2012-13 ENGINE

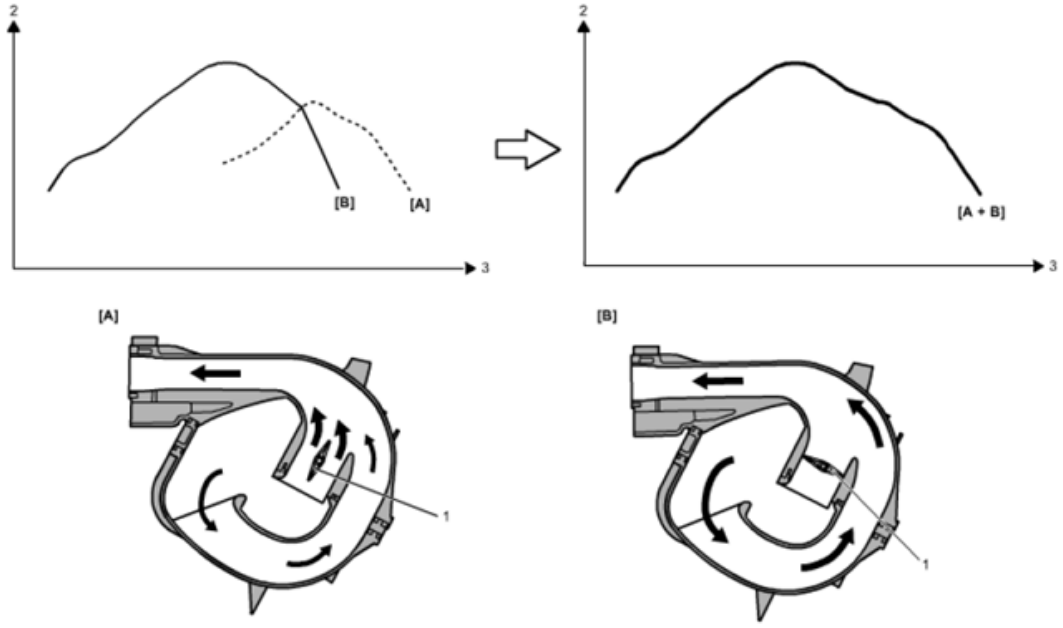
Engine Mechanical - SX4

GENERAL DESCRIPTION

ENGINE CONSTRUCTION DESCRIPTION

The engine is water-cooled, in-line 4 cylinders, 4-stroke-cycle gasoline unit with its DOHC (Double Over Head Camshaft) valve mechanism arranged for "V" type valve configuration and has 16 valves (4 valves/one cylinder). The intake camshaft and exhaust camshaft are mounted over the cylinder head; They are driven by crankshaft through timing chain, and no push rod is provided in the valve train system.

IMT (INTAKE MANIFOLD TUNING) SYSTEM DESCRIPTION



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

Fig. 1: System Description Of IMT (Intake Manifold Tuning)
Courtesy of SUZUKI OF AMERICA CORP.

IMT (Intake manifold tuning) system varies effective length of intake pipe by opening and closing IMT valve in order to improve air volumetric efficiency.

As intake valve in cylinder head is opened and closed repeatedly, intake air pulsation always exists. If intake valve is opened when air pressure is momentarily maximum, intake air volumetric efficiency is increased. This momentary maximum air pressure depends on effective intake pipe length.

 © 2011 Mitchell Repair Information Company, LLC.

When IMT valve is fully open [A]:

The effective intake pipe length is shorter. Engine torque between middle and high engine speed ranges is improved, while it drops between low and middle engine speed ranges.

When IMT valve is totally closed [B]:

The effective intake pipe length is longer. Engine torque between middle and high engine speed ranges drops, while it is improved between low and middle ranges.

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

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

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. Refer to **Air Cleaner Assembly Removal and Installation**.
5. Remove all ignition coils and spark plugs. Refer to **SPARK PLUG REMOVAL AND INSTALLATION** .
6. Disconnect all fuel injector connectors.
7. Install special tools into spark plug hole.

   Special Tool

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

 © 2011 Mitchell Repair Information Company, LLC.

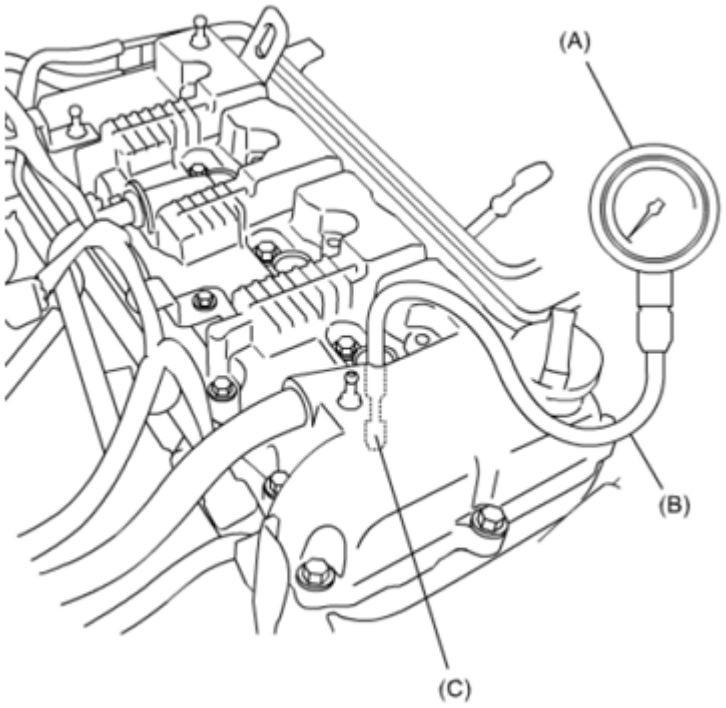


Fig. 2: Identifying Special Tools Into Spark Plug Hole
Courtesy of SUZUKI OF AMERICA CORP.

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 at least 200 rpm by using fully charged battery.**
- **If measured compression pressure is lower than limit value, check installation condition of special tool.**
- **If the measured compression pressure of particular cylinder is lower than 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, there is possibility of the following cause.**
    - **The pressure leakage is caused by worn piston rings or worn cylinder.**
  - **If the compression pressure does not increase significantly, there is possibility of the following causes.**
    - **Incorrect valve timing.**

 © 2011 Mitchell Repair Information Company, LLC.

- **The pressure leakage is at the valves and the valve seats.**
- **The pressure leakage is at 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 (1.02 kgf/cm^2 , 14.5 psi)

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

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. Refer to **Air Cleaner Assembly Removal and Installation**.
4. Remove PCV hose (1) from PCV valve (2).
5. Connect special tool to PCV hose (1).

   Special Tool

   (A): 09915-67311

 © 2011 Mitchell Repair Information Company, LLC.

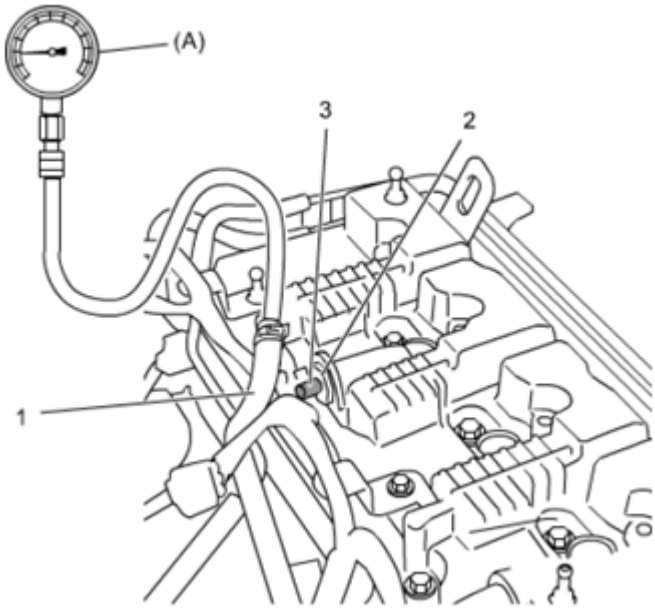


Fig. 3: Connecting Special Tool To PCV Hose
Courtesy of SUZUKI OF AMERICA CORP.

6. Close PCV valve (2) using tape (3) or the like.
7. Start engine and turn off all electric loads.
8. Read vacuum gauge at specified idle speed. Refer to **IDLE SPEED AND IAC THROTTLE VALVE OPENING 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 valve.
10. Peel off tape from PCV hose.
11. Connect PCV hose to PCV valve.
12. Install engine cover.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

Inspection

1. Disconnect negative (-) cable from battery.
2. Remove cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
3. Remove engine under cover.

 © 2011 Mitchell Repair Information Company, LLC.

4. Align timing mark (3) on exhaust camshaft timing sprocket with match mark (2) on camshaft housing No. 1, by turning crankshaft pulley (1) clockwise with 19 mm wrench.

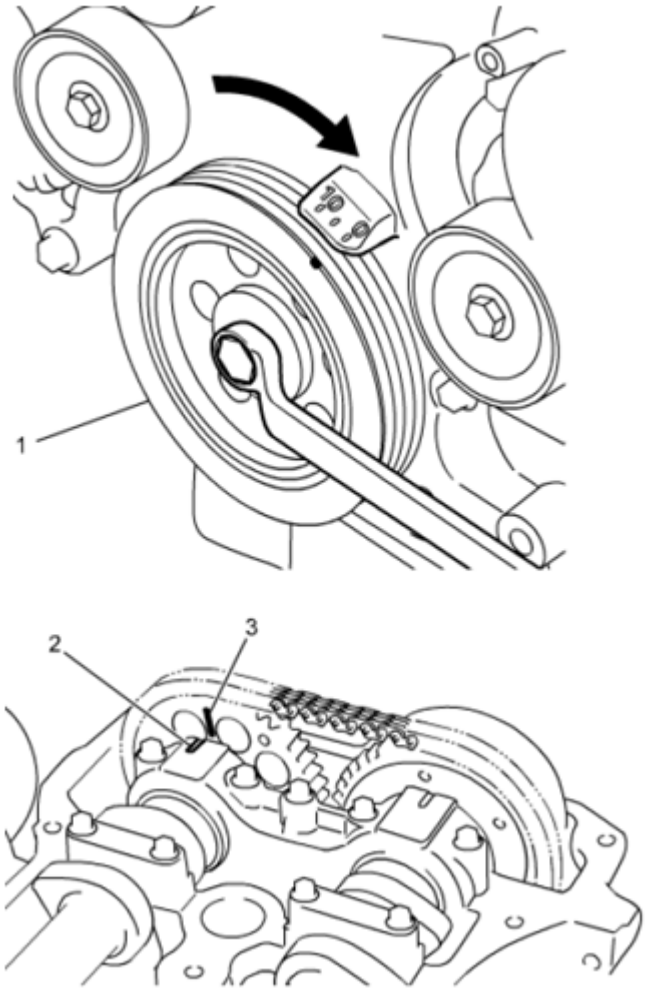


Fig. 4: Aligning Timing Mark On Exhaust Camshaft Timing Sprocket With Match Mark On Camshaft Housing No. 1
Courtesy of SUZUKI OF AMERICA CORP.

5. Measure valve clearances with thickness gauge according to the following procedures.
   a. Measure valve clearances of indicated valves "A" in figure.
   b. Turn crankshaft pulley 360° clockwise with 19 mm wrench.
   c. Measure valve clearances of indicated valves "B" in figure.

 © 2011 Mitchell Repair Information Company, LLC.

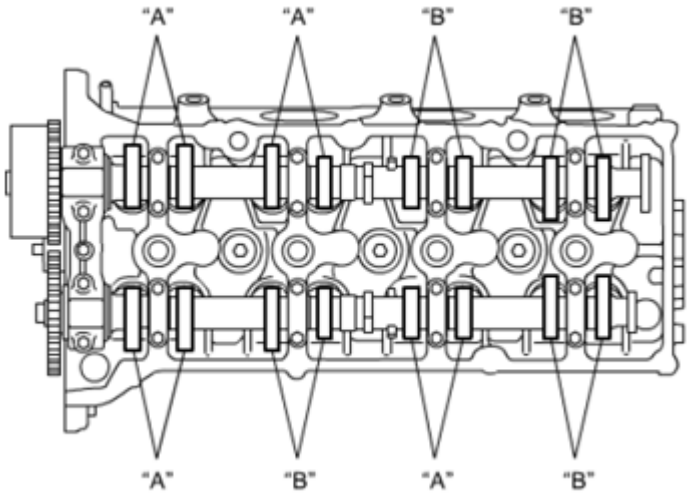


Fig. 5: Identifying Valve Positions
Courtesy of SUZUKI OF AMERICA CORP.

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

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 (0.0123 - 0.0153 in.)**

Adjustment

1. Remove tappet to be replaced. Refer to **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 by formula below.

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

Intake side:

A = B + C - 0.20 mm (0.0079 in.)

Exhaust side:

A = B + C - 0.35 mm (0.0138 in.)

A. Thickness "a" of new tappet

 © 2011 Mitchell Repair Information Company, LLC.

B. Thickness "a" of removed tappet
C. Measured valve clearance

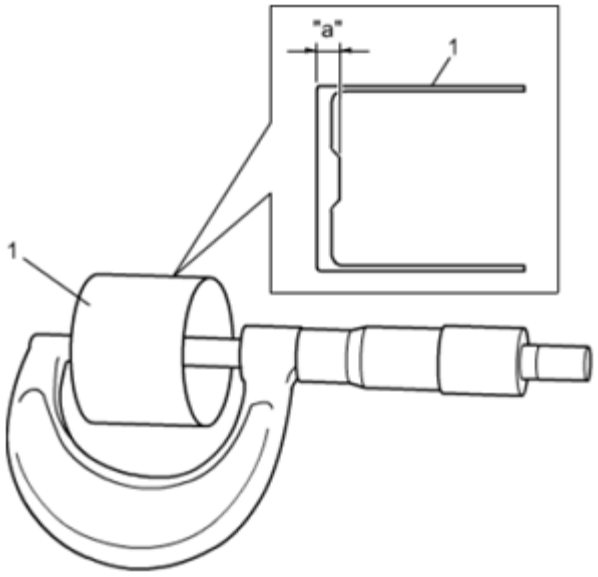


Fig. 6: Measuring Tappet Thickness
Courtesy of SUZUKI OF AMERICA CORP.

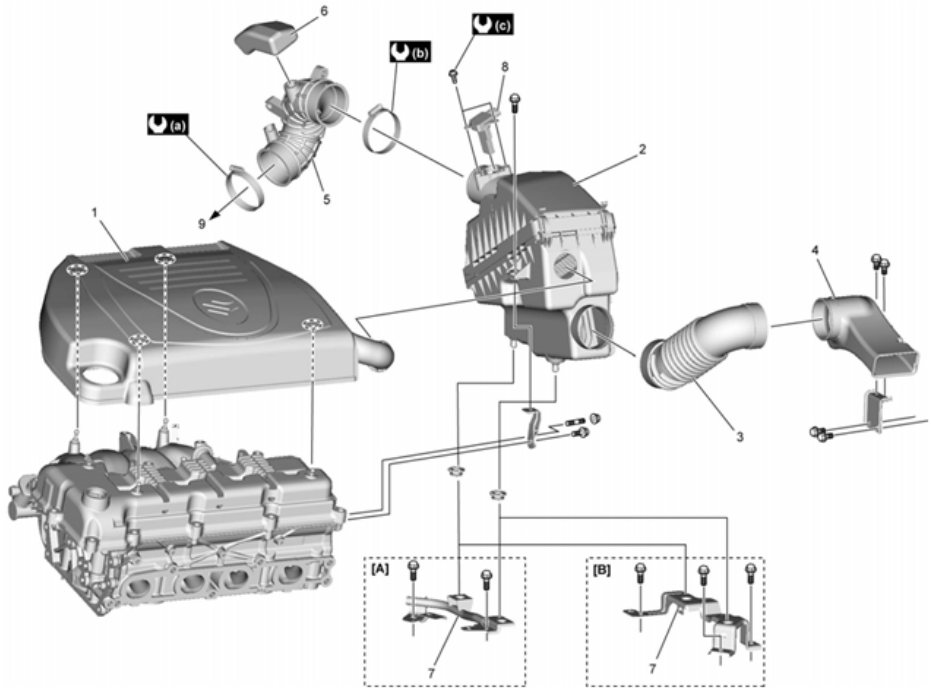
c. Select new tappet closest to calculated value from available size as a spare part.

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

REPAIR INSTRUCTIONS

AIR CLEANER COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



[A]: CVT model	4. Air cleaner suction pipe	9. To throttle body
[B]: M/T model	5. Air cleaner outlet hose	(a) 3.1 Nm (0.32 kgf-m, 2.5 lbf-ft)
1. Engine cover	6. Resonator	(b) 1.3 Nm (0.13 kgf-m, 1.0 lbf-ft)
2. Air cleaner assembly	7. Air cleaner bracket	(c) 1.2 Nm (0.12 kgf-m, 1.0 lbf-ft)
3. Air cleaner inlet hose	8. MAF and IAT sensor	

Fig. 7: Identifying Air Cleaner Replacement 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 its clamps (2).

 © 2011 Mitchell Repair Information Company, LLC.

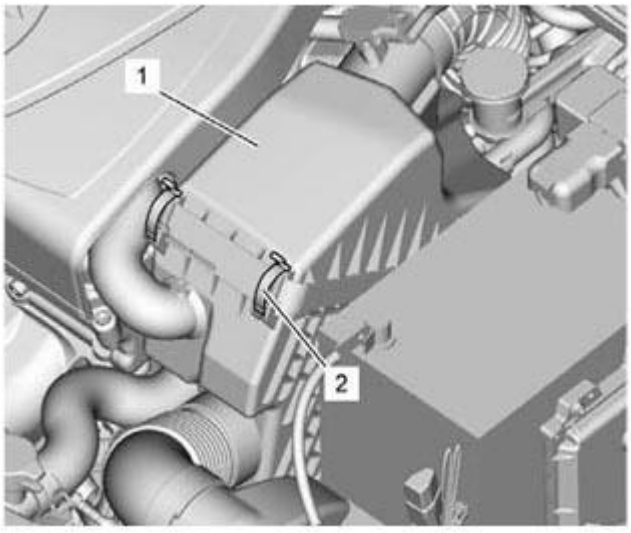


Fig. 8: Identifying Air Cleaner Case And Clamps
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove air cleaner filter from case.

Installation

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

Reverse removal procedure for installation.

AIR CLEANER FILTER INSPECTION AND CLEANING

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

Inspection

Check air cleaner filter for dirt.

Replace excessively dirty filter.

Cleaning

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

 © 2011 Mitchell Repair Information Company, LLC.

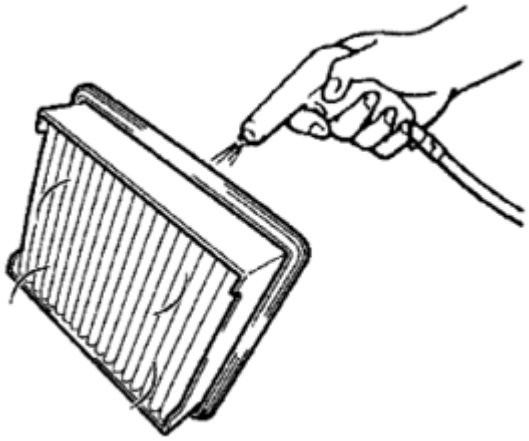


Fig. 9: Cleaning Filter
Courtesy of SUZUKI OF AMERICA CORP.

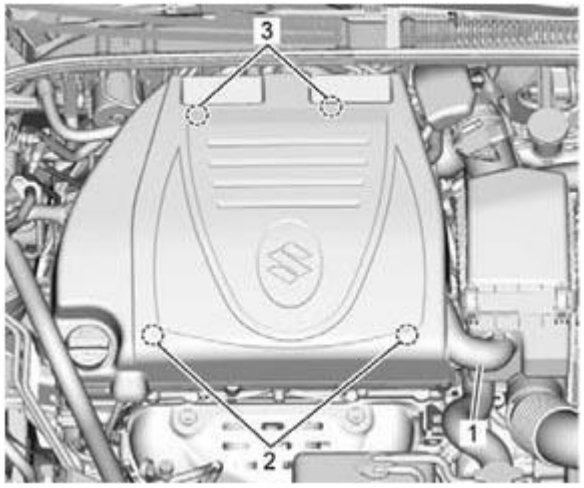
AIR CLEANER ASSEMBLY REMOVAL AND INSTALLATION

Reference: **AIR CLEANER COMPONENTS**

Removal

1. Disconnect negative (-) cable from battery.
2. Remove engine cover according to the following procedure.
    a. Disconnect engine cover hose (1) from air cleaner assembly.
    b. Disconnect engine cover front side hook (2) from engine cover pin.
    c. Disconnect engine cover rear side hook (3) from engine cover pin.

CAUTION: When removing the engine cover, be careful not to hit it against the cowling front panel.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 10: Identifying Air Cleaner Replacement Components
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove air cleaner inlet hose (1).
4. Disconnect MAF and IAT sensor connector (2).
5. Remove air cleaner outlet hose (3).
6. Remove air cleaner assembly (4).

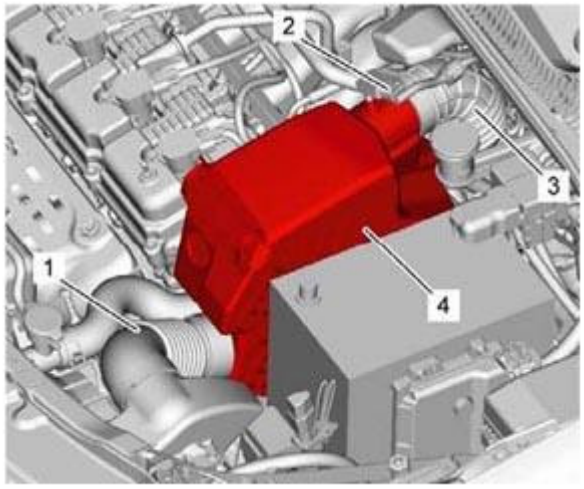


Fig. 11: Identifying Cleaner Outlet Hose And Air Cleaner Assembly
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove air cleaner outlet hose according to the following procedure if necessary.
   a. Disconnect breather pipe (1) from air cleaner outlet hose (2).
   b. Remove air cleaner outlet hose with resonator (3) from electric throttle body assembly (4).

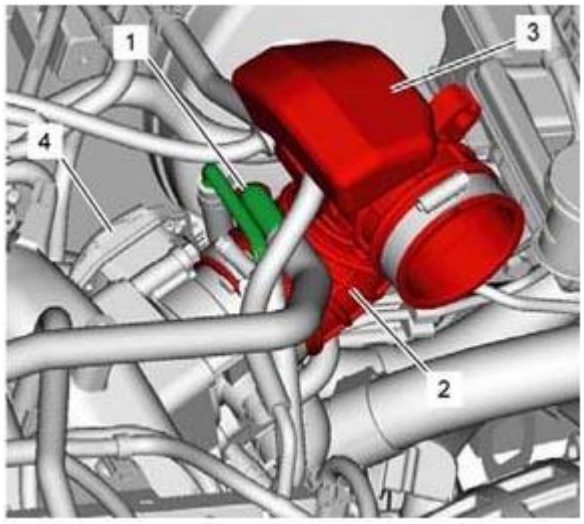


Fig. 12: Removing Air Cleaner Outlet Hose With Resonator From Electric Throttle Body

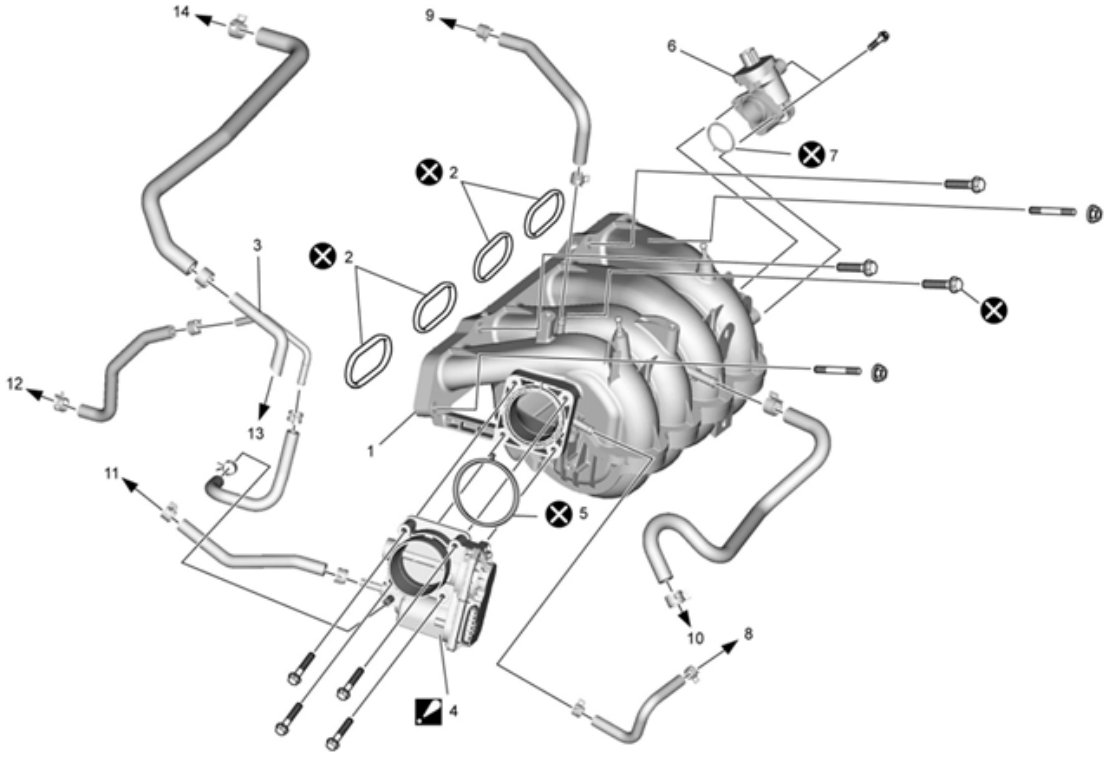
 © 2011 Mitchell Repair Information Company, LLC.

Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation.

THROTTLE BODY AND INTAKE MANIFOLD COMPONENTS



1. Intake manifold	9. To PCV valve
2. Intake manifold gasket	10. To brake booster
3. Breather pipe	11. To water outlet cap
4. Throttle body : Do not disassemble.	12. To heater outlet pipe
5. Throttle body gasket	13. To air cleaner outlet pipe
6. IMT valve actuator	14. To cylinder head cover
7. IMT valve actuator gasket	: Do not reuse.
8. To EVAP canister purge valve	

 © 2011 Mitchell Repair Information Company, LLC.

Fig. 13: Identifying Throttle Body And Intake Manifold Components
Courtesy of SUZUKI OF AMERICA CORP.

THROTTLE BODY ASSEMBLY REMOVAL AND INSTALLATION

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

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

Removal

1. Disconnect negative (-) cable from battery.
2. Drain coolant, see **COOLING SYSTEM DRAINING** .
3. Remove air cleaner assembly, see **Air Cleaner Assembly Removal and Installation**.
4. Disconnect engine coolant hoses (2) and electric connector (3) from throttle body assembly (1).

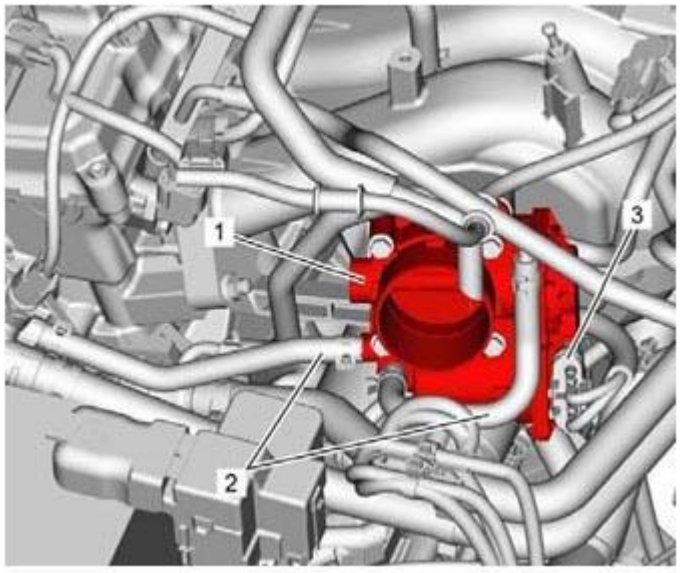


Fig. 14: Disconnecting Engine Coolant Hoses And Electric Connector From Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove throttle body assembly and its gasket from intake manifold.

Installation

Reference: **THROTTLE BODY CLEANING**

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

 © 2011 Mitchell Repair Information Company, LLC.

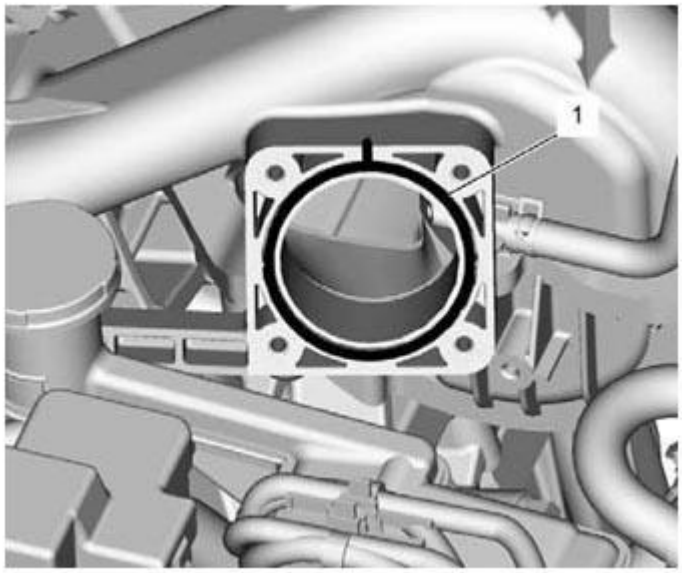


Fig. 15: Identifying Throttle Body Gasket
Courtesy of SUZUKI OF AMERICA CORP.

2. Install throttle body assembly (1) to intake manifold.
3. Connect electric connector (3) and coolant hoses (2) to throttle body assembly (1).

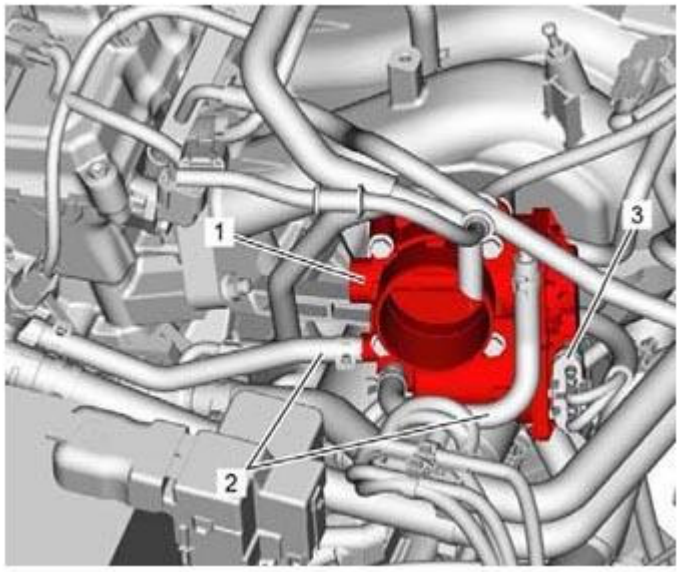


Fig. 16: Connecting Electric Connector And Coolant Hoses To Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.

THROTTLE BODY CLEANING

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

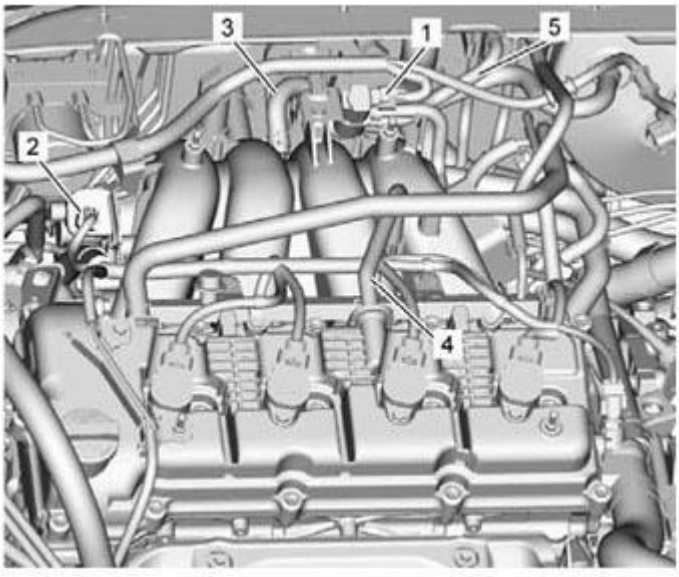
Clean throttle body assembly according to "Throttle Valve Visual Check" under **ELECTRIC THROTTLE BODY ASSEMBLY ON-VEHICLE INSPECTION** .

INTAKE MANIFOLD REMOVAL AND INSTALLATION

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

Removal

1. Disconnect negative (-) cable from battery.
2. Remove windshield wiper arms with wiper blades, see **WINDSHIELD WIPER REMOVAL AND INSTALLATION** .
3. Remove cowl top garnish and cowl top panel, see **COWL TOP AND FRONT LOWER CROSSMEMBER COMPONENTS** .
4. Remove air cleaner assembly, see **Air Cleaner Assembly Removal and Installation**.
5. Remove throttle body assembly, see **Throttle Body Assembly Removal and Installation**.
6. Disconnect the following wiring harness connectors and hoses.
    - EVAP canister purge valve connector (1)
    - IMT valve actuator connector (2)
    - Brake booster hose (3)
    - PCV valve hose (4)
    - Purge hose (5)
    - Engine harness clamps



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 17: Identifying Wiring Harness Connectors And Hoses
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove intake manifold (1) and intake manifold gaskets (2) from cylinder head.

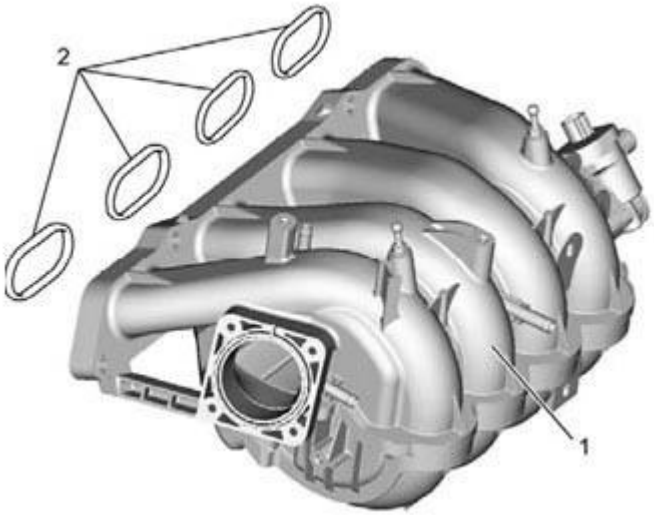


Fig. 18: Removing Intake Manifold And Intake Manifold Gaskets From Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation noting the following.

- Use new Intake manifold bolt for position (1) in figure, because it is not reusable.

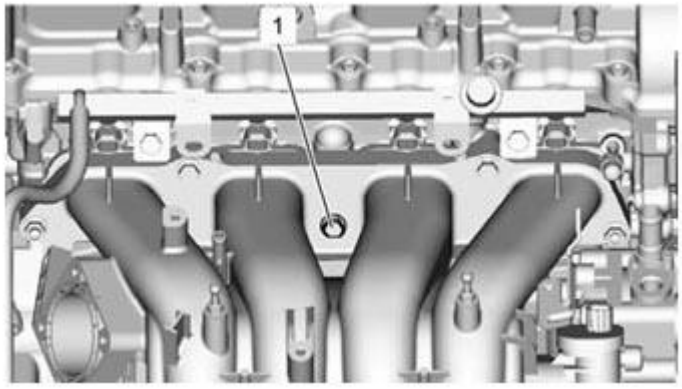


Fig. 19: Identifying Intake Manifold Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.

IMT VALVE ACTUATOR REMOVAL AND INSTALLATION

Removal

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

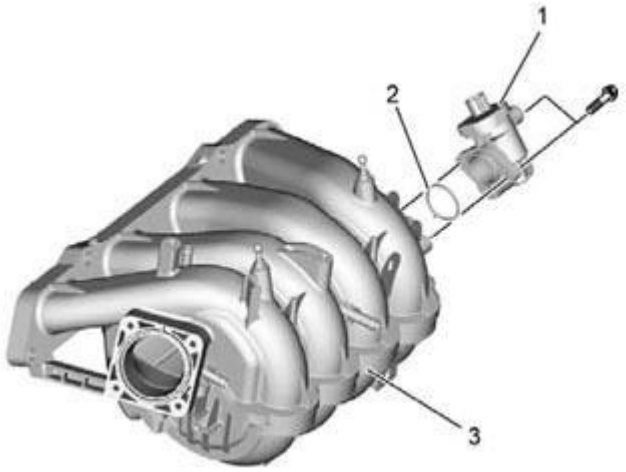


Fig. 20: Removing IMT Valve Actuator And Imt Valve Actuator Gasket From Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: IMT Valve Actuator Inspection

Reverse removal procedure noting the followings.

- Use new gasket.
- Check that IMT valve operates properly after installing IMT valve actuator to intake manifold.

CYLINDER BLOCK HEATER REMOVAL AND INSTALLATION (IF EQUIPPED)

Removal

1. Disconnect negative (-) cable from battery.
2. Drain coolant, see **COOLING SYSTEM DRAINING** .
3. Remove A/C condenser cooling fan.
   - Manual A/C model: Refer to **CYLINDER BLOCK HEATER INSPECTION (IF EQUIPPED)**.
   - Auto A/C model: Refer to **CONDENSER COOLING FAN REMOVAL AND INSTALLATION**
4. Remove exhaust manifold cover.

 © 2011 Mitchell Repair Information Company, LLC.

5. Remove engine block heater (1).

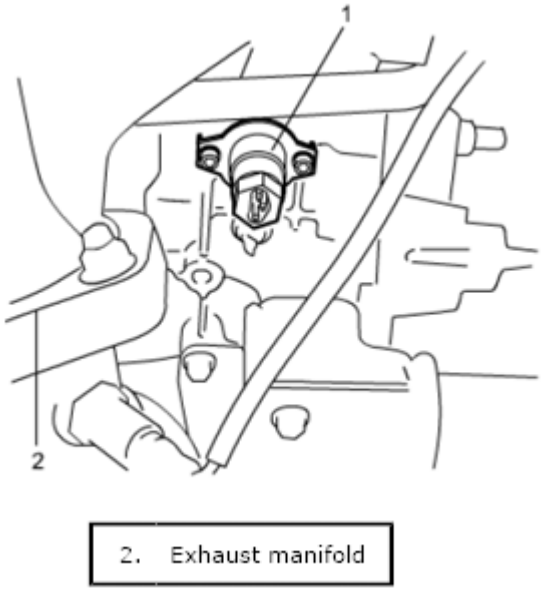


Fig. 21: Identifying Engine Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Reverse removal procedure for installation noting the following.

- 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)

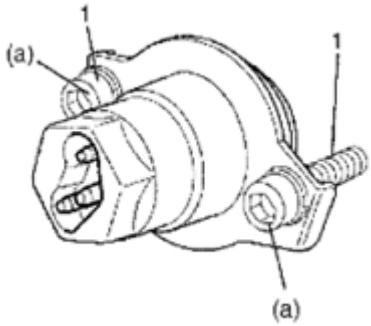


Fig. 22: Identifying Cylinder Block Heater Bolt

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of SUZUKI OF AMERICA CORP.

- Refill coolant. Refer to **COOLING SYSTEM REFILLING** .
- Check for coolant leaks. Refer to **ENGINE COOLING SYSTEM INSPECTION** .

CYLINDER BLOCK HEATER INSPECTION (IF EQUIPPED)

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

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

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

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

  If there is continuity, replace engine block heater. See **Cylinder Block Heater Removal and Installation (If Equipped)**.

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

  If there is no continuity, replace engine block heater. See **Cylinder Block Heater Removal and Installation (If Equipped)**.

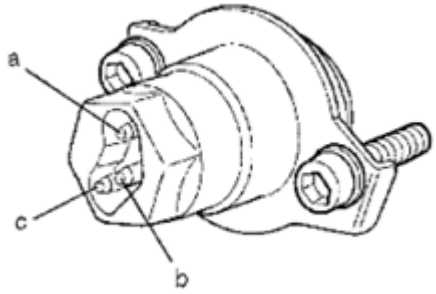
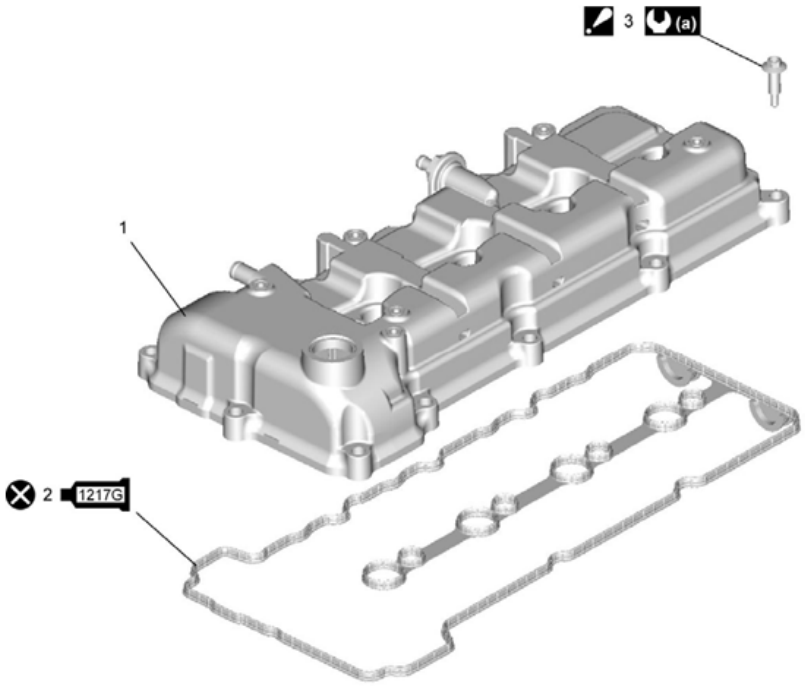


Fig. 23: Inspecting Cylinder Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD COVER COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



1. Cylinder head cover	3. Cylinder head cover bolt : For tightening order, refer to ***Cylinder Head Cover Removal and Installation***.	Do not reuse. :
1217G 2. Cylinder head cover gasket : Apply sealant 99000-31260 referring to ***Cylinder Head Cover Removal and Installation***.	(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)	

Fig. 24: Identifying Cylinder Head Cover Replacement Components
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD COVER REMOVAL AND INSTALLATION

Reference: **CYLINDER HEAD COVER COMPONENTS**

Removal

1. Disconnect negative (-) cable from battery.
2. Remove engine cover. Refer to **Air Cleaner Assembly Removal and Installation**.
3. Remove ignition coil assemblies from cylinder head cover. Refer to **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .
4. Disconnect PCV valve hose (1) and breather hose (2).
5. Detach engine harness clamps.
6. Loosen cylinder head cover bolts in numerical order ("1" - "16") evenly and gradually.

 © 2011 Mitchell Repair Information Company, LLC.

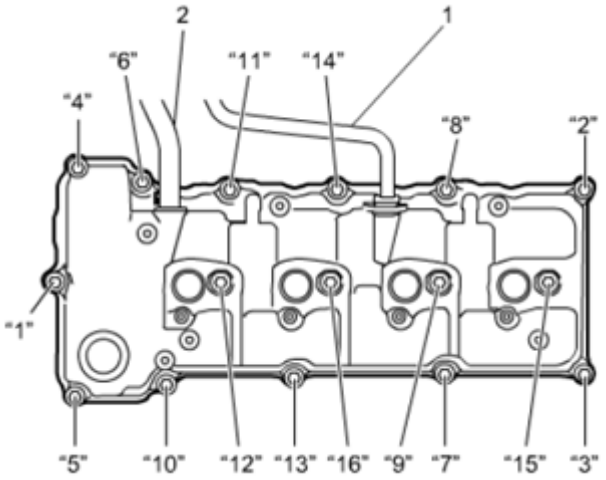


Fig. 25: Identifying Cylinder Head Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove cylinder head cover with its gasket.
8. Remove PCV valve if necessary.

Installation

1. Install new cylinder head cover gasket (1) to cylinder head cover (2) as shown in figure.

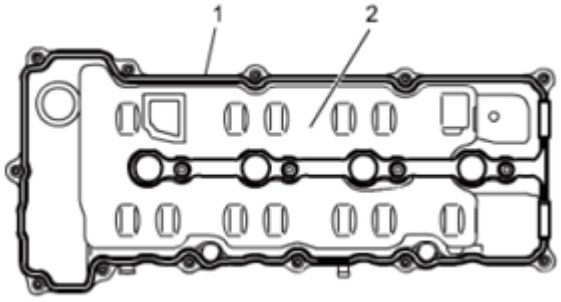


Fig. 26: Identifying Cylinder Head Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove oil, old sealant, and dust from sealing surfaces on cylinder head and cover. After cleaning, apply sealant "A" to the designated area in figure.

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

 © 2011 Mitchell Repair Information Company, LLC.

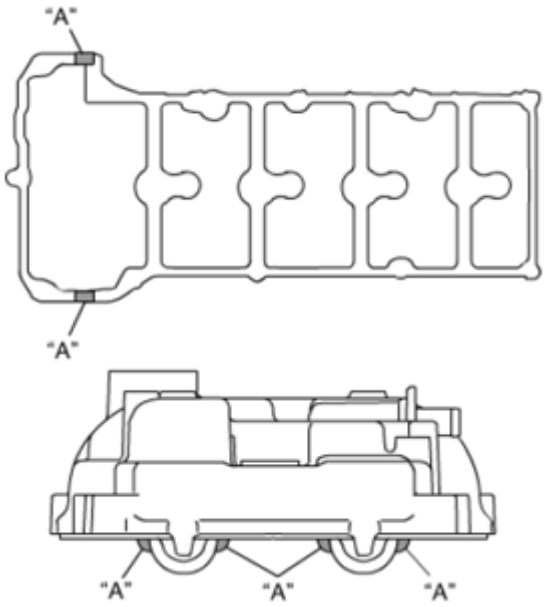


Fig. 27: Identifying "A": Sealant 99000-31260 (Suzuki Bond No. 1217G)
Courtesy of SUZUKI OF AMERICA CORP.

3. Install cylinder head cover to cylinder head.

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

4. Tighten cylinder head cover bolts according to the following procedure.
   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. In the same manner as Step a), retighten them to 5.0 N.m (0.51 kgf-m, 4.0 lbf-ft).
   c. In the same manner as Step a), retighten them to 7.5 N.m (0.76 kgf-m, 5.5 lbf-ft).

   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)

5. Connect PCV valve hose (1) to PCV valve and breather hose (2) to cylinder head cover.

 © 2011 Mitchell Repair Information Company, LLC.

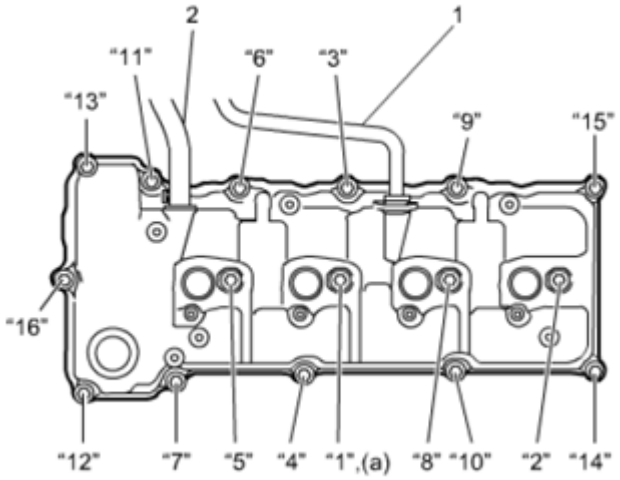
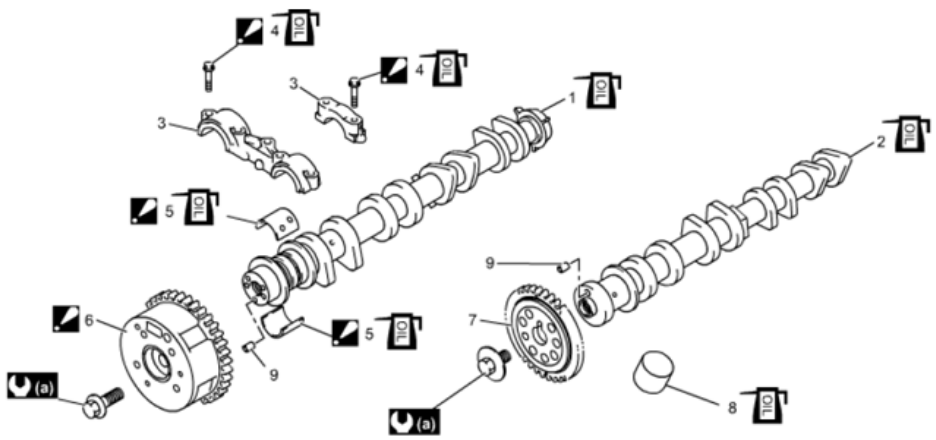


Fig. 28: Identifying Cylinder Head Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

6. Install ignition coil assemblies, see **IGNITION COIL ASSEMBLY REMOVAL AND INSTALLATION** .
7. Install engine cover, see **Air Cleaner Assembly Removal and Installation**.
8. Connect negative (-) cable to battery.

CAMSHAFT AND TAPPET COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 29: Identifying Camshaft And Tappet Replacement Components
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFT AND TAPPET REMOVAL AND INSTALLATION

Reference: **CAMSHAFT AND TAPPET COMPONENTS**

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

Removal

1. Remove cylinder head cover, see **Cylinder Head Cover Removal and Installation**.
2. Remove accessory drive belt, see **ACCESSORY DRIVE BELT INSPECTION** .
3. Turn crankshaft clockwise with 19 mm wrench, and position piston No. 1 at TDC on the compression

 © 2011 Mitchell Repair Information Company, LLC.

stroke according to the following procedure.

a. Align the timing mark (1) on the CMP actuator and the timing mark (2) on the exhaust camshaft timing sprocket with the match marks (3) on the camshaft housing No. 1.

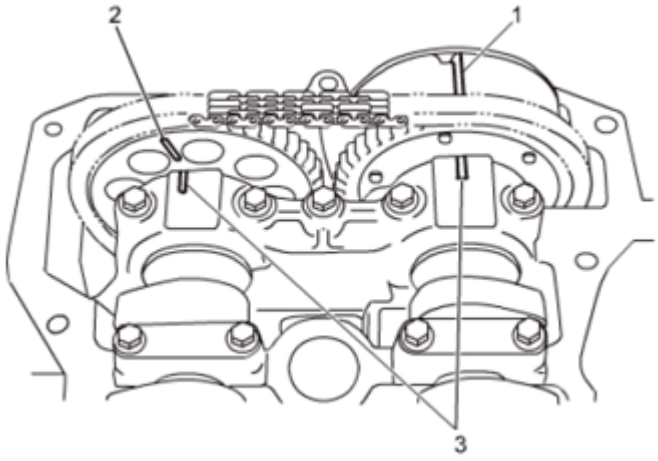


Fig. 30: Aligning Timing Mark On Cmp Actuator And Timing Mark On Exhaust Camshaft Timing Sprocket With Match Marks On Camshaft Housing No. 1
Courtesy of SUZUKI OF AMERICA CORP.

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

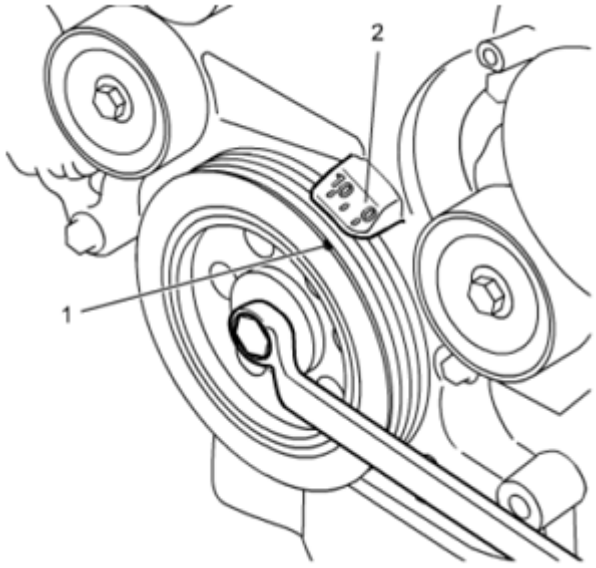


Fig. 31: Aligning Notch On Crankshaft Pulley With "0" On Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

4. Fix timing chain tensioner according to the following procedure.
   a. Remove timing chain cover plug (1) and gasket (2).

 © 2011 Mitchell Repair Information Company, LLC.



Fig. 32: Removing 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) through timing chain cover plug hole.

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

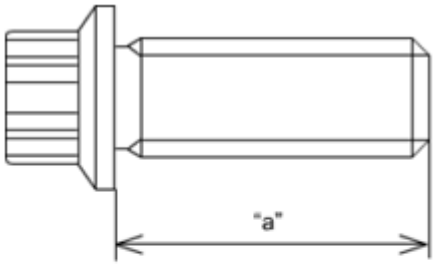
Special Tool

(A): 09917-16710

c. Fix special tool by tightening 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.**

 © 2011 Mitchell Repair Information Company, LLC.



Size: M6
Thread pitch: 1.0 mm (0.039 in.)
"a": 15 mm (0.59 in)

Fig. 33: Identifying Special Tool Fixing Bolt
Courtesy of SUZUKI OF AMERICA CORP.

- **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 reinstall timing chain properly.**
- **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)

 © 2011 Mitchell Repair Information Company, LLC.

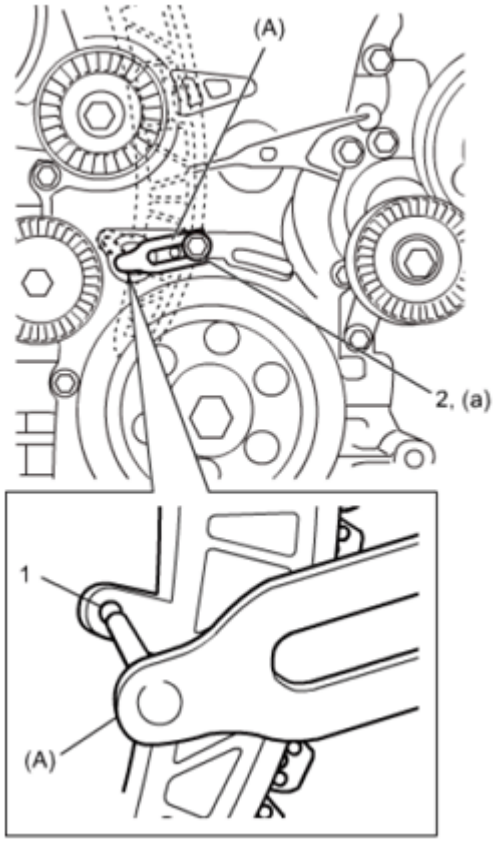


Fig. 34: Identifying Special Tool Fixing Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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.

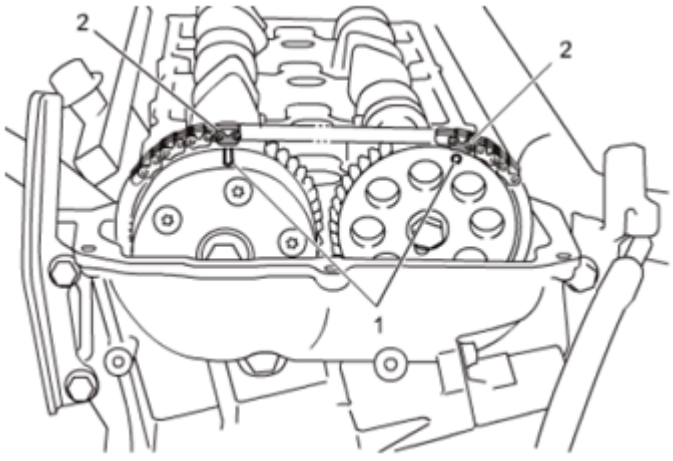


Fig. 35: Identifying Timing Chain Links On Cmp Actuator And Exhaust Camshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

6. Remove exhaust camshaft timing sprocket according to the following procedure.
   a. Hold hexagonal section of exhaust camshaft using wrench or the like.
   b. Loosen exhaust camshaft timing sprocket bolt and remove exhaust camshaft timing sprocket (1).

CAUTION:
- **Be careful not to drop dowel pin into the space between timing chain cover and cylinder block.**
- **Do not remove CMP actuator at this procedure.**

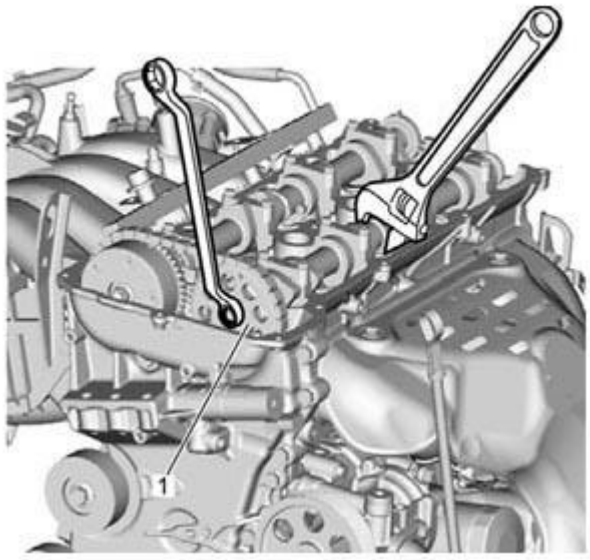


Fig. 36: Removing Exhaust Camshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

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

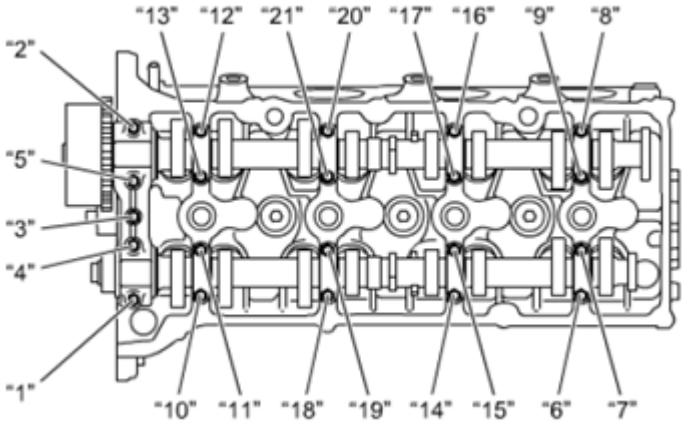


Fig. 37: Identifying Camshaft Housing Bolts
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

9. Remove intake camshaft and exhaust camshaft.

NOTE: Be careful not to drop timing chain into timing chain cover.

10. Remove camshaft bearings and tappets as necessary.
11. Remove CMP actuator from intake camshaft according to the following procedure if necessary.
    a. Hold hexagonal section of intake camshaft using vice.
    b. Loosen CMP actuator bolt and remove CMP actuator (1).

CAUTION: Do not disassemble CMP actuator.

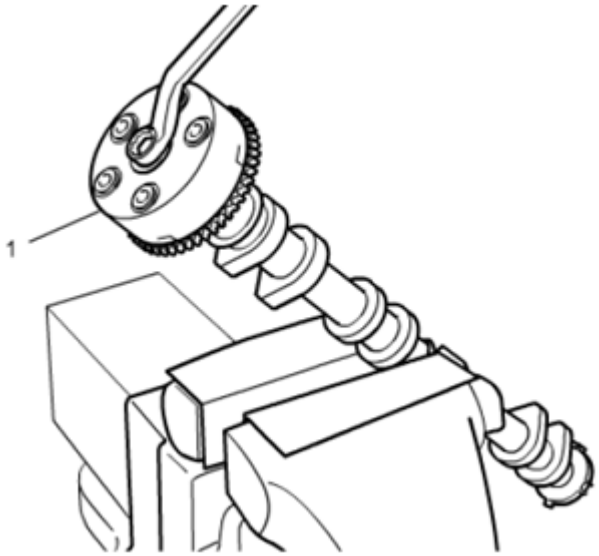


Fig. 38: Loosening CMP Actuator Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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)

 © 2011 Mitchell Repair Information Company, LLC.

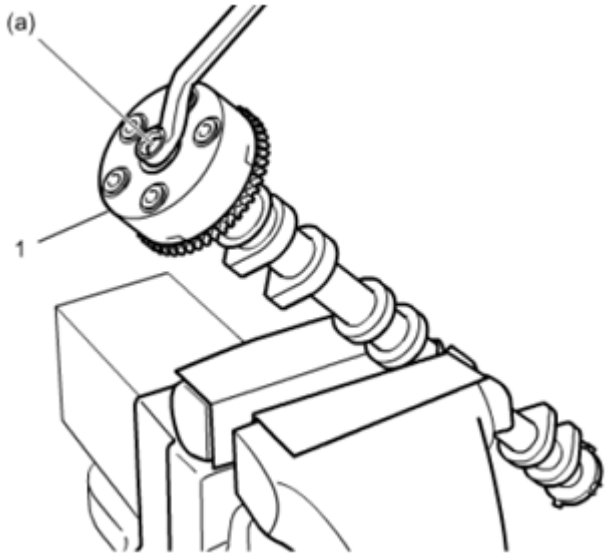


Fig. 39: Installing CMP Actuator To Intake Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

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

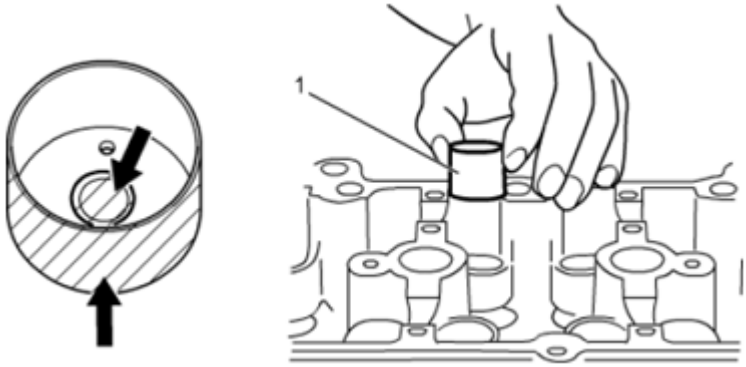


Fig. 40: Installing Tappets To Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

3. Install camshaft bearings according to the following procedure.

CAUTION: Camshaft upper bearing half (1) is different in shape from lower bearing half (2).
Distinguish upper and lower bearing halves certainly when installing.

 © 2011 Mitchell Repair Information Company, LLC.

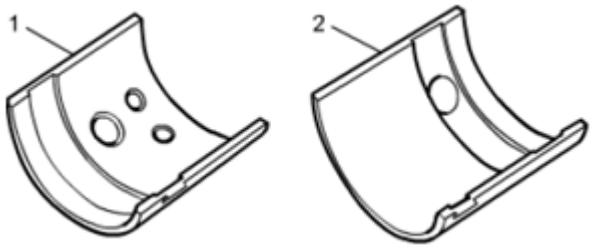


Fig. 41: Identifying Camshaft Upper Bearing Half
Courtesy of SUZUKI OF AMERICA CORP.

a. Fit tab (1) of camshaft bearing to groove (2) of cylinder head or camshaft housing.
b. Press camshaft bearing end (3) until it fully seats in 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).

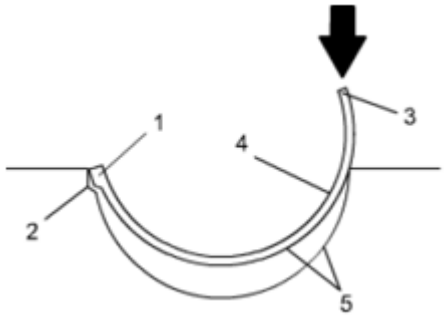


Fig. 42: Fitting Tab Of Camshaft Bearing To Groove Of Cylinder Head Or Camshaft Housing
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply engine oil to sliding surfaces of camshafts, and then install camshafts to cylinder head according to the following procedure.
   a. Align the timing chain link (2), which is painted in removal procedure under this service information, with timing mark (1) on CMP actuator and install intake camshaft.
   b. Install exhaust camshaft and position dowel pin hole (3) of exhaust camshaft downward.

 © 2011 Mitchell Repair Information Company, LLC.

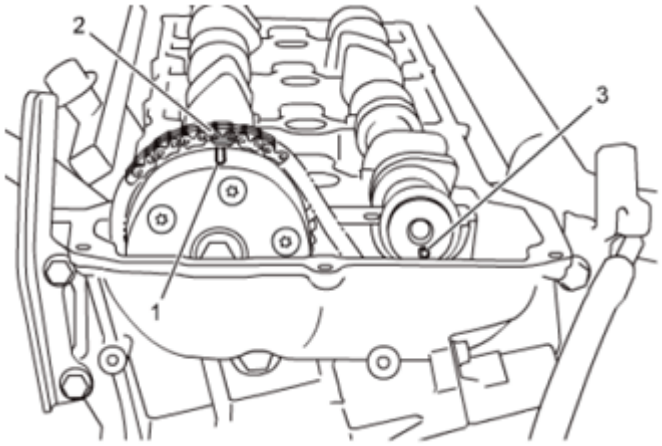
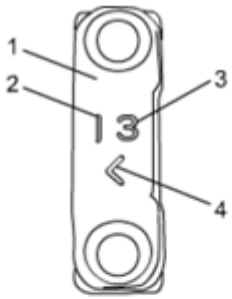


Fig. 43: Identifying Exhaust Camshaft And Position Dowel Pin Hole Of Exhaust Camshaft Downward
Courtesy of SUZUKI OF AMERICA CORP.

5. Install camshaft housings (1) to proper places distinguished by character (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. 44: Identifying Camshaft Housings
Courtesy of SUZUKI OF AMERICA CORP.

6. Tighten camshaft housing bolts according to the following procedure.
   a. Apply engine oil to bolt thread and seat of camshaft housing bolts.
   b. Install camshaft housing No. 1 (1).

      Install camshaft housing bolts, and tighten them by hand.

 © 2011 Mitchell Repair Information Company, LLC.

c. 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)

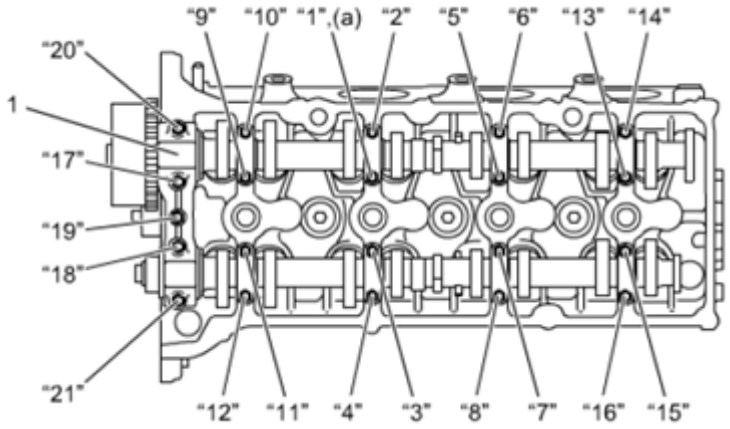
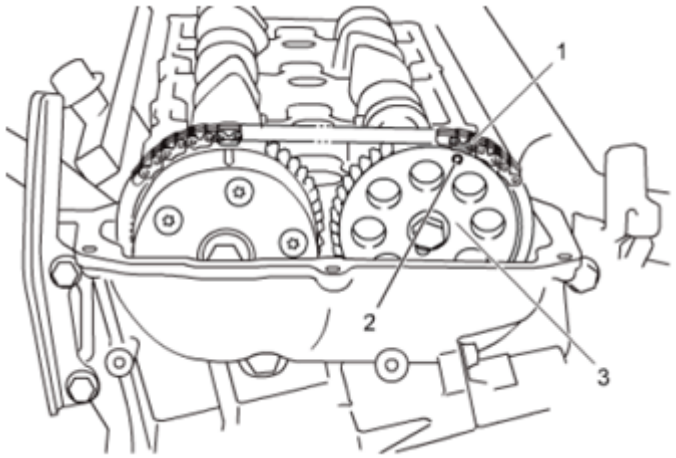


Fig. 45: Identifying Camshaft Housing No. 1
Courtesy of SUZUKI OF AMERICA CORP.

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 according to the following procedure.
   a. Align timing chain link (1), which is painted in "removal" under this service information, 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.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 46: Identifying Exhaust Camshaft Timing Sprocket With Timing Chain To Exhaust Camshaft
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)

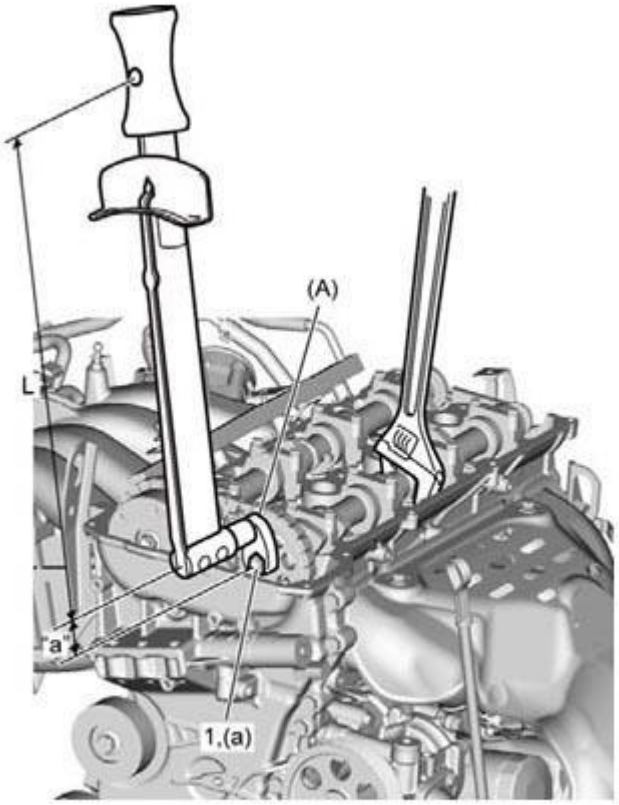
CAUTION: In case of using extension special tool combined with torque wrench, reading value of torque wrench is smaller than actual value. When using extension special tool, reading value should be calculated according to formula below.

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 wench length**
- **"a": Dimension of special tool**

 © 2011 Mitchell Repair Information Company, LLC.



"a": 20 mm (0.79 in.)

Fig. 47: Identifying Torque Wrench
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.

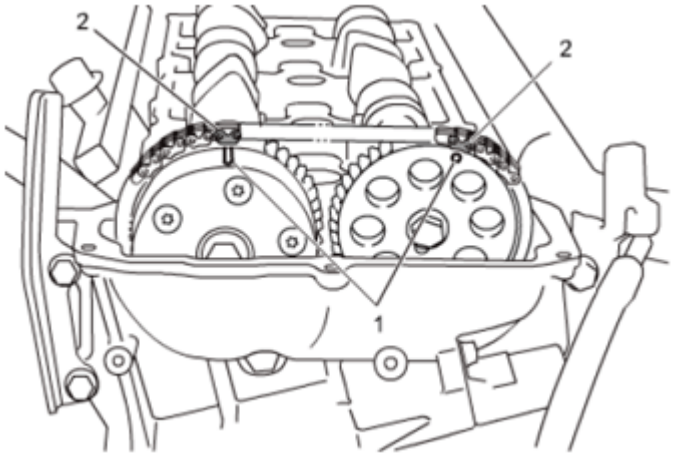


Fig. 48: Identifying Chain Links With Timing Marks On Cmp Actuator

 © 2011 Mitchell Repair Information Company, LLC.

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)

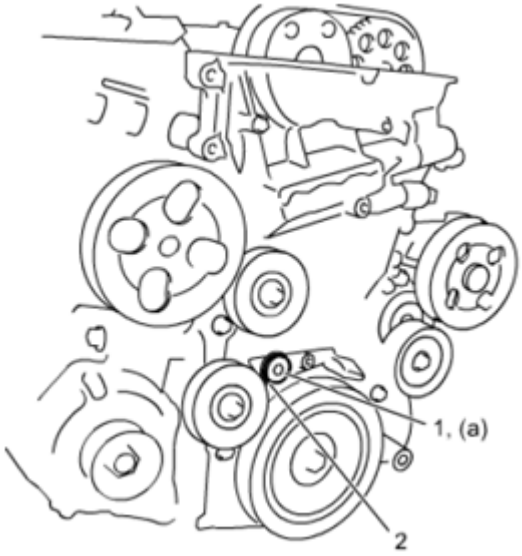


Fig. 49: Identifying Timing Chain Cover Plug With New Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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

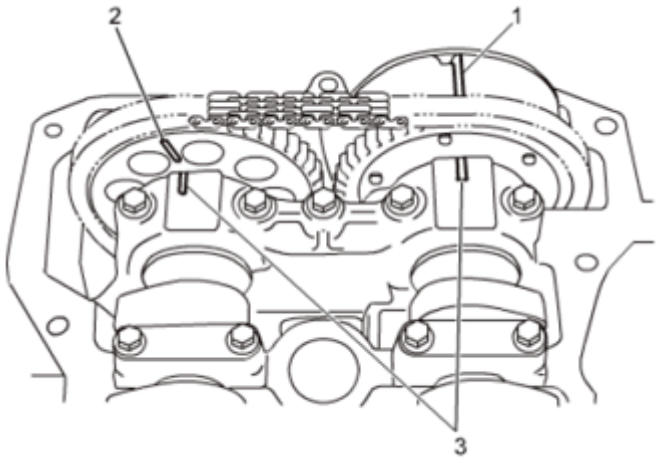


Fig. 50: Identifying Timing Mark On Cmp Actuator

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of SUZUKI OF AMERICA CORP.

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

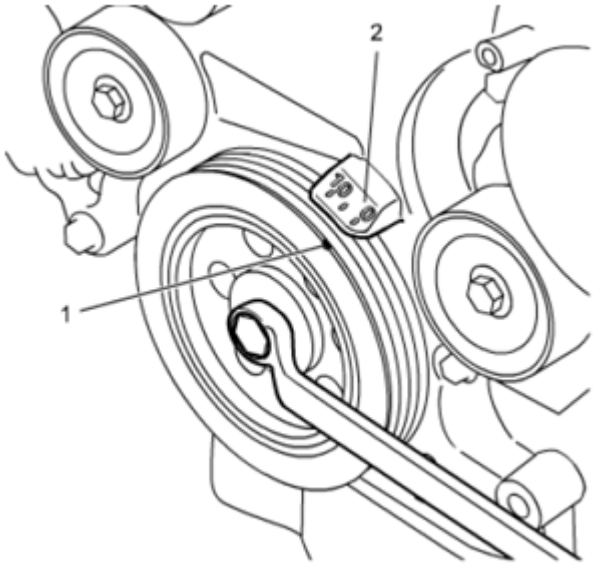


Fig. 51: Identifying Notch On Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

NOTE:

- **Be sure to turn crankshaft fully twice. If it is once, timing marks on CMP actuator and exhaust camshaft timing sprockets do not meet match marks on camshaft housing No. 1.**
- **After turning crankshaft twice, the painted links of timing chain are not aligned with the timing marks on the CMP actuator and the exhaust timing sprocket, but it 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

Using a micrometer, measure cam height "a". If measured height is out of standard values, replace camshaft.

Cam Height (IN)

Standard: 47.023 - 47.183 mm (1.8513 - 1.8576 in.)

 © 2011 Mitchell Repair Information Company, LLC.

Limit: 46.890 mm (1.8461 in.)

Cam Height (EX)

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

Limit: 46.420 mm (1.8276 in.)

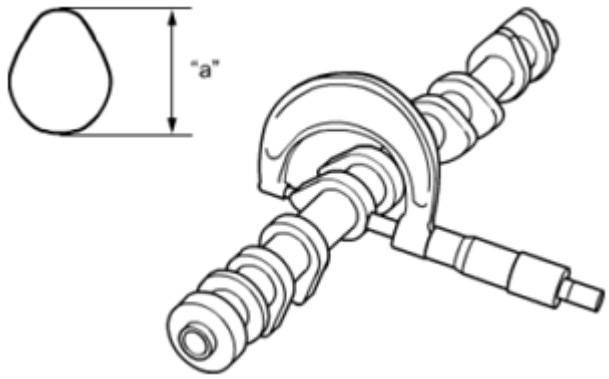


Fig. 52: Measuring Cam Height
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Runout

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

If measured camshaft runout exceeds limit, replace camshaft.

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

Camshaft runout limit

0.015 mm (0.00050 in.)

 © 2011 Mitchell Repair Information Company, LLC.

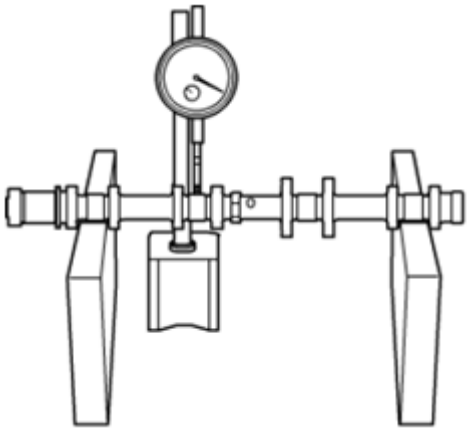


Fig. 53: Measuring Camshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Journal

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

  If any defective is found, replace camshaft or cylinder head with camshaft housings.

  CAUTION: Do not attempt to fix malcondition of camshaft journal and camshaft housing for reuse.

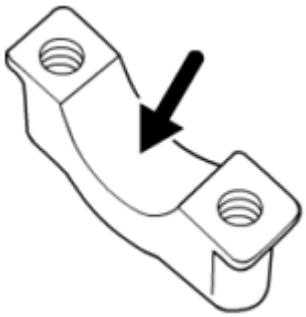


Fig. 54: Locating Camshaft Journal
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Journal Clearance

1. Clean camshaft housings and camshaft journals.
2. Remove all tappets.
3. Install camshafts and lower bearing half to cylinder head.
4. Place a piece of gauging plastic to full width of camshaft journal (parallel to camshaft).
5. Install camshaft housing referring to steps 5) to 6) in "Installation" under **CAMSHAFT AND TAPPET REMOVAL AND INSTALLATION**.

 © 2011 Mitchell Repair Information Company, LLC.

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

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

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

   Standard: 0.020 - 0.072 mm (0.00079 - 0.00283 in.)

   Limit: 0.10 mm (0.0039 in.)

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

   Standard: 0.020 - 0.062 mm (0.00079 - 0.00244 in.)

   Limit: 0.095 mm (0.00374 in.)

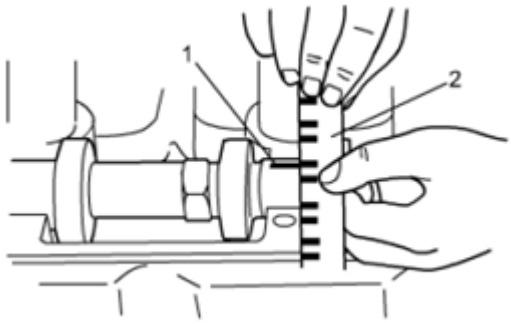


Fig. 55: Measuring Camshaft Journal Clearance
Courtesy of SUZUKI OF AMERICA CORP.

If measured camshaft journal clearance exceeds limit, recheck camshaft journal clearance according to the following procedure.

   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. If measured diameter is out of standard values, replace camshaft and recheck camshaft journal clearance.

      If measured diameter is within standard values, replace camshaft bearings and recheck camshaft journal clearance.

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

 © 2011 Mitchell Repair Information Company, LLC.

If measured diameters are out of standard values, replace corresponding camshaft or cylinder head and camshaft housings.

Camshaft journal outside diameter

CAMSHAFT JOURNAL OUTSIDE DIAMETER

Item	Standard
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

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.)

© 2011 Mitchell Repair Information Company, LLC.

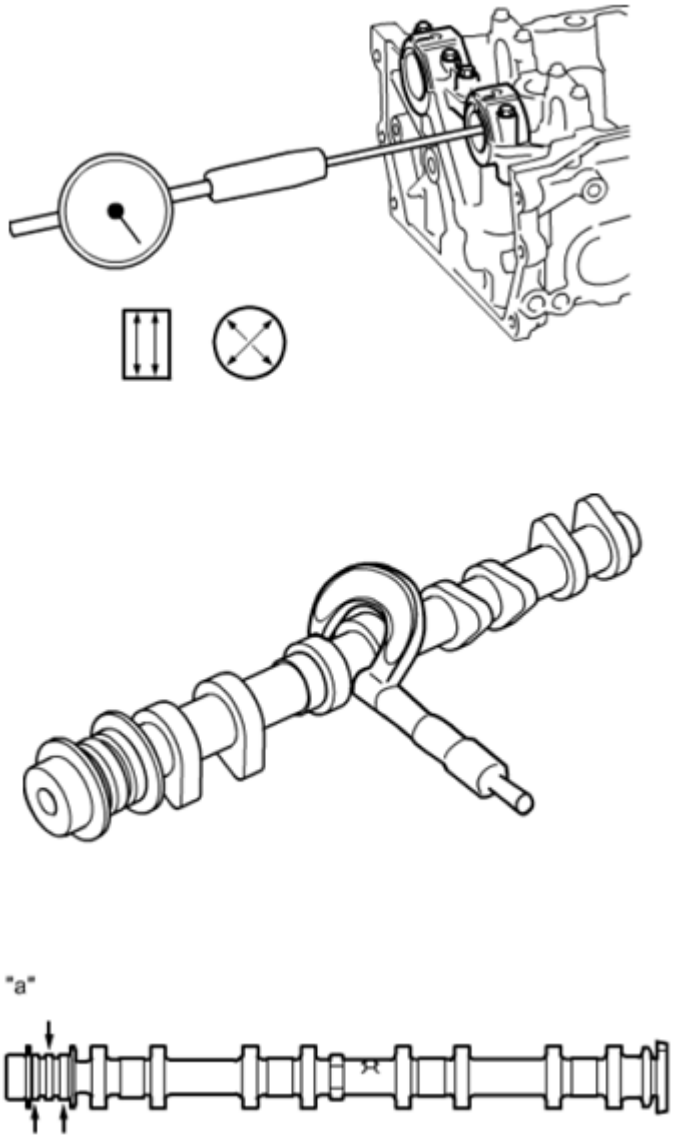


Fig. 56: Measuring Camshaft Housing Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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

   If measured clearance exceeds limit, replace camshaft or cylinder head and camshaft housings.

   Camshaft housing thrust clearance

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

   Limit: 0.50 mm (0.020 in.)

 © 2011 Mitchell Repair Information Company, LLC.

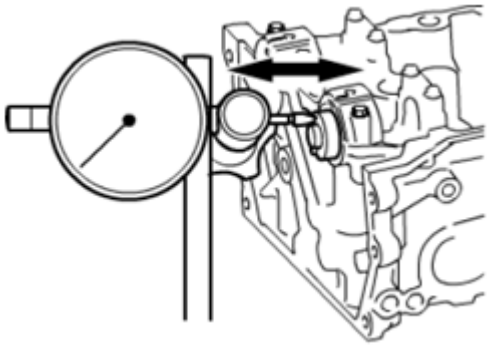


Fig. 57: Measuring Camshaft Housing Thrust Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Wear of Tappet

Check tappet for pitting, scratches, or damage.

If any defective condition is found, replace tappet.

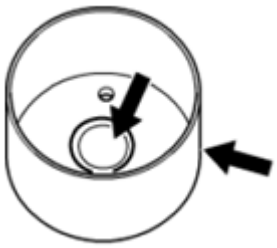


Fig. 58: Checking Tappet For Pitting And Scratches
Courtesy of SUZUKI OF AMERICA CORP.

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

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.)

 © 2011 Mitchell Repair Information Company, LLC.

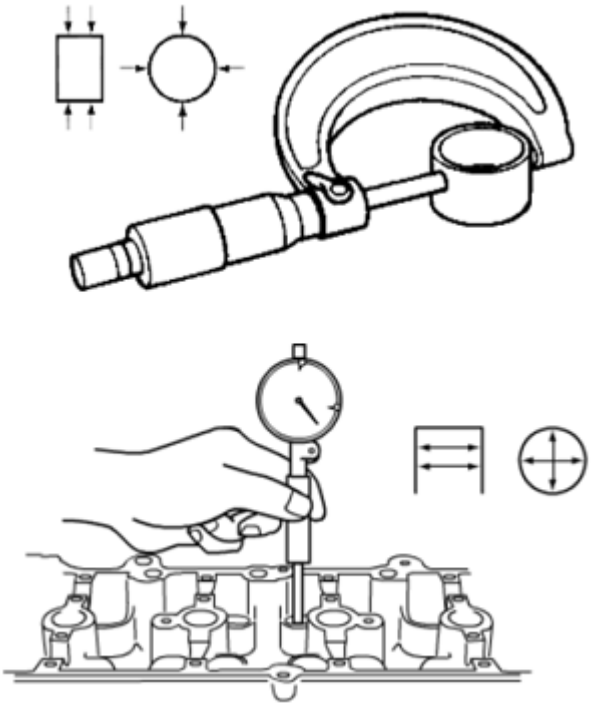


Fig. 59: Measuring Cylinder Head Tappet Bore
Courtesy of SUZUKI OF AMERICA CORP.

Exhaust Camshaft Timing Sprocket

Check exhaust camshaft timing sprocket for wear and damage.

If any defective condition is found, replace exhaust camshaft timing sprocket.

CMP actuator

- Check CMP actuator for wear or damage.

  If any defective condition is found, replace CMP actuator.

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

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

  If it can be turned by hand, replace CMP actuator.

 © 2011 Mitchell Repair Information Company, LLC.

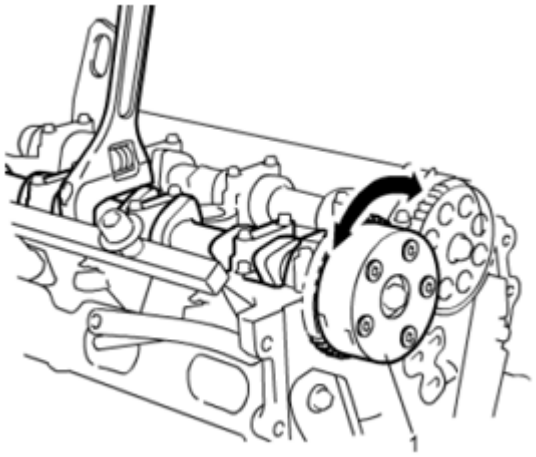


Fig. 60: Locating CMP Actuator
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE MOUNTINGS COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.

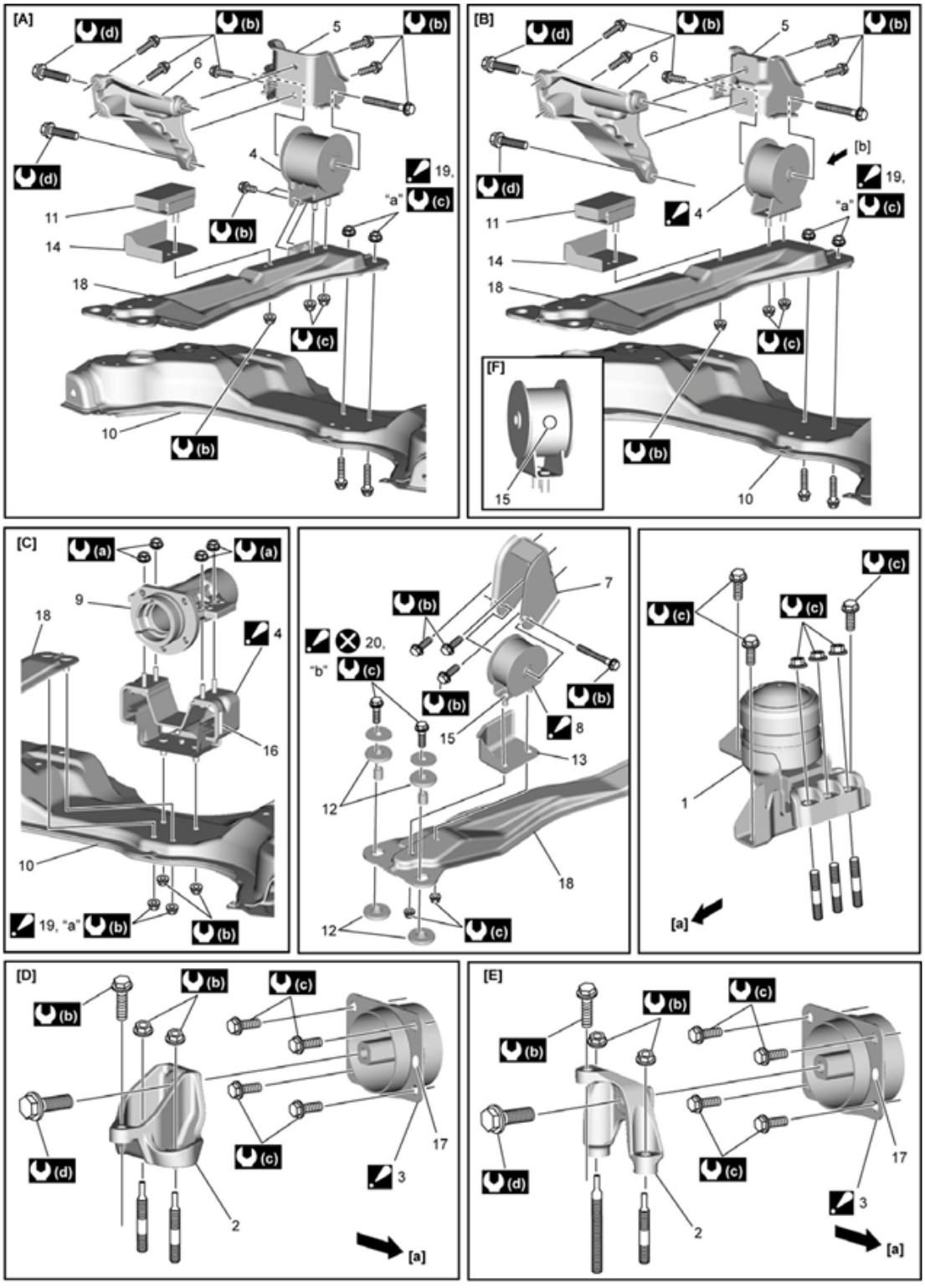


Fig. 61: Identifying Engine Mountings Replacement Components (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

[A]: Engine rear mounting for 2WD-M/T model	5. Engine rear mounting No.1 bracket	16. White make
[B]: Engine rear mounting for 2WD-CVT model	6. Engine rear mounting No.2 bracket	17. Green mark
[C]: Engine rear mounting for 4WD model	7. Engine front mounting bracket	18. Mounting member
[D]: Engine left mounting for M/T model	8. Engine front mounting :Be sure to direct yellow mark to forward.	19. Mounting member nut Tighten order: "a" → "b"
[E]: Engine left mounting for CVT model	9. Transfer	20. Mounting member bolt Tighten order: "a" → "b"
[F]: View [b]	10. Front suspension frame	(a): 25 N·m (2.5 kgf-m, 18.0 lbf-ft)
[a]: Vehicle forward	11. Dynamic damper	(b): 55 N·m (5.5 kgf-m, 40.0 lbf-ft)
1. Engine right mounting	12. Mounting member cushion	(c): 65 N·m (6.5 kgf-m, 47.0 lbf-ft)
2. Engine left mounting bracket	13. Engine front mounting cover	(d): 93 N·m (9.3 kgf-m, 67.5 lbf-ft)
Engine left mounting :Be sure to direct paint mark to forward. 3.	14. Heat insulator	: Do not reuse.
Engine rear mounting :For 2WD-CVT model be sure to direct paint mark to backward. :For 4WD model be sure to direct paint mark to forward. 4.	15. Yellow mark	

Fig. 62: Identifying Engine Mountings Replacement Components (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE ASSEMBLY REMOVAL AND INSTALLATION

Reference: **ENGINE MOUNTINGS COMPONENTS**

Removal

1. Relieve fuel pressure, see **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative and positive cables at battery.
3. Disconnect ECM connectors.
4. Remove battery and battery tray with ECM.
5. Remove right and left side engine under covers.
6. Remove accessory drive belt, see **ACCESSORY DRIVE BELT INSPECTION** .
7. Remove front bumper, see **FRONT BUMPER AND REAR BUMPER COMPONENTS** .
8. Drain the following oils and fluids if necessary.
   - Engine oil, see **ENGINE OIL AND FILTER CHANGE** .
   - Manual transaxle oil (M/T model), see **MANUAL TRANSAXLE OIL CHANGE** .
   - CVT fluid (CVT model), see **CVT FLUID CHANGE** .
   - P/S fluid (Hydraulic P/S model), see **P/S FLUID CHANGE** .

 © 2011 Mitchell Repair Information Company, LLC.

- Transfer oil (4WD model), see **TRANSFER OIL CHANGE** .

9. Remove air cleaner assembly.
10. Remove radiator, see **RADIATOR REMOVAL AND INSTALLATION** .
11. With hose connected, detach A/C compressor from its bracket.
    - Manual A/C model, see **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
    - Auto A/C model, see **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .

CAUTION: Suspend removed A/C compressor at a place where no damage will be caused during removal and installation of engine assembly.

12. Disconnect P/S fluid reservoir hose (1) and P/S gear low pressure hose (2) (Hydraulic P/S model).

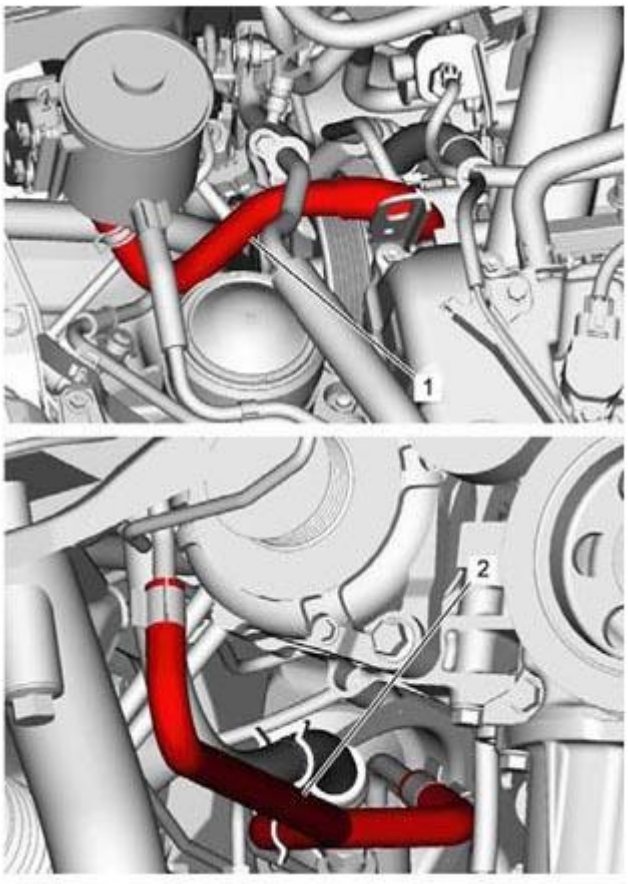
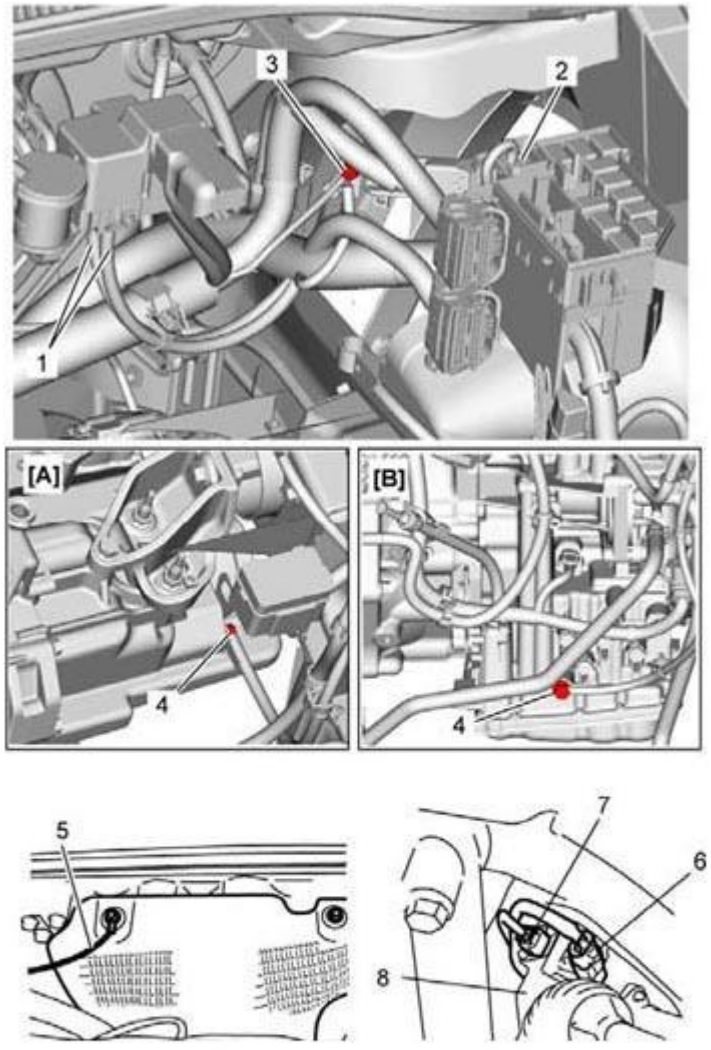


Fig. 63: Disconnecting P/S Fluid Reservoir Hose And P/S Gear Low Pressure Hose
Courtesy of SUZUKI OF AMERICA CORP.

13. Disconnect the following electric wires/connectors and each clamp.
    - Connectors (1) in main fuse box
    - Connector (2) in fuse box No. 1

 © 2011 Mitchell Repair Information Company, LLC.

- Ground terminal (3) from vehicle body
- Battery ground cable (4) from transaxle
- Ground terminal (5) from exhaust manifold
- Torque sensor (6) (EPS model)
- P/S motor (7) (EPS model)



[A]:	M/T model
[B]:	CVT model
8.	Steering gear box (EPS model)

Fig. 64: Disconnecting Electric Wires/Connectors And Clamp
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

14. Disconnect TCM connectors (1), and then pull out engine harness to engine compartment.

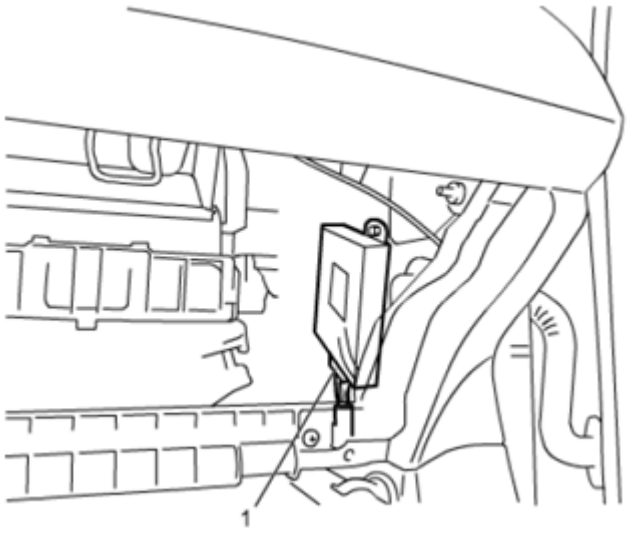
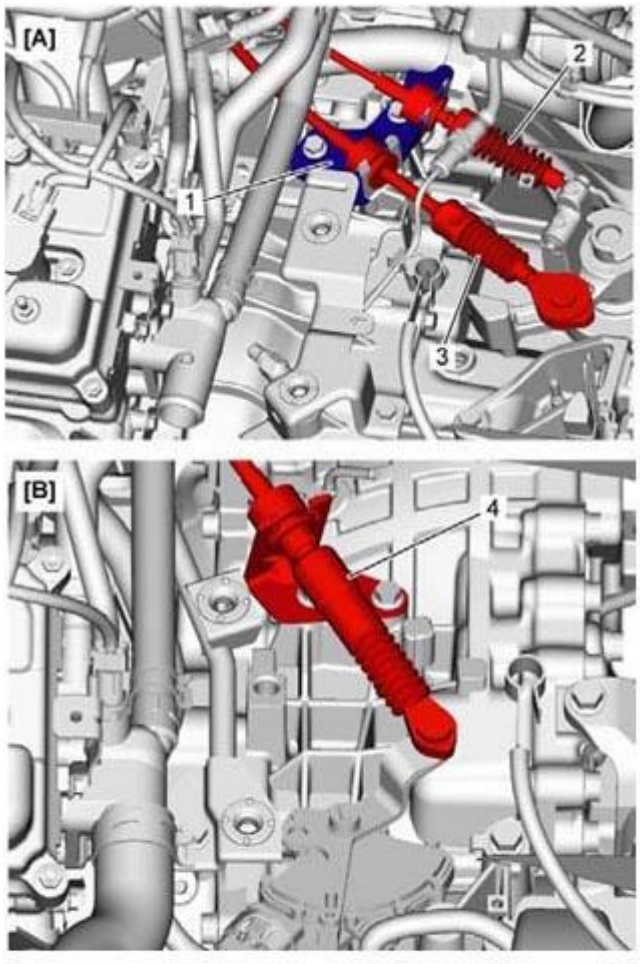


Fig. 65: Disconnecting Tcm Connectors
Courtesy of SUZUKI OF AMERICA CORP.

15. Disconnect the following cables, and remove control cable bracket (1).
    - Gear select control cable (2) (M/T model)
    - Gear shift control cable (3) (M/T model)
    - Select cable with select cable bracket (4) (CVT model)

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 66: Identifying Cables And Control Cable Bracket
Courtesy of SUZUKI OF AMERICA CORP.

16. Disconnect the following hoses.
    - Brake booster hose (1) from brake booster
    - Heater inlet and outlet hoses (2) from water outlet cap and heater outlet pipe
    - Fuel feed hose (3) from fuel feed pipe
    - Purge hose (4) from purge valve
    - Clutch hose (5) from clutch fluid pipe (6) (M/T model)

 © 2011 Mitchell Repair Information Company, LLC.

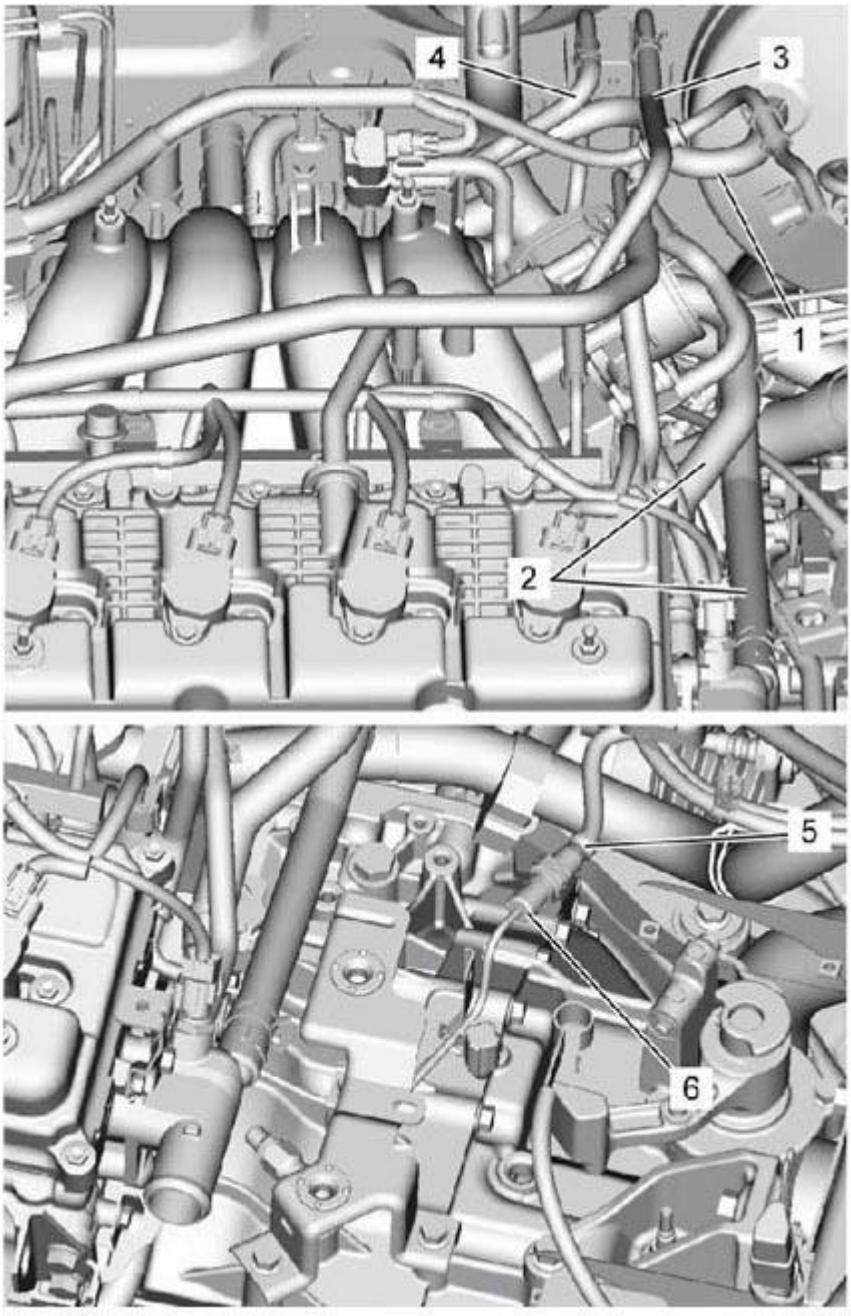


Fig. 67: Disconnecting Hoses
Courtesy of SUZUKI OF AMERICA CORP.

17. Remove right and left drive shaft, see **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
18. Remove exhaust No. 1, No. 2 and center pipe. See **EXHAUST SYSTEM COMPONENTS** .
19. Disconnect propeller shaft from transfer (4WD model), see **PROPELLER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
20. Disconnect steering lower shaft from pinion shaft, see **STEERING LOWER SHAFT REMOVAL**

 © 2011 Mitchell Repair Information Company, LLC.

AND INSTALLATION .

21. Fix A/C condenser to vehicle body with rope so that A/C condenser does not fall off while lowering engine front mounting member.
22. Fix transaxle to suspension frame with rope so that engine assembly does not incline while lowering engine assembly.

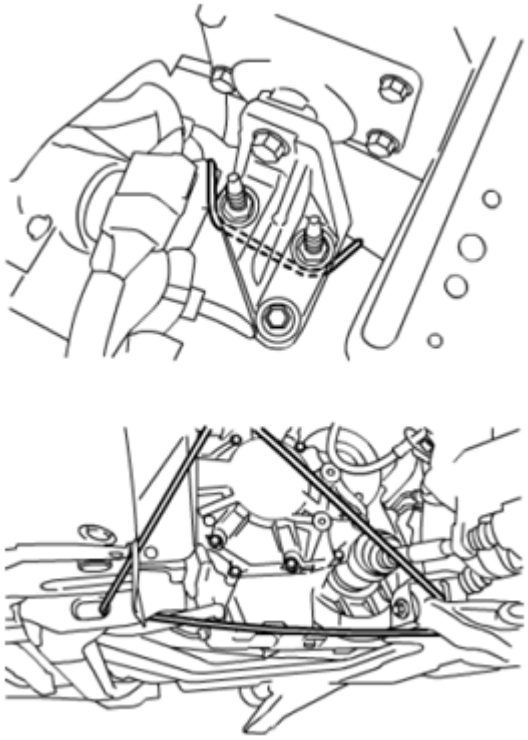
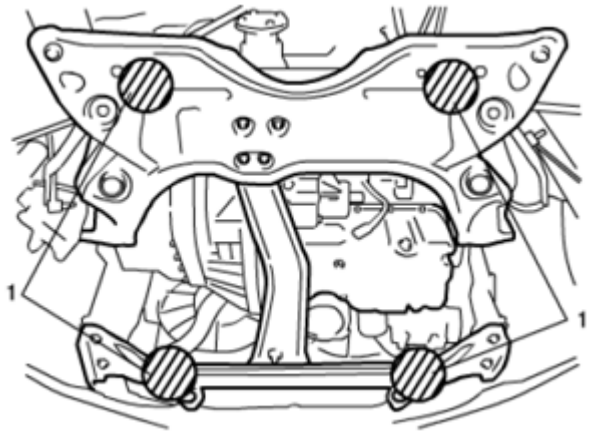


Fig. 68: Fixing Transaxle To Suspension Frame With Rope
Courtesy of SUZUKI OF AMERICA CORP.

23. Support front suspension frame and engine front mounting member putting jack at hatched parts (1) indicated in figure.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 69: Supporting Front Suspension Frame And Engine Front Mounting Member
Courtesy of SUZUKI OF AMERICA CORP.

24. Remove engine right mounting nuts (1) and engine left mounting bracket bolt and nuts (2).

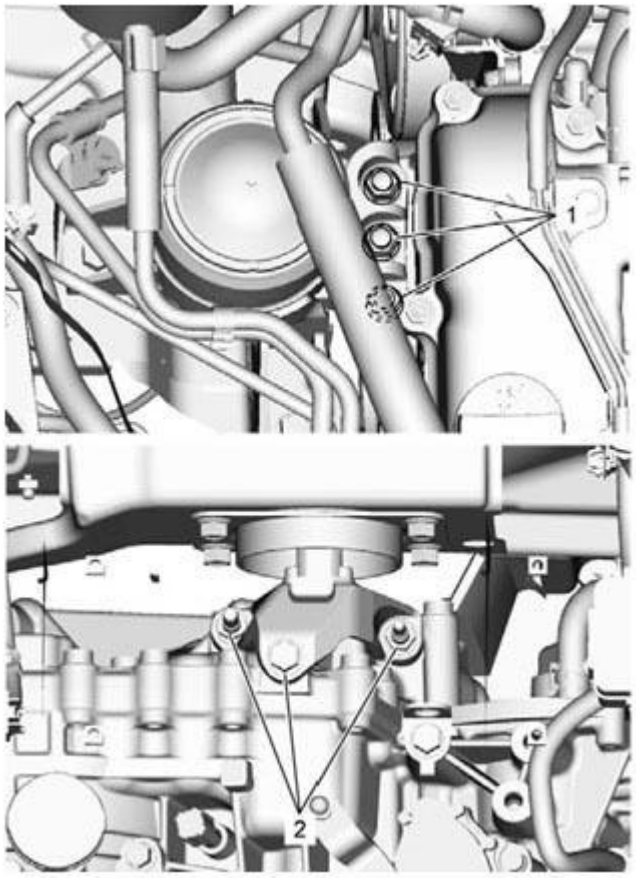


Fig. 70: Removing Engine Right Mounting Nuts And Engine Left Mounting Bracket Bolt And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

25. Remove suspension frame mounting bolts (1) and engine front mounting member No. 1 and No. 2 bolts (2).

 © 2011 Mitchell Repair Information Company, LLC.

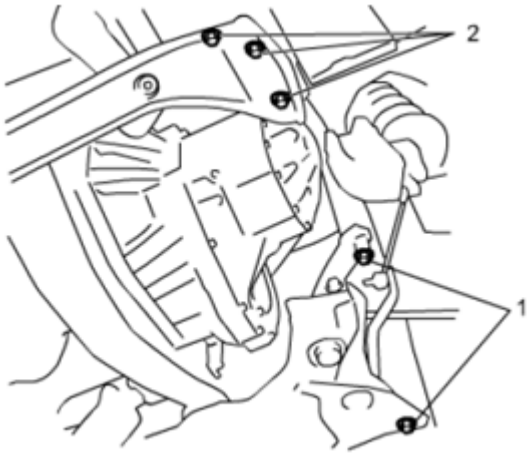


Fig. 71: Removing Suspension Frame Mounting Bolts And Engine Front Mounting Member No. 1 And No. 2 Bolts
Courtesy of SUZUKI OF AMERICA CORP.

26. Lower engine with transaxle, transfer (4WD model), steering gear case, CVT fluid cooler, front suspension frame and engine front mounting member.

CAUTION: When lowering engine, in order to avoid damage to A/C compressor, make clearance by raising A/C compressor.

27. Disconnect steering gear case from suspension frame, if necessary.
    - Hydraulic P/S model, see **STEERING GEAR CASE ASSEMBLY REMOVAL AND INSTALLATION** .
    - EPS model, see **STEERING GEAR CASE ASSEMBLY REMOVAL AND INSTALLATION** .
28. Remove engine with transaxle, transfer (4WD model) from front suspension frame and front lower cross member.
29. Remove engine harness.
30. Disconnect transfer (4WD model).
31. Disconnect transaxle from engine.
32. Remove clutch cover and clutch disk, if necessary (M/T model), see **CLUTCH COVER AND CLUTCH DISC REMOVAL AND INSTALLATION** .

Installation

1. Install clutch cover and clutch disk, if removed (M/T model), see **CLUTCH COVER AND CLUTCH DISC REMOVAL AND INSTALLATION** .
2. Connect transaxle to engine, if removed.
    - M/T model, see **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** .
    - CVT model, see **CVT ASSEMBLY DISMOUNTING AND REMOUNTING** .
3. Connect transfer to transaxle, if removed (4WD model). See **TRANSFER DISMOUNTING AND**

 © 2011 Mitchell Repair Information Company, LLC.

REMOUNTING .

4. Install engine harness, and then tighten bolts and nuts to specified torque.

   Tightening torque

   Starting motor terminal nut (a): 11 N.m (1.1 kg-m, 8.5 lbf-ft)

   Generator terminal nut (b): 11 N.m (1.1 kg-m, 8.5 lbf-ft)

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

   Ground terminal bolt (d): 25 N.m (2.5 kg-m, 18.5 lbf-ft)

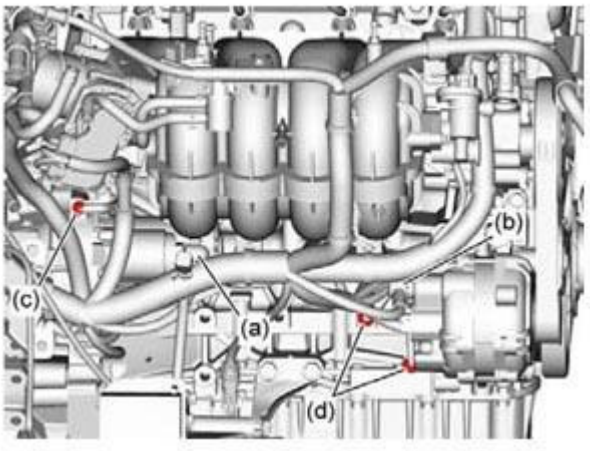


Fig. 72: Identifying Engine Harness And Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

5. Install engine with transaxle, transfer (4WD model) to front suspension frame and engine front mounting member.
6. Connect steering gear case to suspension frame, if removed.
   - Hydraulic P/S model, see **STEERING GEAR CASE ASSEMBLY REMOVAL AND INSTALLATION** .
   - EPS model, see **STEERING GEAR CASE ASSEMBLY REMOVAL AND INSTALLATION** .
7. Lift engine with transaxle, transfer (4WD model), steering gear case, CVT fluid cooler, front suspension frame and engine front mounting member into engine compartment with jack.

   CAUTION: When lifting engine, in order to avoid damage to A/C compressor, make clearance by raising A/C compressor.

8. Tighten suspension frame mounting bolts and engine front mounting member bolts, and then tighten bolts to specified torque.

   Tightening torque

 © 2011 Mitchell Repair Information Company, LLC.

Suspension frame mounting bolt (a): 95 N.m (9.7 kg-m, 70.0 lbf-ft)

Engine front mounting member No. 1 bolt (b): 55 N.m (5.6 kg-m, 40.5 lbf-ft)

Engine front mounting member No. 2 bolt (c): 59 N.m (6.0 kg-m, 43.5 lbf-ft)

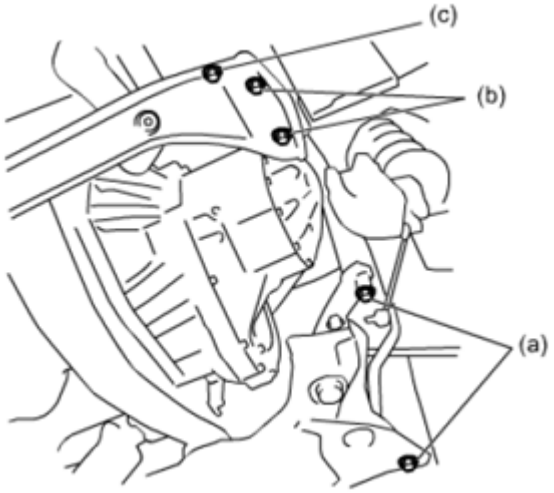


Fig. 73: Identifying Suspension Frame Mounting Bolt
Courtesy of SUZUKI OF AMERICA CORP.

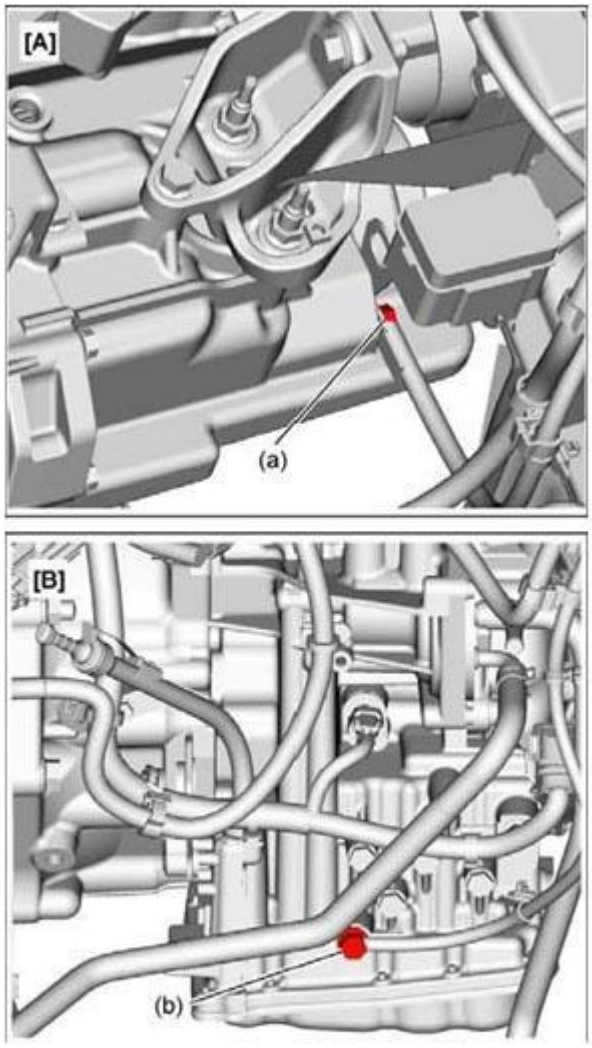
9. Tighten engine right mounting nuts, engine left mounting bolts and nuts to specified torque. See **Engine Mountings Components**.
10. Remove jack.
11. Connect steering lower shaft to pinion shaft, see **STEERING LOWER SHAFT REMOVAL AND INSTALLATION** .
12. Connect propeller shaft (4WD model), see **PROPELLER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
13. Install exhaust No. 1, No. 2 and center pipe. See **EXHAUST SYSTEM COMPONENTS** .
14. Install right and left drive shafts, see **FRONT DRIVE SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
15. Reverse disconnection of hoses, cables and electric wires for connection noting the following. Tighten bolts and nuts to specified torque.

Tightening torque

Battery ground bolt (a): 25 N.m (2.5 kg-m, 18.5 lbf-ft) ((M/T model))

Battery ground bolt (b): 55 N.m (5.6 kg-m, 40.5 lbf-ft) ((CVT model))

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 74: Identifying Battery Ground Bolts
Courtesy of SUZUKI OF AMERICA CORP.

16. Connect P/S fluid reservoir hose (1) and P/S gear low pressure hose (2) (Hydraulic P/S model).

 © 2011 Mitchell Repair Information Company, LLC.

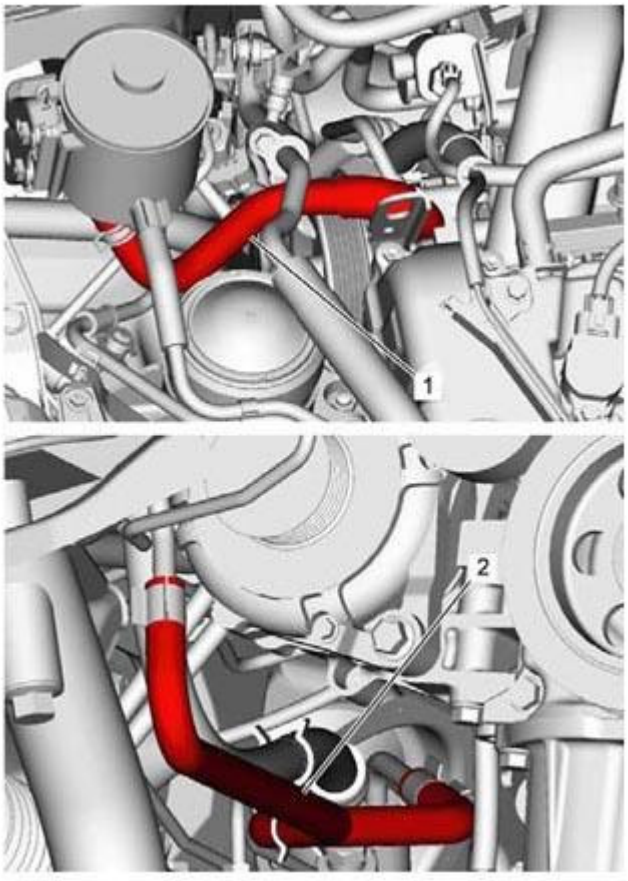


Fig. 75: Connecting P/S Fluid Reservoir Hose And P/S Gear Low Pressure Hose
Courtesy of SUZUKI OF AMERICA CORP.

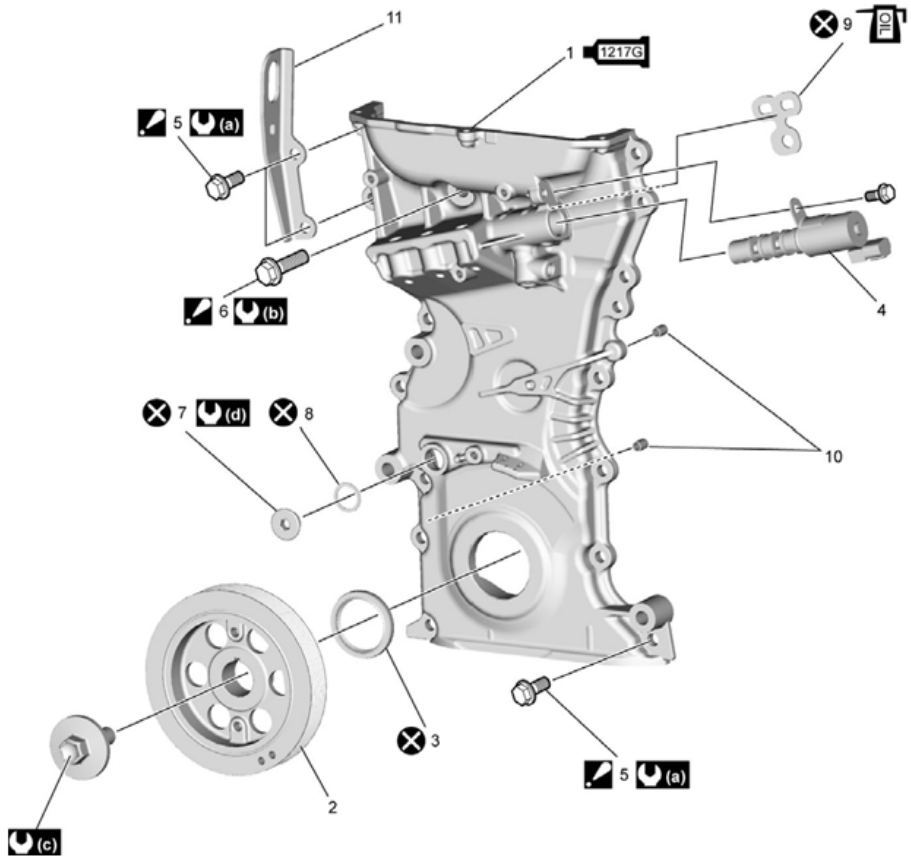
17. Install A/C compressor to cylinder block.
    - Manual A/C model:
    - Auto A/C model:
18. Install radiator, radiator outlet hose, CVT fluid cooler inlet and outlet hoses.
19. Install A/C condenser cooling fan to radiator.
    - Manual A/C model, see **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
    - Auto A/C model, see **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** .
20. Install radiator cooling fan assembly and radiator inlet hose, see **RADIATOR REMOVAL AND INSTALLATION** .
21. Install air cleaner assembly, see **Air Cleaner Assembly Removal and Installation**.
22. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
23. Install accessory drive belt, see **ACCESSORY DRIVE BELT INSPECTION** .
24. Install front bumper, see **FRONT BUMPER AND REAR BUMPER COMPONENTS** .
25. Install battery and battery tray with ECM.
26. Connect ECM connectors.

 © 2011 Mitchell Repair Information Company, LLC.

27. Connect negative and positive cable at battery.
28. Refill cooling system with coolant, see **COOLING SYSTEM REFILLING** .
29. Fill all drained oils and fluids.
    - Engine oil, see **ENGINE OIL AND FILTER CHANGE** .
    - Manual transaxle oil (M/T model), see **MANUAL TRANSAXLE OIL CHANGE** .
    - CVT fluid (CVT model), see **CVT FLUID CHANGE** .
    - P/S fluid (Hydraulic P/S model), see **P/S FLUID CHANGE** .
    - Transfer oil (4WD model), see **TRANSFER OIL CHANGE** .
30. Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.
31. Install right and left side engine under covers.

TIMING CHAIN COVER COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 76: Identifying Timing Chain Cover Replacement Components
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN COVER REMOVAL AND INSTALLATION

Reference: **TIMING CHAIN COVER COMPONENTS**

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: **If the crankshaft pulley bolt is loosened and tightened without crankshaft locked using the special tool, the timing chain, sprocket and their related parts may receive undue forces, which could cause damage to these components. When loosening and tightening the crankshaft pulley bolt, be sure to use the special tool, which should be securely installed to the crankshaft pulley using a bolt of the following specifications:**

Bolt size: M8

Pitch: 1.25 mm

Length: 25 mm (0.98 in.)

Strength: 7T

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 figure.

CAUTION:
- **Use special tool to avoid applying unnecessary load to 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**

  Length: 25 mm (0.98 in.)

  Strength: 7T

Special Tool

(A): 09917-68221

 © 2011 Mitchell Repair Information Company, LLC.

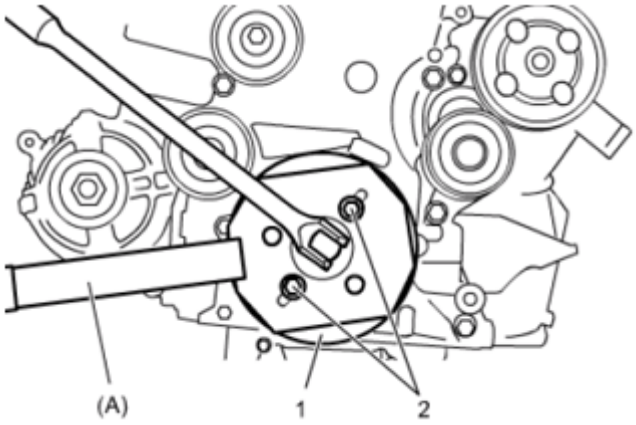


Fig. 77: Removing Crankshaft Pulley Bolt Using Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove crankshaft pulley (1).

   If it is hard to remove, use special tools as shown in figure.

   Special Tool

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

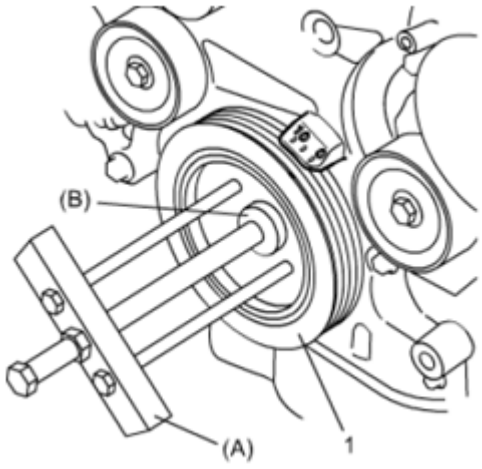


Fig. 78: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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 **ACCESSORY DRIVE BELT TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
7. Remove timing chain cover by loosing timing chain cover bolts in numerical order ("1" - "17") evenly

 © 2011 Mitchell Repair Information Company, LLC.

and gradually.

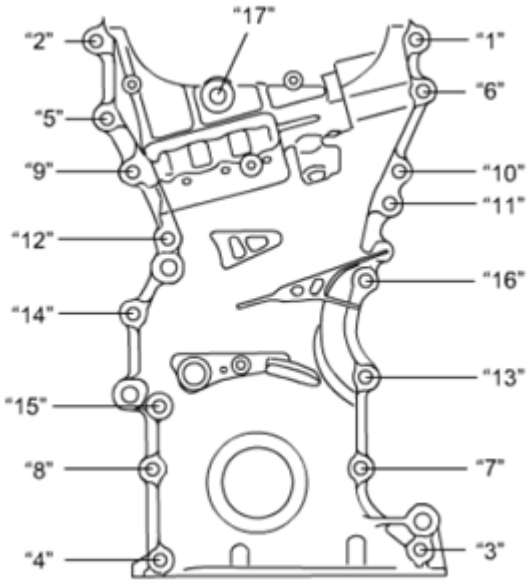


Fig. 79: Identifying Timing Chain Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove crankshaft oil seal from timing chain cover using flat-head screwdriver or the like, if necessary.
9. Remove oil seal from timing chain cover if necessary.

Installation

Reference: **TIMING CHAIN COVER INSPECTION**

1. Clean mating surface of timing chain cover, cylinder block and cylinder head.

   Remove oil, old sealant and dust from mating surface.

2. Check oil seal (1) for any damage.

   If abnormality is found, replace oil seal.

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

 © 2011 Mitchell Repair Information Company, LLC.

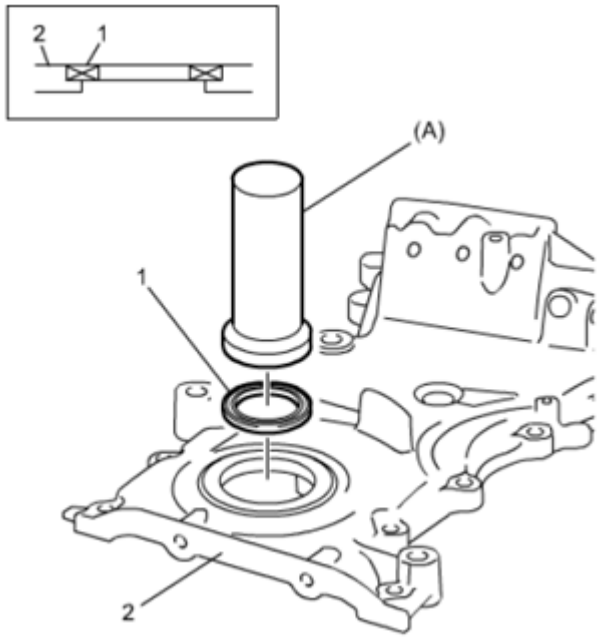


Fig. 80: Pressing Oil Seal Into Timing Chain Cover Using Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

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

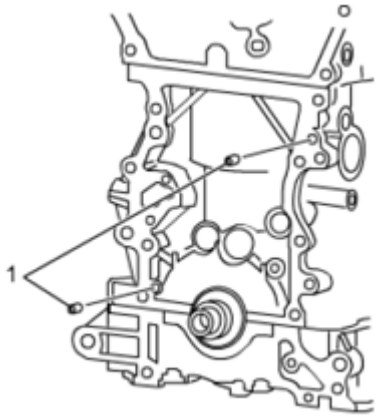


Fig. 81: Identifying Dowel Pins To Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply sealant "A" to mating surface of cylinder, cylinder head and timing chain cover as shown in figure.

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

   Sealant bead size for timing chain cover

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

 © 2011 Mitchell Repair Information Company, LLC.

Height "b": 2 mm (0.08 in.)

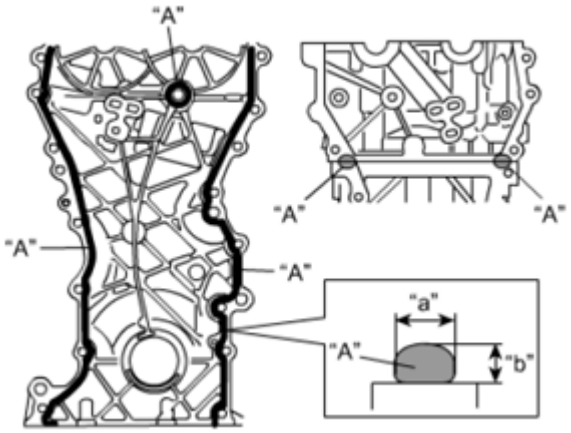


Fig. 82: Applying Sealant "A" To Mating Surface Of Cylinder, Cylinder Head And Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

5. Apply engine oil to oil seal lip, then install timing chain cover. 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)

 © 2011 Mitchell Repair Information Company, LLC.

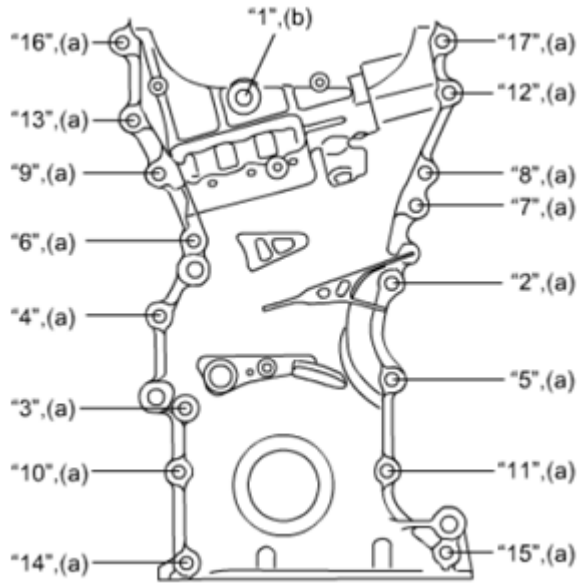


Fig. 83: Identifying Timing Chain Cover Bolt
Courtesy of SUZUKI OF AMERICA CORP.

6. Install tensioner pulley and idler pulley, see **ACCESSORY DRIVE BELT TENSIONER AND IDLER PULLEY REMOVAL AND INSTALLATION** .
7. Install cylinder head cover, see **Cylinder Head Cover Removal and Installation**.
8. Install oil pan, see **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION** .
9. 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 avoid being applying unnecessary load to 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

Length: 25 mm (0.98 in.)

Strength: 7T

Special Tool

(A): 09917-68221

 © 2011 Mitchell Repair Information Company, LLC.

Tightening torque

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

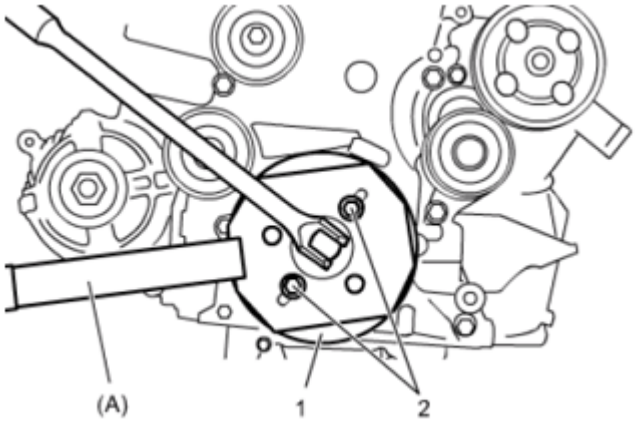


Fig. 84: Identifying Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

10. Install engine assembly to vehicle, see **Engine Assembly Removal and Installation**.

TIMING CHAIN COVER INSPECTION

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

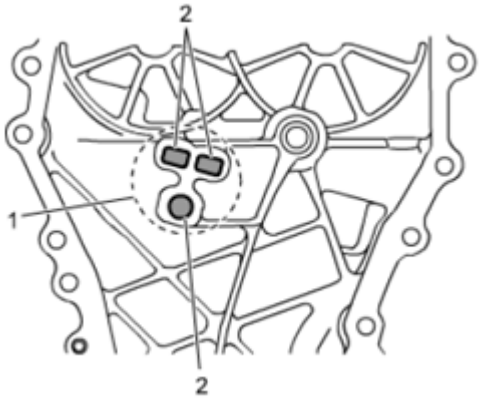
Oil Seal

Check oil seal lip for any damage. If abnormality is found, replace oil seal.

Timing Chain Cover

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

If clog or foreign matter exists, clean strainer.



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 85: Identifying Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

OCV (OIL CONTROL VALVE) REMOVAL AND INSTALLATION

Reference: **TIMING CHAIN COVER COMPONENTS**

Removal

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

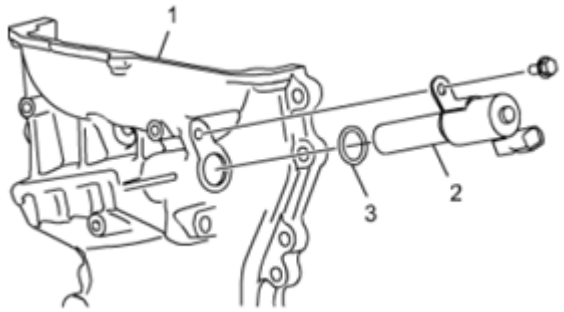


Fig. 86: Removing Ocv And O-Ring From Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure noting the following.

- Install new O-ring.
- 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 transaxle assembly.
   - M/T model: Refer to **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** .
   - CVT model: Refer to **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

 © 2011 Mitchell Repair Information Company, LLC.

(A): 09924-17811

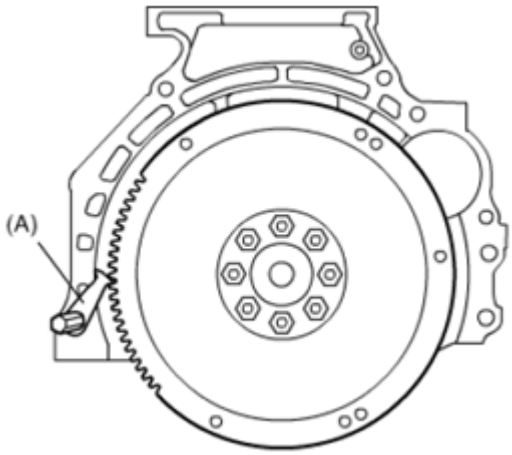


Fig. 87: Identifying Special Tool For Flywheel Lock
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove flywheel or drive plate from engine assembly.

Installation

Reverse removal procedure noting the following.

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

  Special Tool

  (A): 09924-17811

- 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)

 © 2011 Mitchell Repair Information Company, LLC.

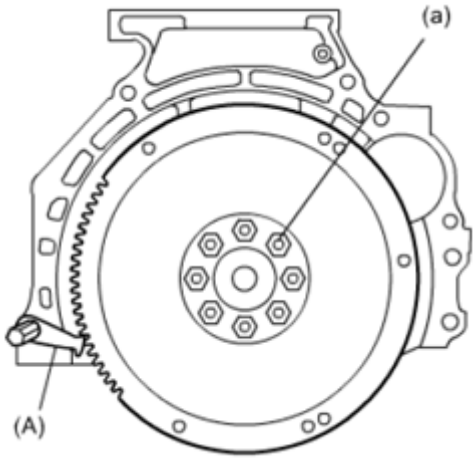
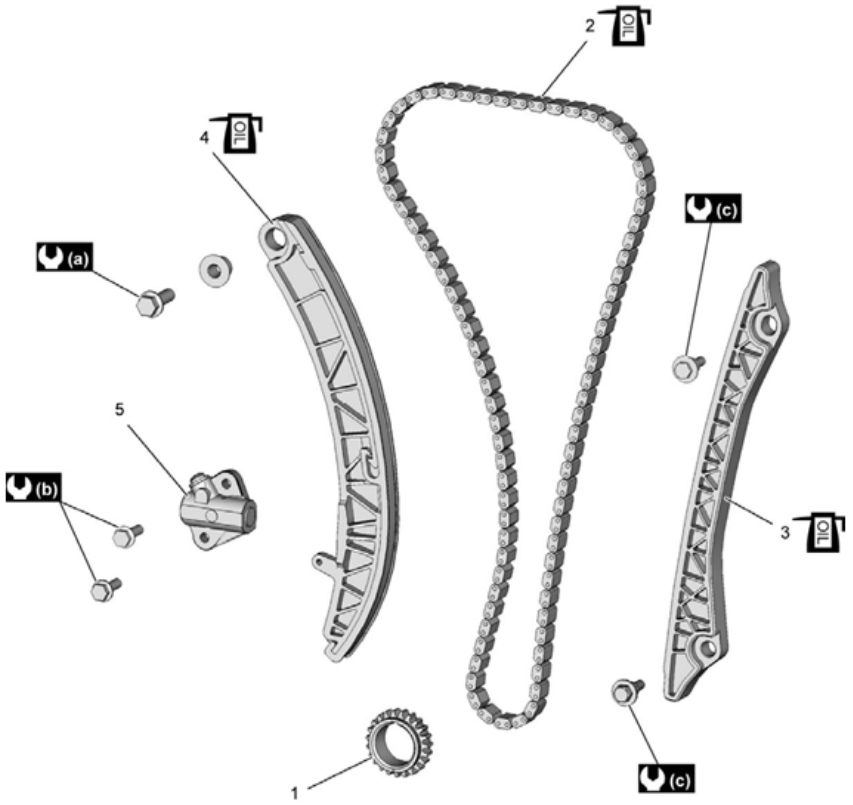


Fig. 88: Identifying Drive Plate Bolt And Flywheel Bolt
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN AND CHAIN TENSIONER COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



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. 89: Identifying Timing Chain And Chain Tensioner Replacement Components
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN AND CHAIN TENSIONER REMOVAL AND INSTALLATION

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

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

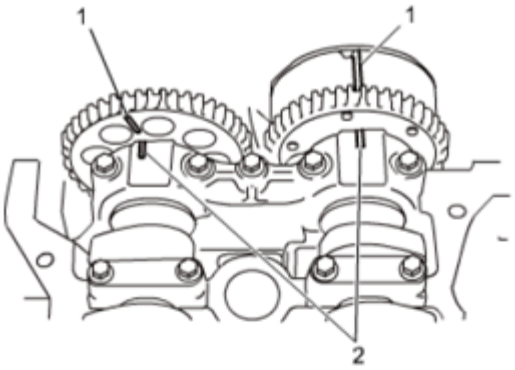
Removal

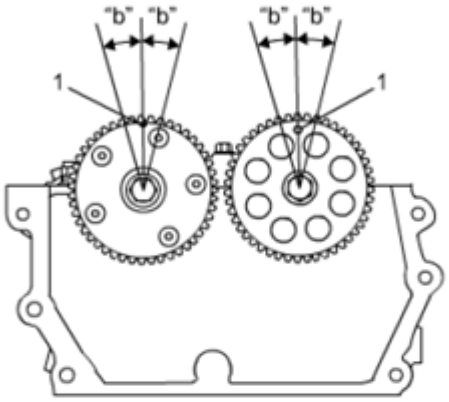
CAUTION: After the timing chain has been removed, independently turning the camshaft or crankshaft beyond the allowable angle ranges ("a" and "b") shown in figure will cause interference between pistons and valves or

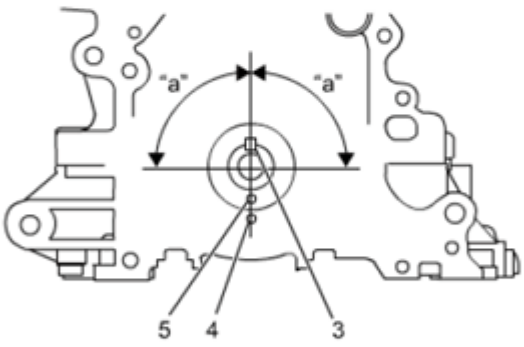
 © 2011 Mitchell Repair Information Company, LLC.

between the valves themselves, which will cause damage to these parts and/or related parts. Avoid turning the camshafts or crankshaft beyond the angle ranges shown in figure.

 © 2011 Mitchell Repair Information Company, LLC.





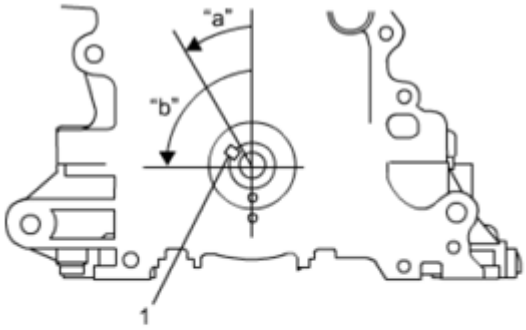


1.	Timing marks on camshaft timing sprockets
2.	Match marks on camshaft housing No.1
3.	Key
4.	Match mark on lower crank case
5.	Timing mark on crankshaft timing sprocket
"a":	90°
"b":	15°

 © 2011 Mitchell Repair Information Company, LLC.

Fig. 90: Identifying Crankshaft And Camshafts Range Position
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: If it is necessary to rotate the camshaft after removing timing chain, turn crankshaft counterclockwise and position key (1) within specified range (30 - 90°) as shown in figure before rotating camshaft.



"a":	30°
"b":	90°
1.	Key

Fig. 91: Identifying Crankshaft Rotating Position
Courtesy of SUZUKI OF AMERICA CORP.

1. Remove timing chain cover, see **Timing Chain Cover Removal and Installation**.
2. By turning crankshaft, align camshafts and crankshaft at specific position as follows.
   a. Align timing marks on CMP actuator (1) and timing mark (2) on exhaust camshaft timing sprocket with match marks (3) on camshaft housing No. 1.

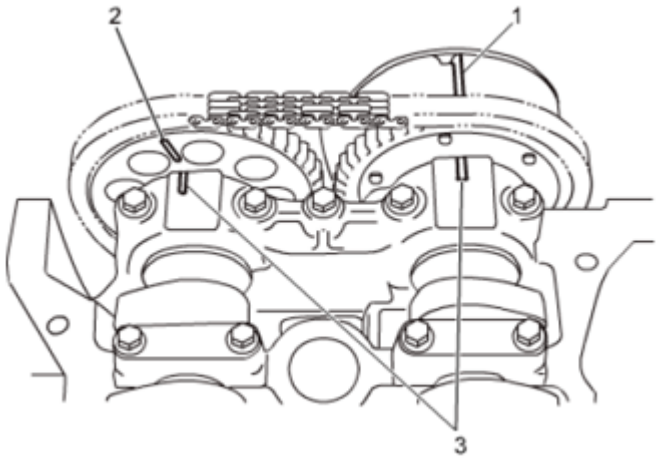


Fig. 92: Aligning Timing Marks On Cmp Actuator And Timing Mark On Exhaust Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

b. Align timing mark (1) on crankshaft timing sprocket with match mark (2) on lower crank case.

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).

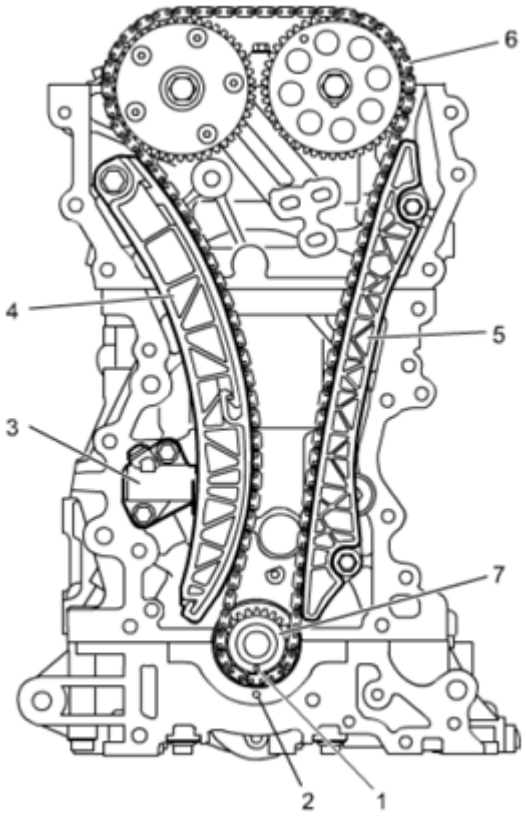


Fig. 93: Removing Timing Chain And Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

1. Turn crankshaft 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 match marks (4) on camshaft housing No. 1.
3. Align timing mark (5) on exhaust camshaft timing sprocket with match marks (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.

 © 2011 Mitchell Repair Information Company, LLC.

b. Align timing mark (8) on crankshaft timing sprocket with match mark (9) on lower crank case.

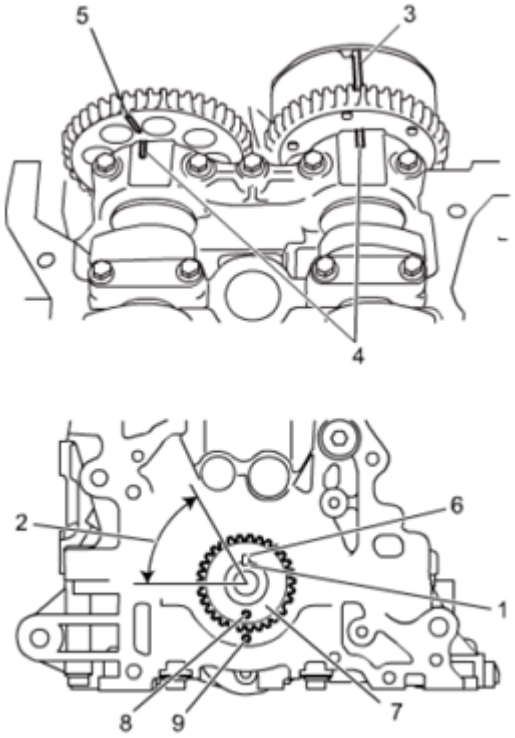


Fig. 94: Aligning Timing Mark On Crankshaft Timing Sprocket With Match Mark On Lower Crank Case
Courtesy of SUZUKI OF AMERICA CORP.

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

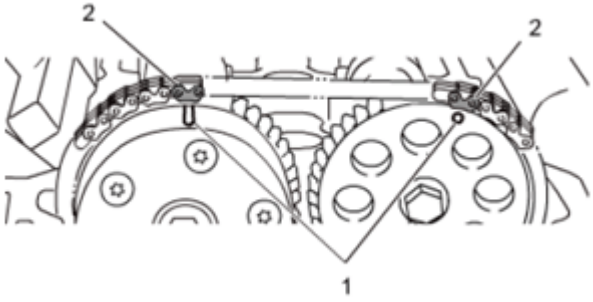


Fig. 95: Installing Timing Chain While Aligning Two Blue Plates With Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.

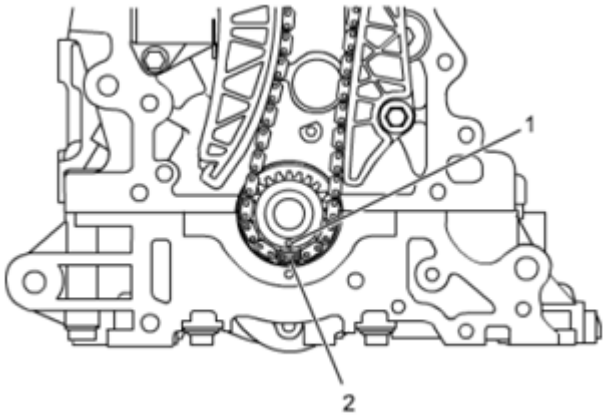


Fig. 96: Aligning Blue Plate With Timing Mark On Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

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

   Tightening torque

   Timing chain guide bolt (a): 9 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 plated (6) are aligned with timing marks (7) on corresponding timing sprockets.

 © 2011 Mitchell Repair Information Company, LLC.

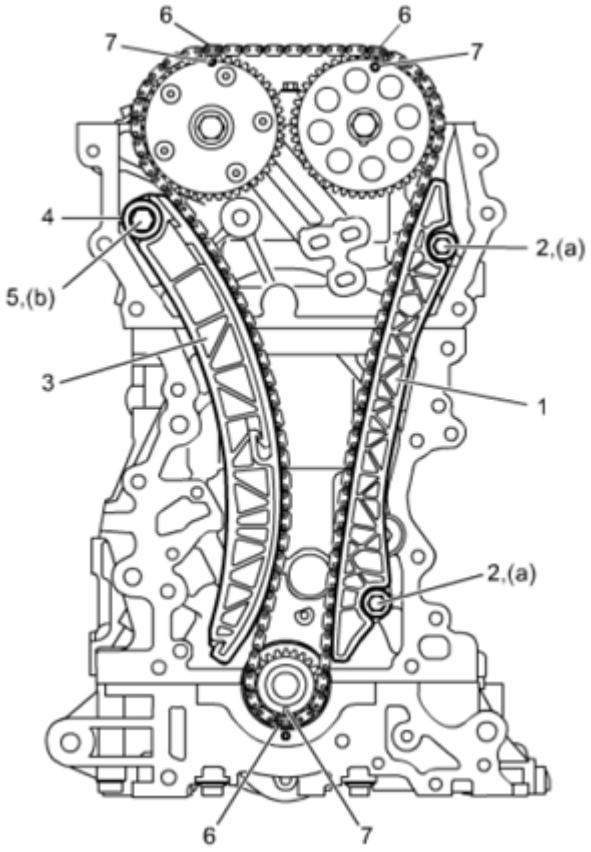


Fig. 97: Identifying Timing Marks On Corresponding Timing Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

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

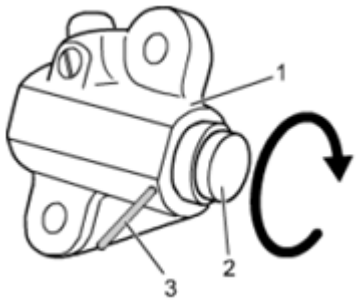


Fig. 98: Identifying Plunger Of Timing Chain Tensioner Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

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.

 © 2011 Mitchell Repair Information Company, LLC.

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, and then turn crankshaft clockwise fully twice, and make sure the following items.
    - Timing mark (4) on CMP actuator is aligned with match mark (3) on camshaft housing No. 1.
    - Timing mark (5) on exhaust camshaft timing sprocket is aligned with match mark (3) on camshaft housing No. 1.
    - Timing mark (6) on crankshaft timing sprocket is aligned with match mark (7) on lower crank case.

NOTE:

- **Be sure to turn crankshaft fully twice. If it is once, timing marks on CMP actuator and exhaust camshaft timing sprocket do not meet match marks on camshaft housing No. 1.**
- **After turning crankshaft twice, the discrimination links of timing chain are not aligned with the timing marks on the CMP actuator and the exhaust timing sprocket, but it is normal.**

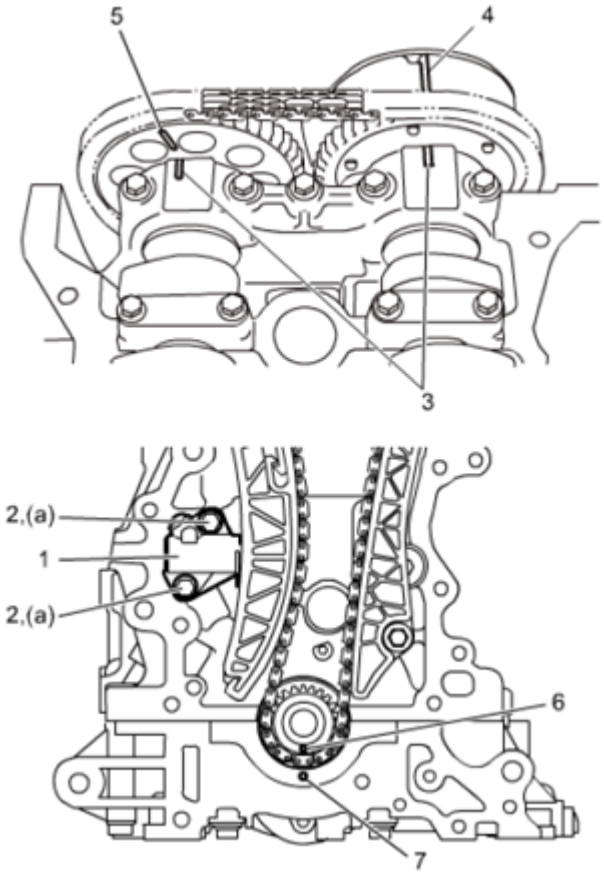


Fig. 99: Identifying Discrimination Links Of Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

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

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

If abnormality is found, replace timing chain guide.

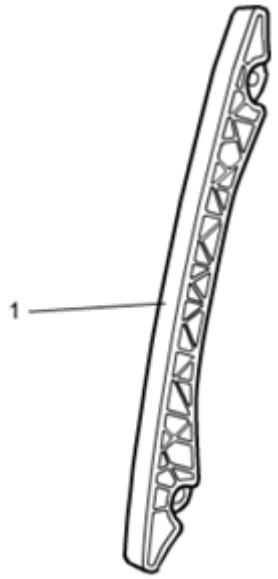


Fig. 100: Identifying Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner

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

If abnormality is found, replace timing chain tensioner.

© 2011 Mitchell Repair Information Company, LLC.

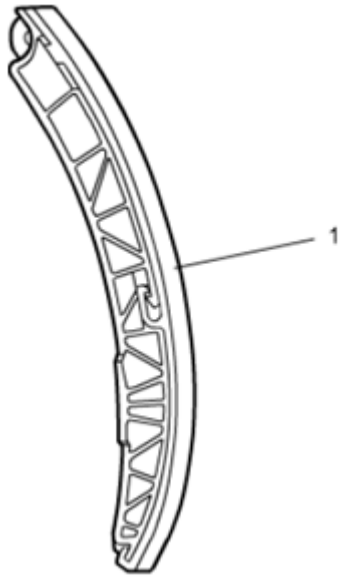


Fig. 101: Identifying Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Timing Sprocket

Check sprocket teeth for wear or damage.

If abnormality is found, replace crankshaft timing sprocket.



Fig. 102: Identifying Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain

Check timing chain for wear or damage.

If abnormality is found, replace timing chain.

 © 2011 Mitchell Repair Information Company, LLC.

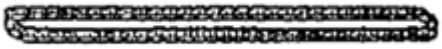


Fig. 103: Identifying Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner Adjuster

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

If abnormality is found, replace timing chain tensioner adjuster.

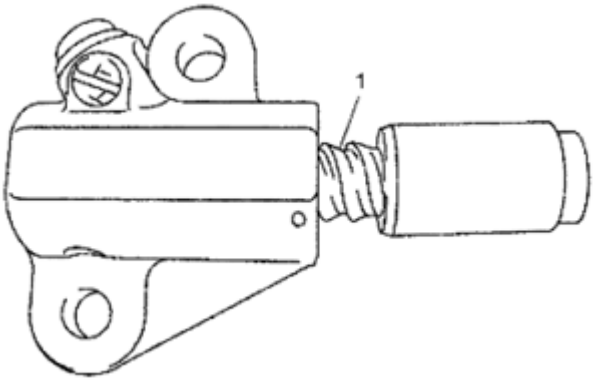
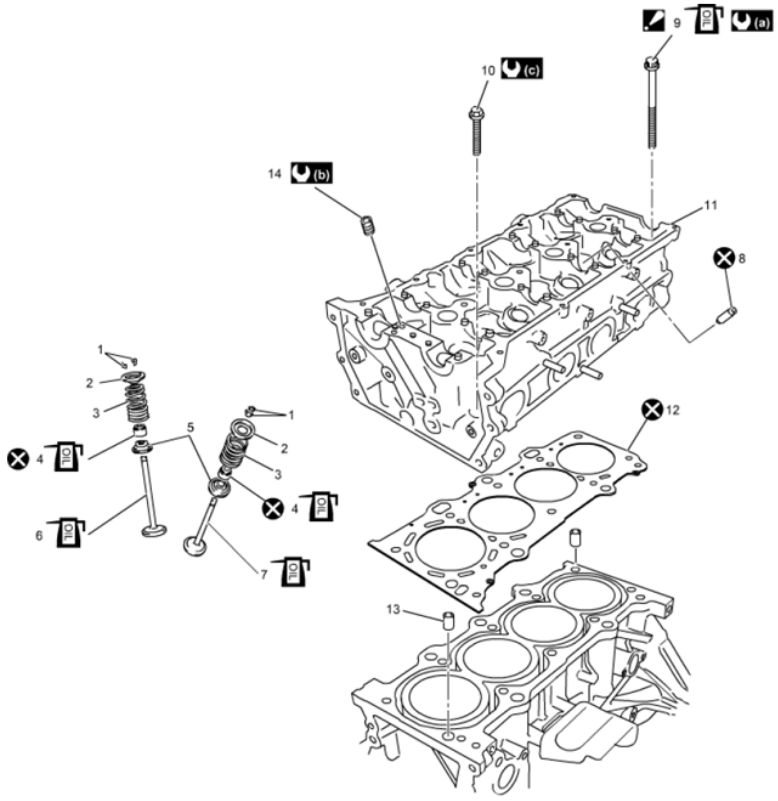


Fig. 104: Identifying Timing Chain Tensioner Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND CYLINDER HEAD COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



1. Valve cotters	Exhaust valve: Apply engine oil to sliding surface. 7.	13. Dowel pin
2. Valve spring retainer	8. Valve guide	14. Venturi plug
3. Valve spring	Cylinder head No.1 bolt : Check cylinder head No.1 bolt for deformation to reuse. ***Cylinder Head No.1 Bolt Inspection*** : Apply engine oil to bolt thread. : For tightening order, refer to ***Valve and Cylinder Head Removal and Installation***. : After tightening cylinder head No.1 bolt, tighten cylinder head No.2 bolt. 9.	(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°)
Valve stem seal : Apply engine oil to valve stem seal lip. 4.	10. Cylinder head No.2 bolt	(b) 3.5 N·m (0.36 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) :
Intake valve : Apply engine oil to sliding surface. 6.	12. Cylinder head gasket	: Do not reuse.

Fig. 105: Identifying Valve And Cylinder Head Components
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND CYLINDER HEAD REMOVAL AND INSTALLATION

 © 2011 Mitchell Repair Information Company, LLC.

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 with CMP actuator and exhaust camshaft with timing sprocket, see **Camshaft and Tappet Removal and Installation**.
4. Remove camshaft bearings.
5. Remove heater outlet pipe bolt (1) from cylinder head (2).

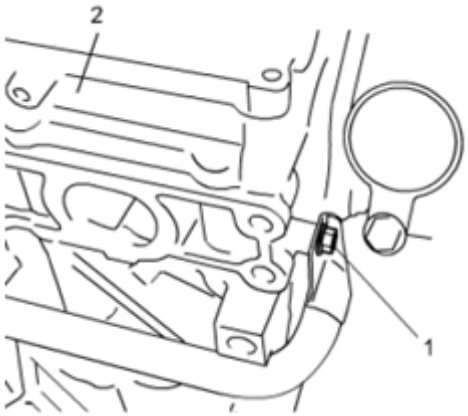


Fig. 106: Removing Heater Outlet Pipe Bolt From Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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

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

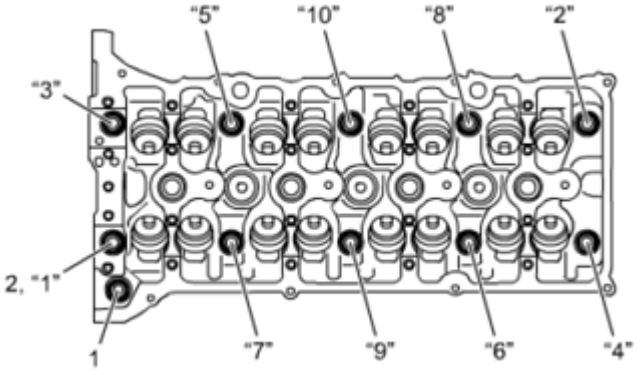


Fig. 107: Identifying Cylinder Head Bolts
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

8. Remove cylinder head with its gasket, intake manifold and exhaust manifold from cylinder block.
9. Remove the following components cylinder head if necessary.
    - Intake manifold, see **Intake Manifold Removal and Installation**.
    - Exhaust manifold, see **EXHAUST MANIFOLD REMOVAL AND INSTALLATION** .
    - Fuel injector, see **FUEL INJECTOR REMOVAL AND INSTALLATION** .
    - Water outlet cap, see **COOLING SYSTEM COMPONENTS** .
    - Oil venture plug, see **Valve and Cylinder Head Disassembly and Reassembly**.

Installation

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

Reference: **CYLINDER HEAD INSPECTION**

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

CAUTION: If cylinder head No. 1 bolts are reused, check them for deformation referring to CYLINDER HEAD NO. 1 BOLT INSPECTION.

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

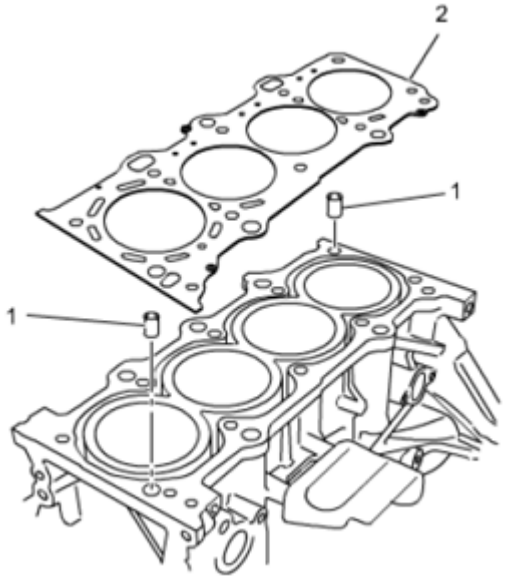
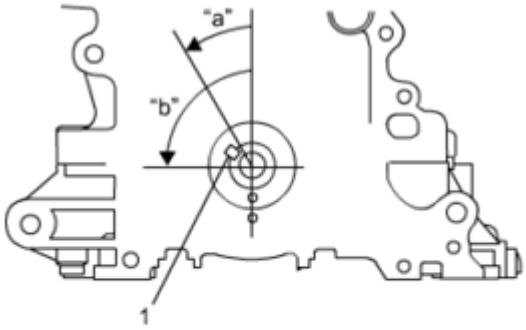


Fig. 108: Identifying Cylinder Head Gasket To Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

4. Install cylinder head to cylinder block as follows.

NOTE: Before Installing cylinder head to cylinder block, turn crankshaft and position key (1) within specified range (30 - 90°) in counterclockwise direction from top as shown in figure.



"a":	30°
"b":	90°

Fig. 109: Identifying Position Key Range
Courtesy of SUZUKI OF AMERICA CORP.

a. Install cylinder head to cylinder block.
b. Apply engine oil to cylinder head No. 1 bolts (1) threads.
c. Tighten cylinder head No. 1 bolts 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 to cylinder head No. 1 bolts.

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

Tightening torque

Cylinder head No. 1 bolt * (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 No. 2 bolt (2) to specified torque.

Tightening torque

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

© 2011 Mitchell Repair Information Company, LLC.

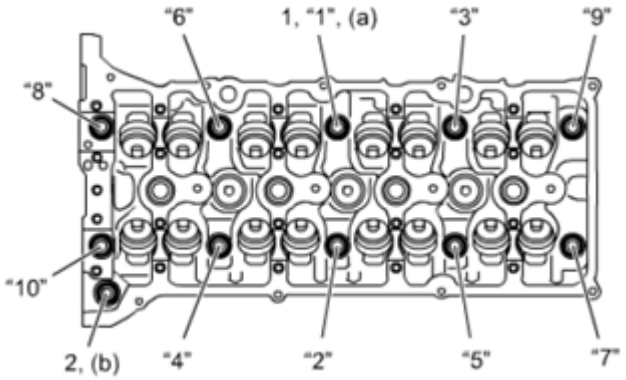


Fig. 110: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

5. Install intake camshaft and exhaust camshaft, see **Camshaft and Tappet Removal and Installation**.
6. Install timing chain, see **Timing Chain and Chain Tensioner Removal and Installation**.
7. Install timing chain cover, see **Timing Chain Cover 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 water outlet cap if removed, see **COOLING SYSTEM COMPONENTS** .
11. Install heater outlet pipe bolt to cylinder head, see **COOLING SYSTEM COMPONENTS** .
12. Install spark plugs, see **SPARK PLUG REMOVAL AND INSTALLATION** .
13. Install exhaust manifold if removed, see **EXHAUST MANIFOLD REMOVAL AND INSTALLATION** .
14. Install intake manifold if removed, see **Intake Manifold Removal and Installation**.
15. Install fuel injectors if removed, see **FUEL INJECTOR REMOVAL AND INSTALLATION** .
16. 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: **If following parts are removed, keep them in order. They must go back in the position from which they were removed.**

- **Valve cotter**
- **Valve spring retainer**
- **Valve spring**
- **Valve spring seat**
- **Intake valve**

 © 2011 Mitchell Repair Information Company, LLC.

- **Exhaust valve**
- **Tappet**

1. Remove oil venturi plug (1).

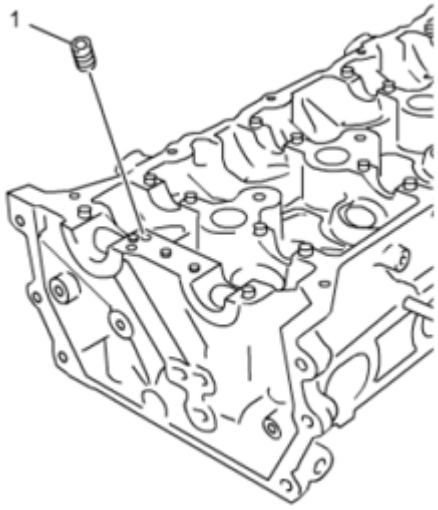


Fig. 111: Identifying Oil Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove tappets from cylinder head.
3. Using special tools (A) and (B), compress valve spring and then remove valve cotters (1) also by using special tool (C).

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

Special Tool

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

 © 2011 Mitchell Repair Information Company, LLC.

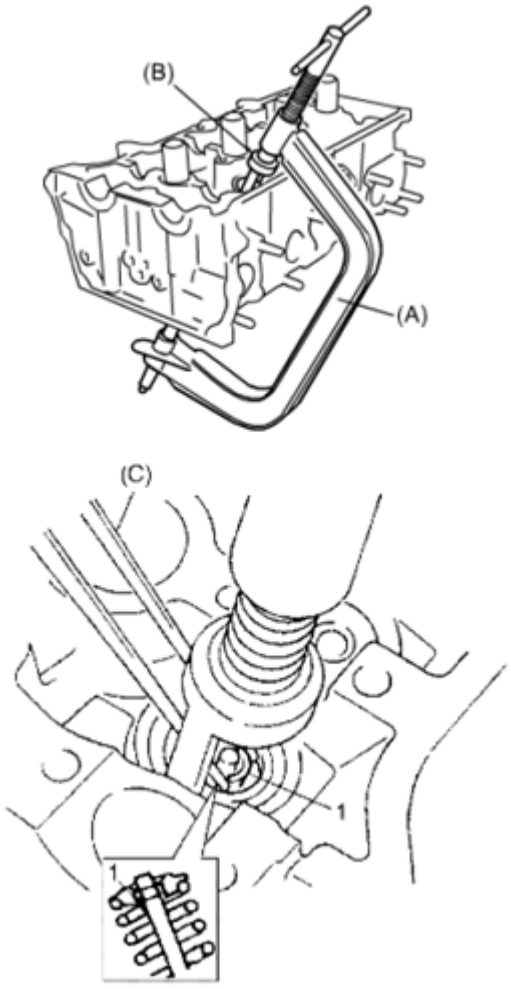


Fig. 112: Identifying Special Tools For Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.



Fig. 113: Removing Valve Stem Seal And Valve Spring Seat
Courtesy of SUZUKI OF AMERICA CORP.

7. Using special tool, drive out valve guide from combustion chamber side to valve spring side.

NOTE: Heat cylinder head to remove valve guide, if necessary.

Special Tool

(A): 09916-44910

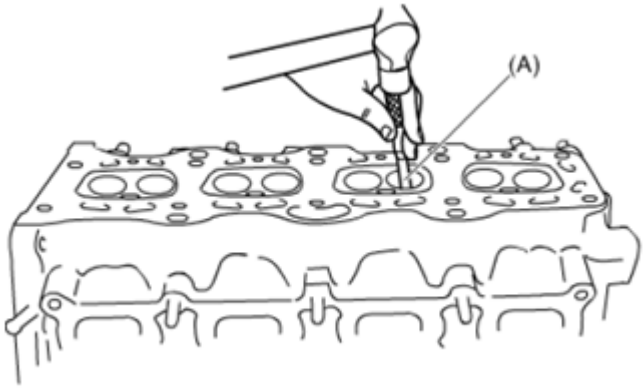


Fig. 114: Driving Out Valve Guide From Combustion Chamber Side To Valve Spring Side
Courtesy of SUZUKI OF AMERICA CORP.

Reassembly

Reference: **VALVE AND VALVE GUIDE INSPECTION**

Reference: **CYLINDER HEAD INSPECTION**

Reference: **VALVE SPRING INSPECTION**

 © 2011 Mitchell Repair Information Company, LLC.

1. Before installing valve guide into cylinder head, ream guide hole with special tool (10.5 mm reamer) 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**

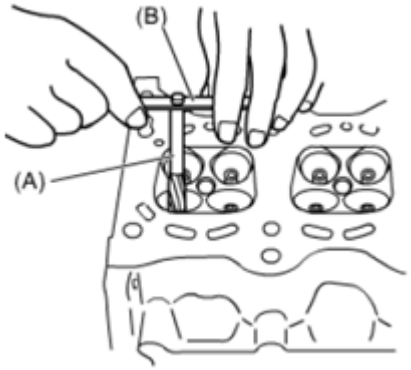


Fig. 115: Reaming Guide Hole With Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

2. Using special tools, 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.
- **Intake and exhaust valve guides are identical.**

a. Heat cylinder head uniformly 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. Drive in new valve guide until special tool contacts cylinder head.

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

 © 2011 Mitchell Repair Information Company, LLC.

CAUTION: For installing intake valve guide and exhaust valve guide, the same special tool (B) is used, but its application direction is different. Use it in proper direction.

- **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.

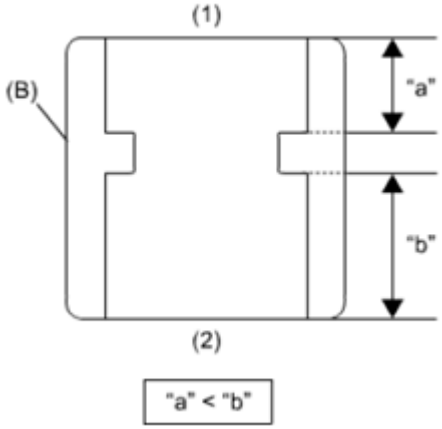
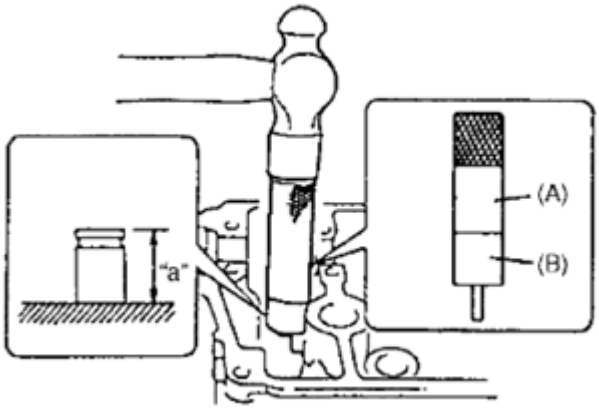


Fig. 116: Identifying Intake Valve Guide And Exhaust Valve Guide Dimension
Courtesy of SUZUKI OF AMERICA CORP.

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.)



 © 2011 Mitchell Repair Information Company, LLC.

Fig. 117: Identifying Valve Guide Protrusion
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**

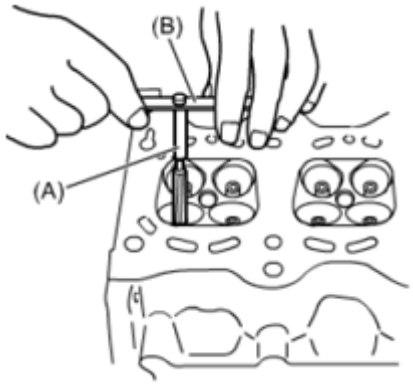


Fig. 118: Reaming Valve Guide Bore With Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

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

After applying engine oil to 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 else. 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**

 © 2011 Mitchell Repair Information Company, LLC.

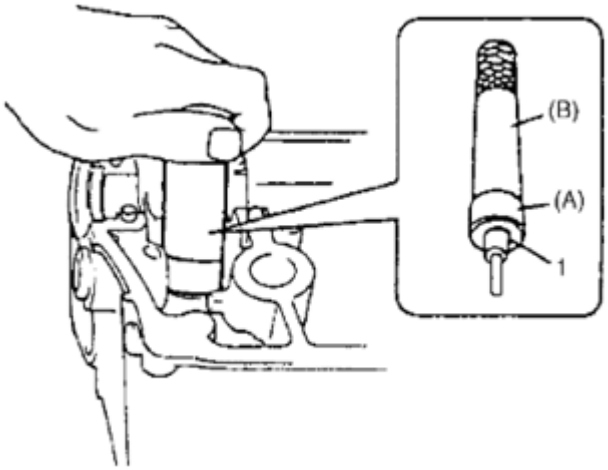


Fig. 119: Installing New Valve Stem Seal To Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

6. Apply engine oil to valve stem seal, valve guide bore and valve stem.
7. Install valve to valve guide.
8. Install valve spring and valve spring retainer.

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

9. Using special tools, 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 tappet installing hole.

Special Tool

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

 © 2011 Mitchell Repair Information Company, LLC.

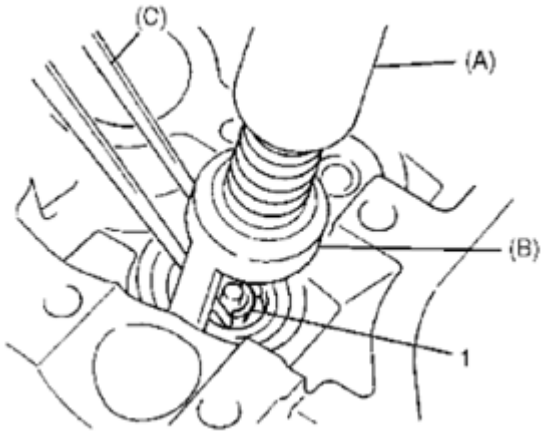


Fig. 120: Fitting Valve Cotters Into Groove In Valve Stem
Courtesy of SUZUKI OF AMERICA CORP.

10. Install venturi plug (1).

Tightening torque

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

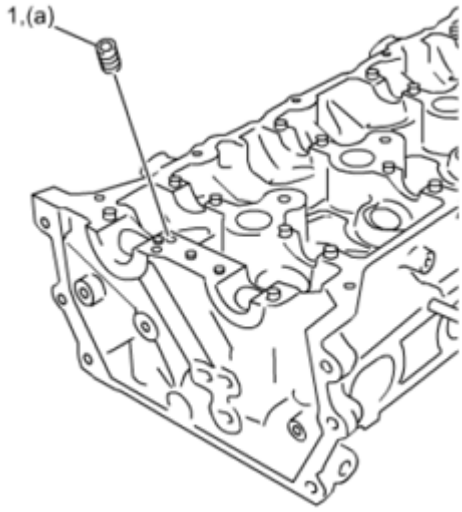


Fig. 121: Identifying Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

VALVE AND VALVE GUIDE INSPECTION

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

Valve Guide

Valve stem-to-guide clearance

 © 2011 Mitchell Repair Information Company, LLC.

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

Valve stem 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

Standard

IN: 0.020 - 0.047 mm (0.0008 - 0.0018 in.)

EX: 0.045 - 0.072 mm (0.0018 - 0.0028 in.)

Limit

IN: 0.070 mm (0.0027 in.)

EX: 0.090 mm (0.0035 in.)

 © 2011 Mitchell Repair Information Company, LLC.

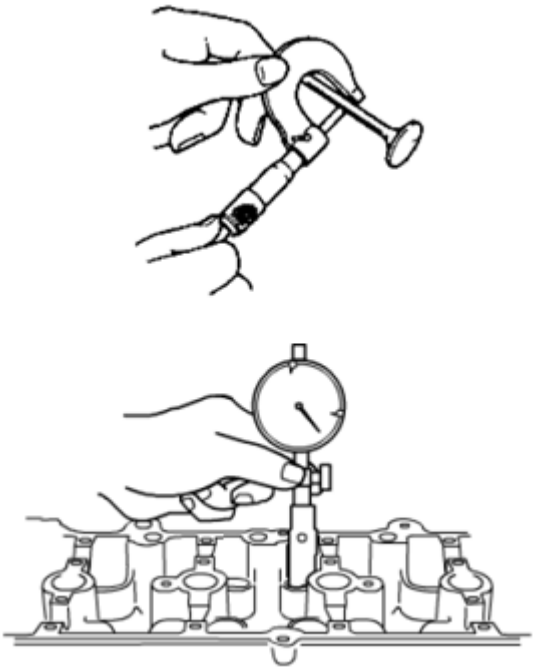


Fig. 122: Inspecting Stem-To-Guide Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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.

If deflection exceeds its limit, replace valve and valve guide.

Valve stem end deflection limit

In: 0.14 mm (0.0055 in.)

Ex: 0.18 mm (0.0070 in.)

 © 2011 Mitchell Repair Information Company, LLC.

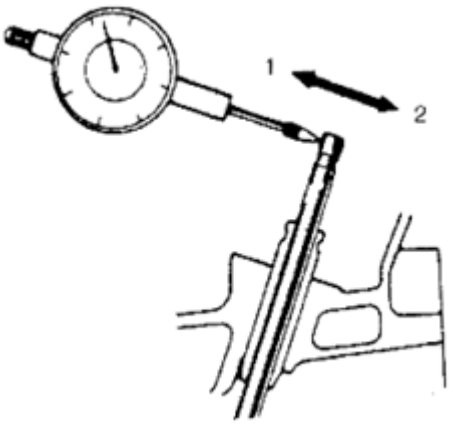


Fig. 123: Checking Valve Stem End Deflection
Courtesy of SUZUKI OF AMERICA CORP.

Valve

Visual inspection

- Remove all carbon deposits from all valves (1).
- Check each valve for wear, burn or distortion at its face and stem end.

  Replace it if necessary.

- Measure valve protrusion length "a".

  If measured length is out of standard value, replace valve.

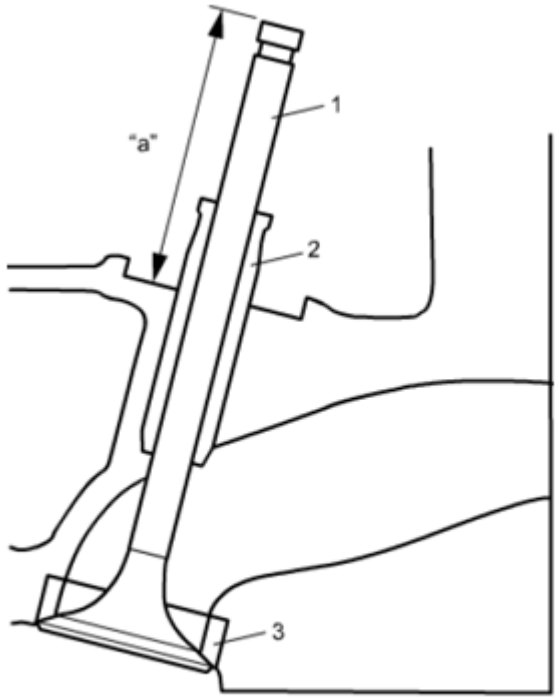
  Valve protrusion length "a"

  Standard

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

  EX: 43.55 - 44.15 mm (1.715 - 1.738 in.)

 © 2011 Mitchell Repair Information Company, LLC.



2. Valve guide	3. Valve seat

Fig. 124: Checking 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.

If runout exceeds its limit, replace valve.

Valve head radial runout

Standard

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

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.)

 © 2011 Mitchell Repair Information Company, LLC.

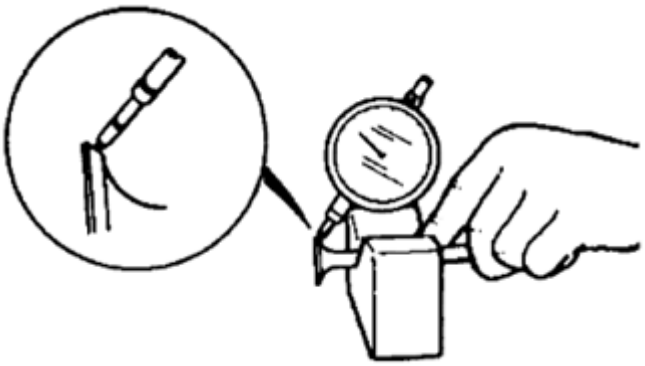


Fig. 125: Checking Valve Head Radial Runout
Courtesy of SUZUKI OF AMERICA CORP.

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 tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.

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.)

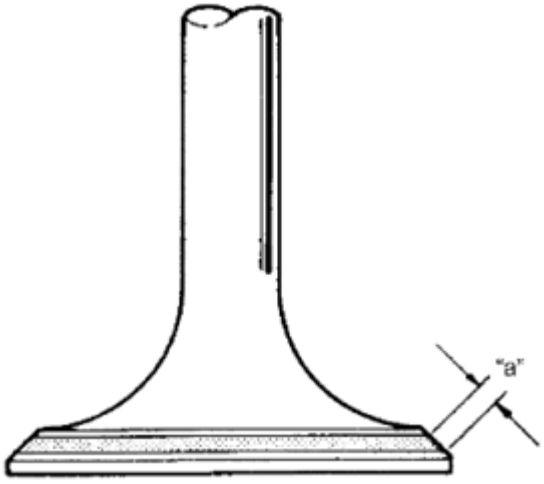


Fig. 126: Checking Standard Seating Width
Courtesy of SUZUKI OF AMERICA CORP.

Valve seat repair

 © 2011 Mitchell Repair Information Company, LLC.

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

1. **Intake valve seat:**

   Use valve seat cutters to make three cuts as illustrated in figure. Three cutters must be used: 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

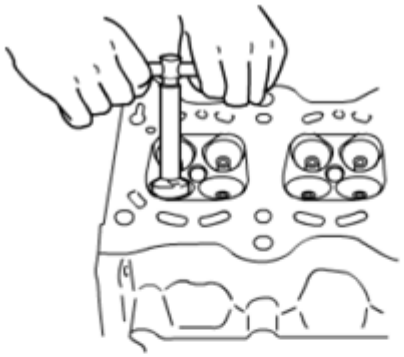
   "a": 1.05 - 1.35 mm (0.0414 - 0.0531 in.)

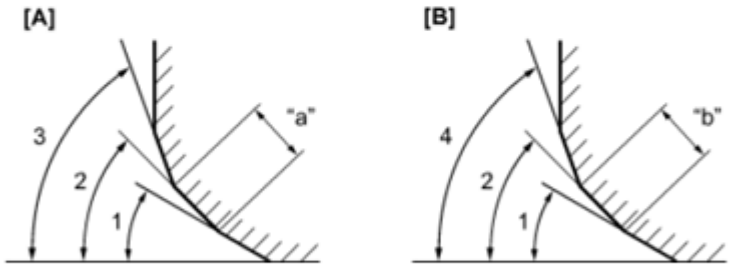
2. **Exhaust valve seat:**

   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. The 3rd cut must be made to produce desired seat width.

   Seat width for exhaust valve seat

   "b": 1.12 - 1.42 mm (0.0441 - 0.0559 in.)





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

 © 2011 Mitchell Repair Information Company, LLC.

Fig. 127: Reaming Exhaust Valve Seat
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.

If venturi plug passage is clogged, clean or replace venturi plug.

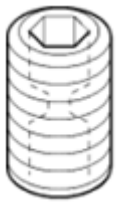


Fig. 128: Identifying Venturi Plug
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD INSPECTION

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

Combustion Chamber

- Remove all carbon deposits from all combustion chambers.

  NOTE: Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when removing carbon 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

Using a straightedge (1) and thickness gauge (2), check flatness of gasket surface at a total of 6 locations. If any measure value exceeds its limit, correct gasket surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place abrasive paper on and over surface plate, and rub gasket surface against paper to grind off high spots.

If it is impossible to correct cylinder head distortion, replace cylinder head.

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Distorted mating surface of cylinder head and cylinder head gasket causes combustion gas leakage, overheating and reduced power output.

Distortion of mating surface of cylinder head and cylinder head gasket

Limit: 0.03 mm (0.0011 in.)

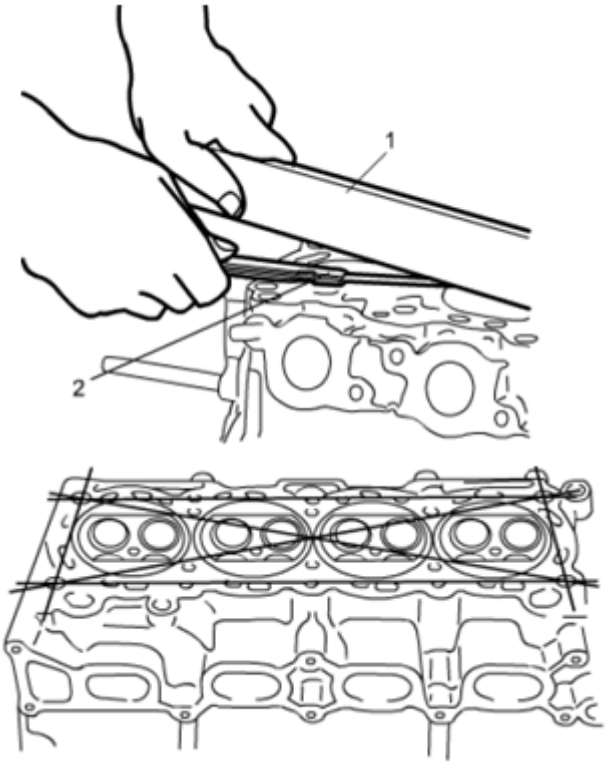


Fig. 129: Checking Cylinder Head Flatness
Courtesy of SUZUKI OF AMERICA CORP.

Manifold Seating Surface Flatness

Using straightedge (1) and thickness gauge (2), check flatness of manifold seating surface.

If measured value exceeds its limit, correct seating surface or replace cylinder head.

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

Limit: 0.05 mm (0.0019 in.)

 © 2011 Mitchell Repair Information Company, LLC.

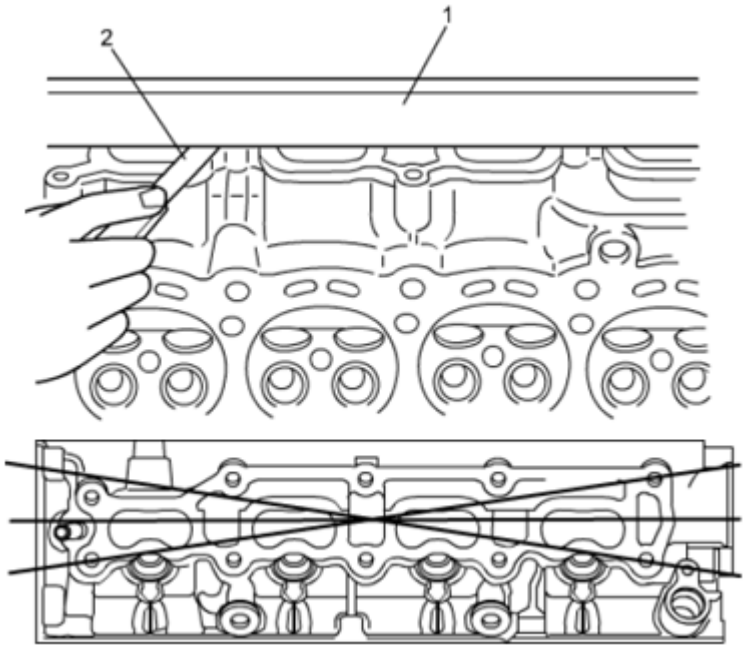


Fig. 130: Checking Manifold Seating Surface Flatness
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD NO. 1 BOLT INSPECTION

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

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

Measure each thread diameter of cylinder head No. 1 bolt "A" at "a" and "B" at "b" using micrometer (3).

Then calculate difference in diameters (A - B).

If it exceeds limit, replace cylinder head No. 1 bolt with new bolt.

Cylinder head No. 1 bolt diameter measurement points

"a": 95.0 mm (3.74 in.)

"b": 130.0 mm (5.12 in.)

Cylinder head No. 1 bolt diameter difference (deformation)

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

 © 2011 Mitchell Repair Information Company, LLC.

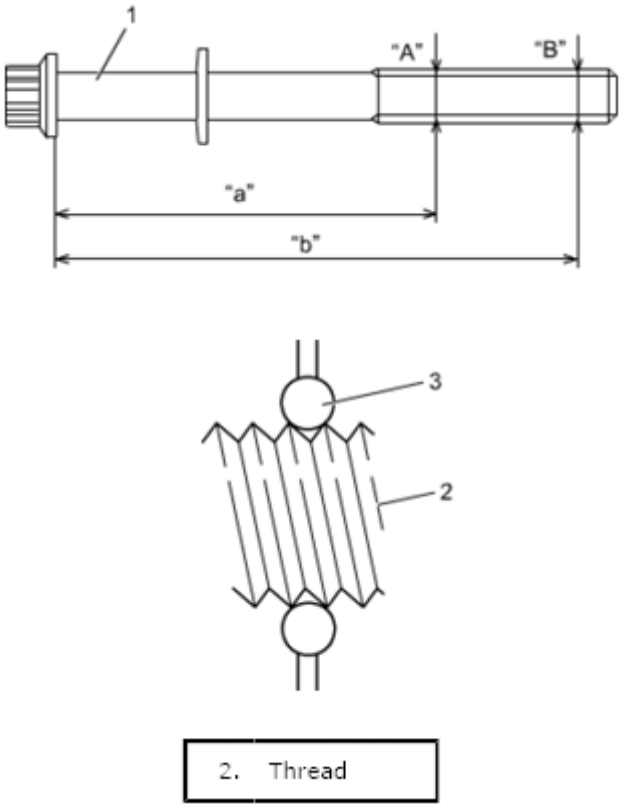


Fig. 131: Identifying Cylinder Head No. 1 Bolt Diameter Difference
Courtesy of SUZUKI OF AMERICA CORP.

VALVE SPRING INSPECTION

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

Valve Spring Free Length and Preload

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

If measured value is less than limit, replace valve spring.

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.)

 © 2011 Mitchell Repair Information Company, LLC.

Valve spring preload when compressed to 41 mm (1.61 in.)

Standard: 170 - 196 N (17.4 kgf - 19.9 kgf, 38.3 lbf - 44.0 lbf)

Limit: 165 N (16.9 kgf, 37.1 lbf)

Valve spring preload when compressed to 31.2 mm (1.23 in.)

Standard: 379 - 437 N (38.7 - 44.5 kgf, 85.2 - 98.2 lbf)

Limit: 375 N (38.3 kgf, 84.3 lbf)

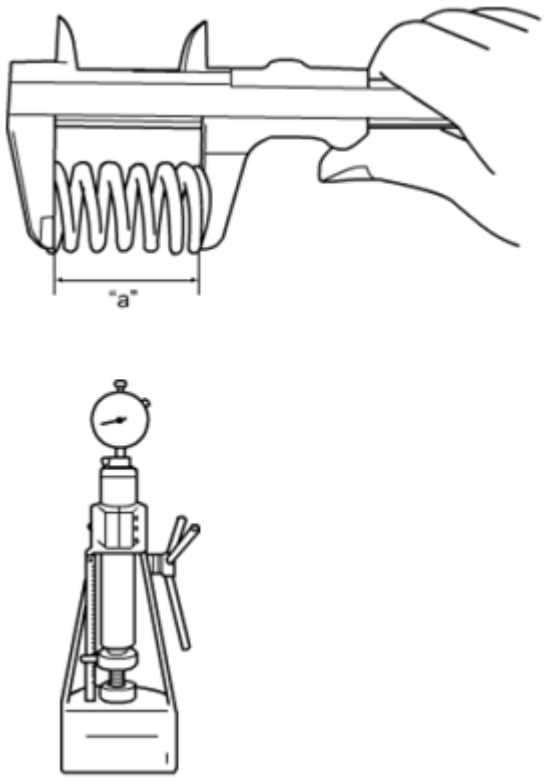


Fig. 132: Checking Valve Spring Free Length
Courtesy of SUZUKI OF AMERICA CORP.

Spring Squareness

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

Valve spring squareness

Limit: 2.2 mm (0.086 in.)

 © 2011 Mitchell Repair Information Company, LLC.

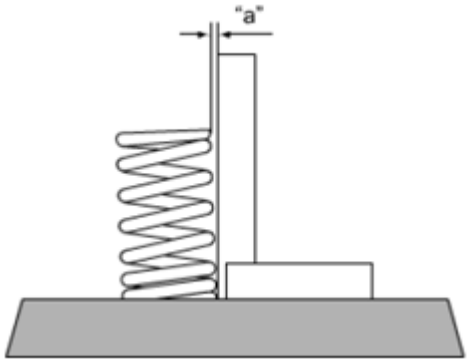
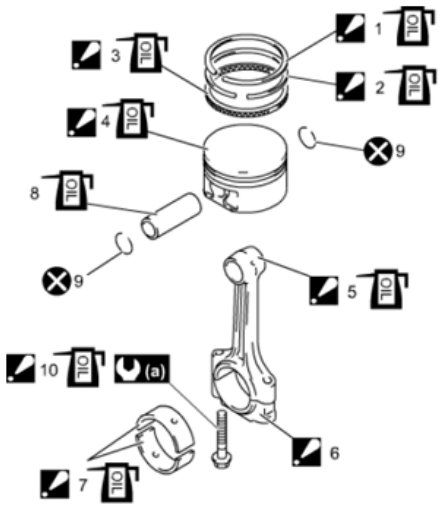


Fig. 133: Checking Valve Spring Squareness
Courtesy of SUZUKI OF AMERICA CORP.

PISTON, PISTON RING AND CONNECTING ROD COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 134: Identifying Piston, Piston Ring And Connecting Rod Components
Courtesy of SUZUKI OF AMERICA CORP.

PISTON, PISTON RING AND CONNECTING ROD REMOVAL AND INSTALLATION

CAUTION: If any of the parts listed below is reinstalled into a position different from

 © 2011 Mitchell Repair Information Company, LLC.

the original position, engine problems could occur. If these parts are to be reused, keep them in numerical order so that they may be reinstalled in their original positions.

- **Connecting rods**
- **Connecting rod bearings**
- **Connecting rod bearing caps**
- **Pistons**

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 from which they were removed.**
  - **Connecting rod**
  - **Connecting rod bearing**
  - **Connecting rod bearing cap**
  - **Piston**

 © 2011 Mitchell Repair Information Company, LLC.

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, between connecting rod bearing cap and bearing.

2. Install connecting rod bearing to connecting rod bearing cap and connecting rod 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 and bearing cap.

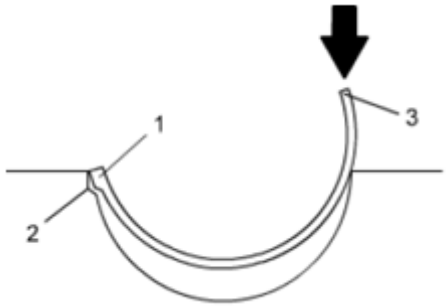


Fig. 135: Fitting Tab Of Connecting Rod Bearing To Groove Of Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

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

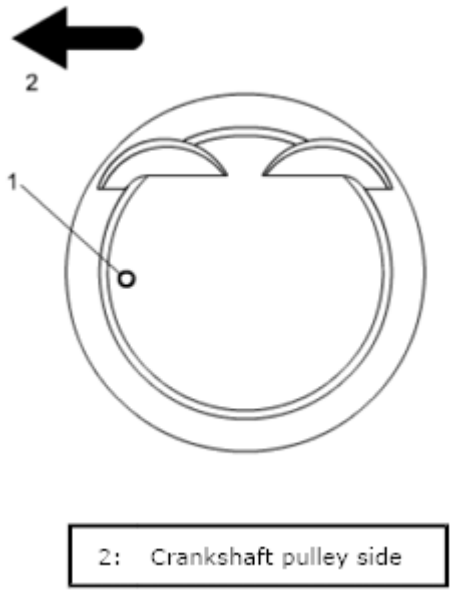


Fig. 136: Identifying Point Front Mark On Piston Head
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.

Guide connecting rod into place on crankshaft.

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

Special Tool

(A): 09916-77310

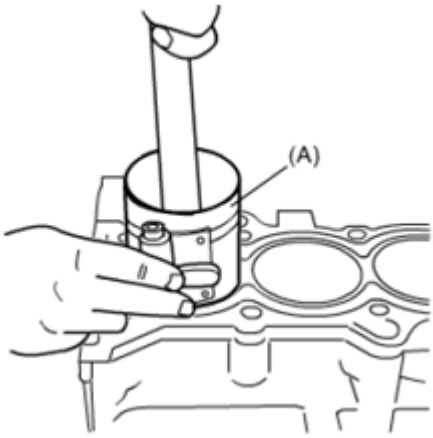


Fig. 137: Installing Piston And Connecting Rod Assembly Into Cylinder Bore
Courtesy of SUZUKI OF AMERICA CORP.

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

NOTE:

- **Before installing connecting rod bearing cap, check connecting rod bearing 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. Point 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. Tighten all connecting rod bearing cap bolt to 15 N.m (1.5 kgf-m, 11.0 lbf-ft) evenly and gradually.
d. In the same manner as Step c), retighten them to 45°.
e. In the same manner as Step c), retighten them to 45°.

Tightening torque

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

 © 2011 Mitchell Repair Information Company, LLC.

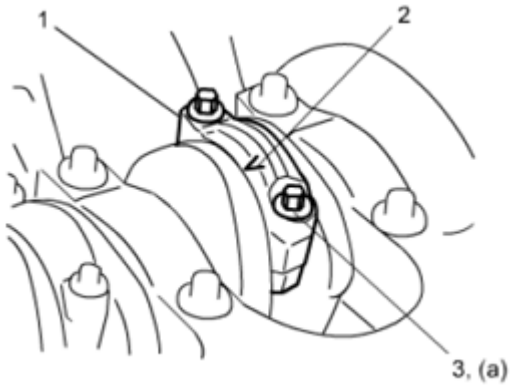


Fig. 138: Identifying Arrow Mark On Connecting Rod Bearing Cap
Courtesy of SUZUKI OF AMERICA CORP.

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: Using the parts removed from a piston for another piston may lead to engine problems. If the following parts are to be reused, be sure to use them only in the original combination.

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

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

Disassembly

1. Using piston ring expander, 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.

 © 2011 Mitchell Repair Information Company, LLC.

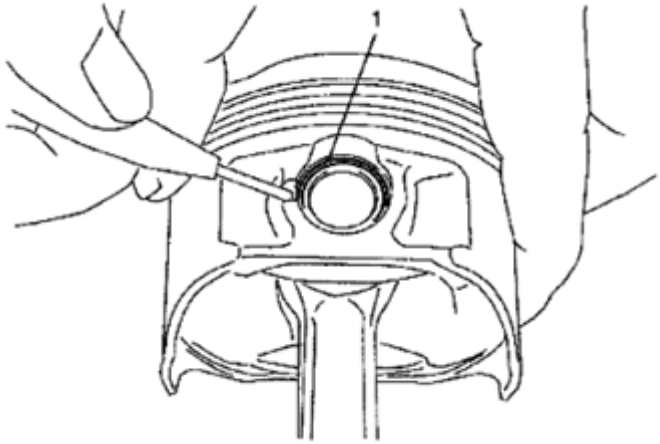


Fig. 139: Removing Piston Pin Circlips Using Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

b. Take out piston pin.

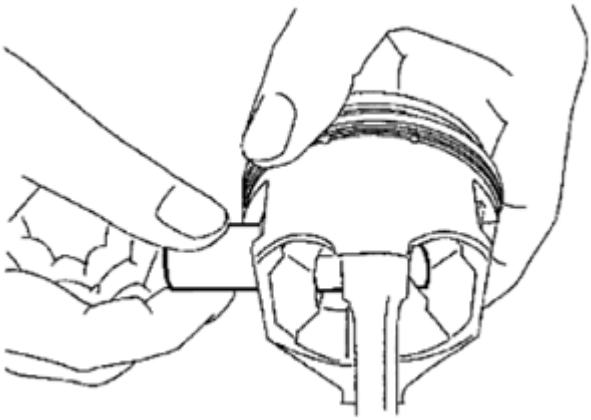


Fig. 140: Removing Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

Reassembly

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

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

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

CAUTION:

- **Apply engine oil to the following parts.**
  - **Piston pin hole**
  - **Piston pin**
  - **Connecting rod small-end bore**

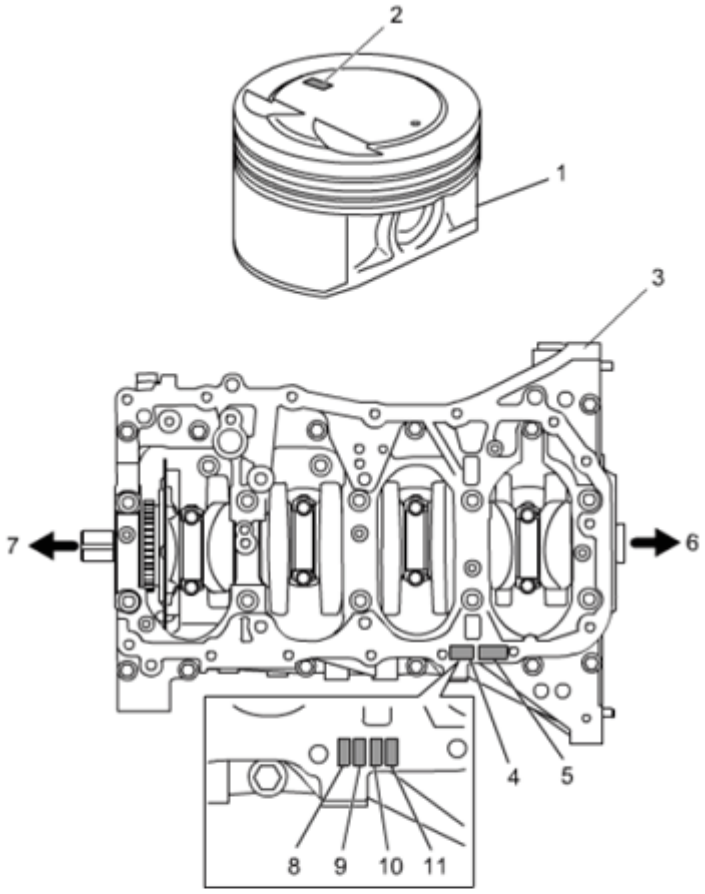
 © 2011 Mitchell Repair Information Company, LLC.

- **Reassemble the following parts in the position from which they were removed.**
  - **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 according the following procedure
   a. Check stamped number (2) on piston (1) as shown in figure.
   b. Check stamped number (4) on lower crank case (3) as shown in figure.

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 141: Identifying Stamped Number On Lower Crank Case
Courtesy of SUZUKI OF AMERICA CORP.

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

Select proper piston referring the following table.

Piston selection table

PISTON SELECTION TABLE

	Stamped number on lower crank case	
	1	2

 © 2011 Mitchell Repair Information Company, LLC.

Stamped number on piston	1	2

2. Remove carbon deposit from piston head and ring grooves using a suitable tool.
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 so that circlip end gap comes within the range indicated by arrow (6).

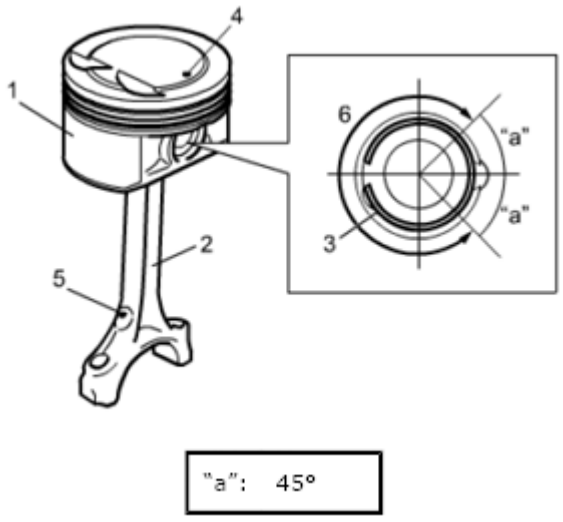


Fig. 142: Identifying Circlip End Gap Positions
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

 © 2011 Mitchell Repair Information Company, LLC.

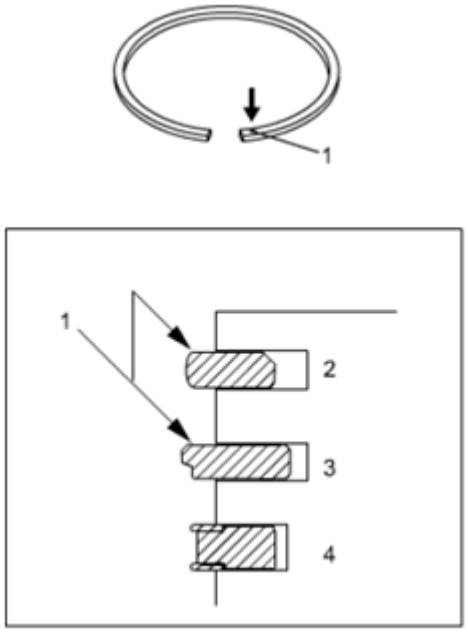
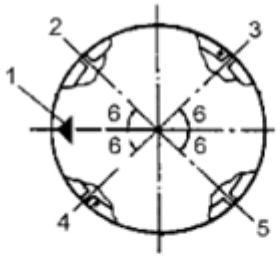


Fig. 143: Identifying Piston Rings On Piston
Courtesy of SUZUKI OF AMERICA CORP.

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



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. 144: Identifying Rings End Gaps Positions
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER, PISTON AND PISTON RING INSPECTION

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

 © 2011 Mitchell Repair Information Company, LLC.

Cylinder

Visual inspection

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

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

Cylinder bore diameter, taper and out-of-round

Using cylinder gauge, measure cylinder bore in thrust and axial directions.

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

- 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: If abnormality is found on cylinder inside wall, replace cylinder block.

**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

Stamped number on lower crank case	1	84.0101 - 84.0200 mm (3.30749 - 3.30787 in.)
	2	84.0000 - 84.0100 mm (3.30709 - 3.30748 in.)

Cylinder bore diameter

Limit: 84.050 mm (3.3268 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.)

© 2011 Mitchell Repair Information Company, LLC.

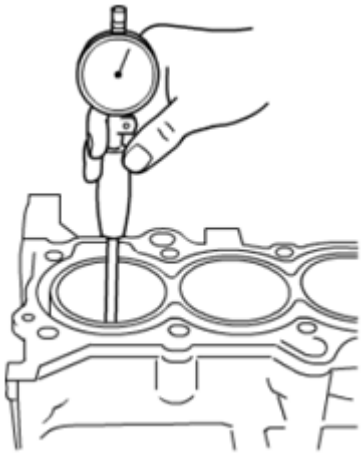
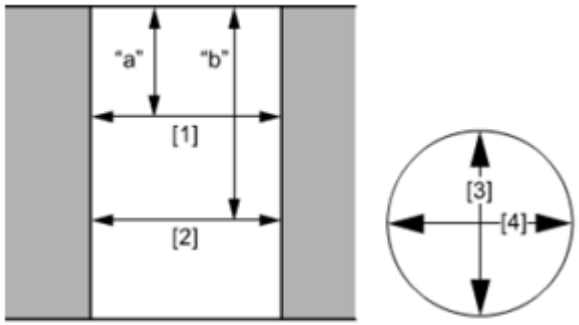


Fig. 145: Checking Cylinder Bore Taper
Courtesy of SUZUKI OF AMERICA CORP.



"a":	50 mm (1.97 in.)
"b":	100 mm (3.94 in.)

Fig. 146: Checking 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.

If abnormality is found, replace piston.

Piston diameter

 © 2011 Mitchell Repair Information Company, LLC.

As indicated in figure, piston diameter should be measured at specified position "a" 16.0 mm (0.630 in) from piston skirt end in the direction perpendicular to piston pin.

If measured diameter is less than its limit, replace piston.

New piston diameter standard size

PISTON DIAMETER STANDARD SIZE

Stamped number on piston	1	83.996 - 84.022 mm (3.3070 - 3.3079 in.)
	2	83.986 - 84.012 mm (3.3066 - 3.3075 in.)

Piston diameter limit size

PISTON DIAMETER LIMIT SIZE

Stamped number on piston	1	83.930 mm (3.3043 in.)
	2	83.920 mm (3.3039 in.)

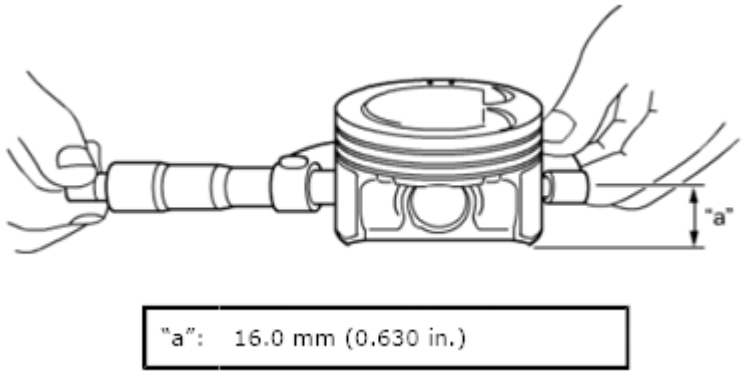


Fig. 147: Measuring Piston Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Piston clearance

Measure cylinder bore diameter and piston diameter to find their difference called is piston clearance.

Piston clearance should be within its standard value.

If it is out of its limit, replace piston.

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

Piston clearance

Limit: 0.12 mm (0.0047 in.)

© 2011 Mitchell Repair Information Company, LLC.

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. Measure clearance between ring and ring land using thickness gauge (2).

   If clearance is out of limit, replace piston.

   Ring groove clearance

RING GROOVE CLEARANCE

	Standard	Limit
1st ring	0.03 - 0.07 mm (0.0012 - 0.0027 in.)	0.11 mm (0.0043 in.)
2nd ring	0.02 - 0.06 mm (0.0008 - 0.0023 in.)	0.11 mm (0.0043 in.)
Oil ring	0.03 - 0.17 mm (0.0012 - 0.0066 in.)	-

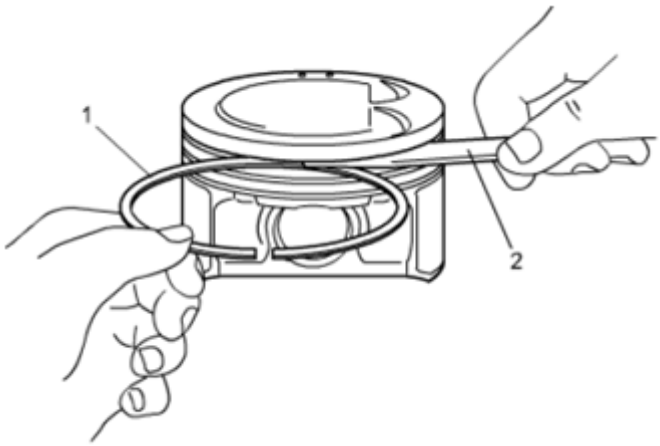


Fig. 148: Checking Ring Groove Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Piston Ring

Piston ring end gap

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

If measured gap exceeds limit, replace piston ring.

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

Piston ring end gap

 © 2011 Mitchell Repair Information Company, LLC.

PISTON RING END GAP REFERENCE CHART

Item	Standard	Limit
1st ring	0.20 - 0.33 mm (0.0079 - 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 (0.0079 - 0.0196 in.)	1.8 mm (0.0708 in.)

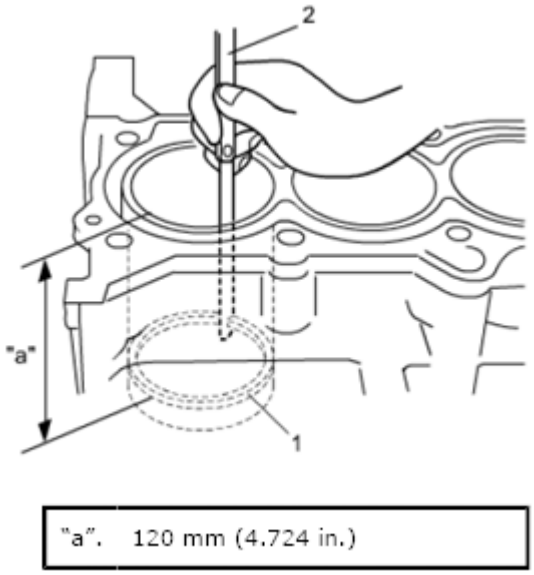


Fig. 149: Measuring Piston Ring End Gap
Courtesy of SUZUKI OF AMERICA CORP.

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 bush.

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

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

 © 2011 Mitchell Repair Information Company, LLC.

Standard: 0.003 - 0.016 mm (0.00012 - 0.00062 in.)

Limit: 0.040 mm (0.0015 in.)

Piston pin clearance in piston

Standard: 0.006 - 0.017 mm (0.00024 - 0.00066 in.)

Limit: 0.05 mm (0.0019 in.)

Small-end bore

21.003 - 21.013 mm (0.82689 - 0.82728 in.)

Piston pin outside diameter

20.997 - 21.000 mm (0.82666 - 0.82677 in.)

Diameter of piston pin hole in piston

21.006 - 21.014 mm (0.82701 - 0.82732 in.)

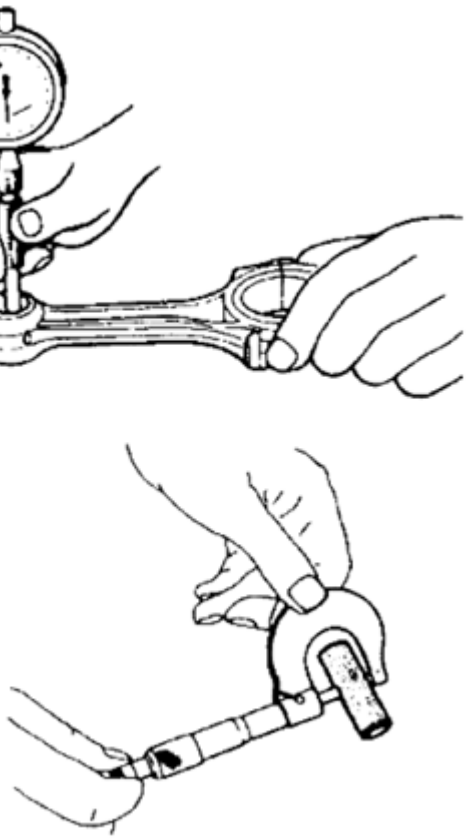


Fig. 150: Checking Diameter Of Piston Pin Hole In Piston

 © 2011 Mitchell Repair Information Company, LLC.

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.

If measured clearance is out of its standard value, replace connecting rod.

Big-end side clearance

Standard: 0.25 - 0.40 mm (0.0099 - 0.0157 in.)

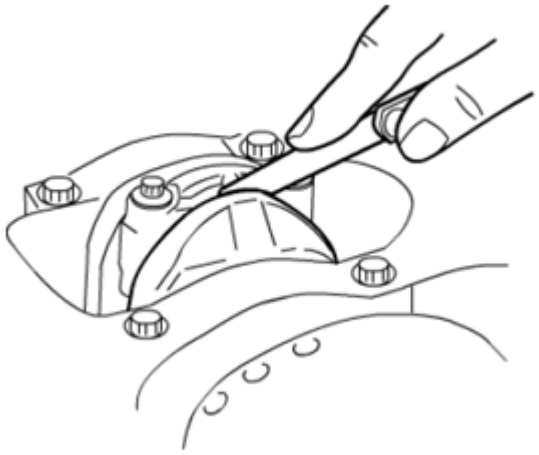


Fig. 151: Measuring Big-End Side Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Connecting rod alignment

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

If measured value exceeds the limit, replace it.

Connecting rod alignment

Limit on bow: 0.05 mm (0.0019 in.)

Limit on twist: 0.10 mm (0.0039 in.)

 © 2011 Mitchell Repair Information Company, LLC.

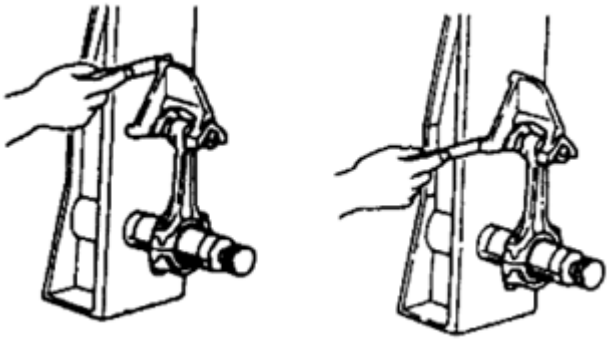


Fig. 152: Checking Connecting Rod Alignment
Courtesy of SUZUKI OF AMERICA CORP.

Connecting rod bolt deformation

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

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

If it is exceeds limit, replace connected rod (1).

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.)

 © 2011 Mitchell Repair Information Company, LLC.

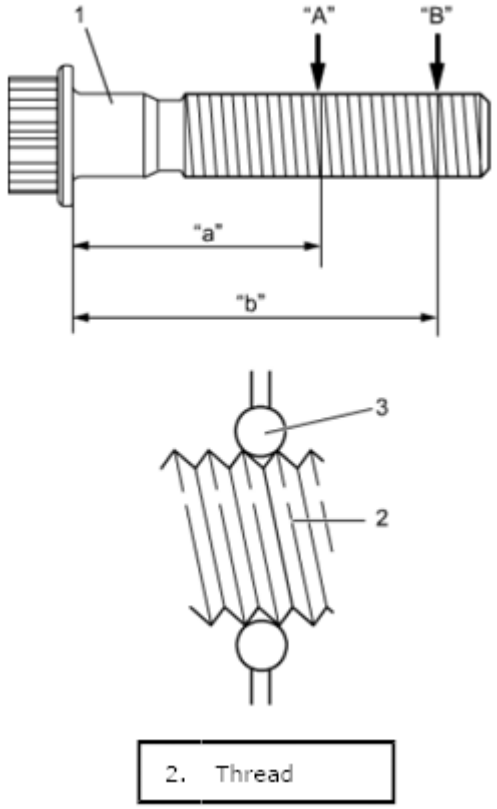


Fig. 153: Checking Connecting Rod Bolt Measurement Points
Courtesy of SUZUKI OF AMERICA CORP.

CRANKSHAFT PIN AND CONNECTING ROD BEARINGS INSPECTION

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

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

Crankshaft Pin Diameter

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

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

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

Crankshaft pin diameter

 © 2011 Mitchell Repair Information Company, LLC.

Standard: 49.982 - 50.000 mm (1.96780 - 1.96850 in)

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

Limit: 0.01 mm (0.0003 in.)

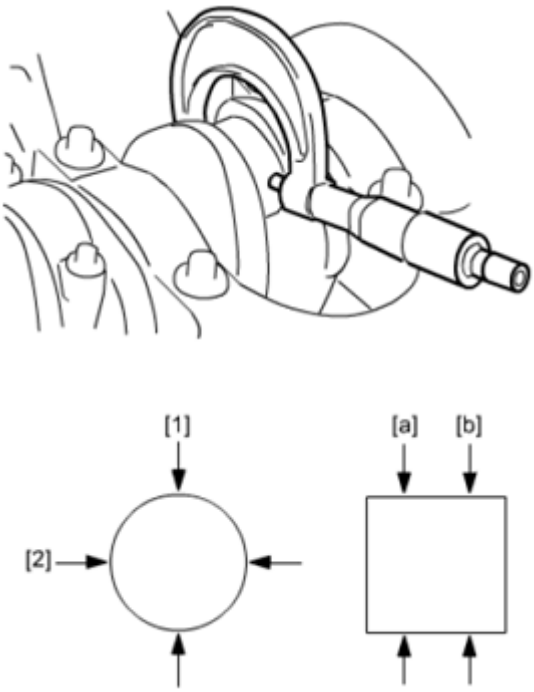


Fig. 154: Checking Crankshaft Pin Taper And Out-Of-Round
Courtesy of SUZUKI OF AMERICA CORP.

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 SPECIFICATIONS

	Painted color	Bearing thickness
Standard size	Blue	1.494 - 1.497 mm (0.05882 - 0.05893 in.)
	Yellow	1.491 - 1.494 mm (0.05871 - 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.)

 © 2011 Mitchell Repair Information Company, LLC.



Fig. 155: Identifying Connecting Rod Bearing
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. If abnormality is found, replace connecting rod bearings.

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 referring to "CONNECTING ROD DEFORMATION" under PISTON PINS AND CONNECTING RODS INSPECTION.

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

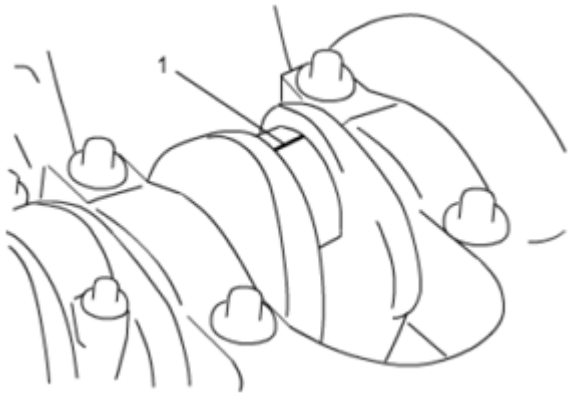


Fig. 156: Identifying Gauging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

3. Install connecting rod bearings and its cap, see **Piston, Piston Ring and Connecting Rod Removal and Installation**.

 © 2011 Mitchell Repair Information Company, LLC.

4. After three minutes elapsed, remove cap and using a scale (2) on gauging plastic envelope, measure gauging plastic (1) width at the widest point.

   Connecting rod bearing clearance

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

   Limit: 0.065 mm (0.0025 in.)

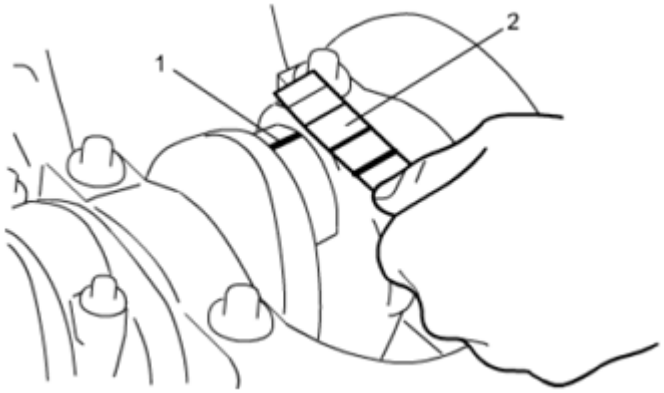


Fig. 157: Checking Connecting Rod Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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 according to 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.

Selection of Connecting Rod Bearings

Standard size

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

 © 2011 Mitchell Repair Information Company, LLC.

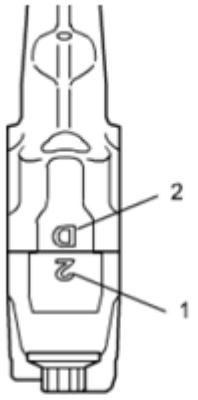
figure.

- That number represent connecting rod big-end inside diameter as follows.

Connecting rod big-end inside diameter

CONNECTING ROD BIG-END INSIDE DIAMETER SPECIFICATIONS

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 (2.08710 - 2.08732 in.)



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

Fig. 158: Checking Connecting Rod Big-End Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

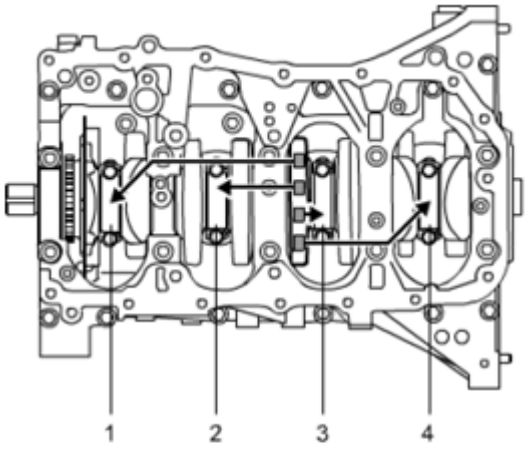
2. Check crankshaft pin diameter according to the following procedures.
   - There are four stamped alphabets (any of "A", "B" or "C") on crank web No. 5 as shown in figure.
   - Those alphabets represent crankshaft pin diameter as follows.

Crankshaft pin diameter

CRANKSHAFT PIN DIAMETER SPECIFICATIONS

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.)

 © 2011 Mitchell Repair Information Company, LLC.



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

Fig. 159: Identifying Crankshaft Pins
Courtesy of SUZUKI OF AMERICA CORP.

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

Connecting rod bearing cross-reference selection table

CONNECTING ROD BEARING CROSS-REFERENCE SELECTION TABLE

		Stamped number for connecting rod big-end inside diameter		
		1	2	3
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), referring to step 2) to 5) of "Installation" under Piston, **Piston, Piston Ring and Connecting Rod Removal and Installation**.
   b. Using bore gauge, measure connecting rod bearing inside diameter "a".
   c. Calculate target diameter according to formula below.

 © 2011 Mitchell Repair Information Company, LLC.

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, see **Connecting Rod Bearing Clearance**.

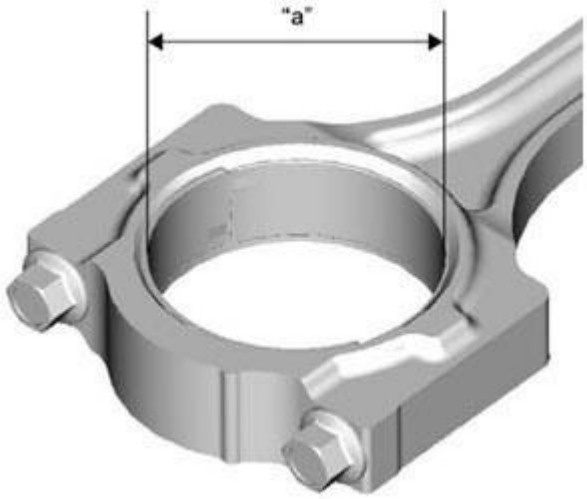
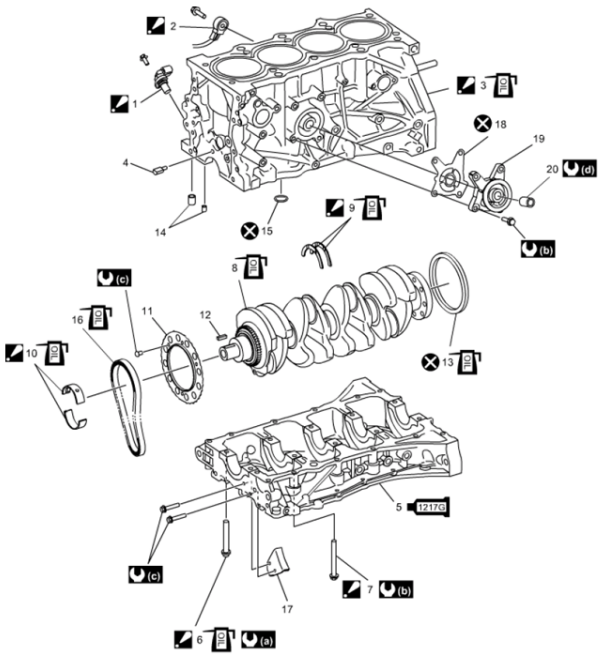


Fig. 160: Measuring Connecting Rod Bearing Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARING, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

 © 2011 Mitchell Repair Information Company, LLC.



1. CKP sensor : For removal and installation, refer to *Crankshaft Position (CKP) Sensor Removal and Installation*.	Main bearing : For applying engine oil, refer to *Main Bearings, Crankshaft and Cylinder Block Removal and Installation*. 10.	19. Oil filter adapter case
2. Knock sensor : For removal and installation, refer to *Knock Sensor Removal and Installation*.	11. Sensor plate	20. Oil filter stand
Cylinder block : Do not apply engine oil to main bearing seating face. 3. : Apply engine oil to sliding surface	12. Crankshaft timing sprocket key	(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°)
4. Timing chain oil jet	Rear oil seal : Apply engine oil to oil seal lip. 13.	(b) 25 N·m (2.5 kgf-m, 18.5 lbf-ft) :
1217G Lower crank case : Apply sealant 99000-31260 referring to *Main Bearings, Crankshaft and Cylinder Block Removal and Installation*. 5.	14. Dowel pin	(c) 11 N·m (1.1 kgf-m, 8.5 lbf-ft) :
Crank case bolt No.1 : Check crank case bolt No.1 for deformation to reuse. 6. : Apply engine oil to bolt thread and seat.: For tightening order, refer to *Main Bearings, Crankshaft and Cylinder Block Removal and Installation*.	15. O-ring	(d) 18 N·m (1.8 kgf-m, 13.5 lbf-ft) :
7. Crank case bolt No.2 : For tightening order, refer to *Main Bearings, Crankshaft and Cylinder Block Removal and Installation*.	Oil pump chain : Apply engine oil to sliding surface. 16.	: Do not reuse.
Crankshaft 8. : Apply engine oil to sliding surface	17. Oil pump chain guide	
Thrust bearing : Install thrust bearing with oil grooves facing out.: Apply engine oil to sliding surface. 9.	18. Gasket	

Fig. 161: Identifying Main Bearing, Crankshaft And Cylinder Block Components
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION

 © 2011 Mitchell Repair Information Company, LLC.

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

CAUTION: If any of the parts listed below is reinstalled into a position different from the original position, engine problems could occur. If these parts are to be reused, keep them in numerical order so that they may be reinstalled in their original positions.

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

NOTE: For identification of each cylinder, refer to PRECAUTIONS FOR IDENTIFICATION OF CYLINDER .

Removal

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

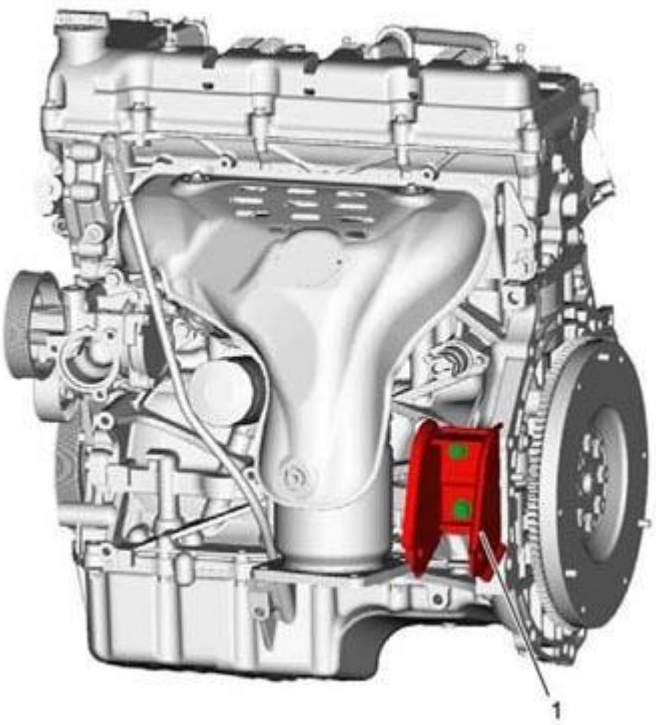


Fig. 162: Removing Engine Front Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

6. Remove piston and connecting rod. Refer to **Piston, Piston Ring and Connecting Rod Removal and Installation**.
7. Remove oil pump chain guide (1) from lower crank case.

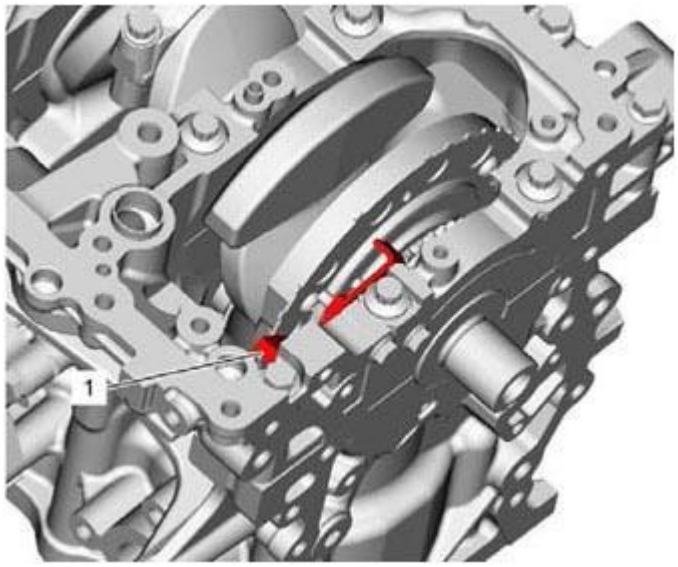


Fig. 163: Removing Oil Pump Chain Guide From Lower Crank Case
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove CKP sensor. Refer to **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL AND INSTALLATION** .
9. Loosen crank case bolt No. 2s in numerical order ("1" - "12") evenly and gradually.

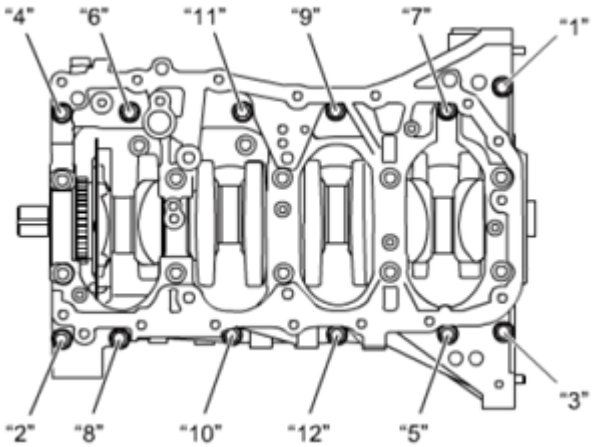


Fig. 164: Identifying Crank Case Bolts Loosining Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

 © 2011 Mitchell Repair Information Company, LLC.

NOTE: Use 12-point socket wrench to crank case bolt No. 1s.

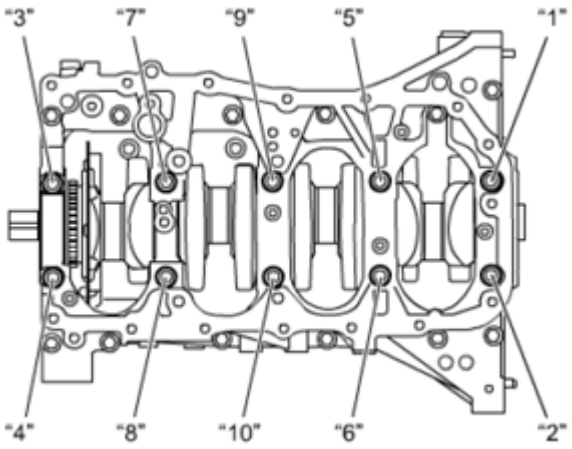


Fig. 165: Identifying Crank Case Bolt Loosining Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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).

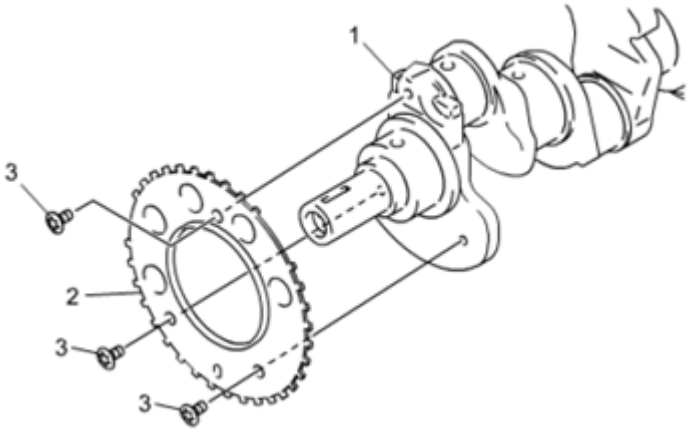


Fig. 166: Removing Sensor Plate From Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **CRANKSHAFT INSPECTION**

Reference: **MAIN BEARINGS INSPECTION**

Reference: **SENSOR PLATE INSPECTION**

 © 2011 Mitchell Repair Information Company, LLC.

Reference: **FLYWHEEL/DRIVE PLATE INSPECTION**

Reference: **CYLINDER BLOCK INSPECTION**

Reference: **OIL PUMP DRIVE SPROCKET INSPECTION**

Reference: **OIL PUMP CHAIN INSPECTION**

NOTE:

- **The engine will seize up if it is operated when the parts listed below are not properly lubricated.**

  The engine will seize up if it is operated when the parts listed below are not properly lubricated.
  - **Crankshaft journal**
  - **Main bearing**
  - **Thrust bearing**
  - **Oil pump chain guide**

- **Using crank case bolt No. 1s that are deformed exceeding the service limit could lead to engine problems.**

  When crank case bolt No. 1s are reused, make sure that crank case bolt No. 1s are not deformed exceeding the service limit referring to "Crank Case Bolt No. 1 Inspection" under Main Bearings Inspection.

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

      NOTE: Use spring pin which is genuine SUZUKI part (09205-05006).

   b. Install sensor plate to crankshaft, fitting pin (2) into hole (4) and facing inside edge (5) outward as shown in figure.

      Tightening torque

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

 © 2011 Mitchell Repair Information Company, LLC.

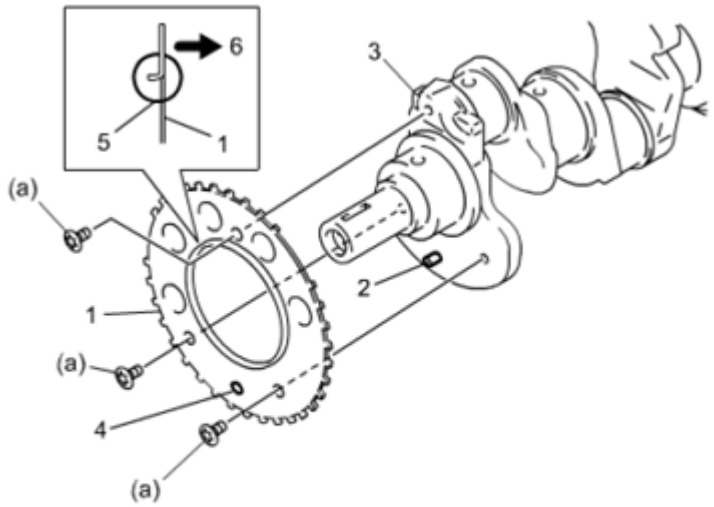


Fig. 167: Identifying Sensor Plate Screw Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

c. Detach spring pin from crankshaft.

2. Install main bearings to cylinder block and lower crankcase according to the following procedure.

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 crank case.
b. Press bearing end (3) until it fully seat in cylinder block or lower crankcase.
c. Apply engine oil to sliding surface (4) of main bearing halves.

NOTE: **If oil is present between the bearing's outside surface (5) and the cylinder block / lower crank case surface (6), the bearing could heat up to very high temperature, resulting in seizure. Be sure to thoroughly wipe off any trace of oil that is present between the bearing's outside surface (5) and the cylinder block / lower crank case surface (6).**

 © 2011 Mitchell Repair Information Company, LLC.

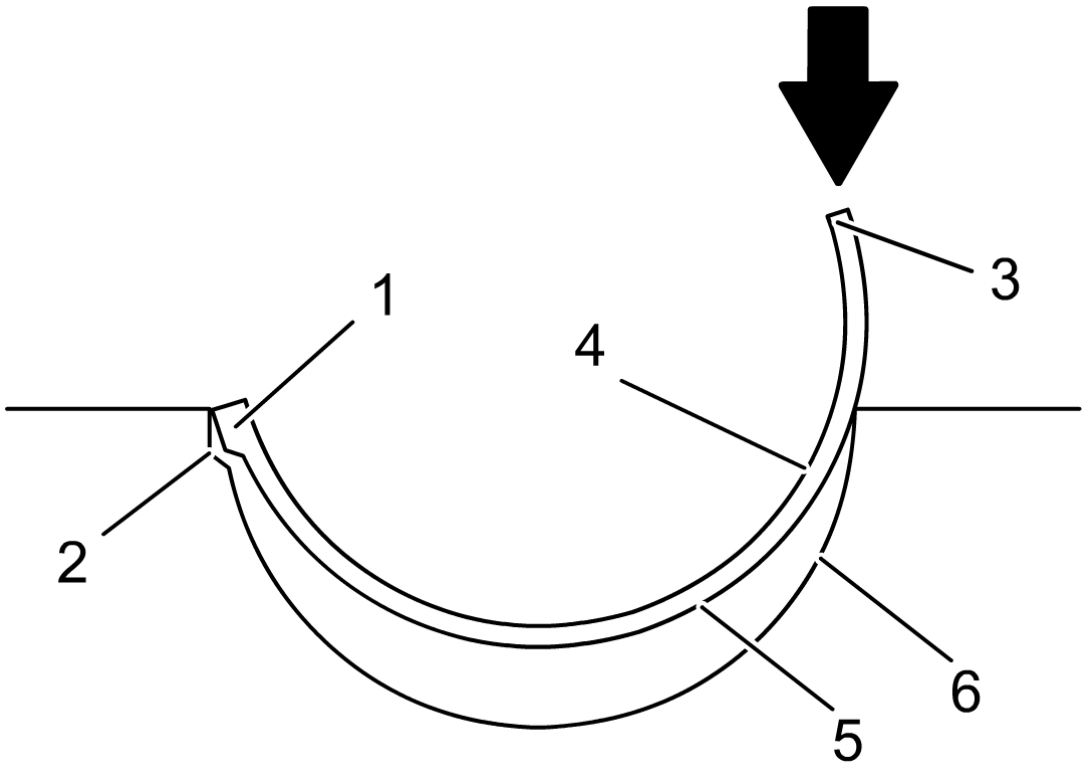


Fig. 168: Pressing Bearing End
Courtesy of SUZUKI OF AMERICA CORP.

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

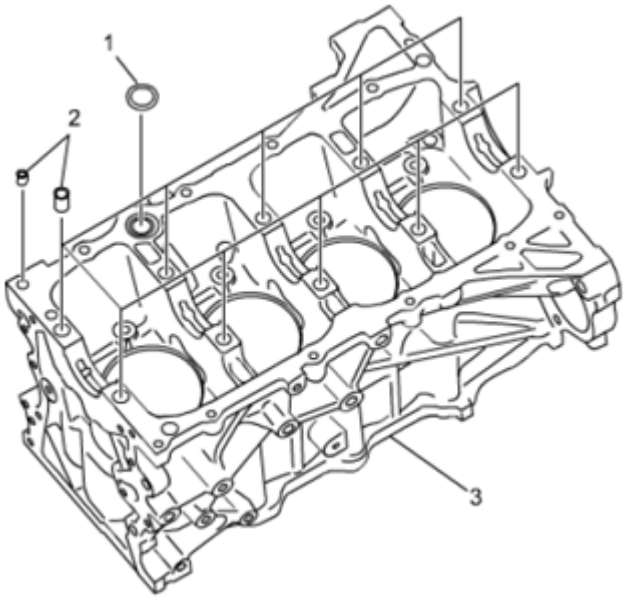


Fig. 169: Identifying Thrust Bearings
Courtesy of SUZUKI OF AMERICA CORP.

 © 2011 Mitchell Repair Information Company, LLC.

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

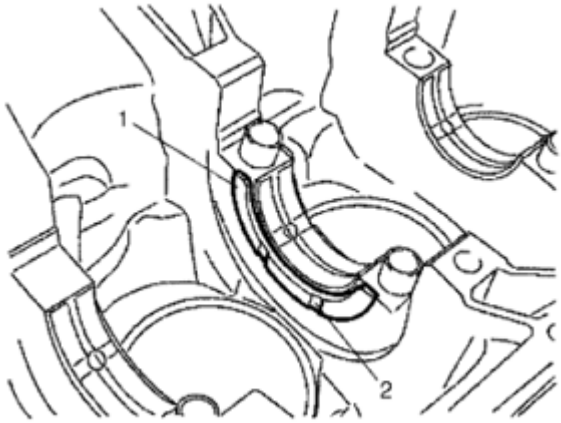


Fig. 170: Installing Thrust Bearings To Cylinder Block Journal No. 3, With Oil Grooves Facing Outward
Courtesy of SUZUKI OF AMERICA CORP.

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.

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

Sealant bead size for lower crankcase

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

Height "b": 2 mm (0.08 in.)

 © 2011 Mitchell Repair Information Company, LLC.

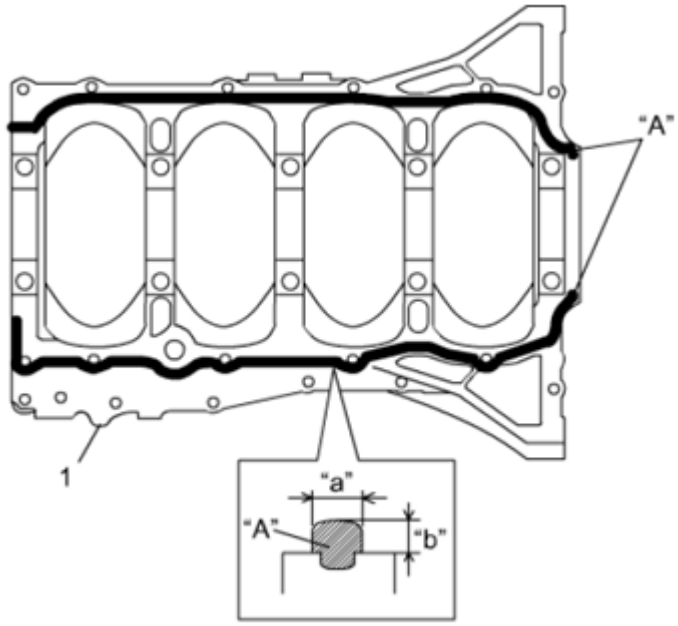


Fig. 171: Identifying Sealant Bead Size For Lower Crankcase
Courtesy of SUZUKI OF AMERICA CORP.

9. Install lower crank case to cylinder block and tighten crank case bolt No. 1s according to the following procedure.

NOTE: Use 12-point socket wrench to crank case bolt No. 1s.

a. Apply engine oil to bolt threads and seats of crank case 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. In the same manner as Step a), retighten them to 20 N.m (2.0 kgf-m, 15.0 lbf-ft).
d. In the same manner as Step a), retighten them to 35 N.m (3.6 kgf-m, 26.0 lbf-ft).
e. In the same manner as Step a), retighten them to 40°.
f. In the same manner as Step a), retighten them to 40°.

Tightening torque

Crank case 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 --> 26.0 lbf-ft --> 40° --> 40°)

© 2011 Mitchell Repair Information Company, LLC.

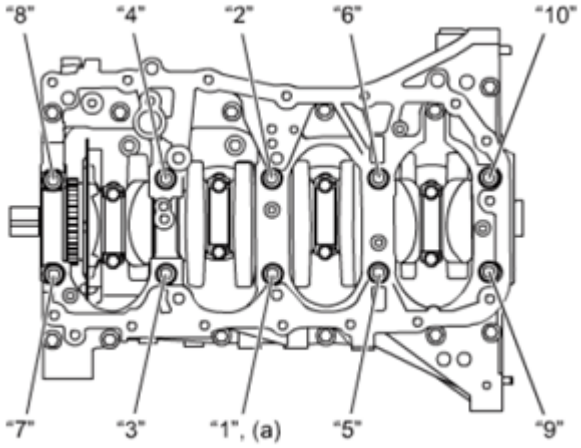


Fig. 172: Identifying Crank Case Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

    Tightening torque

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

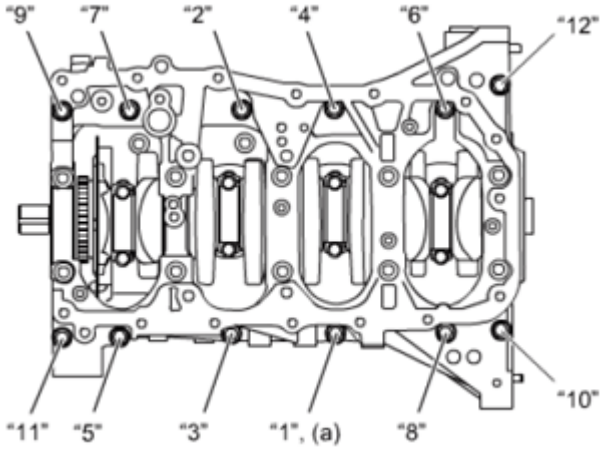


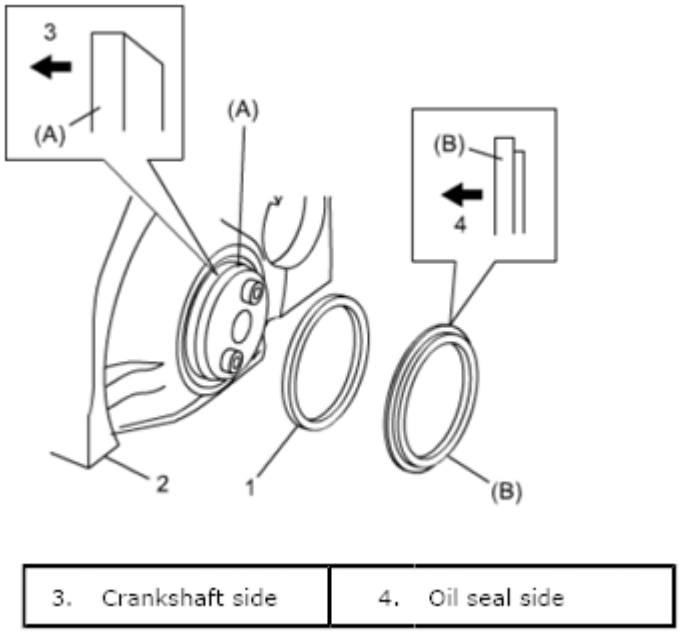
Fig. 173: Identifying Crank Case Bolt No. 2 Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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**

 © 2011 Mitchell Repair Information Company, LLC.



3. Crankshaft side	4. Oil seal side

Fig. 174: Installing Rear Oil Seal To Cylinder Block Using Special Tools
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 guide (1).

Tightening torque

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

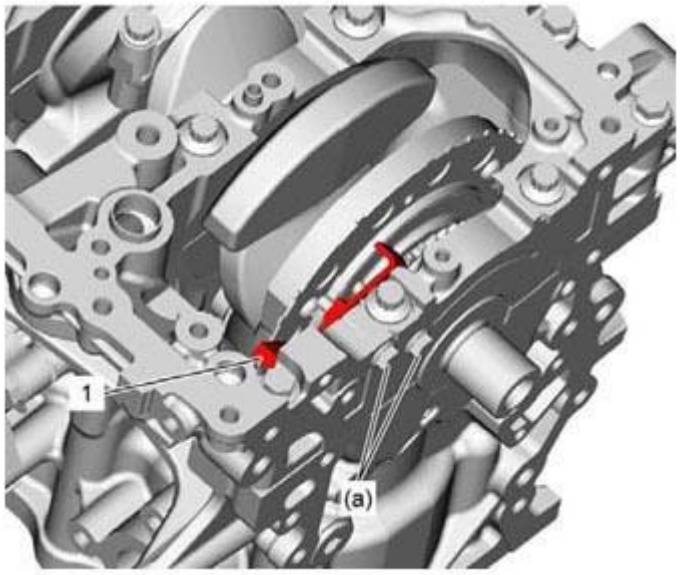


Fig. 175: Identifying Oil Pump Chain Guide Bolt

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of SUZUKI OF AMERICA CORP.

15. Install CKP sensor, see **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL AND INSTALLATION** .
16. Install flywheel for M/T model, or drive plate for CVT model. See **Flywheel/Drive Plate Removal and Installation**.
17. 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)

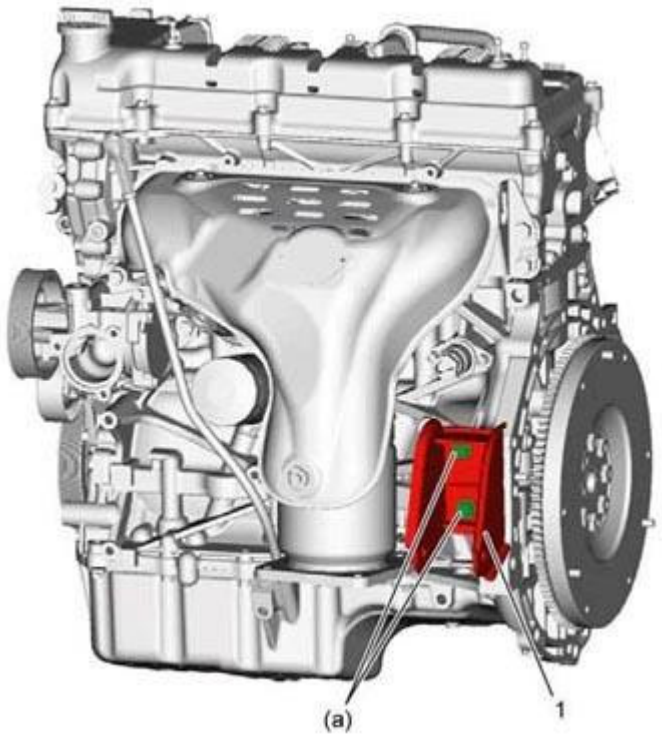


Fig. 176: Identifying Engine Front Mounting Bracket Bolt
Courtesy of SUZUKI OF AMERICA CORP.

18. Install P/S pump. Refer to **P/S PUMP REMOVAL AND INSTALLATION** .
19. Install water pump. Refer to **WATER PUMP REMOVAL AND INSTALLATION** .
20. Install generator. Refer to **GENERATOR REMOVAL AND INSTALLATION** .
21. Install engine assembly. Refer to **Engine Assembly Removal and Installation**.

CRANKSHAFT INSPECTION

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

 © 2011 Mitchell Repair Information Company, LLC.

Crankshaft Runout

Using dial gauge, measure runout at center journal. Rotate crankshaft slowly.

If runout exceeds its limit, replace crankshaft.

Crankshaft runout

Limit: 0.02 mm (0.0007 in.)

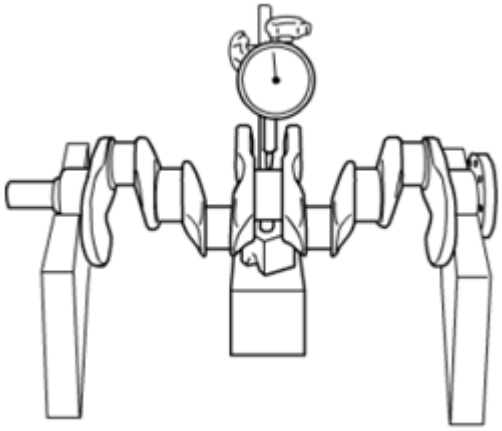


Fig. 177: Measuring Crankshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Thrust Play

1. Assemble crankshaft, main bearings, thrust bearings and lower crank case. See **Main Bearings, Crankshaft and Cylinder Block Removal and Installation**.
2. Using dial gauge (1), measure crankshaft thrust play (2) as shown in figure.

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

   Recheck crankshaft thrust play.

   Crankshaft thrust play

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

 © 2011 Mitchell Repair Information Company, LLC.

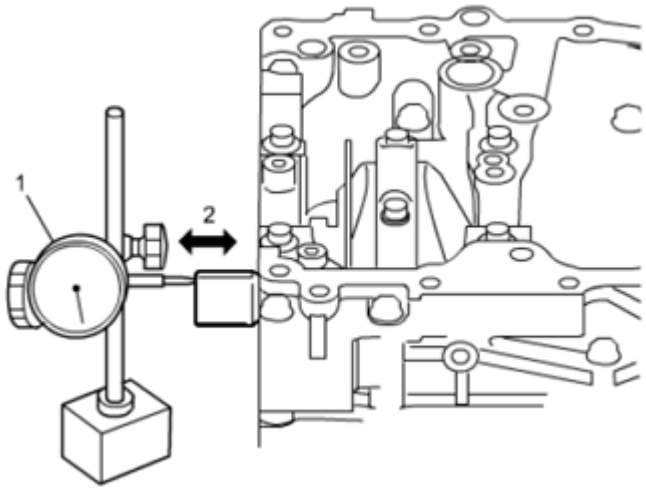


Fig. 178: Measuring Crankshaft Thrust Play
Courtesy of SUZUKI OF AMERICA CORP.

Thrust bearing thickness

Standard size: 2.470 - 2.520 mm (0.0973 - 0.0992 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.

If any one of journals is badly damaged or uneven wear exceeds its limit, regrind or replace crankshaft.

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.)

 © 2011 Mitchell Repair Information Company, LLC.

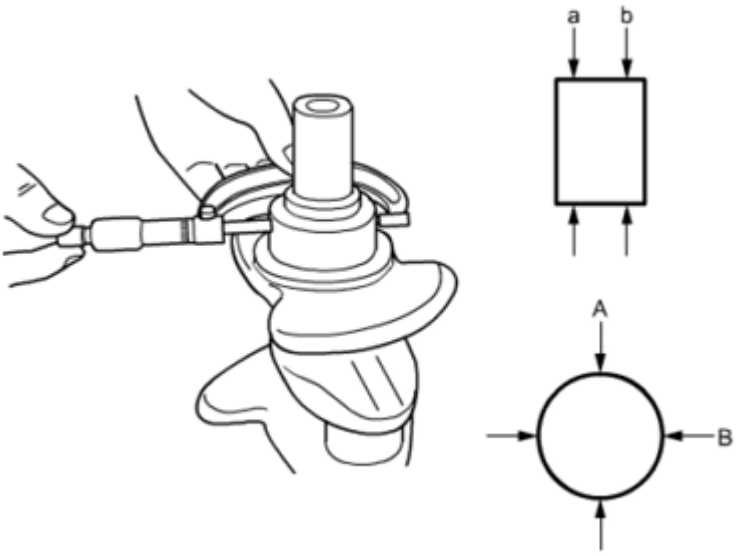


Fig. 179: Checking Crankshaft Out-Of-Round And Taper
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS INSPECTION

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

Visual Inspection

Check bearings for pitting, scratches, wear or damage.

If any defective condition is found, replace both upper and lower halves. 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 crank case bolt No. 1 for deformation. See Crank Case Bolt No. 1 Inspection.

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

 © 2011 Mitchell Repair Information Company, LLC.

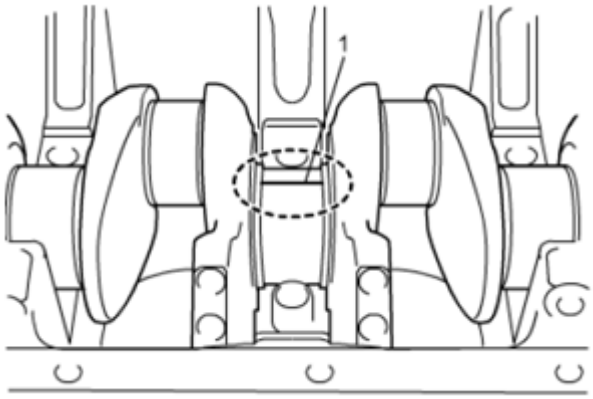


Fig. 180: Placing Piece Of Gauging Plastic Over Full Width Of Bearing (Parallel To Crankshaft) On Journal
Courtesy of SUZUKI OF AMERICA CORP.

4. Install lower crank case, see **Main Bearings, Crankshaft and Cylinder Block Removal and Installation**.
5. After three minutes, remove lower crank case and using scale (2) on gauging plastic envelop (1), measure gauging plastic width at its widest point.

NOTE: If pair of crankshaft journal and cylinder block journal is in the following condition, different values are applied as standard.

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

  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 (0.00098 - 0.00145 in.)

For more information about stamped number and stamped alphabet, refer to SELECTION OF MAIN BEARINGS.

Main bearing clearance

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

Limit: 0.050 mm (0.00196 in.)

 © 2011 Mitchell Repair Information Company, LLC.

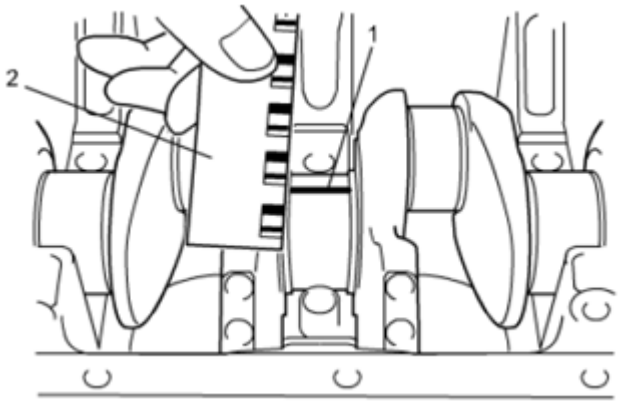


Fig. 181: Checking Main Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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 bearings according to the following procedures and recheck main bearing clearance.

- More than standard:

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

- Less than standard:

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

Selection of Main Bearings

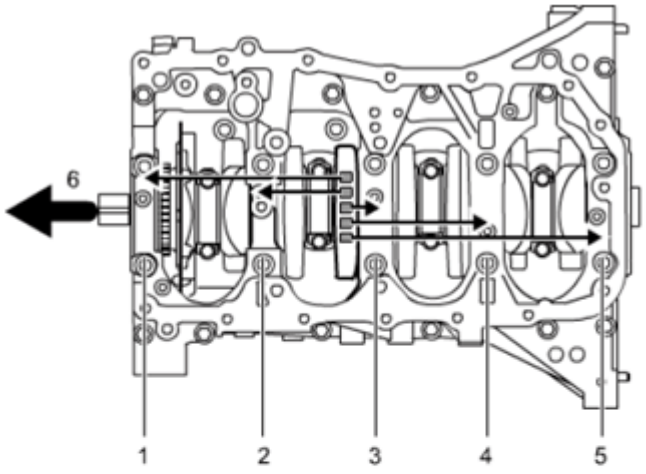
Standard size bearing

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 according to 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.

 © 2011 Mitchell Repair Information Company, LLC.



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. 182: Identifying Stamped Numbers
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

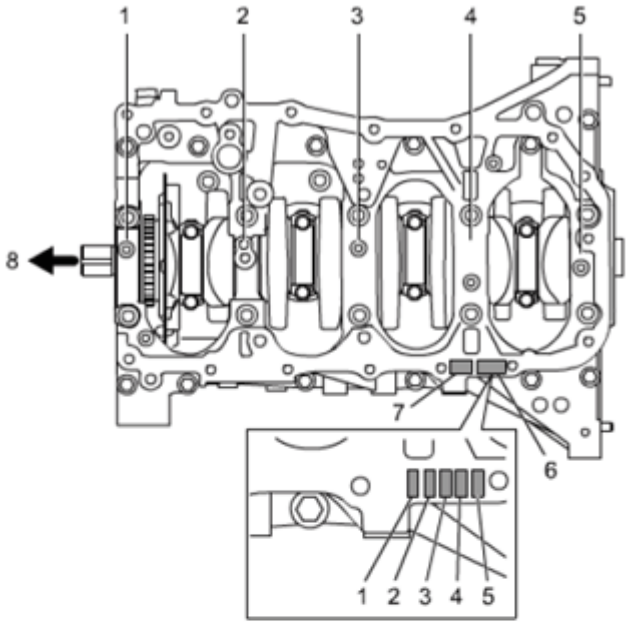
CRANKSHAFT JOURNAL DIAMETER SPECIFICATIONS

Stamped number	Journal diameter
4	51.997 - 52.000 mm (2.04713 - 2.04724 in.)
5	51.994 - 51.997 mm (2.04701 - 2.04712 in.)
6	51.991 - 51.994 mm (2.04689 - 2.04700 in.)
7	51.988 - 51.991 mm (2.04678 - 2.04688 in.)
8	51.985 - 51.988 mm (2.04666 - 2.04677 in.)
9	51.982 - 51.985 mm (2.04654 - 2.04665 in.)

2. Check cylinder block journal inside diameter according to the following procedures.
   - There are five stamped alphabets (6) (any of "A" through "F") on lower crank case as shown in figure.

 © 2011 Mitchell Repair Information Company, LLC.

- Those alphabets represent cylinder block journal inside diameter as follows.



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
8.	Crankshaft pulley side

Fig. 183: Identifying Cylinder Block Journal Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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

CYLINDER BLOCK JOURNAL INSIDE DIAMETER FOR JOURNALS REFERENCE CHART

Stamped alphabet	Cylinder block journal in side diameter

© 2011 Mitchell Repair Information Company, LLC.

A	56.000 - 56.003 mm (2.20473 - 2.20484 in.)
B	56.003 - 56.006 mm (2.20485 - 2.20496 in.)
C	56.006 - 56.009 mm (2.20496 - 2.20507 in.)
D	56.009 - 56.012 mm (2.20508 - 2.20519 in.)
E	56.012 - 56.015 mm (2.20520 - 2.20531 in.)
F	56.015 - 56.018 mm (2.20532 - 2.20543 in.)

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

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

   Standard size crankshaft main bearing thickness

   STANDARD SIZE CRANKSHAFT MAIN BEARING THICKNESS SPECIFICATIONS

Painted color	Bearing thickness
Blue	2.011 - 2.014 mm (0.07918 - 0.07929 in)
Yellow	2.008 - 2.011 mm (0.07906 - 0.07917 in)
Colorless	2.005 - 2.008 mm (0.07894 - 0.07905 in)
Black	2.002 - 2.005 mm (0.07882 - 0.07893 in)
Green	1.999 - 2.002 mm (0.07870 - 0.07881 in)



1. Paint

Fig. 184: Identifying Crankshaft Main Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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 CROSS - REFERENCE SELECTION TABLE (STANDARD SIZE)

	Stamped number on crank web No. 4					

 © 2011 Mitchell Repair Information Company, LLC.

			4	5	6	7	8	9
Stamped alphabets on lower crank case	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)

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

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

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

  Undersize of crankshaft main bearing thickness

UNDERSIZE OF CRANKSHAFT MAIN BEARING THICKNESS SPECIFICATIONS

Painted color	Bearing thickness
Red & Blue	2.136 - 2.139 mm (0.08410 - 0.08421 in.)
Red & Yellow	2.133 - 2.136 mm (0.08398 - 0.08409 in.)
Red	2.130 - 2.133 mm (0.08386 - 0.08397 in.)
Red & Black	2.127 - 2.130 mm (0.08374 - 0.08385 in.)
Red & Green	2.124 - 2.127 mm (0.08362 - 0.08374 in.)

© 2011 Mitchell Repair Information Company, LLC.

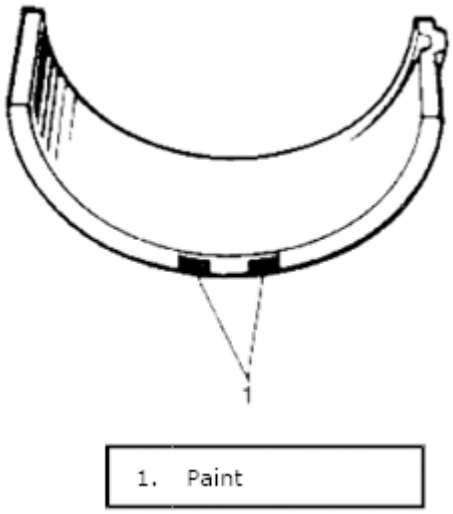


Fig. 185: Identifying Undersize Of Crankshaft Main Bearing
Courtesy of SUZUKI OF AMERICA CORP.

- 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 (2.03670 - 2.03740 in.)

  b. Using micrometer, measure reground journal diameter. See **Crankshaft Inspection**.
  c. Using measured journal diameter above and alphabets stamped on cylinder block, select an undersize bearing by referring to the following table.

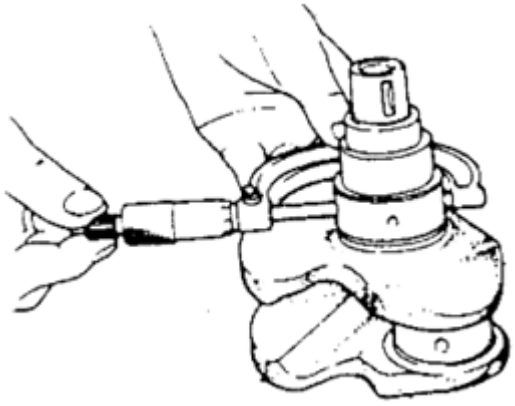


Fig. 186: Checking Crankshaft Journal Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Main bearing cross - reference table (under size)

 © 2011 Mitchell Repair Information Company, LLC.

MAIN BEARING CROSS - REFERENCE TABLE (UNDER SIZE)

			Measured journal diameter					
			51.7470 - 51.7499 (2.03728 - 2.03739 in.)	**51.7440 - 51.7469 (2.03717 - 2.03727 in.)**	**51.7410 - 51.7439 (2.03705 - 2.03716 in.)**	**51.7380 - 51.7409 (2.03693 - 2.03704 in.)**	**51.7350 - 51.7379 (2.03681 - 2.03692 in.)**	**51.7320 - 51.7349 (2.03669 - 2.03680 in.)**
Stamped alphabet on lower crank case	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
		Lower	Red	Red	Red & Yellow	Red & 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, see **Main 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.

Crank Case Bolt No. 1 Inspection

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

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

© 2011 Mitchell Repair Information Company, LLC.

If it exceeds limit, replace with new one.

Crank case bolt diameter measurement points

"a": 61.0 mm (2.40 in.)

"b": 98.0 mm (3.86 in.)

Crank case cap bolt diameter difference

Limit ("A" - "B"): 0.013 mm (0.00051 in.)

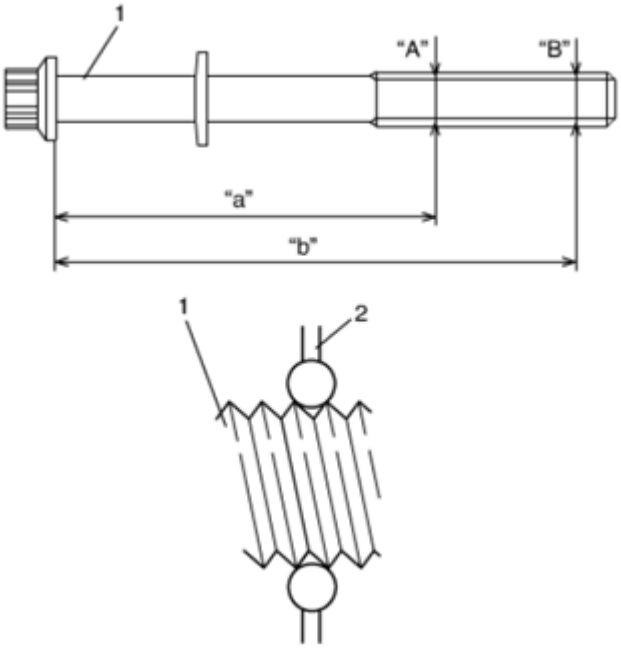


Fig. 187: Inspecting Crank Case Cap Bolt Diameter Difference
Courtesy of SUZUKI OF AMERICA CORP.

SENSOR PLATE INSPECTION

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

Check sensor plate (1) for crack or damage.

If defective condition is found, replace it.

 © 2011 Mitchell Repair Information Company, LLC.

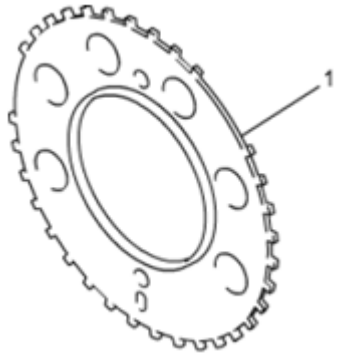


Fig. 188: Identifying Sensor Plate
Courtesy of SUZUKI OF AMERICA CORP.

OIL PUMP DRIVE SPROCKET INSPECTION

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

If defective condition is found, replace crankshaft (1).

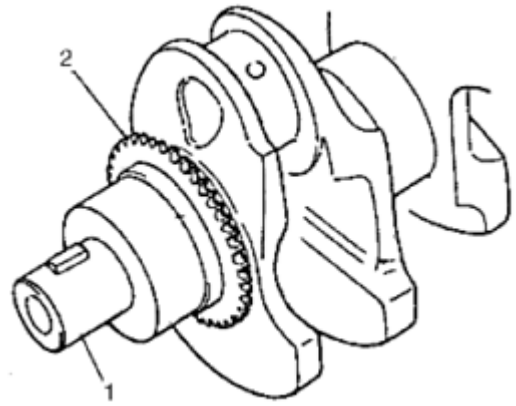


Fig. 189: Identifying Oil Pump Drive Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

OIL PUMP CHAIN INSPECTION

Oil Pump Chain

Check oil pump chain for wear or any damage.

If malcondition is found, replace oil pump chain.



Fig. 190: Identifying Oil Pump Chain

 © 2011 Mitchell Repair Information Company, LLC.

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 crack, wear or any damage. If defective condition is found, replace flywheel for M/T model or drive plate for CVT model. Refer to **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. If measured runout exceeds its limit, replace flywheel for M/T model or drive plate for CVT model. Refer to **Flywheel/Drive Plate Removal and Installation**.

Flywheel/drive plate face runout

Limit: 0.2 mm (0.0078 in.)

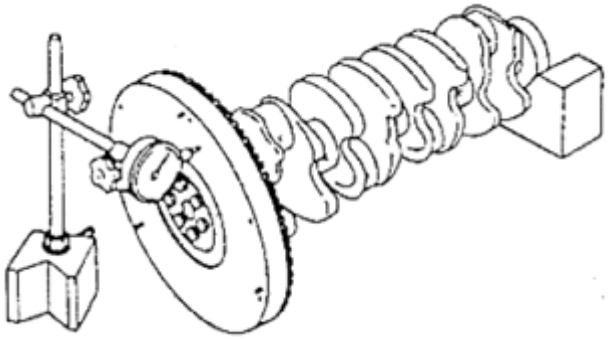


Fig. 191: Checking Flywheel/Drive Plate Face Runout
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER BLOCK INSPECTION

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

Distortion of Gasket Surface

Using straightedge and thickness gauge, check gasket surface for distortion and, if flatness exceeds its limit, repair It.

If repair is not possible, replace cylinder block.

 © 2011 Mitchell Repair Information Company, LLC.

Cylinder block flatness

Limit: 0.03 mm (0.001 in.)

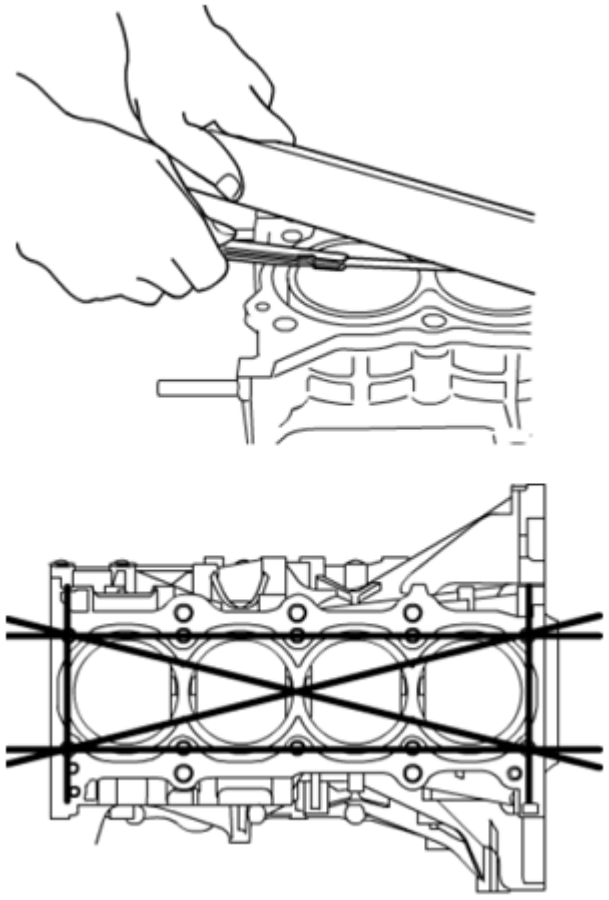


Fig. 192: Measuring Cylinder Block Flatness
Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

TIGHTENING TORQUE SPECIFICATIONS

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

TIGHTENING TORQUE SPECIFICATIONS

Fastening part	Tightening torque		
	N.m	kgf-m	lbf-ft
Cylinder block heater bolt	11	1.1	8.5
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)		

© 2011 Mitchell Repair Information Company, LLC.

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
Starting motor terminal nut	11	1.1	8.5
Generator terminal nut	11	1.1	8.5
Ground terminal bolt	11	1.1	8.5
Ground terminal bolt	25	2.5	18.5
Suspension frame mounting bolt	95	9.7	70.0
Engine front mounting member No. 1 bolt	55	5.6	40.5
Engine front mounting member No. 2 bolt	59	6.0	43.5
Battery ground bolt (M/T model)	25	2.5	18.5
Battery ground bolt (CVT model)	55	5.6	40.5
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	0.92	7.0
Timing chain tensioner bolt	25	2.5	18.5
Timing chain tensioner adjuster bolt	11	1.1	8.5
Cylinder head No. 1 bolt*	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 No. 2 bolt	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
Crank case 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 -->		

© 2011 Mitchell Repair Information Company, LLC.

	15.0 lbf-ft --> 26.0 lbf-ft --> 40° --> 40°)		
Crank case bolt No. 2*	25	2.5	18.5
Oil pump chain guide 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
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

Reference:

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

SPECIAL TOOLS AND EQUIPMENT

RECOMMENDED SERVICE MATERIAL

RECOMMENDED SERVICE MATERIAL REFERENCE CHART

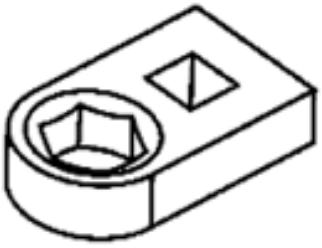
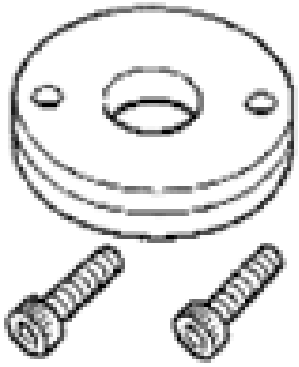
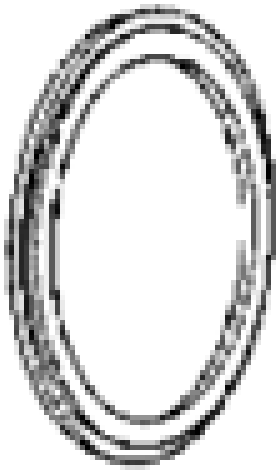
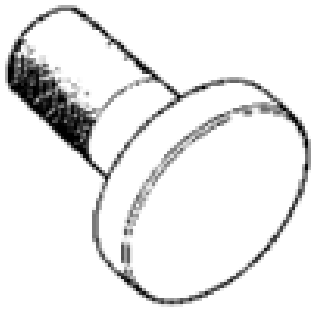
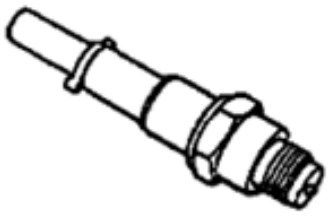
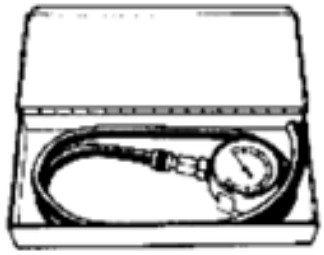
Material	SUZUKI recommended product or Specification		Note
Sealant	SUZUKI Bond No. 1217G	P/No.: 99000-31260	

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

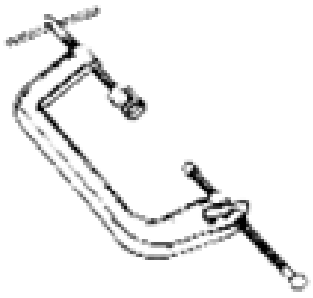
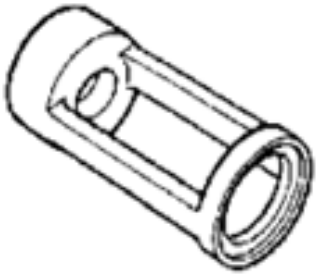
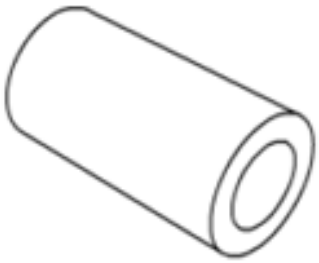
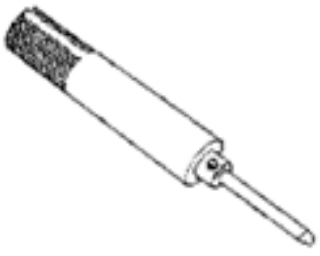
SPECIAL TOOL

SPECIAL TOOL REFERENCE CHART

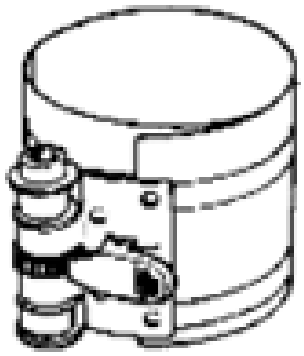
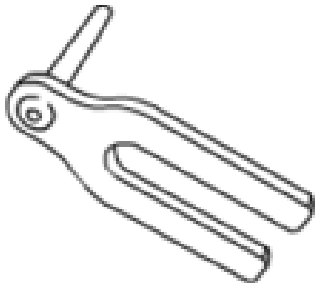
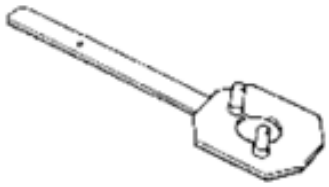
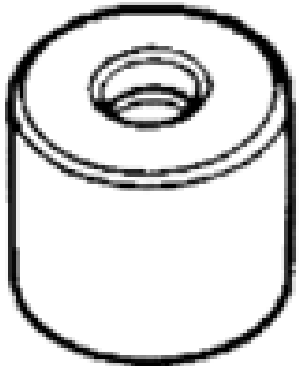
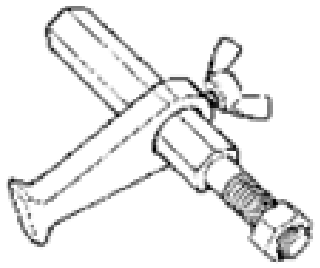
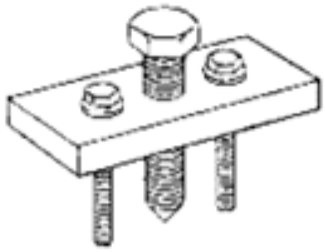
© 2011 Mitchell Repair Information Company, LLC.

09911-05120 Box end wrench (14 mm) 	09911-97710 Oil seal guide 
09911-97811 Oil seal installer 	09913-75510 Bearing installer 
09915-64512 Compression gauge 	09915-64530 Compression gauge hose 
09915-67010 Compression gauge attachment (C) 	09915-67311 Vacuum gauge 

 © 2011 Mitchell Repair Information Company, LLC.

09916-14510 Valve lifter 	09916-14522 Valve spring compressor attachment 
09916-34542 Reamer handle 	09916-34550 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	09916-84511

 © 2011 Mitchell Repair Information Company, LLC.

Piston ring compressor (50-125 mm) 	Forceps 
09917-16710 Timing chain tensioner holder 	09917-68221 Camshaft pulley holder 
09917-98221 Valve guide stem attachment 	09924-17811 Flywheel holder 
09926-58010 Bearing remover attachment 	09944-36011 Steering wheel remover 

 © 2011 Mitchell Repair Information Company, LLC.