915-64530 Compression gauge hose 
09915-67010 Compression gauge attachment (C) 	09915-67311 Vacuum gauge 
09916-14510 Valve lifter 	09916-14522 Valve spring compressor attachment 
	09916-34550

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09916-34542 Reamer handle 	Valve guide reamer (5.5 mm) 
09916-37320 Valve guide outer reamer (10.5 mm) 	09916-44910 Valve guide installer & remover 
09916-56510 Valve guide installer attachment 	09916-58210 Valve guide installer handle 
09916-77310 Piston ring compressor (50-125 mm) 	09916-84511 Forceps 
09917-16710	09917-68221

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Timing chain tensioner holder 	Camshaft pulley holder 
09917-98221 Valve guide stem attachment 	09924-17811 Flywheel holder 
09926-58010 Bearing remover attachment 	09944-36011 Steering wheel remover 

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