2002-04 ENGINES

2.0L 4-Cylinder

ENGINE MECHANICAL

GENERAL DESCRIPTION

Engine Construction Description

The engine is water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for "V" type valve configuration consisting of 16 valves (4 valves/one cylinder). The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chains, and no push rods are provided in the valve train system.

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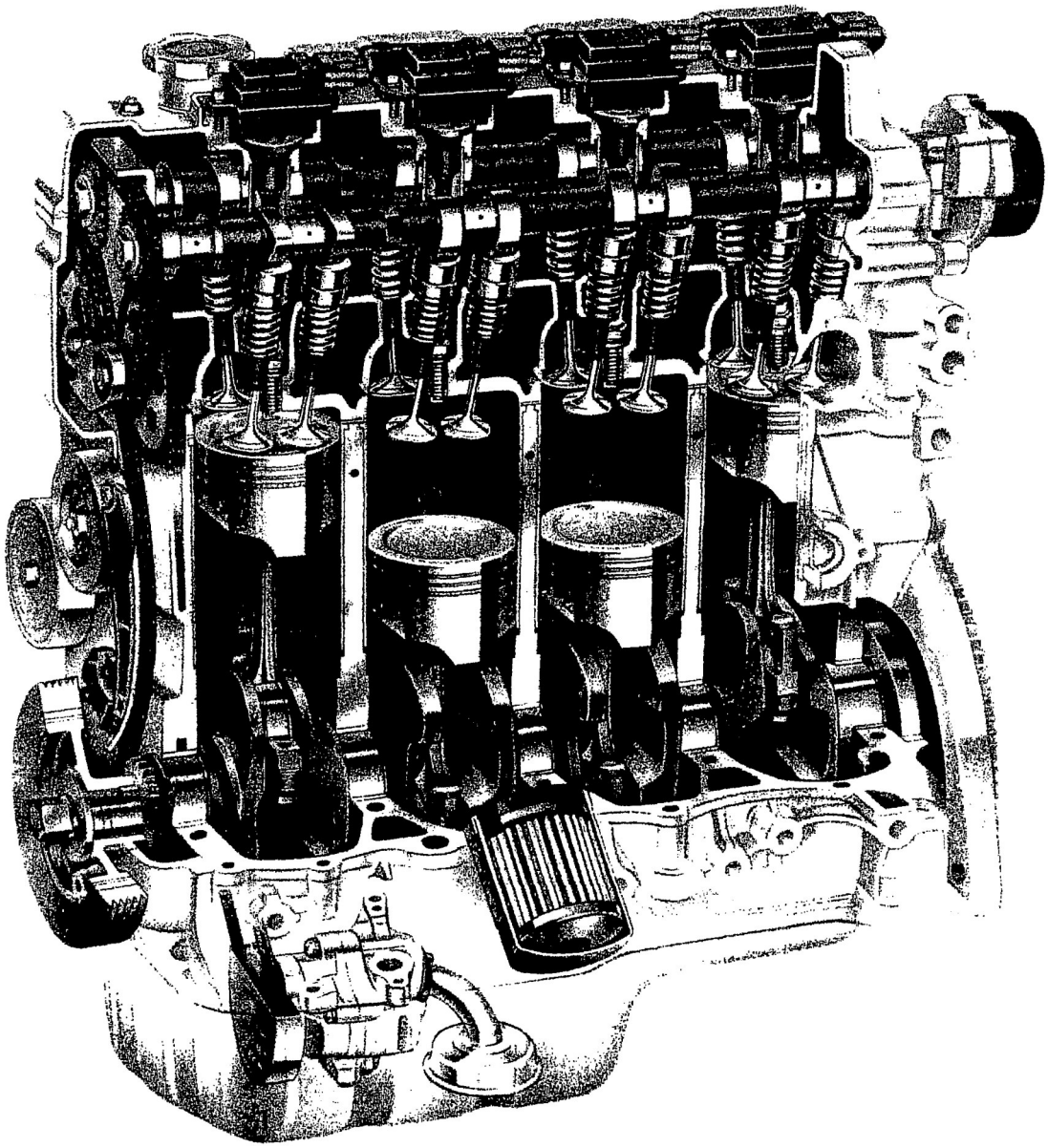


Fig. 1: Exploded View Of Engine
Courtesy of SUZUKI OF AMERICA CORP.

Air Cleaner Element Introduction

This air cleaner element is dry type. Remember that it needs cleaning. **Air Cleaner Element Inspection and Cleaning**.

DIAGNOSTIC INFORMATION AND PROCEDURES

Compression Check

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Check compression pressure on all 4 cylinders as follows:

1. Warm up engine.
2. Stop engine after warming up.

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

3. Remove engine cover. **Engine Cover Removal and Installation**.
4. Disconnect ignition coil couplers.
5. Disconnect ignition coils (1).
6. Remove all spark plugs (2).

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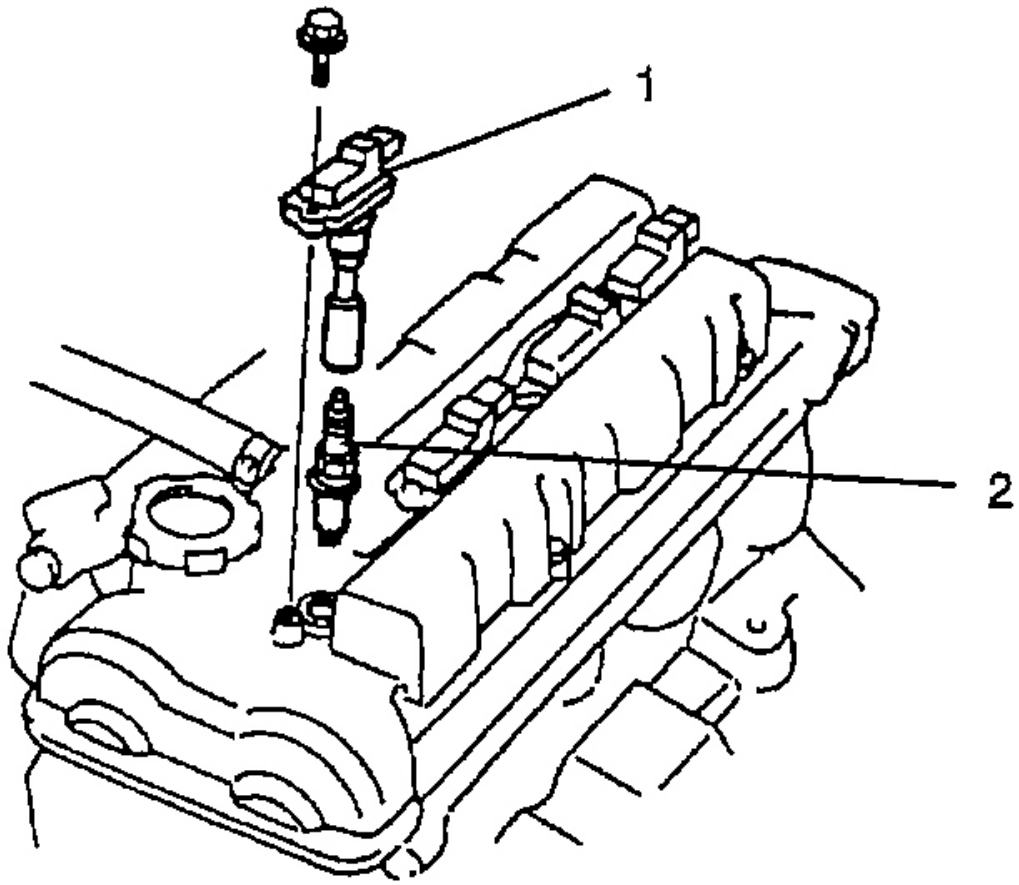


Fig. 2: Removing Spark Plugs & Ignition Coil
Courtesy of SUZUKI OF AMERICA CORP.

7. Disconnect fuel injector wire harness at the coupler.
8. Install special tool (Compression gauge) into spark plug hole.

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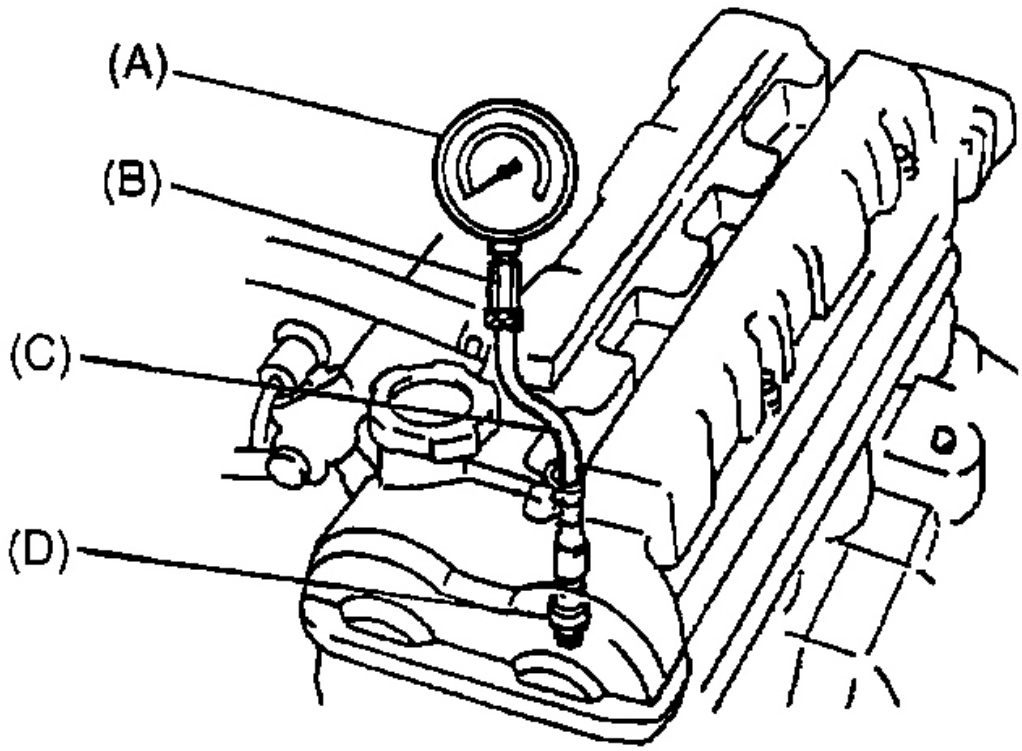


Fig. 3: Installing Compression Gauge
Courtesy of SUZUKI OF AMERICA CORP.

Special tool

(A): 09915-64510-001

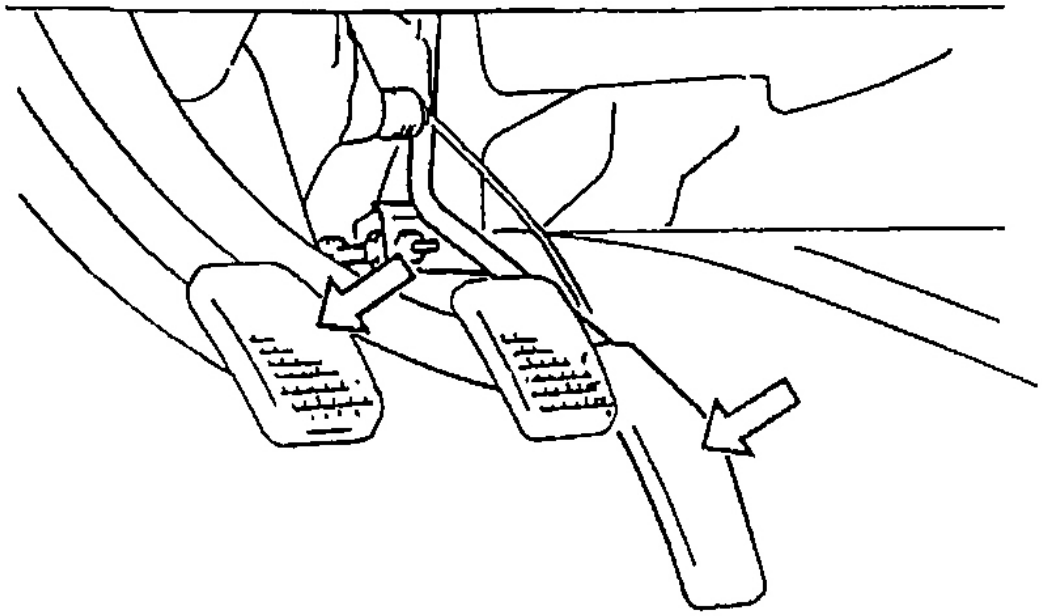
(B): 09915-64510-002

(C): 09915-64530

(D): 09915-67010

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

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Fig. 4: Disengaging Clutch (M/T)
Courtesy of SUZUKI OF AMERICA CORP.

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

NOTE: For measuring compression pressure, crank engine at least 250 RPM by using fully charged battery.
Compression pressure
Standard: 1400 kPa (14.0 kg/cm^2 , 199.0 psi)
Limit: 1200 kPa (12.0 kg/cm^2 , 170.0 psi)
Max. difference between any two cylinders: 100 kPa (1.0 kg/cm^2 , 14.2 psi)

11. Carry out steps 8, 9 and 10 on each cylinder to obtain 4 readings.
12. After checking, install spark plugs (2) and ignition coils (1).

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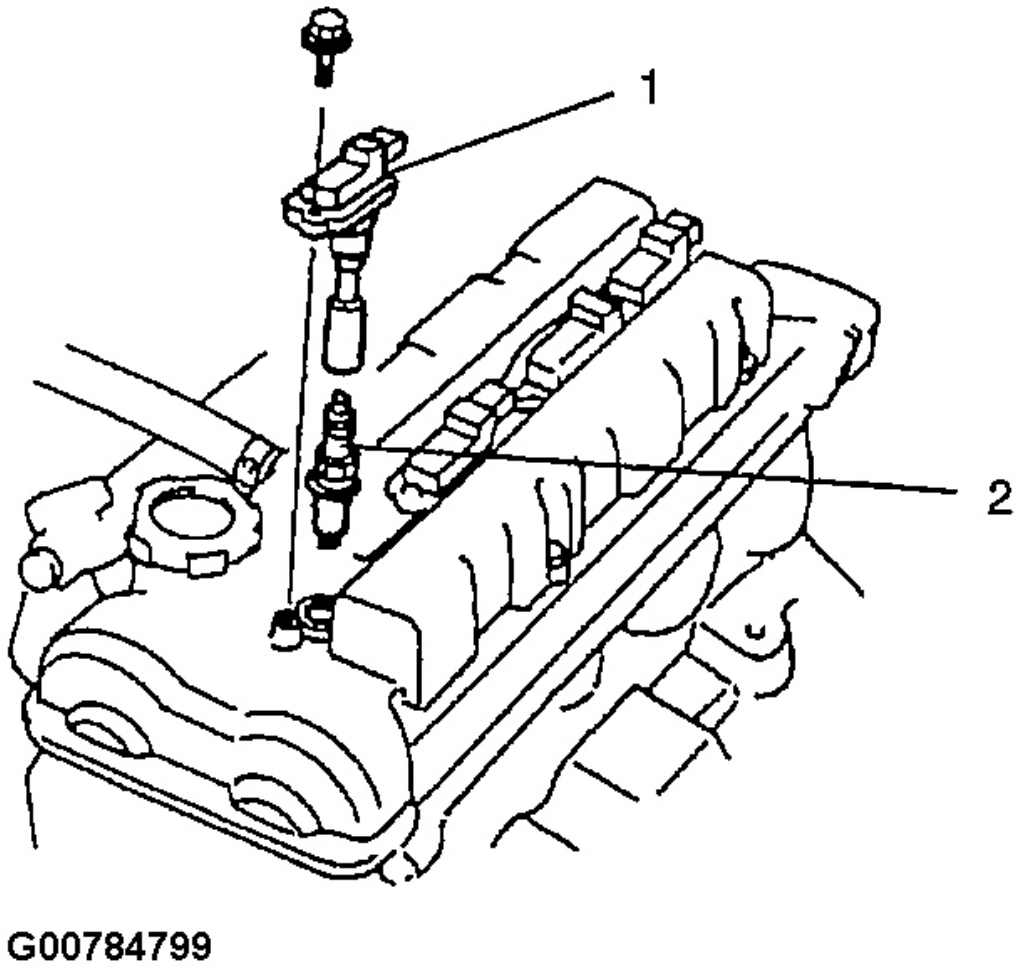


Fig. 5: Installing Spark Plug & Ignition Coil
Courtesy of SUZUKI OF AMERICA CORP.

13. Install ignition coil couplers.
14. Connect injector wire harness at coupler.
15. Install engine cover. Refer to **Engine Cover Removal and Installation**.

Engine Vacuum Check

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

1. Warm up engine to normal operating temperature and make sure that engine idle speed is within

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specification.

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

2. Stop engine and remove engine cover. Refer to **Engine Cover Removal and Installation**.
3. Disconnect vacuum hose between vacuum pipe (2) and intake manifold (1) from vacuum pipe.
4. Connect special tools (vacuum gauge and hose joint) to vacuum hose of intake manifold side.

Special tool

(A): 09915-67311

(B): 09918-08210

(C): 09355-35754-600 (Hose, SUZUKI GENUINE PARTS)

(D): 09367-04002 (3-way joint, SUZUKI GENUINE PARTS)

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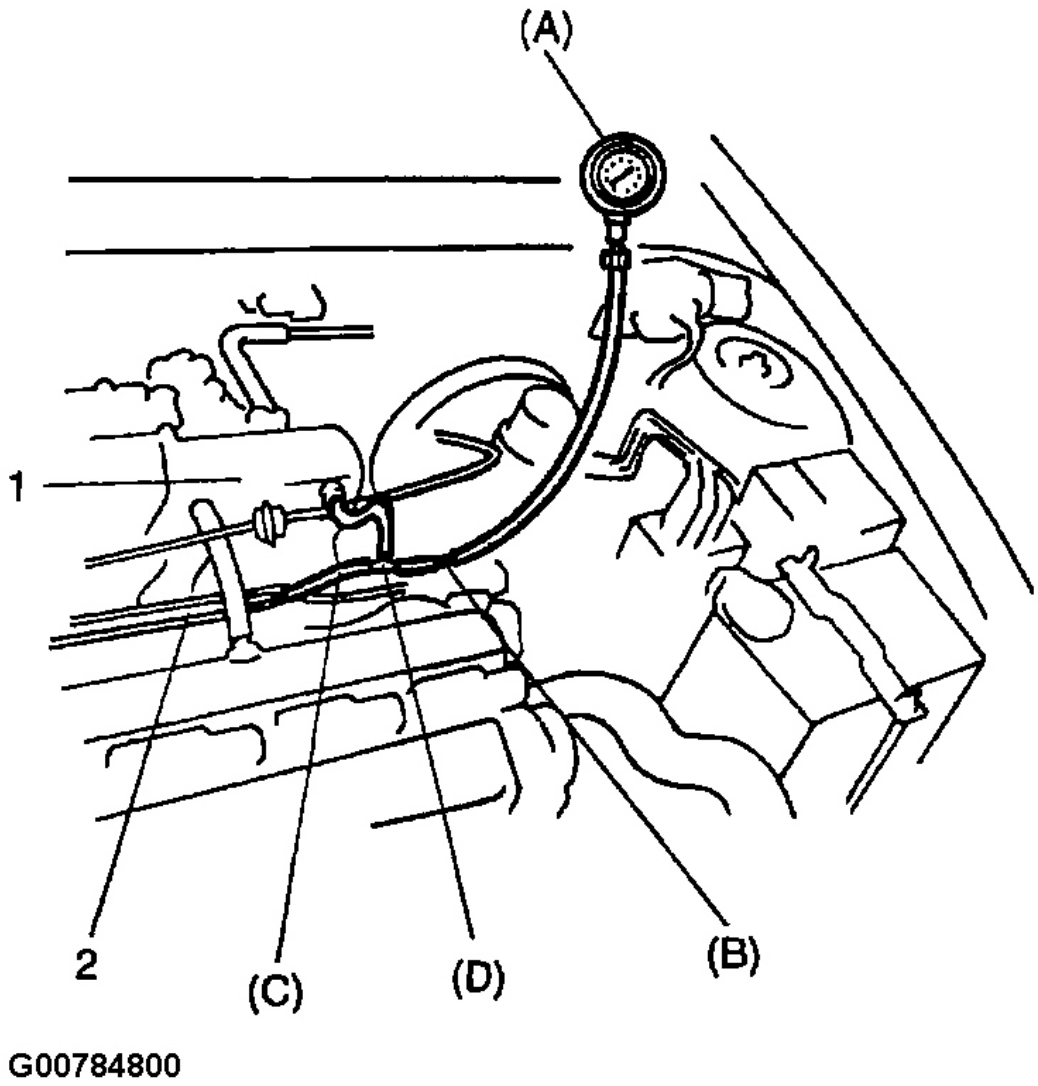


Fig. 6: Connecting Vacuum Gauge & Hose Joint
Courtesy of SUZUKI OF AMERICA CORP.

5. Start engine and run engine at specified idle speed and read vacuum gauge. Vacuum should be within specification. Refer to Idle Speed/Idle Air Control (IAC) Duty Inspection .

   Vacuum specification

   52.6 - 65.8 kPa (40 - 50 cm Hg, 15.7 - 19.7 in.Hg) at specified idle speed

6. After checking, remove special tools.

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7. Connect vacuum hose to vacuum pipe.
8. Install engine cover. Refer to **Engine Cover Removal and Installation**.

REPAIR INSTRUCTIONS

Fuel Pressure Relief Procedure

CAUTION: This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, release fuel pressure as follows.

1. Place transmission gear shift lever in "Neutral" (Shift selector lever to "P" range for A/T model), set parking brake, and block drive wheels.
2. Remove relay box cover.
3. Disconnect fuel pump relay (1) from relay box (2).
4. Remove fuel filter cap to release fuel vapor pressure in fuel tank and then reinstall it.
5. Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2 - 3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6. Upon completion of servicing, connect fuel pump relay (1) to relay box (2) and install relay box cover.

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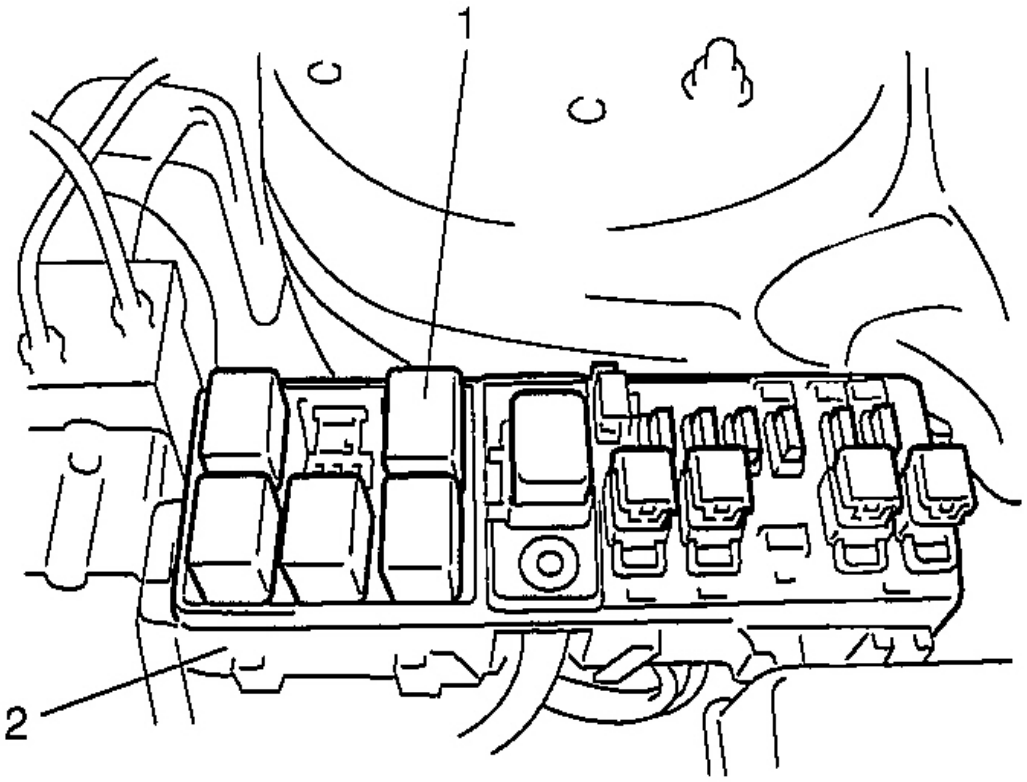


Fig. 7: Removing/Installing Relay Box Cover
Courtesy of SUZUKI OF AMERICA CORP.

Valve Lash Adjuster Noise Diagnosis

In case of the following, valve lash adjuster noise may be caused by air trapped into valve lash adjusters.

- Vehicle is left for 24 hours or more.
- Engine oil is changed.
- Hydraulic lash adjuster is replaced or reinstalled.
- Engine is overhauled.

If noise from valve lash adjusters is suspected, perform the following checks.

1. Check engine oil for the following.
    - Oil level in oil pan

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If oil level is low, add oil up to Full level hole on oil level gauge.

- Oil quality

  If oil is discolored, or deteriorated, change it. Refer to Engine Oil and Filter Change .

- Oil leaks

  If leak is found, repair it.

- Oil pressure (refer to**Oil Pressure Check**)

  If defective pressure is found, repair it.

2. Run engine for about half an hour at about 2,000 to 3,000 RPM, and then air will be purge and tapping sound will cease.
3. Should tapping sound not cease, it is possible that hydraulic valve lash adjuster is defective.

   Replace it if defective.

   If defective adjuster can't be located by hearing among 16 of them, check as follows.

   a. Stop engine and remove cylinder head cover. **Cylinder Head Cover Removal and Installation**.
   b. Push adjuster downward by hand (with less than 20 kg or 44 lbs. force) when cam crest is not on adjuster to check if clearance exists between cam and adjuster.

      If it does, adjuster is defective and needs replacement.

Air Cleaner Element Removal and Installation

Removal

1. Disconnect MAF sensor coupler (3) and air cleaner outlet hose (4) from air cleaner upper case (1).
2. Remove air cleaner upper case (1) from lower case after hooking clamps (2) from upper case.
3. Remove air cleaner element.

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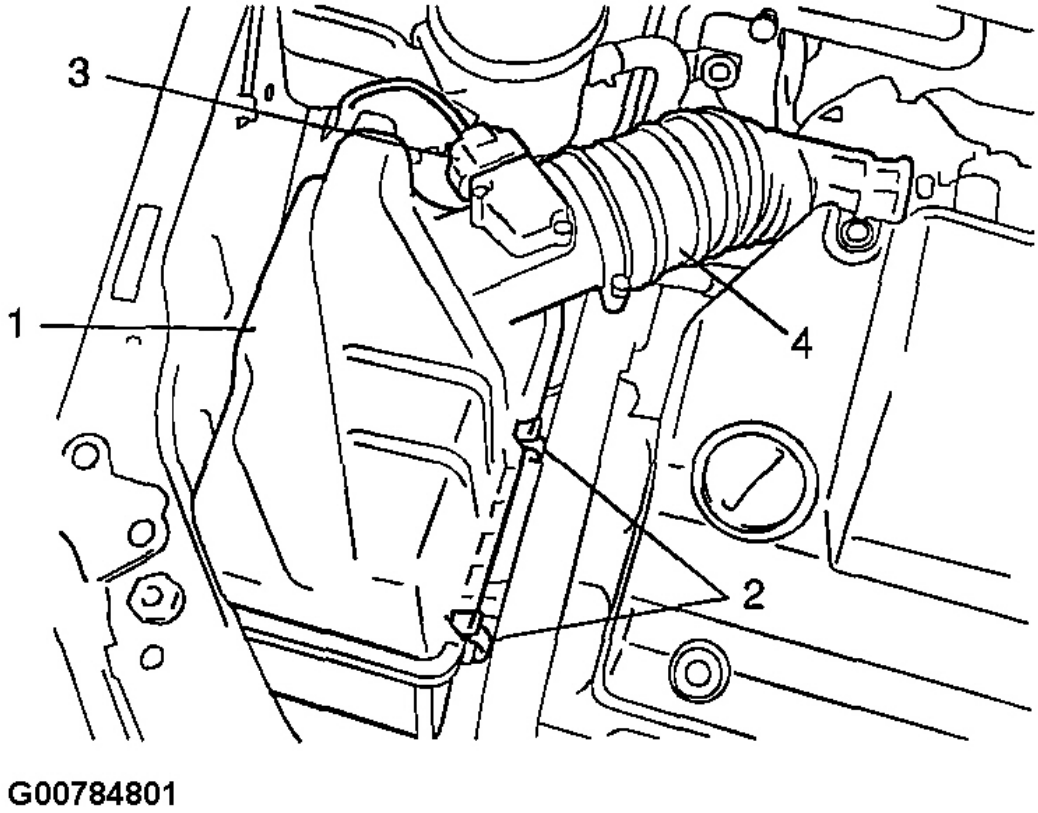


Fig. 8: Removing Air Cleaner Element
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation.

Air Cleaner Element Inspection and Cleaning

Inspection

Check air cleaner element for dirt.

Cleaning

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

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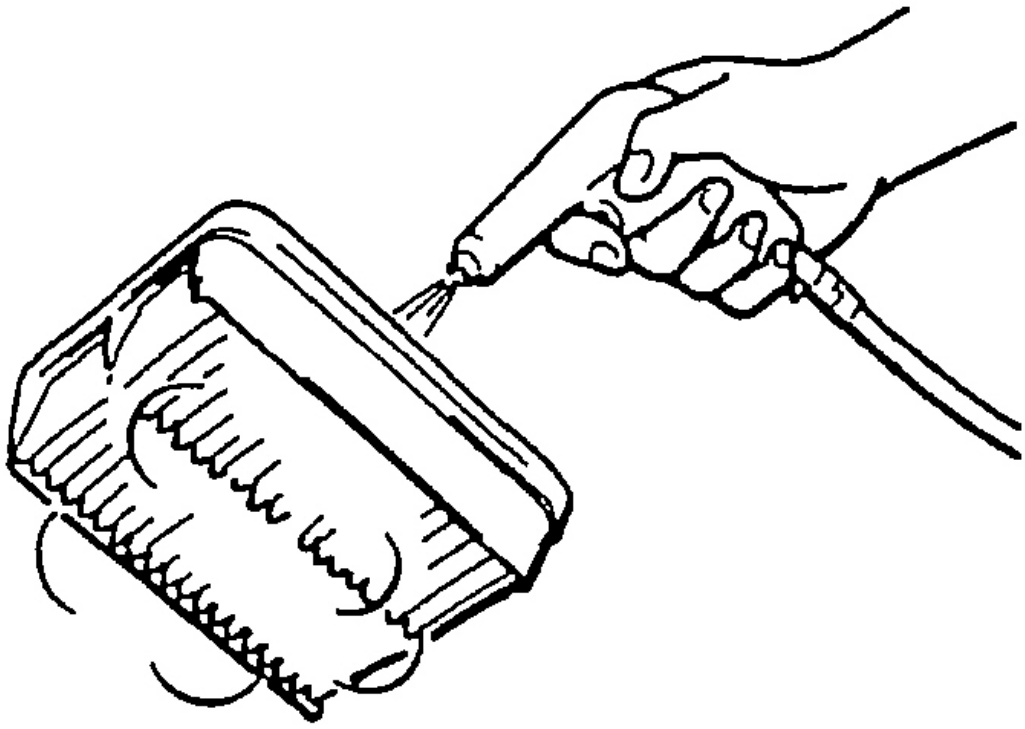


Fig. 9: Cleaning Air Outlet Side Of Element
Courtesy of SUZUKI OF AMERICA CORP.

Air Cleaner Outlet Hose Removal and Installation

Removal

1. Remove air cleaner outlet hose (1).

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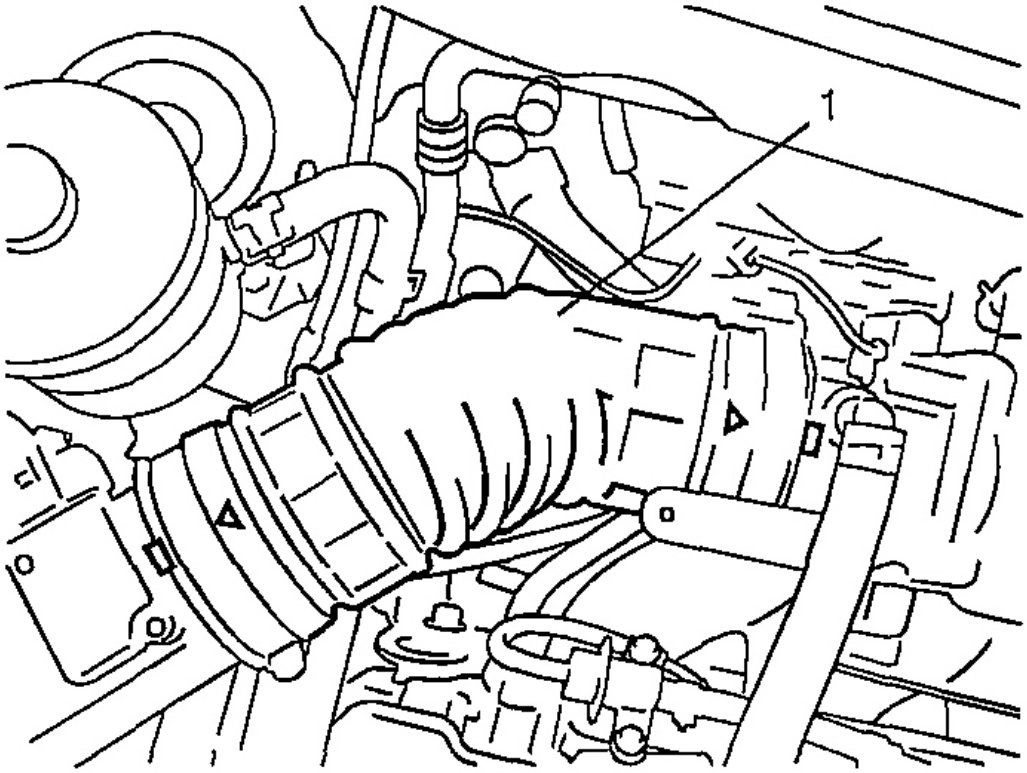


Fig. 10: Removing Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation.

1. Install air cleaner outlet hose (1) by aligning match marks (2) as shown in figure.

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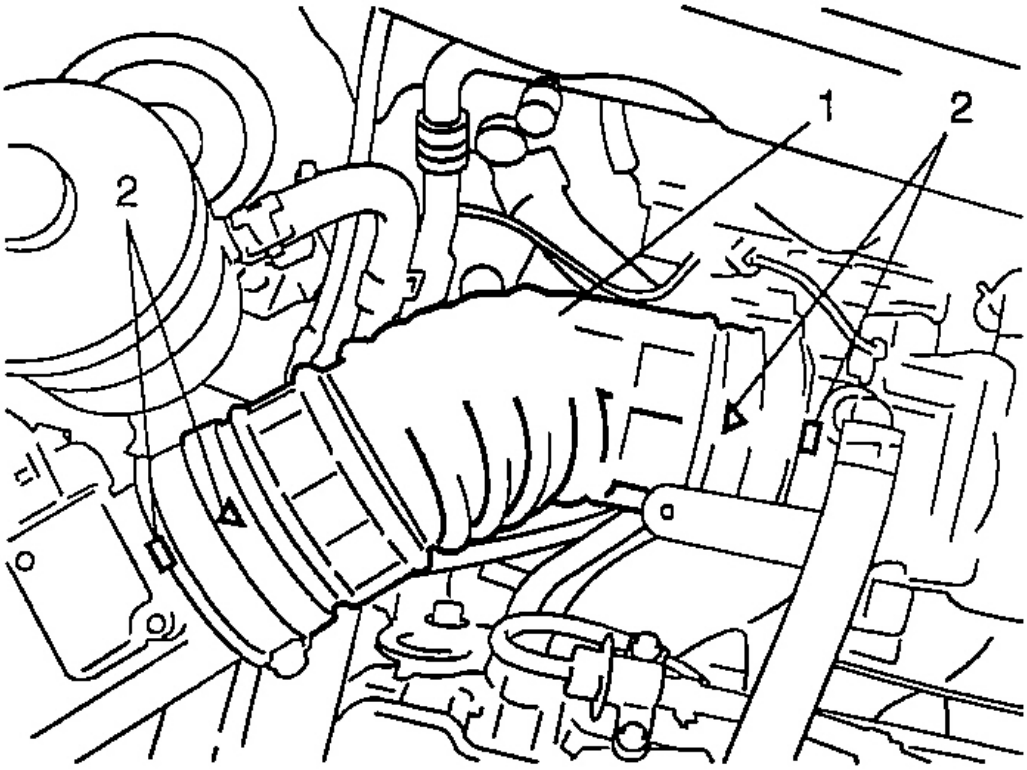


Fig. 11: Installing Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

Engine Cover Removal and Installation

Removal

1. Remove engine cover bolts (1).
2. Remove engine cover (2) from cylinder head cover.

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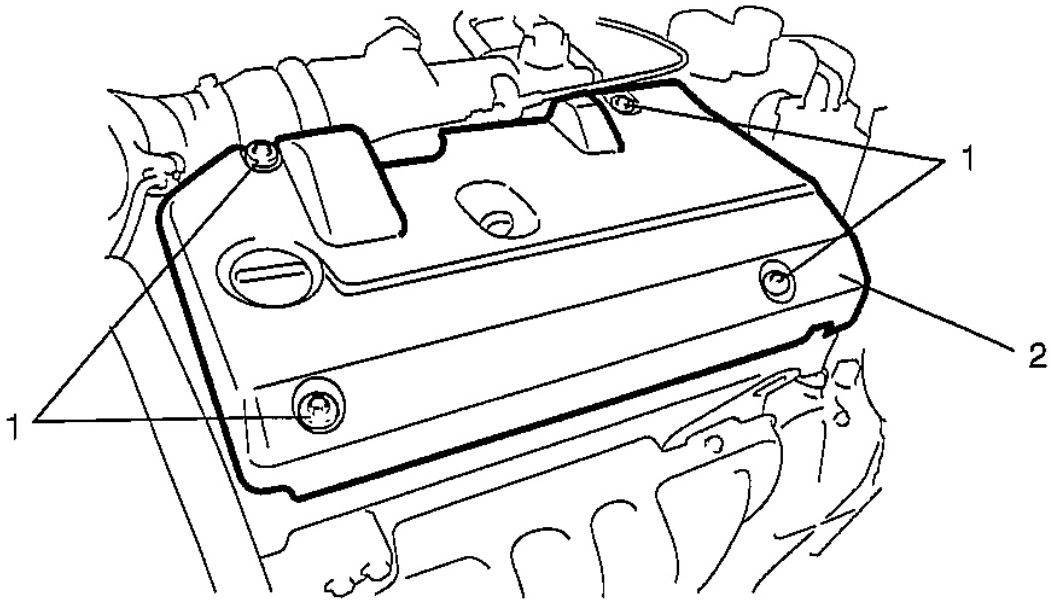


Fig. 12: Removing Engine Cover
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install engine cover (2) from cylinder head cover.
2. Install engine cover bolts (1).

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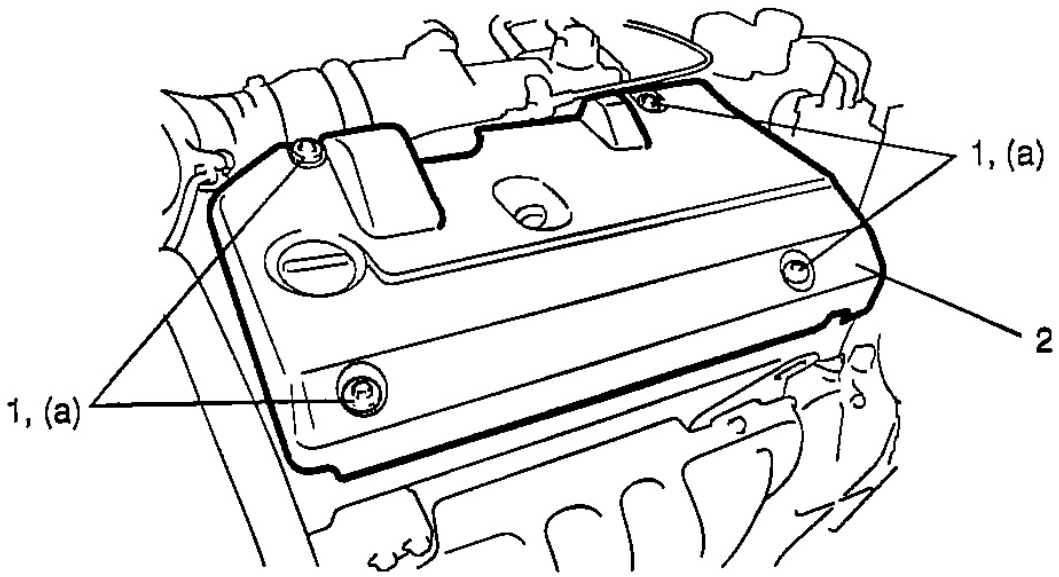


Fig. 13: Installing Engine Cover
Courtesy of SUZUKI OF AMERICA CORP.

Tightening torque

Engine cover bolt (a): 8 N.m (0.8 kg-m, 5.8 lb-ft)

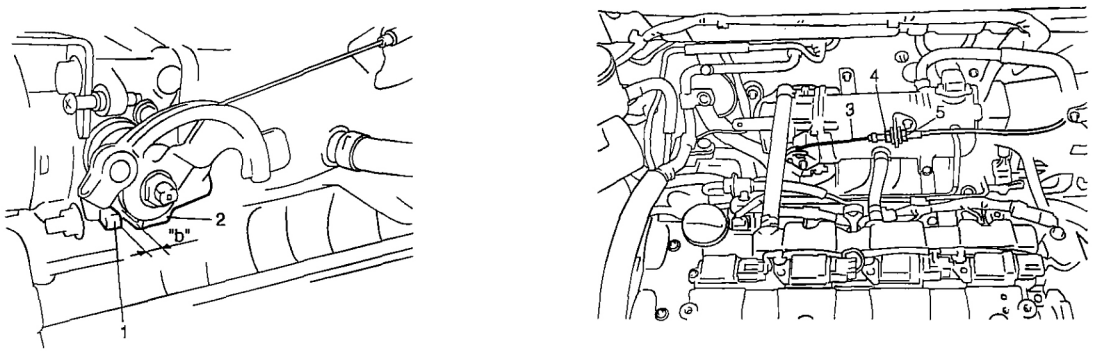
Accelerator Cable Adjustment

With accelerator pedal depressed fully, check clearance between throttle lever (2) and lever stopper (1) (throttle body) which should be within the following specification.

Clearance between throttle lever and lever stopper (with pedal depressed fully) "b" 0.5 - 2.0 mm (0.02 - 0.07 in.)

If measured value is out of specification, adjust it to specification with cable adjusting nut (4).

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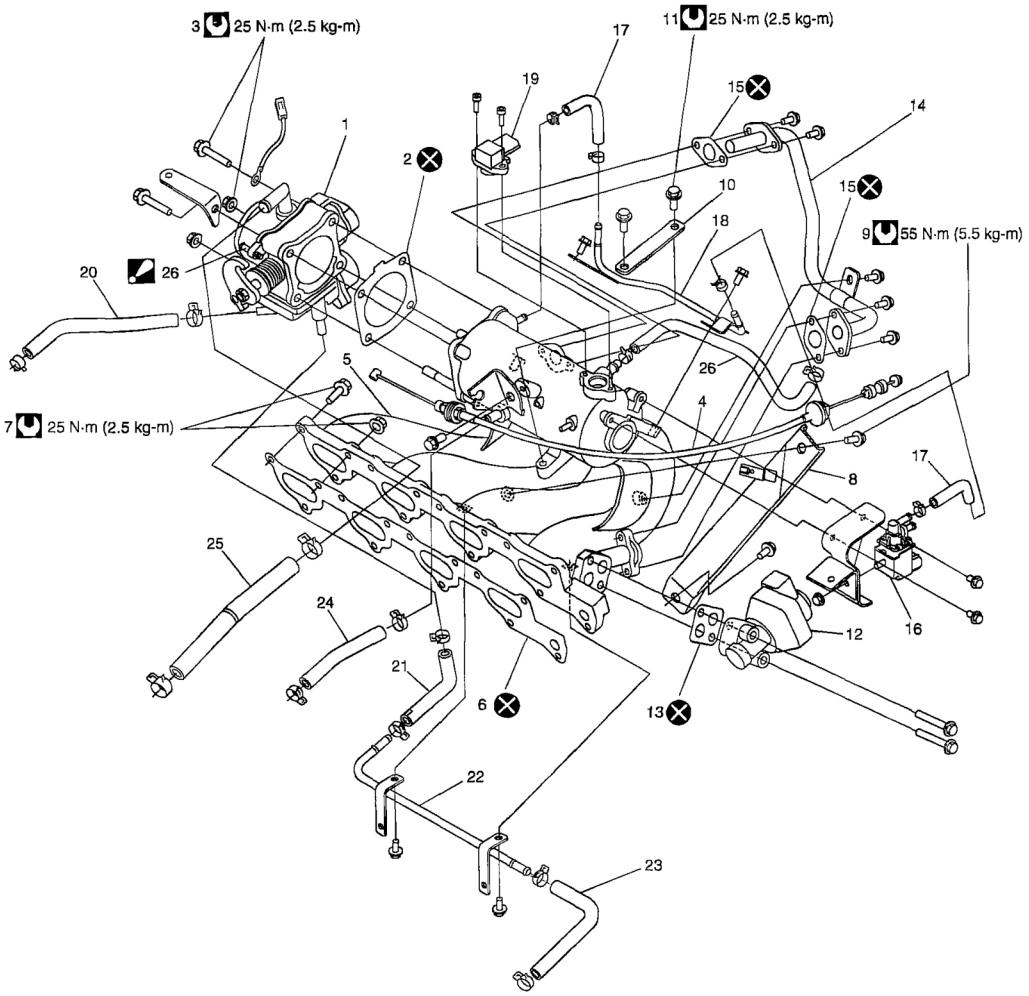
3.	Accelerator cable
5.	Lock nut

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Fig. 14: Adjusting Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

Throttle Body and Intake Manifold Components

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1. Throttle body	8. Intake manifold rear stiffener	15. Gasket	22. Coolant pipe
2. Gasket	9. Intake manifold rear stiffener bolt	16. EVAP canister purge valve	23. Coolant pipe hose
3. Throttle body bolt and nut	10. Intake manifold front stiffener	17. EVAP canister purge valve hose	24. PCV valve hose
4. Accelerator cable	11. Intake manifold front stiffener bolt	18. EVAP canister purge valve pipe	25. Breather hose
5. Intake manifold	12. EGR valve	19. MAP sensor	26. Throttle stop screw. : Do not remove or adjust this screw as it is factory adjusted precisely.
6. Gasket	13. Gasket	20. Throttle body coolant inlet hose	: Tightening torque
7. Intake manifold bolt and nut	14. EGR pipe	21. Throttle body coolant outlet hose	: Do not reuse.

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Fig. 15: Identifying Throttle Body & Intake Manifold Components
Courtesy of SUZUKI OF AMERICA CORP.

Throttle Body On-Vehicle Inspection

Check that throttle valve lever (2) moves smoothly.

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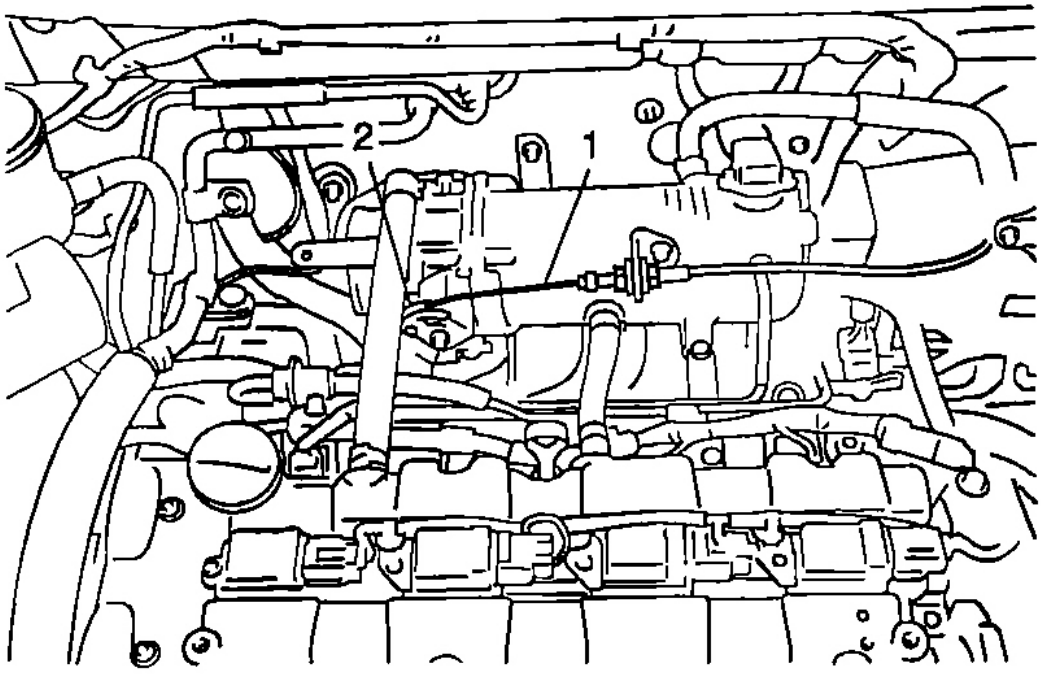


Fig. 16: Inspecting Throttle Valve Lever
Courtesy of SUZUKI OF AMERICA CORP.

Throttle Body Removal and Installation

Removal

1. Disconnect negative cable at battery.
2. Drain coolant.

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

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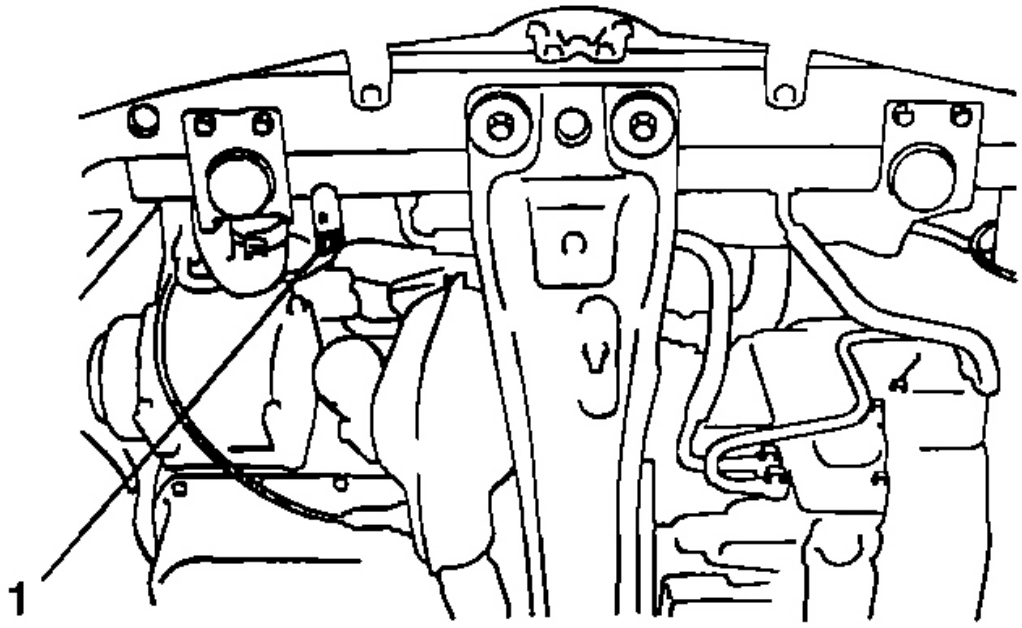


Fig. 17: Draining Coolant
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove engine cover. Refer to **Engine Cover Removal and Installation**.
4. Remove air cleaner outlet hose. Refer to **Air Cleaner Outlet Hose Removal and Installation**.
5. Remove generator drive belt. Refer to **GENERATOR DRIVE BELT** .
6. With hose connected, detach P/S pump from its bracket.
7. Disconnect accelerator cable (1) from throttle valve lever (2).
8. Disconnect couplers of TP sensor (3), IAC valve (4) and ground connector (5).
9. Disconnect coolant hoses (6) and breather hose (7) from throttle body.

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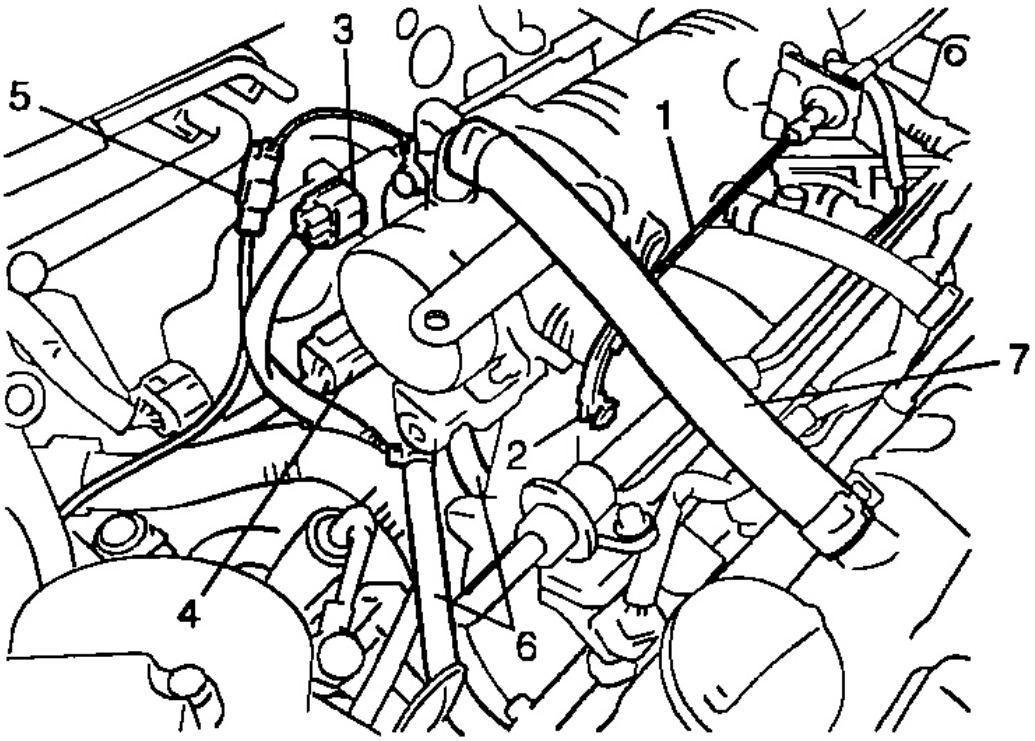


Fig. 18: Disconnecting Coolant & Breather Hose
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove throttle body from intake manifold.

Installation

1. Clean mating surfaces and install throttle body gasket to intake manifold. Use new gasket.
2. Install throttle body to intake manifold and tighten bolts and nuts.
3. Connect coolant hoses (6) and breather hose (7).
4. Connect couplers of TP sensor (3), IAC sensor (4) and ground terminal (5).

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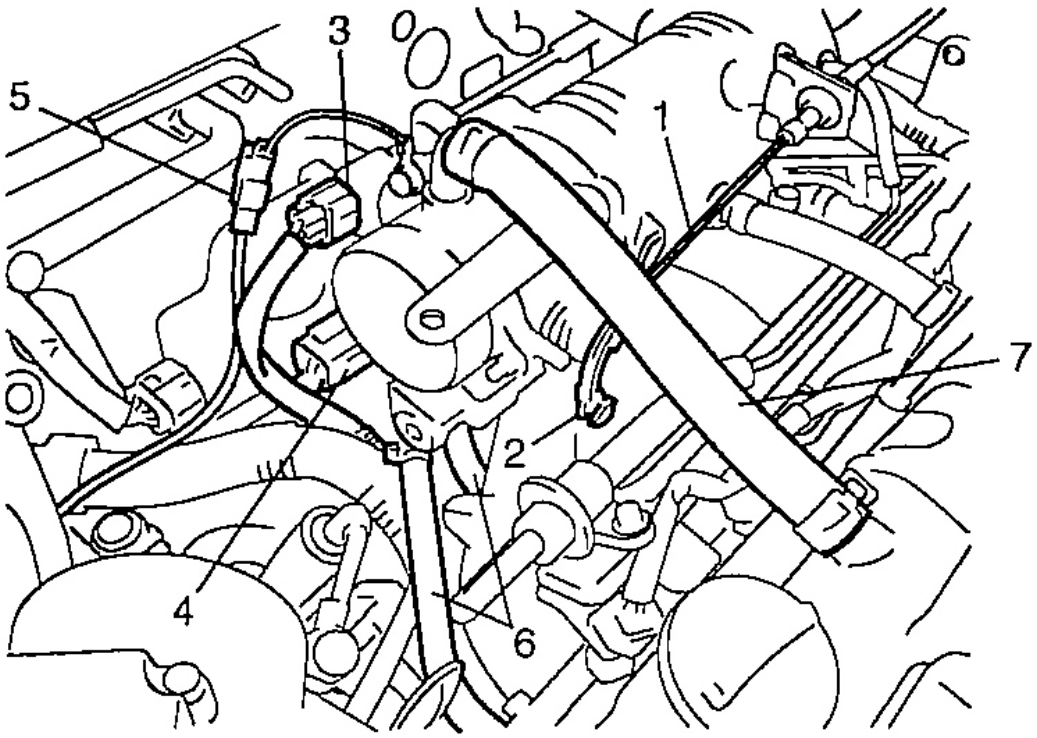
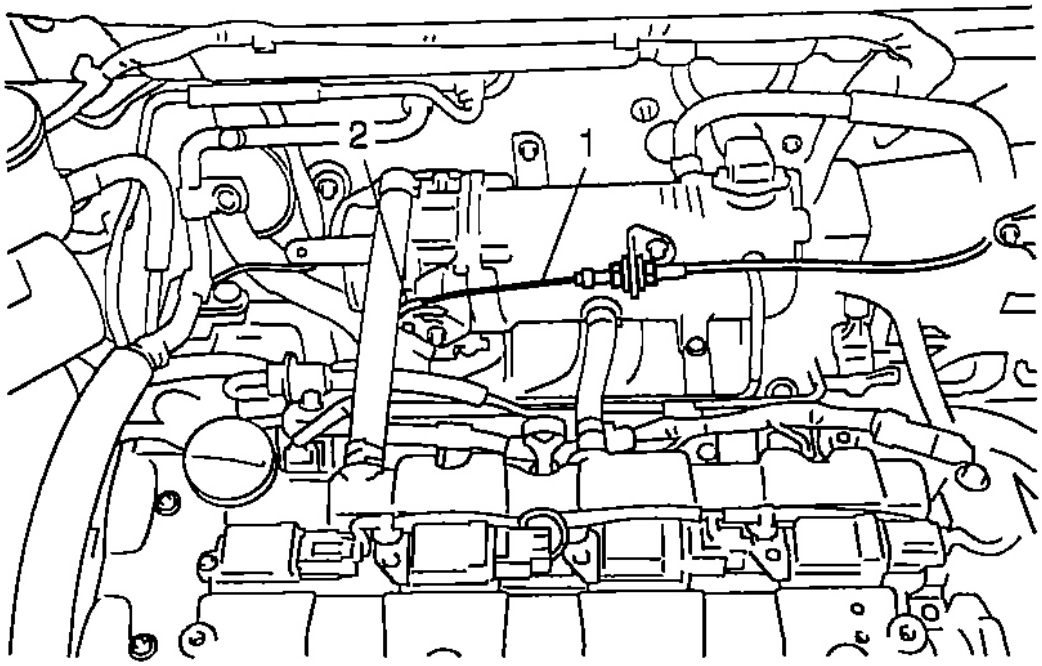


Fig. 19: Connecting TP, IAC Sensor & Ground Terminal
Courtesy of SUZUKI OF AMERICA CORP.

5. Connect accelerator cable (1) to throttle valve lever (2).

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Fig. 20: Connecting Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

6. Install P/S pump to its bracket. Refer to **P/S PUMP REMOVAL AND INSTALLATION** .
7. Install generator drive belt. Refer to **GENERATOR DRIVE BELT**
8. Install air cleaner outlet hose. Refer to **Air Cleaner Outlet Hose Removal and Installation**.

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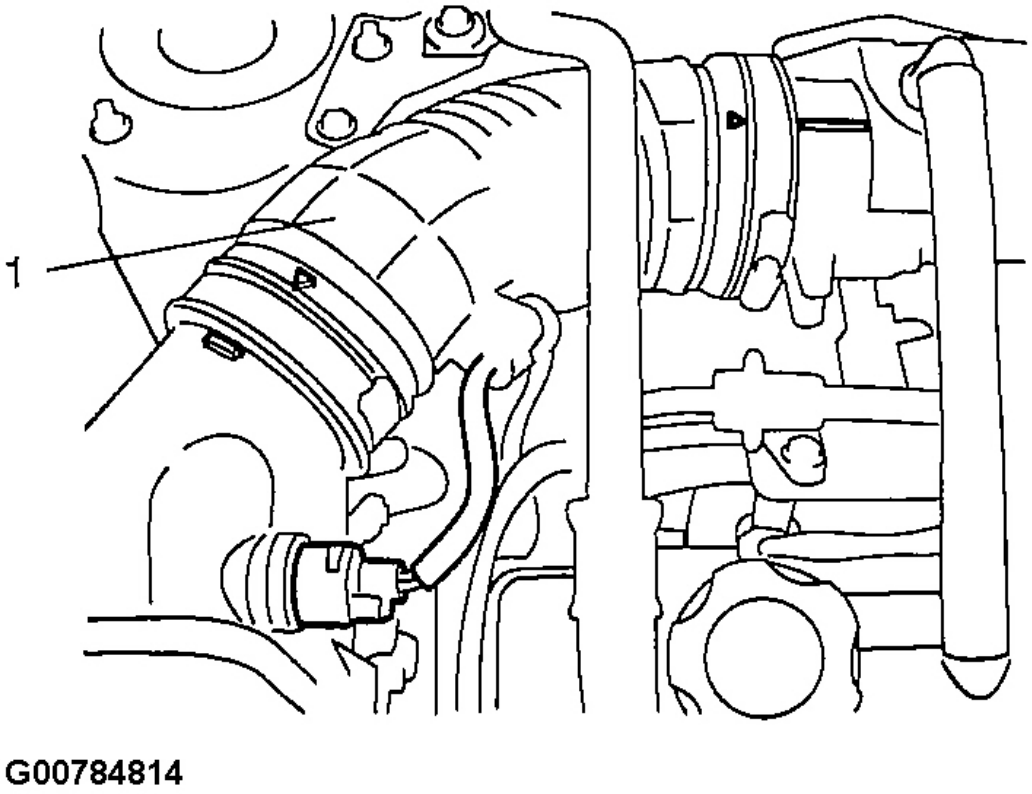


Fig. 21: Installing Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

9. Install engine cover. Refer to **Engine Cover Removal and Installation**.
10. Refill cooling system. Refer to **COOLING SYSTEM FLUSH AND REFILL** .
11. Connect negative cable at battery.
12. Start engine and check for engine coolant leakage.

Throttle Body Cleaning

Clean passages by blowing compressed air.

CAUTION:
- **IAC valve, TP sensor, or other components containing rubber must not be placed in a solvent or cleaner both. A chemical reaction will cause these parts to swell, harden or get distorted.**
- **Don't put drills or wires into passages for cleaning. It causes damages in passages.**

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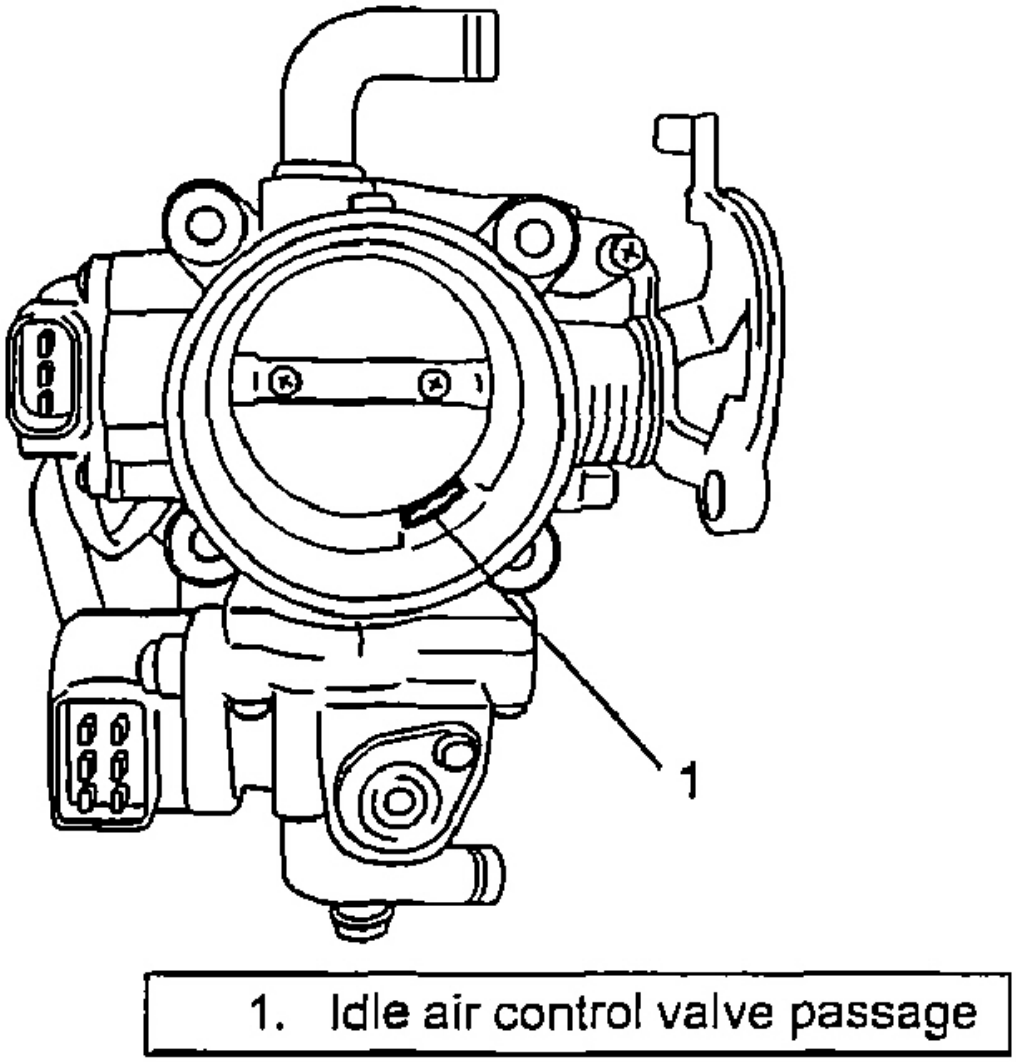


Fig. 22: Cleaning Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

Intake Manifold Removal and Installation

Removal

1. Disconnect negative cable at battery.
2. Drain cooling system.

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

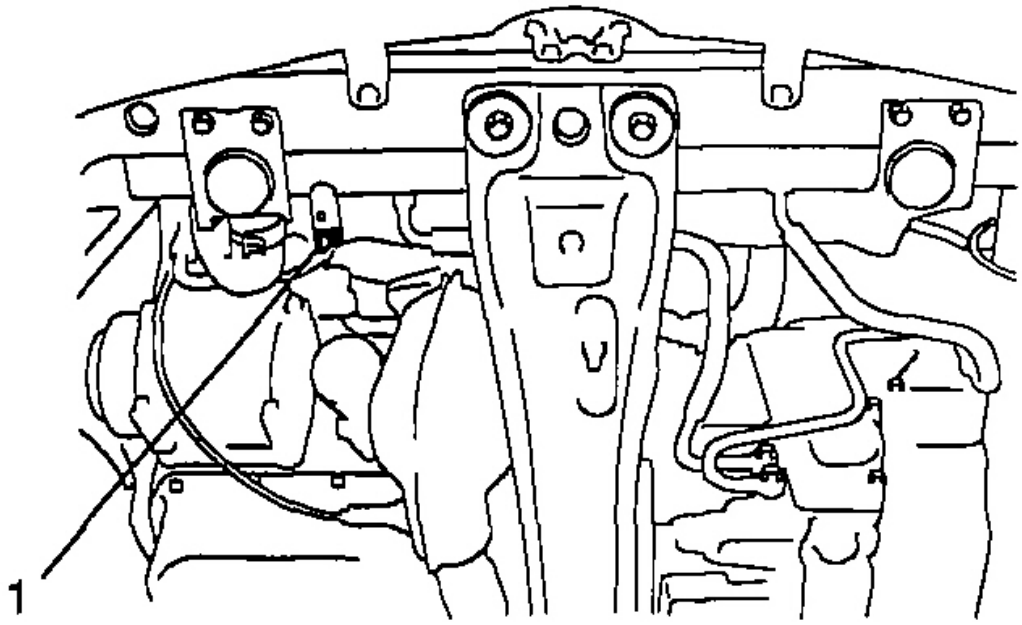


Fig. 23: Draining Cooling System
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove engine cover. Refer to **Engine Cover Removal and Installation**
4. Remove air cleaner outlet hose. Refer to **Air Cleaner Outlet Hose Removal and Installation**.
5. Disconnect accelerator cable (2) from throttle valve lever (1).
6. Disconnect accelerator cable (2) with cable bracket (3) from intake manifold.
7. Disconnect the following electric lead wires:
   - IAC valve coupler (4)
   - TP sensor coupler (5)
   - EGR valve coupler (6)
   - EVAP canister purge valve coupler (7)
   - MAP sensor coupler (8)
   - Ground terminal (9) from throttle body

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8. Disconnect the following hoses:
    - Brake booster hose (10) from intake manifold
    - PCV hose (11) from PCV valve
    - Fuel pressure regulator vacuum hose (12) from intake manifold
    - Coolant hoses from (13) throttle
    - Breather hose (14) from throttle body
    - Vacuum hose (15) from EVAP canister purge valve
9. Remove intake manifold front stiffener (16).

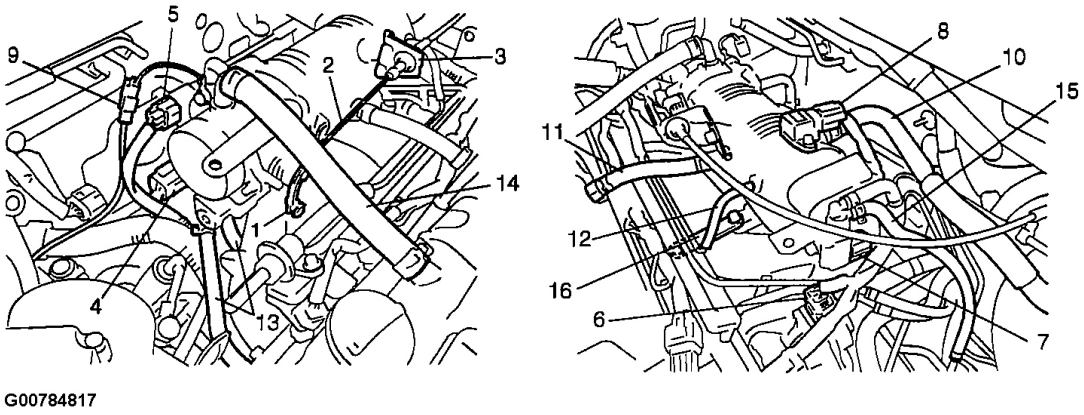


Fig. 24: Identifying Engine Hoses
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove rear stiffener (17), and disconnect coolant pipe (18) from intake manifold.

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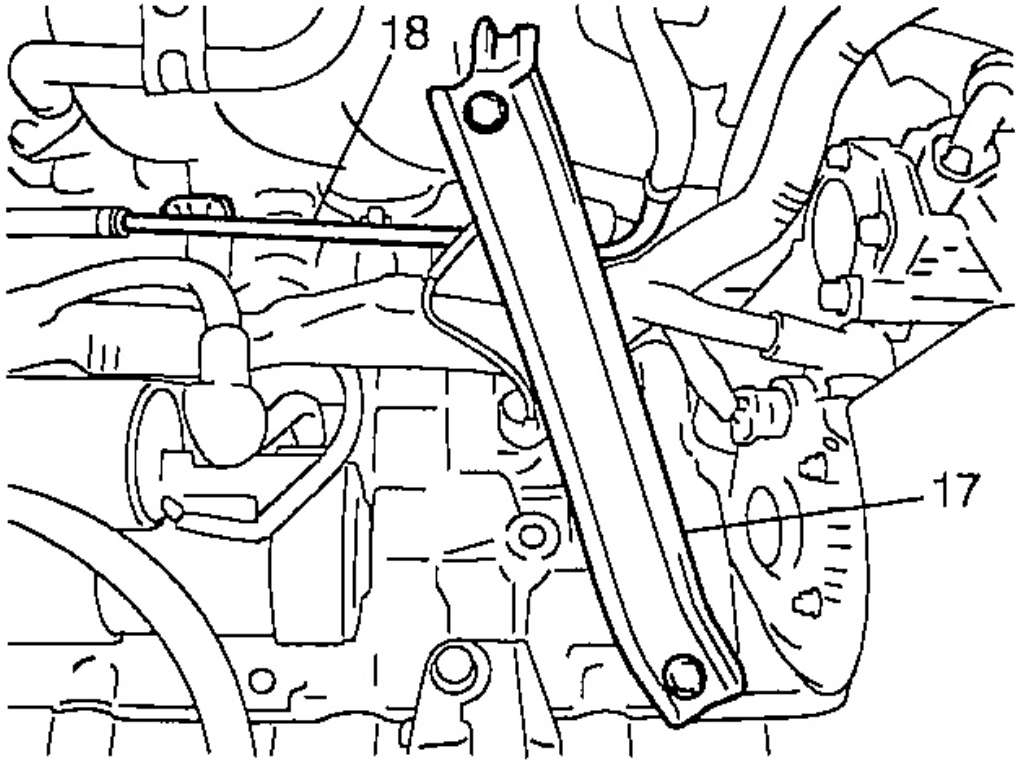


Fig. 25: Removing Rear Stiffener
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove intake manifold (2) with throttle body from cylinder head, and then its gasket (1).

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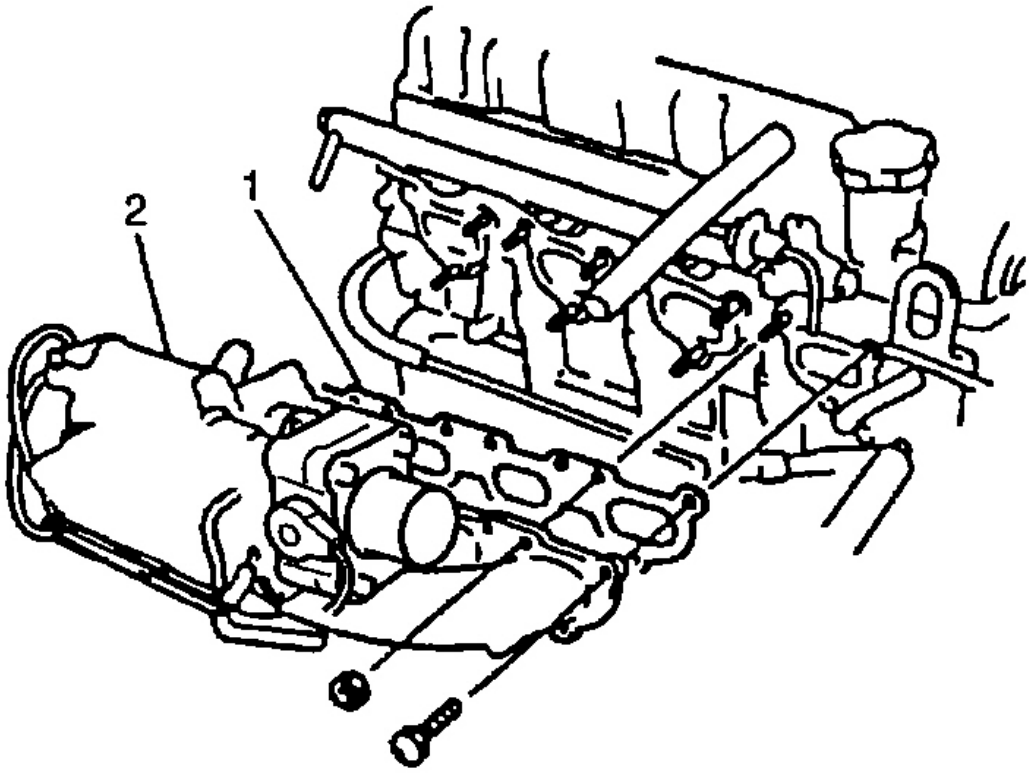


Fig. 26: Removing Intake Manifold With Throttle Body & It's Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install new intake manifold gasket (1) to cylinder head.
2. Install intake manifold (2) with throttle body. Tighten bolts and nuts to specified torque.

Tightening torque

Intake manifold bolt and nut (a): 25 N.m (2.5 kg-m, 18.0 lb-ft)

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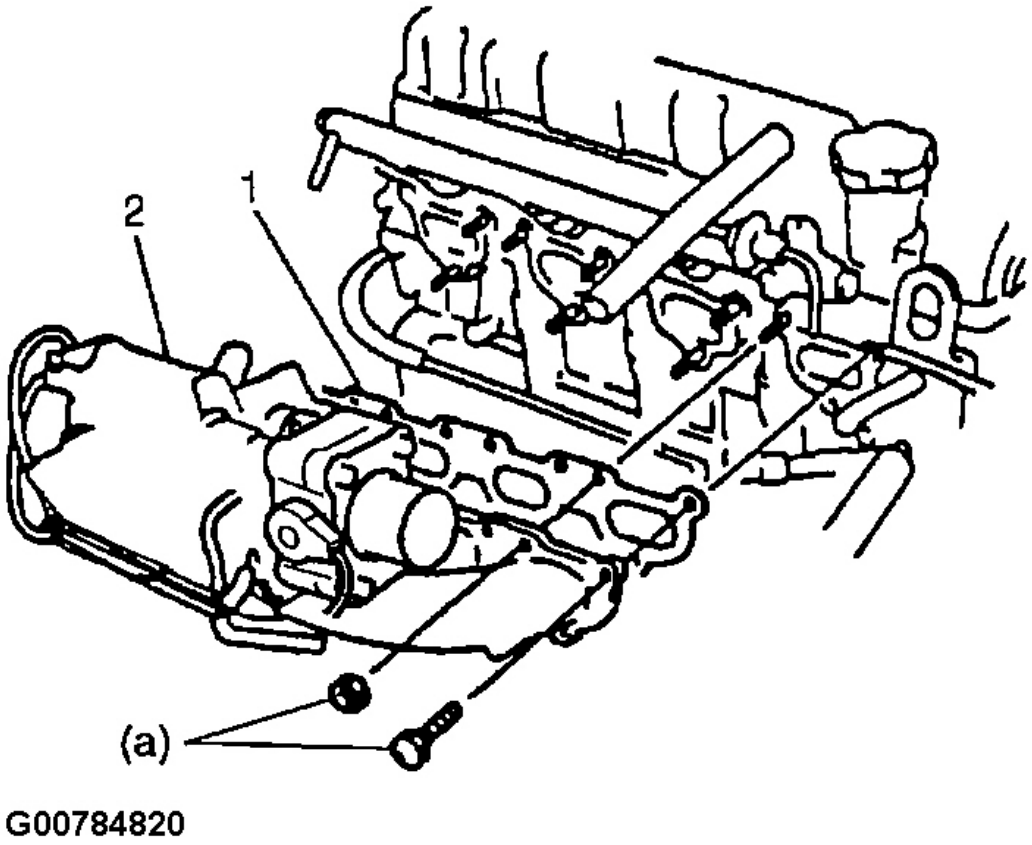


Fig. 27: Installing Intake Manifold With Throttle Body & New Gasket
Courtesy of SUZUKI OF AMERICA CORP.

3. Connect coolant pipe (1) to intake manifold and install rear stiffener (2). Tighten bolts to specified torque.

   Tightening torque

   Intake manifold rear stiffener bolt (a): 25 N.m (2.5 kg-m, 18.0 lb-ft)

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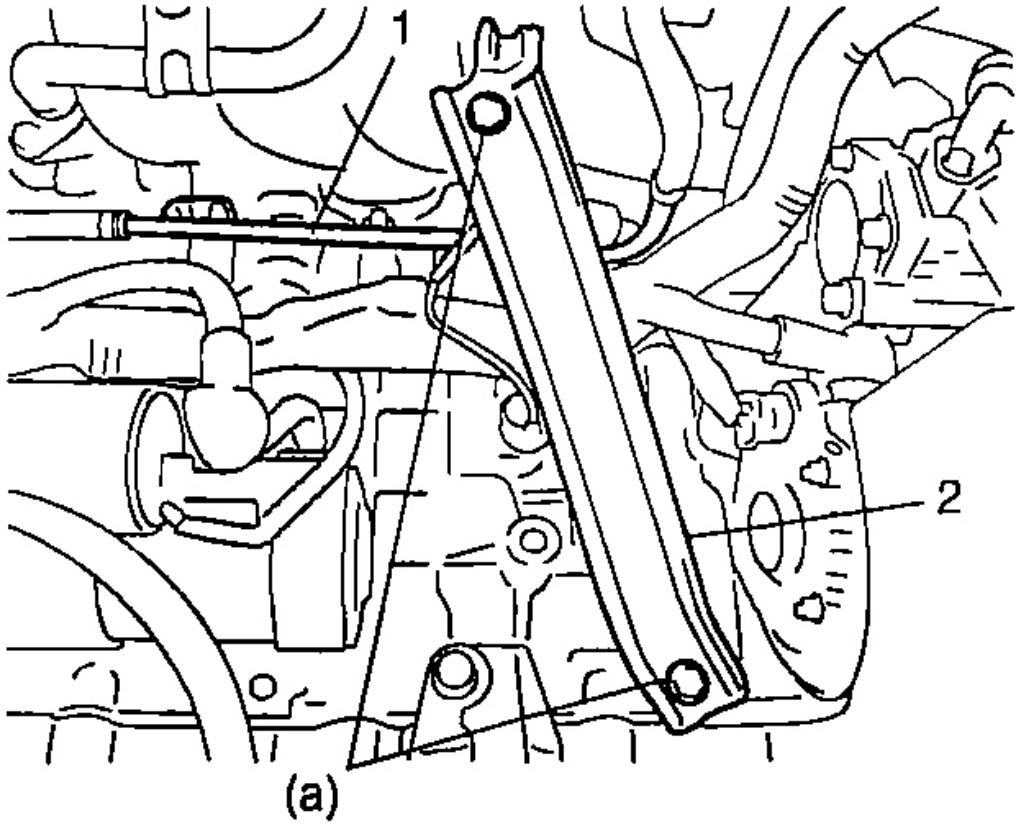


Fig. 28: Installing Rear Stiffener
Courtesy of SUZUKI OF AMERICA CORP.

4. Install intake manifold front stiffener (1). Tighten bolts to specified torque.

   Tightening torque

   Intake manifold front stiffener bolt (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

5. Connect the following hoses:
   - Brake booster hose (2) to intake manifold
   - PCV hose (3) to PCV valve
   - Fuel pressure regulator vacuum hose (4) to intake manifold
   - Coolant hoses (5) to throttle body

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- Breather hose (6) to throttle body
- Vacuum hose (7) to EVAP canister purge valve

6. Connect the following electric lead wires:
   - IAC valve (8)
   - TP sensor (9)
   - EGR valve (10)
   - EVAP canister purge valve (11)
   - MAP sensor (12)
   - Ground terminal (13) to throttle body
7. Connect accelerator cable (14) to throttle valve lever (15) and install its bracket (16) to intake manifold. Adjust accelerator cable play. **Accelerator Cable Adjustment**.

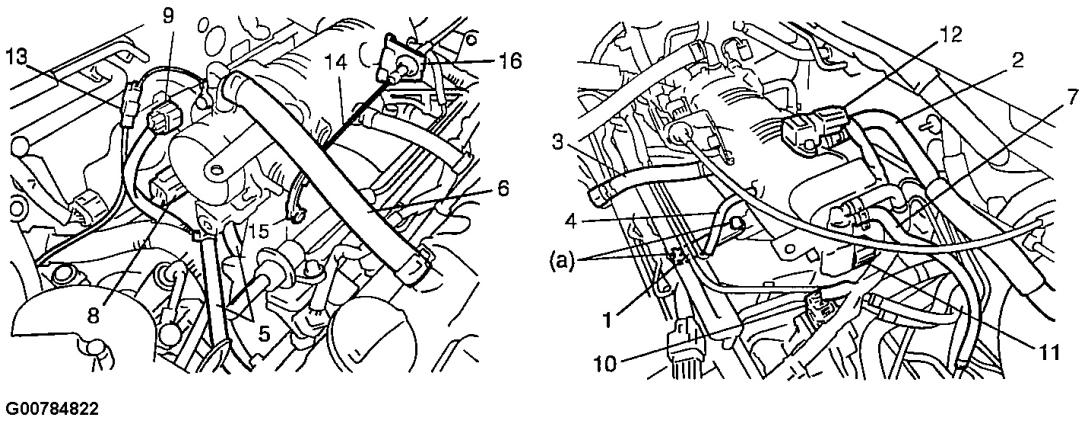


Fig. 29: Adjusting Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

8. Install air cleaner outlet hose. **Air Cleaner Outlet Hose Removal and Installation**.
9. Install engine cover. **Engine Cover Removal and Installation**
10. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
11. Refill cooling system. Refer to **COOLING SYSTEM FLUSH AND REFILL** .
12. Connect negative cable at battery.
13. Start engine and check for engine coolant leaks.

Cylinder Head Cover Removal and Installation

Removal

1. Disconnect negative cable at battery.
2. Remove engine cover. Refer to **Engine Cover Removal and Installation**

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3. Disconnect ignition coil couplers.
4. Remove ignition coils.
5. Remove oil level gauge.
6. Disconnect breather hose (2) and PCV hose (3) from cylinder head cover (4).
7. Remove cylinder head cover (4).

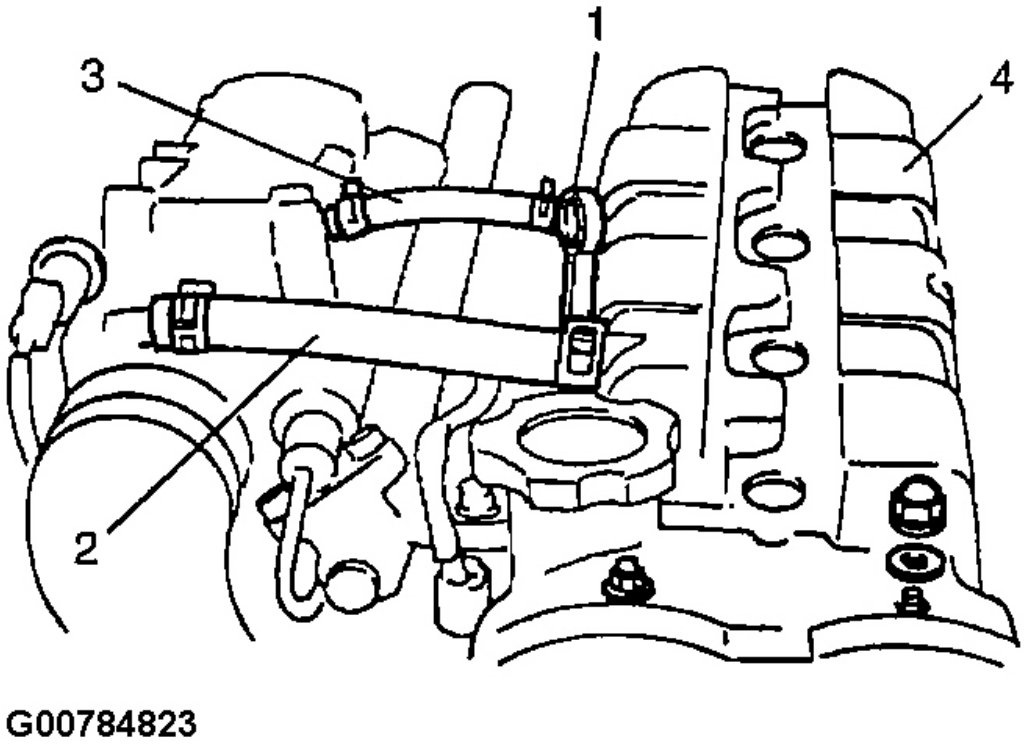


Fig. 30: Disonnecting Breather Hose & PCV Hose
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove PCV valve (1) from cylinder head cover (4), if equipped.

Installation

1. Install PCV valve to cylinder head cover.
2. Remove oil, old sealant and dust from sealing surfaces on cylinder head and cover. After cleaning, apply sealant "A" to cylinder head sealing surface area as shown in figure.

"A": Sealant 99000-31250

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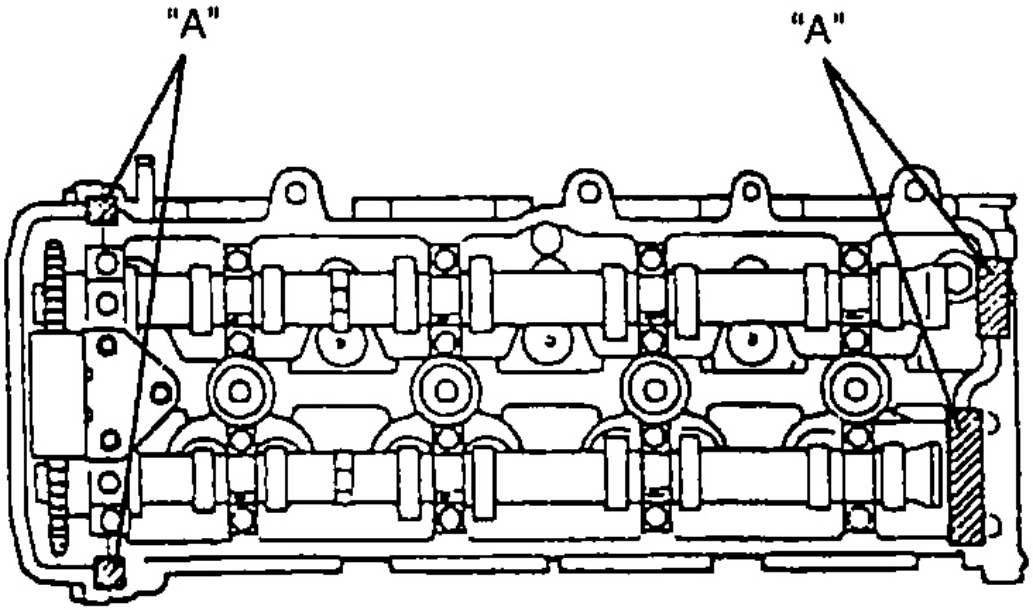


Fig. 31: Applying Sealant "A" To Cylinder Head Sealing Surface
Courtesy of SUZUKI OF AMERICA CORP.

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

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

4. Install new cylinder head side seal (4) and cylinder head cover to cylinder head.

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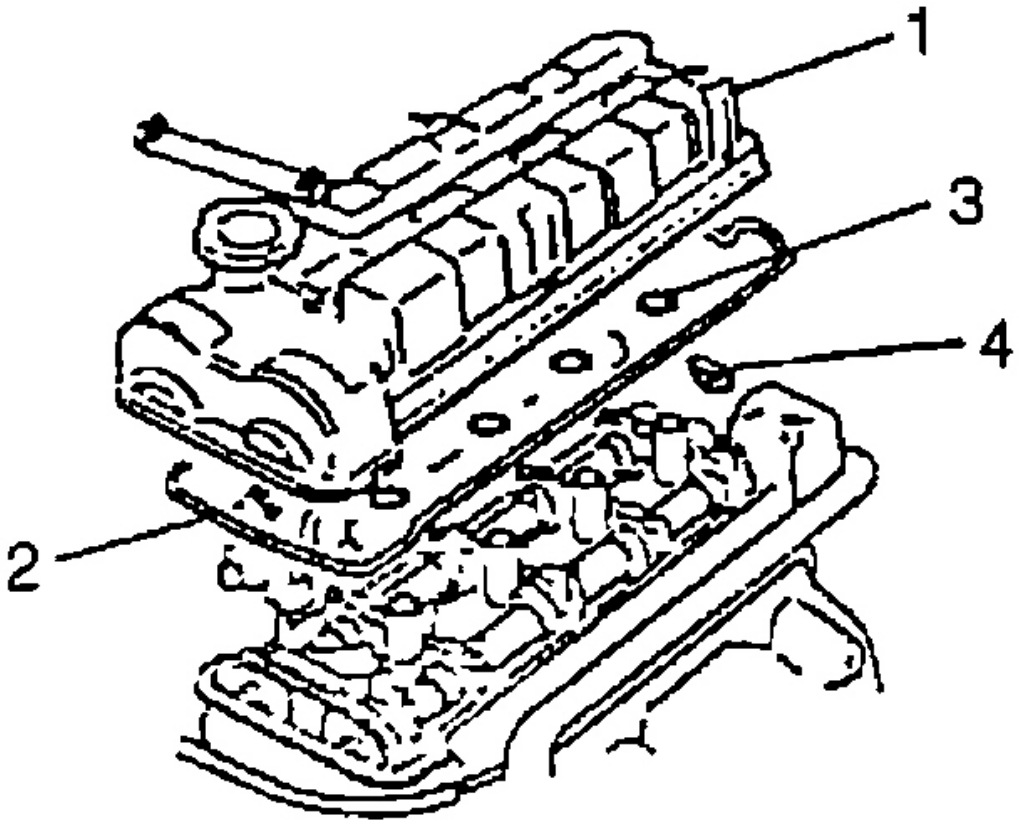


Fig. 32: Installing New O-rings, Cylinder Head Cover Gasket & Cylinder Head Side Seal
Courtesy of SUZUKI OF AMERICA CORP.

5. Tighten nuts (2) to specified torque.
   - Use new seal washers (1).

   Tightening torque

   Cylinder head cover nut (a): 11 N.m (1.1 kg-m, 8.0 lb-ft)

6. Install oil level gauge (3).
7. Connect breather hose (4) and PCV hose (5) to cylinder head cover.

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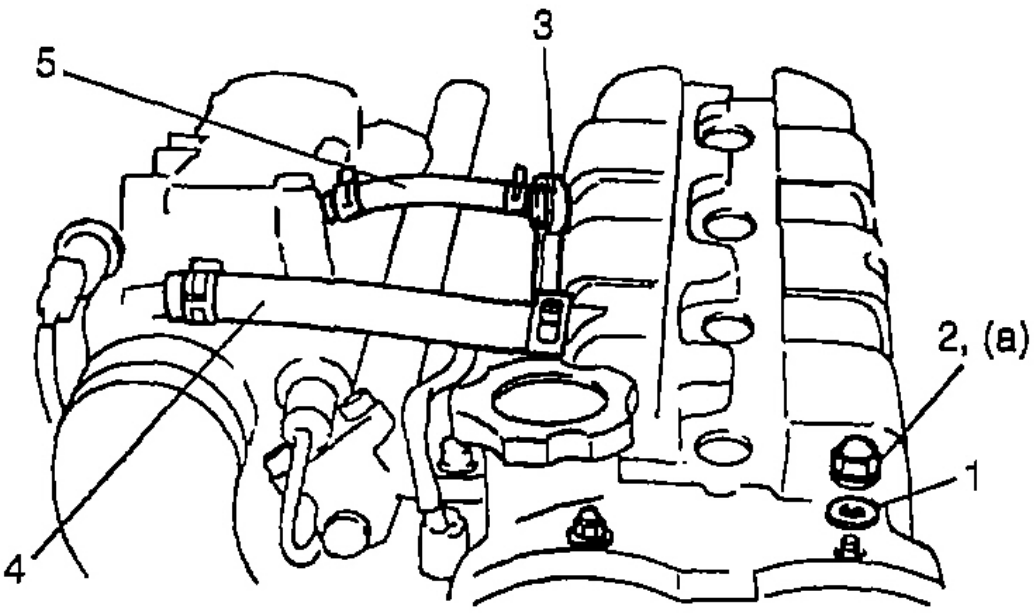
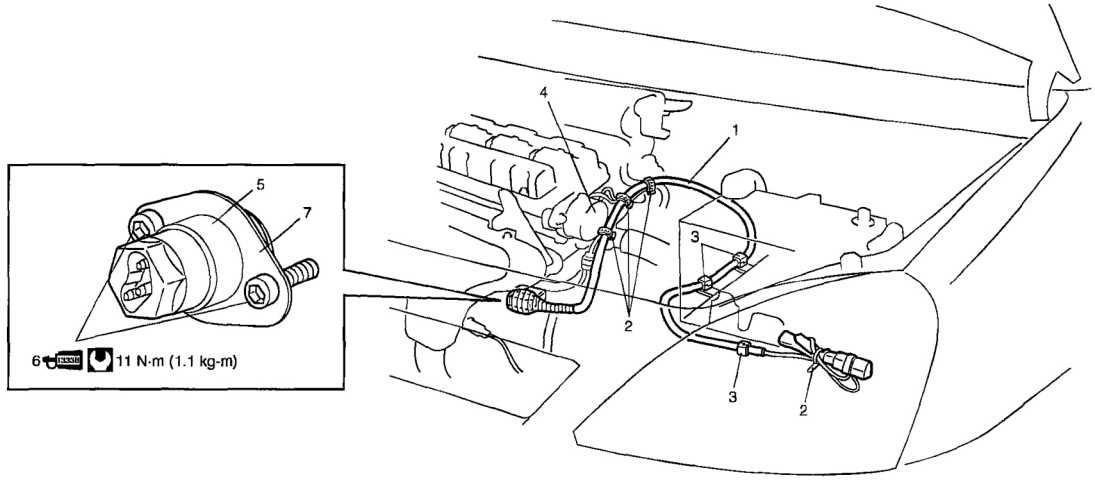


Fig. 33: Connecting Breather Hose & PCV Hose
Courtesy of SUZUKI OF AMERICA CORP.

8. Install ignition coils and connect ignition coil couplers.
9. Install engine cover. **Engine Cover Removal and Installation**
10. Connect negative cable at battery.

Cylinder Block Heater (If Equipped) Components

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1. Cylinder block heater harness	3. Clip	5. Cylinder block heater	7. Retainer
2. Clamp	4. CMP sensor	1333 6. Cylinder block heater bolt : Apply thread lock 99000-32020 to all around thread part of bolt.	: Tightening torque

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Fig. 34: Identifying Cylinder Block Heater Components
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Block Heater (If Equipped) Removal and Installation

Removal

1. Disconnect negative (-) cable battery.
2. Drain coolant.

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

3. Disconnect cylinder block heater connector and remove cylinder block heater (1).

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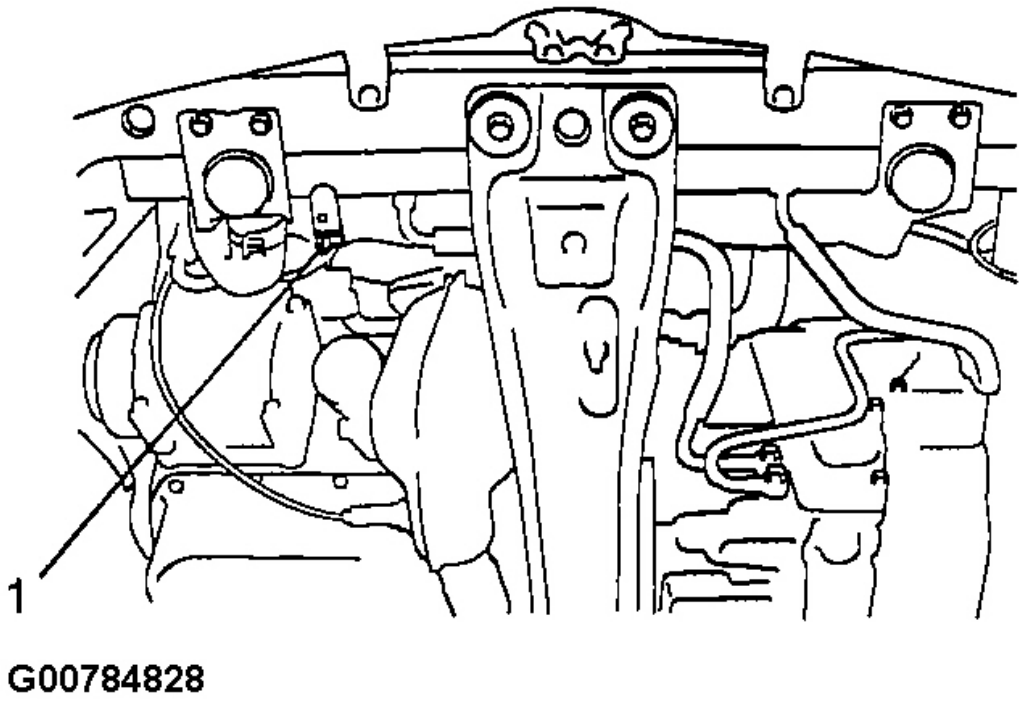


Fig. 35: Removing Cylinder Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal procedure for installation noting the following.

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

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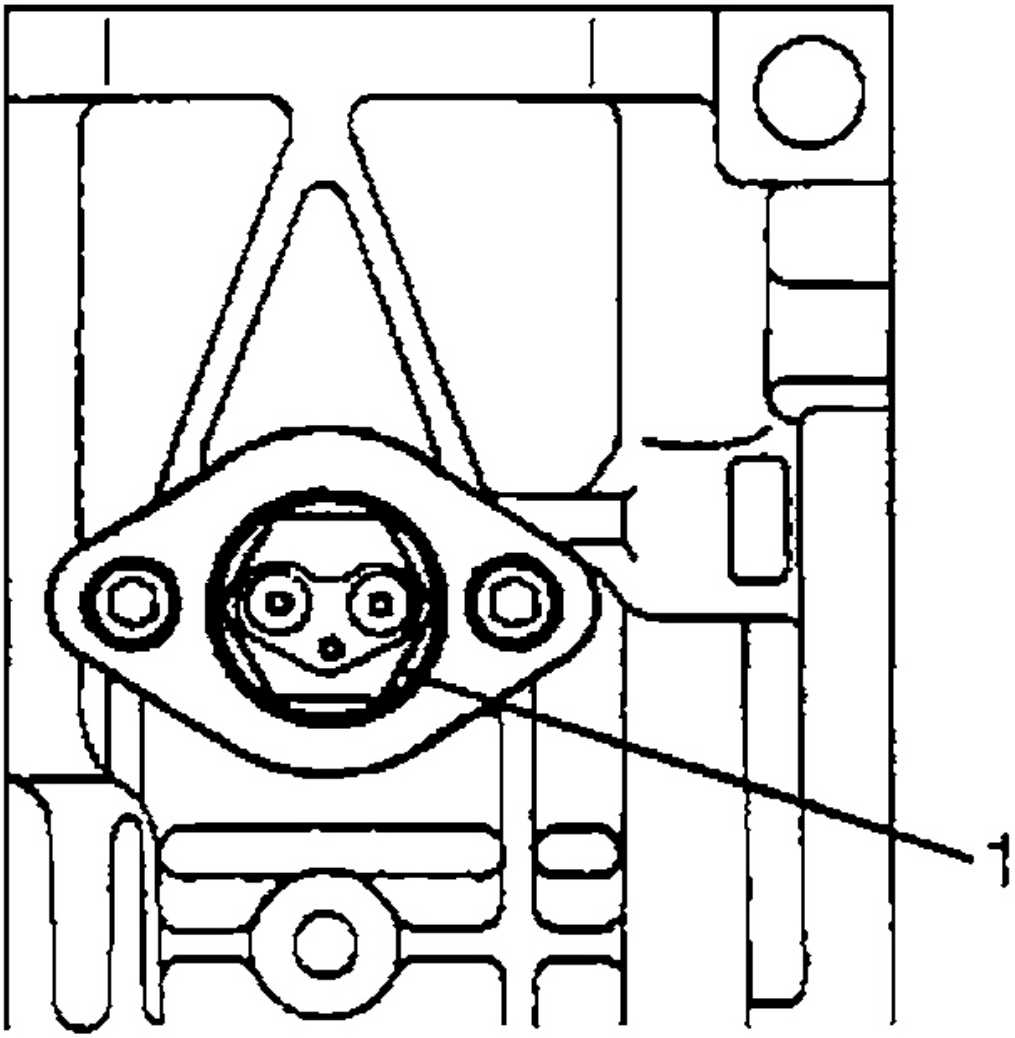


Fig. 36: Installing Cylinder Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

- Apply thread lock cement to block heater bolts (1).

  "A": Thread lock cement 99000-32020

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

  Tightening torque

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

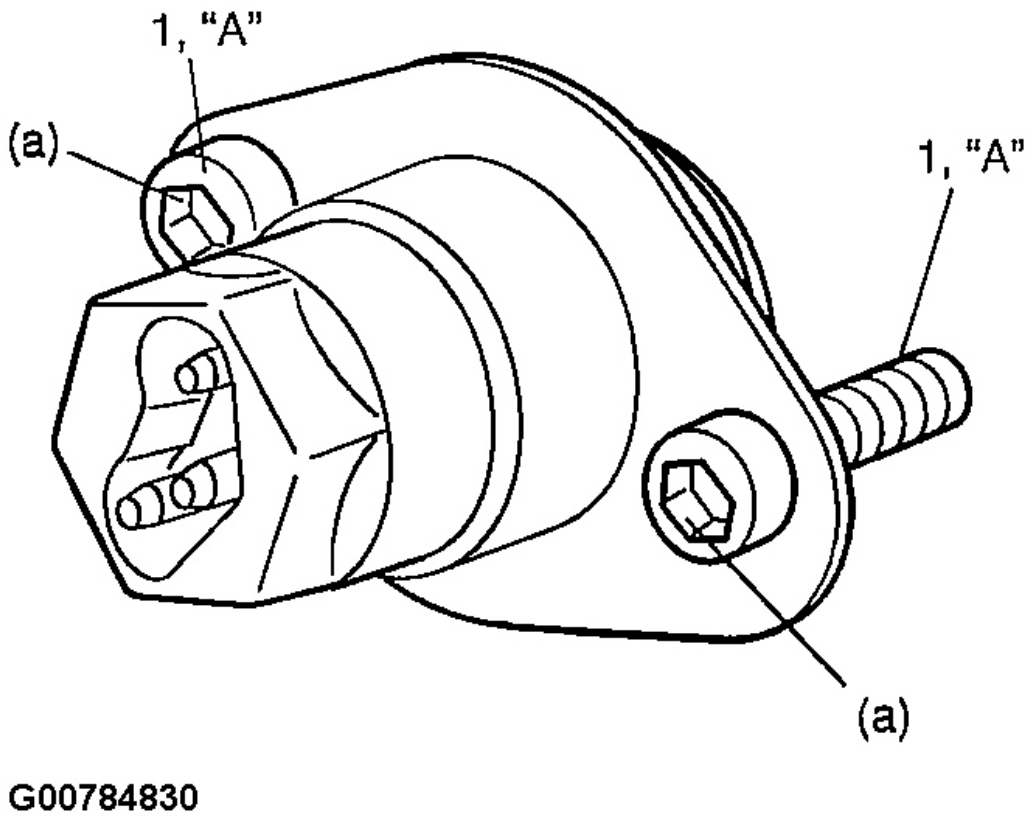


Fig. 37: Tightening Cylinder Block Heater Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Block Heater (If Equipped) Inspection

1. Check continuity between terminal "a" and "c" by using ohmmeter. If there is no continuity, replace cylinder block heater.
2. Check that there is no continuity between terminal "a" and "b" or "c" and "b". If there is continuity, replace cylinder block heater.
3. Check no continuity between "c" and block heater body. If there is continuity, replace cylinder block heater.

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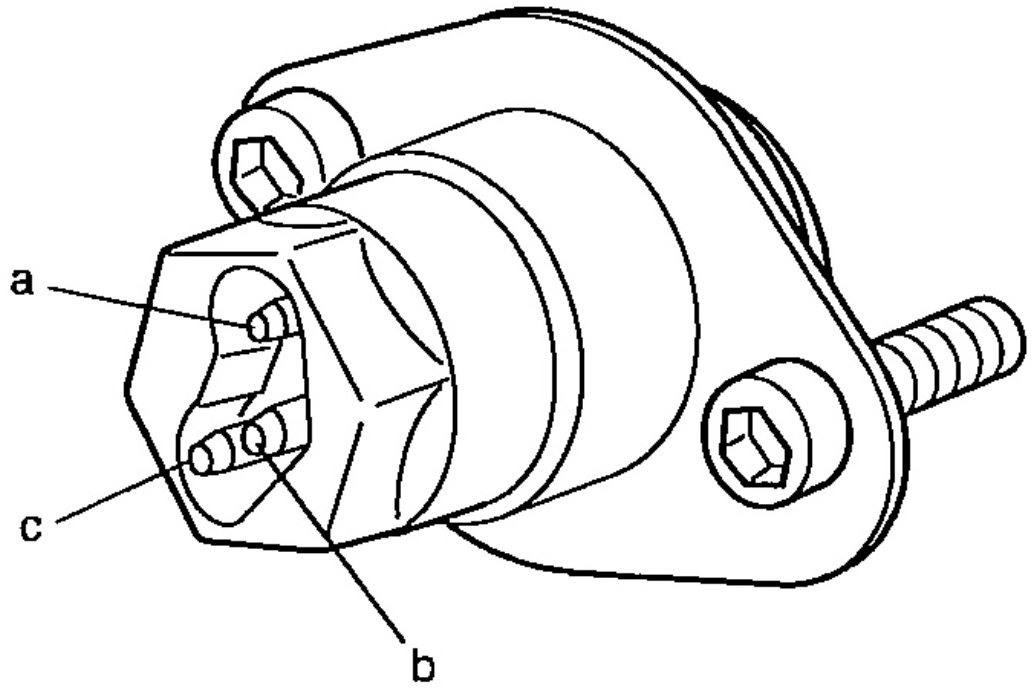


Fig. 38: Identifying Cylinder Block Heater Terminals
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Block Heater Harness (If Equipped) Removal and Installation

Removal

1. Disconnect cylinder block heater connector (1) from block heater.
2. Unclamp cylinder block heater harness (2) and then remove it.

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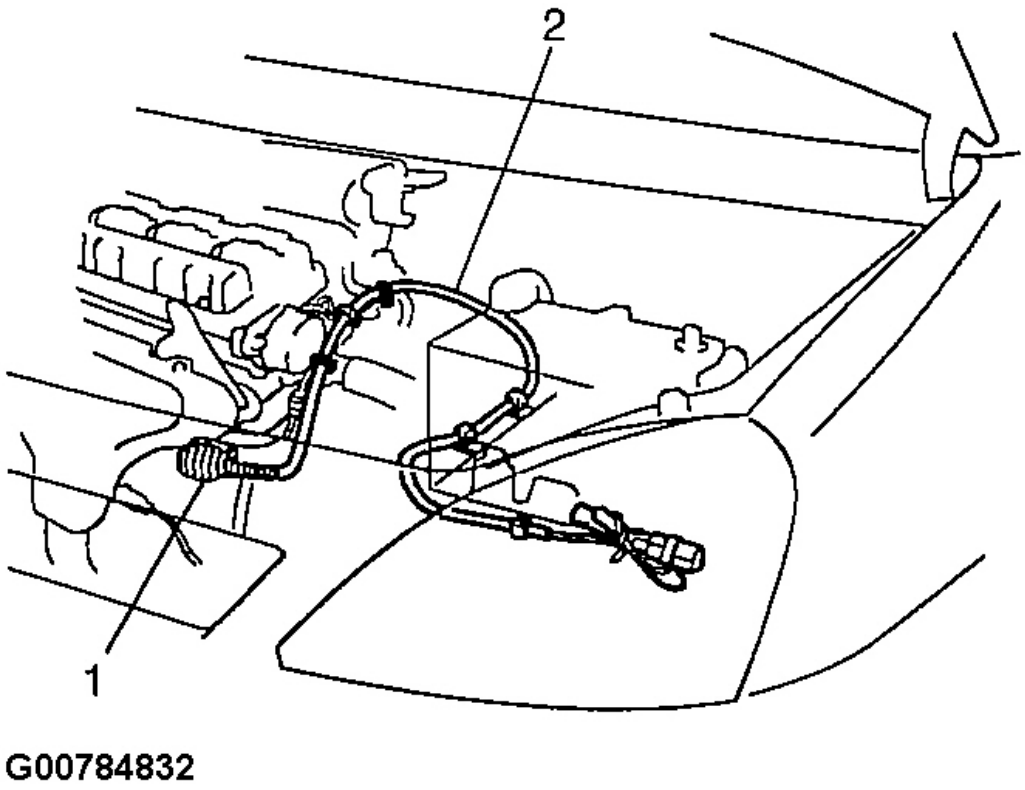


Fig. 39: Removing Cylinder Block Heater Harness
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Connect cylinder block heater connector to block heater.
2. Install clips (1) with open end facing left side and clip (2) with open end facing upward and clamp (7) to body.
3. Fix cylinder block heater harness with clips (1 and 2) and clamp (7) securely.
4. Fix cylinder block heater harness to engine harness (3) with clamps (4) at white tape parts (5).
5. Check to make sure that harness protector (6) is installed as shown and its open end faces downward.

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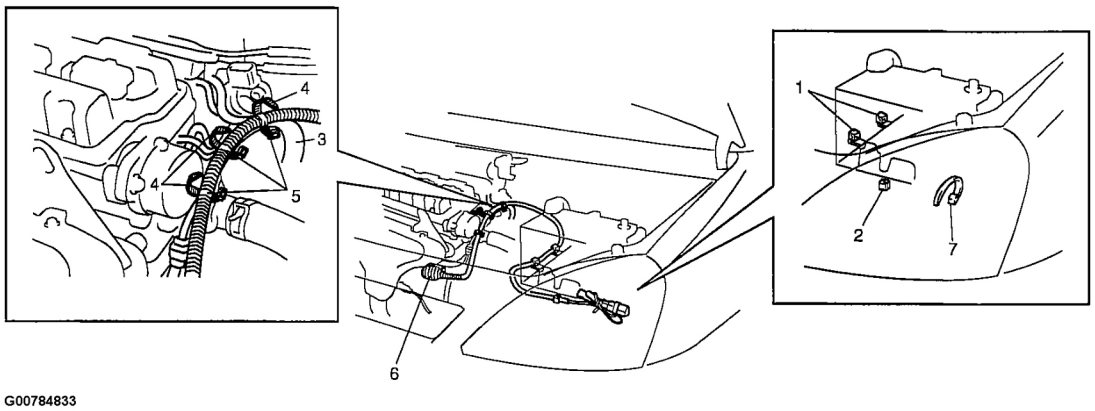


Fig. 40: Fixing Cylinder Block Heater Harness With Clips
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Block Heater Harness (If Equipped) Inspection

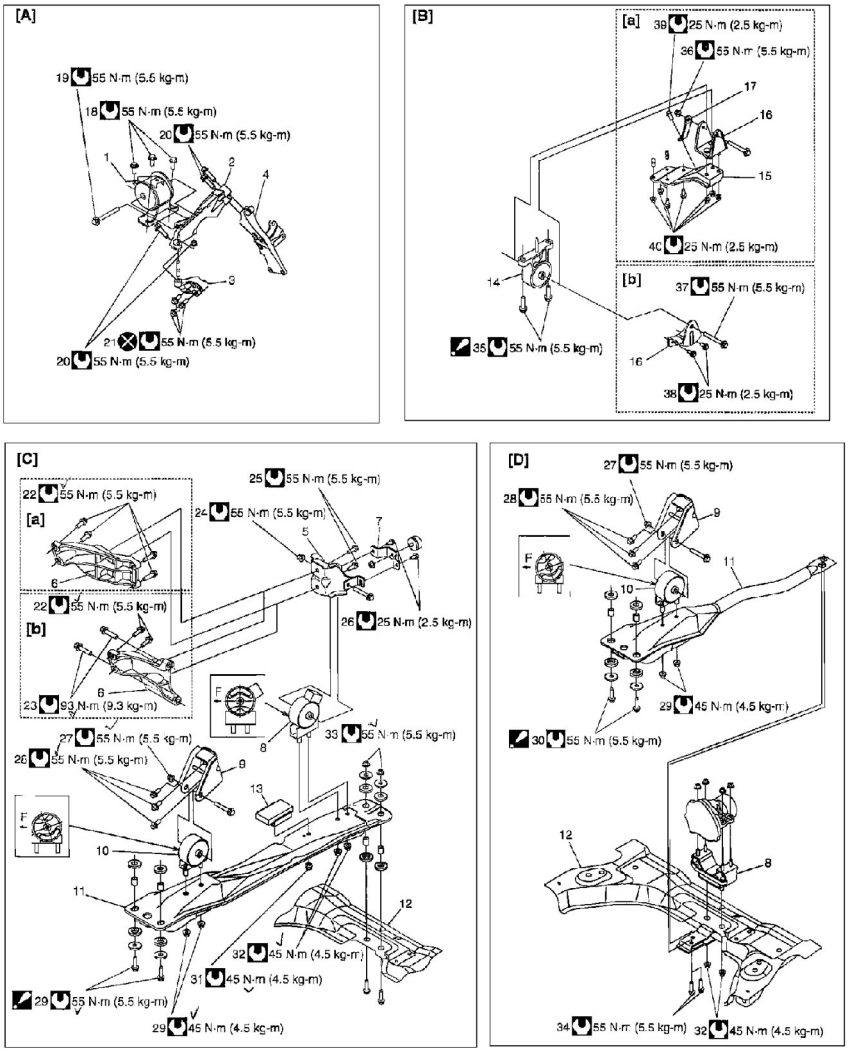
- Check cylinder block heater harness for damage.

Engine Mountings Components

WARNING:

- **"A": Tighten mounting member to suspension frame nuts or bolts first, and tighten mounting member to body bolts with specified torque.**
- **"B": Tighten engine right mounting No. 1 bracket bolts first, and tighten engine left mounting bolts with specified torque.**

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[A]: Engine right mounting assembly	12. Suspension frame	29. Engine front mounting nut
[B]: Engine left mounting assembly	13. Dynamic damper	30. Mounting member to body bolt : See NOTE "A" below
[C]: Engine front and rear mounting assemblies for 2WD model	14. Engine left mounting	31. Dynamic damper nut
[D]: Engine front and rear mounting assemblies for 4WD model	15. Engine left mounting No.1 bracket	32. Engine rear mounting nut
[a]: For M/T model	16. Engine left mounting No.2 bracket	33. Mounting member to suspension frame nut
[b]: For A/T model	17. Engine left mounting stiffener	34. Mounting member to suspension frame bolt
1. Engine right mounting	18. Engine right mounting bolt	35. Engine left mounting bolt : See NOTE "B" below
2. Engine right mounting No.1 bracket	19. Engine right mounting bolt	36. Engine left mounting No.2 bracket nut
3. Engine right mounting bracket	20. Engine right mounting No.1 bracket bolt and nut	37. Engine left mounting No.2 bracket bolt (long)
4. Generator and P/S pump bracket	21. Engine right mounting bracket bolt	38. Engine left mounting No.2 bracket bolt (short)
5. Engine rear mounting No.1 bracket	22. Engine rear mounting No.2 bracket bolt (short)	39. Engine left mounting stiffener bolt
6. Engine rear mounting No.2 bracket	23. Engine rear mounting No.2 bracket bolt (long)	40. Engine left mounting No.1 bracket bolt and nut
7. Engine rear mounting No.3 bracket	24. Engine rear mounting No.1 bracket nut	F: Forward
8. Engine rear mounting	25. Engine rear mounting No.1 bracket bolt	: Tightening torque
9. Engine front bush bracket	26. Engine rear mounting No.3 bracket bolt	: Do not reuse
10. Engine front mounting	27. Engine front bush bracket nut	
11. Mounting member	28. Engine front bush bracket bolt	

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Fig. 41: Identifying Engine Mounting Component Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Engine Assembly Removal and Installation.

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Removal

1. Release fuel pressure in fuel feed line. Refer to **Fuel Pressure Relief Procedure**.
2. Disconnect negative cable at battery.
3. Remove engine hood after disconnecting windshield washer hose.
4. Drain cooling system.

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

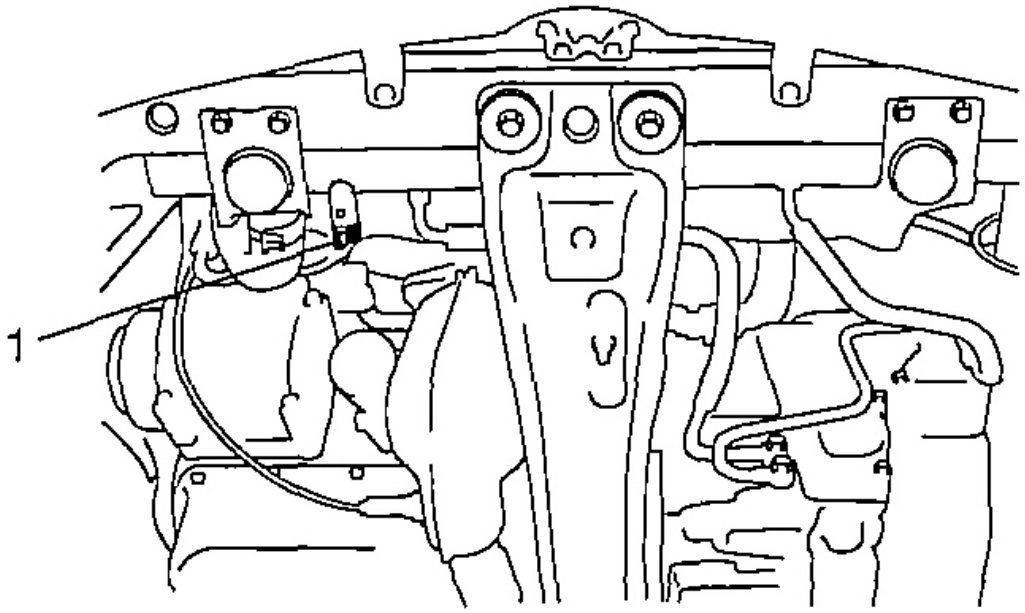


Fig. 42: Draining Cooling System
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove radiator. Refer to **RADIATOR REMOVAL AND INSTALLATION** .
6. Remove engine cover. Refer to **Engine Cover Removal and Installation**.
7. Remove air cleaner outlet hose. Refer to **Air Cleaner Outlet Hose Removal and Installation**.
8. Disconnect MAF sensor coupler (1).
9. Remove air cleaner case assembly (2).

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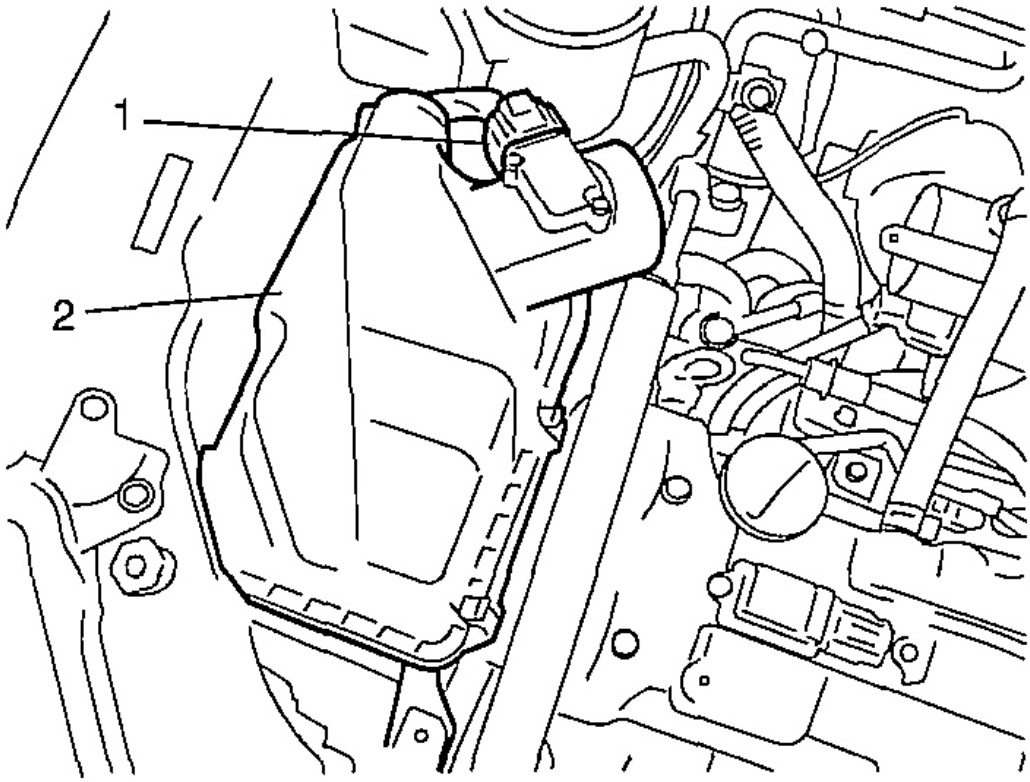
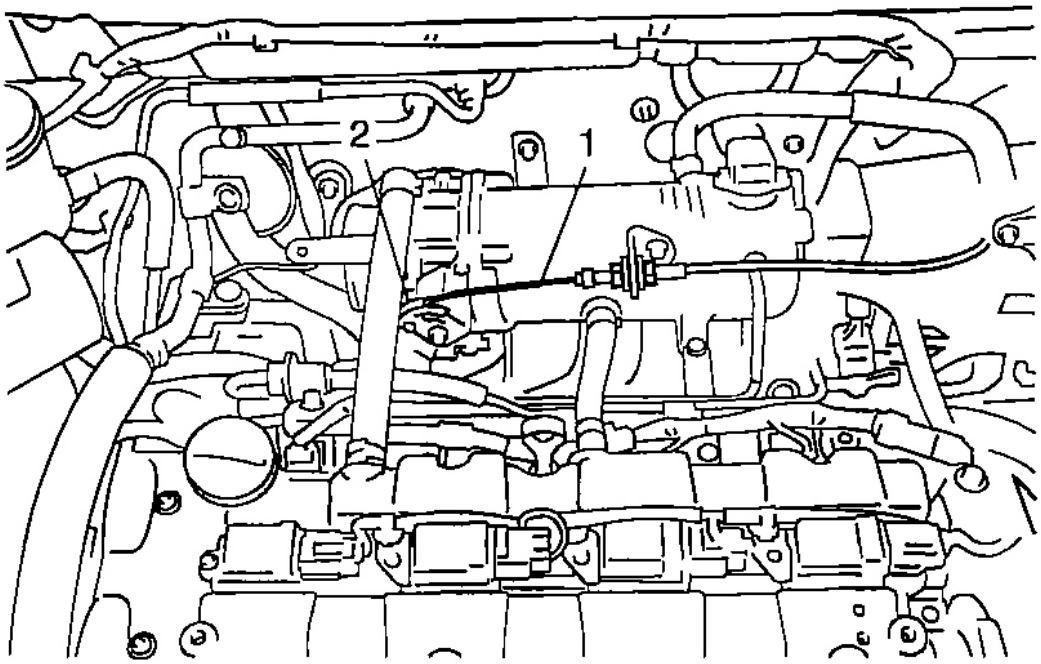


Fig. 43: Removing Air Cleaner Case Assembly
Courtesy of SUZUKI OF AMERICA CORP.

10. Disconnect the following cables.
    - Accelerator cable (1) from throttle valve lever (2).
    - Shift and select cable from transaxle (for M/T model)
    - Gear select cable from transaxle (for A/T model)

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Fig. 44: Disconnecting Accelerator Cable From Throttle Valve Lever
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove accelerator cable with its bracket from intake manifold.
12. Disconnect the following hoses:

Brake booster hose (1) from intake manifold	Heater outlet hose (5) from heater outlet pipe
Fuel feed hose (2) from delivery pipe	Vacuum hose (6) from EVAP canister purge valve
Fuel return hose (3) from return pipe	P/S suction hose (7) and high pressure pipe (8) from P/S pump
Heater inlet hose (4) from water outlet cap	

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Fig. 45: Identifying Engine Hoses (1 Of 2)
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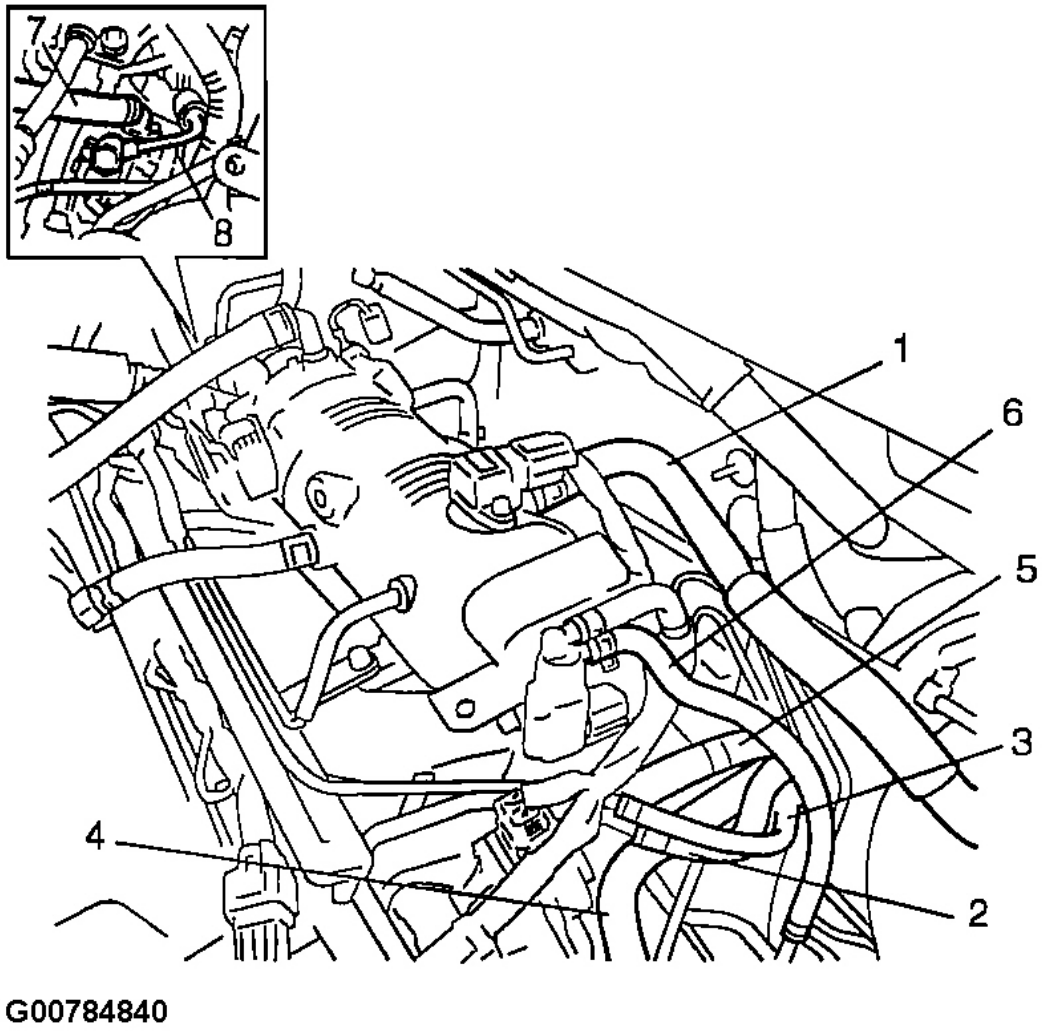


Fig. 46: Identifying Engine Hoses (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

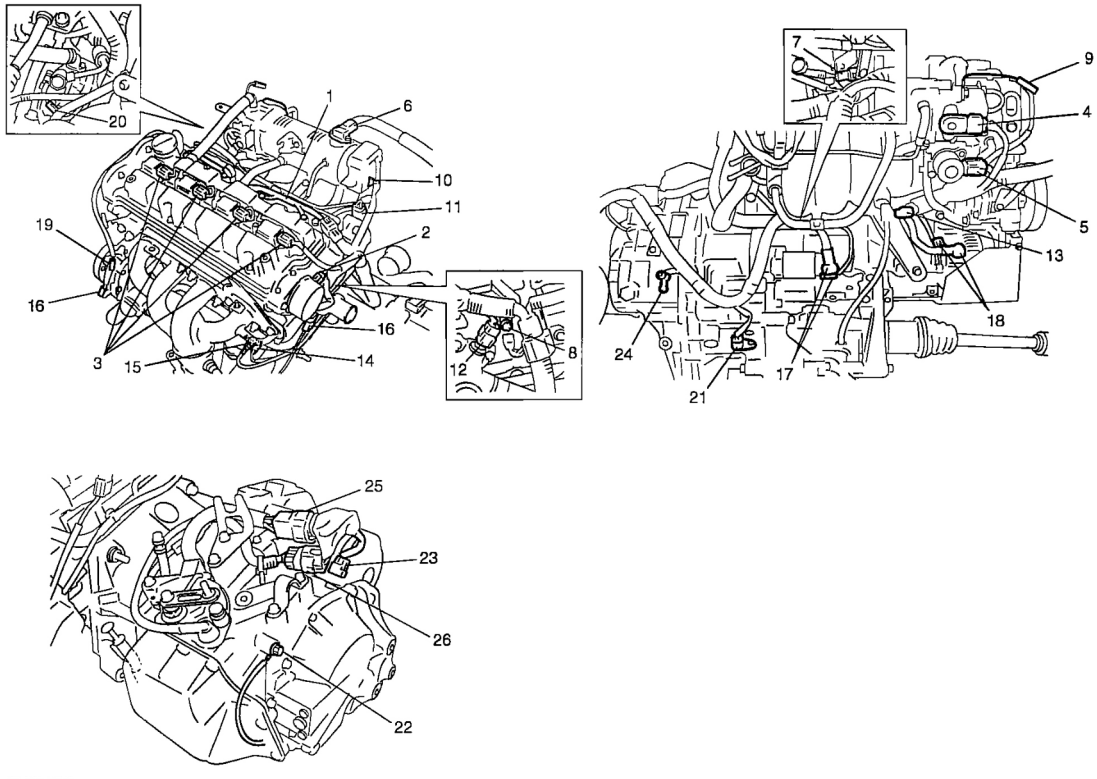
13. Disconnect the following electric wires:

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Injector wire (1)	Cylinder block heater connector (15) (if equipped)
CMP sensor coupler (2)	Heated oxygen sensor wire (16)
Ignition coil wire (3)	Starter wires (17)
TP sensor coupler (4)	Generator wires (18)
IAC valve coupler (5)	A/C magnetic switch wire (19) (if equipped)
IAC valve coupler (6)	Power steering pressure switch coupler (20)
MAP sensor coupler (6)	Vehicle speed sensor (21)
CKP sensor coupler (7)	Battery negative cable from transmission (22)
Ground terminals from cylinder head (8) and throttle body (9)	Input shaft speed sensor (23) (A/T)
EVAP canister purge valve coupler (10)	Output shaft speed sensor (24) (A/T)
EGR valve coupler (11)	Transmission range switch (25) (for A/T model)
ECT sensor coupler (12)	Valve body and transmission fluid temperature sensor connector (26) (for A/T model)
Knock sensor coupler (13)	Back-up light switch (for M/T model)
Oil pressure switch wire (14)	

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Fig. 47: Identifying Engine Assembly Electric Wires (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 48: Identifying Engine Assembly Electric Wires (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

14. Release the wire harness from clamps.
15. Remove clutch operating cylinder (1) from transmission with hose still attached (for M/T model).

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NOTE: Suspend removed clutch operating cylinder at a place free from any possible damage during removal and installation of engine assembly.

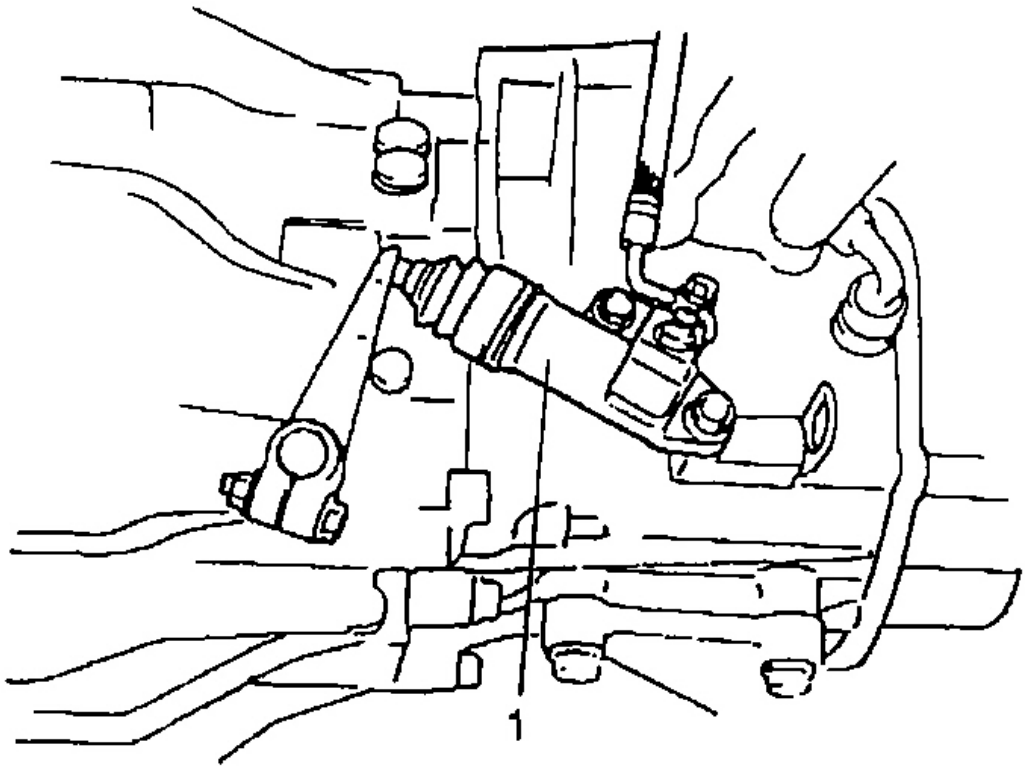


Fig. 49: Removing Clutch Operating Cylinder
Courtesy of SUZUKI OF AMERICA CORP.

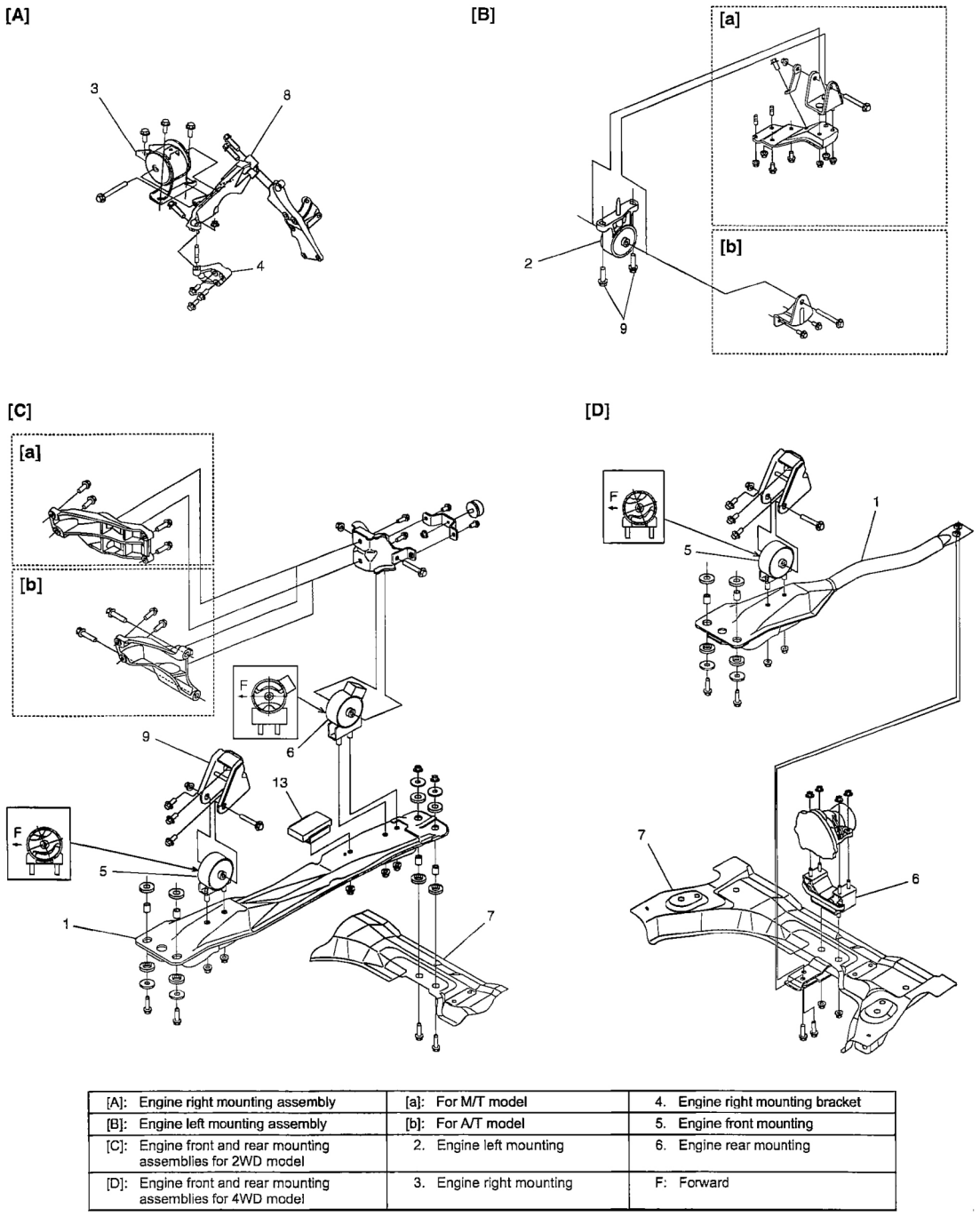
16. Remove right and left engine under covers.
17. Remove generator belt (Power steering pump drive belt) for equipped with A/C. Refer to **GENERATOR DRIVE BELT** .
18. Remove exhaust No. 1 pipe and No. 2 pipe.
19. Drain engine oil, transaxle oil for M/T vehicle or A/T fluid for A/T vehicle and transfer oil for 4WD vehicle.
20. Remove axle shafts. Refer to **AXLE SHAFTS** .
21. Separate propeller shaft front end from transfer output flange for 4WD vehicle.
22. Remove A/C compressor from compressor bracket with hoses still attached, if equipped with A/C.

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NOTE: Suspend removed compressor at a place free from any possible damage during removal and installation of engine assembly.

23. Remove intake manifold rear stiffener.
24. Install lifting device.
25. Remove mounting member (1) from front member and suspension frame (7).
26. Remove suspension frame (7) with stabilizer bar and suspension control arms. Refer to **FRONT SUSPENSION FRAME REMOVAL AND INSTALLATION** for 4WD vehicle.
27. Remove engine left mounting bolts (9).
28. Remove engine right mounting No. 1 bracket (8).

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[A]: Engine right mounting assembly	[a]: For M/T model	4. Engine right mounting bracket
[B]: Engine left mounting assembly	[b]: For A/T model	5. Engine front mounting
[C]: Engine front and rear mounting assemblies for 2WD model	2. Engine left mounting	6. Engine rear mounting
[D]: Engine front and rear mounting assemblies for 4WD model	3. Engine right mounting	F: Forward

Fig. 50: Identifying Engine Assembly Mountings
Courtesy of SUZUKI OF AMERICA CORP.

29. Before removing engine with transaxle and transfer (for 4WD model) from vehicle body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transaxle.
30. Lower engine with transaxle and transfer (for 4WD model) from vehicle body.

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NOTE: **Before lowering engine, to avoid damage to A/C compressor, raise it through clearance made on engine crankshaft pulley side. At this time, use care so that no excessive force is applied to hoses.**

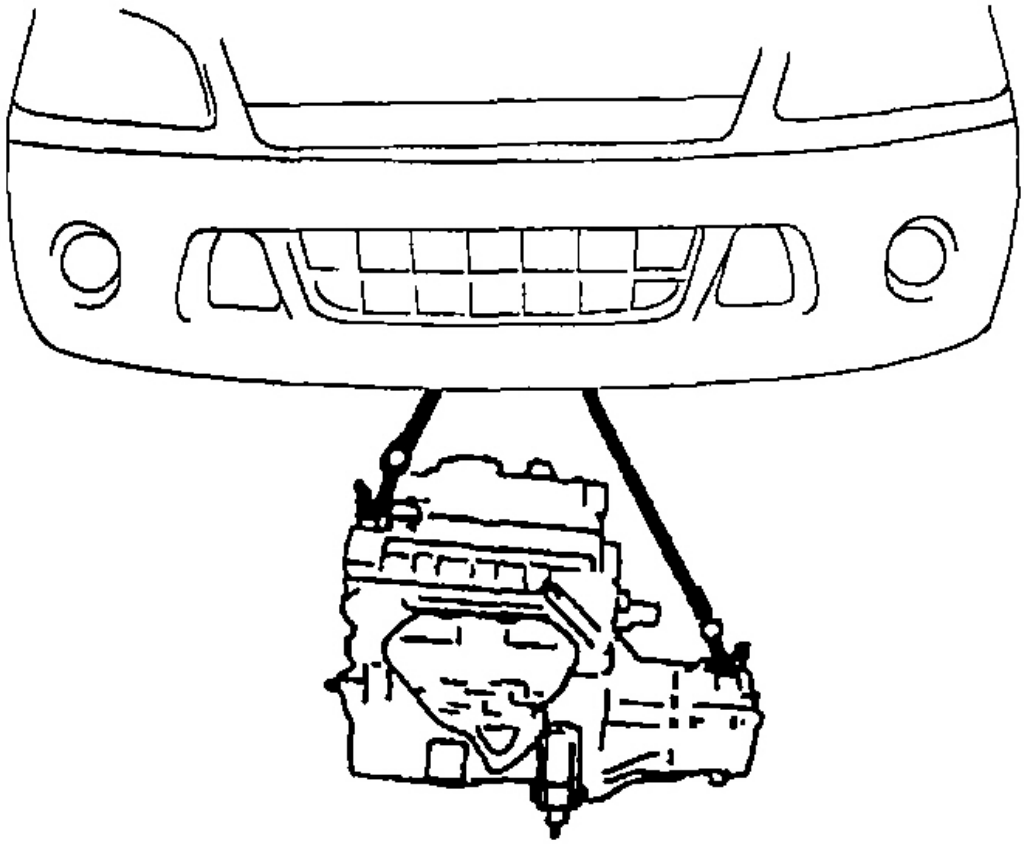


Fig. 51: Lowering Engine With Transaxle & Transfer Case
Courtesy of SUZUKI OF AMERICA CORP.

31. Disconnect transfer from transaxle. Refer to **TRANSFER DISMOUNTING AND REMOUNTING** .
32. Disconnect transaxle from engine. Refer to **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** .
33. Remove clutch cover and clutch disk. Refer to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL** (M/T).

Installation

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1. Install clutch cover and clutch disk. Refer to **CLUTCH COVER, CLUTCH DISC AND FLYWHEEL REMOVAL** (M/T).
2. Connect transaxle to engine. Refer to **MANUAL TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** or **AUTOMATIC TRANSAXLE UNIT DISMOUNTING AND REMOUNTING** .
3. Connect transfer to transaxle. Refer to **TRANSFER DISMOUNTING AND REMOUNTING** .
4. Lift engine with transaxle and transfer (for 4WD model) into engine compartment, but do not remove lifting device.
5. Install engine right mounting No. 1 bracket (8) to right mounting bracket (4), generator & P/S bracket and engine right mounting (3) with temporal tightening its bolts.
6. Install engine left mounting bolts (9) with temporal tightening its nut.
7. Install mounting member (1) to front member and suspension frame (7).
8. Install suspension frame (7) with stabilizer bar and suspension control arms. Refer to **FRONT SUSPENSION FRAME REMOVAL AND INSTALLATION** for 4WD model.
9. Tighten bolts and nuts of all parts installed in steps 5), 6) and 7) to specified torque.

NOTE:

- **Be sure to tighten engine right mounting No.1 bracket bolt (10) previously, and tighten engine left mounting bolts (9).**
- **Be sure to tighten mounting member to suspension frame bolts (12) or nuts (12) previously, and tighten mounting member to body bolts (11).**

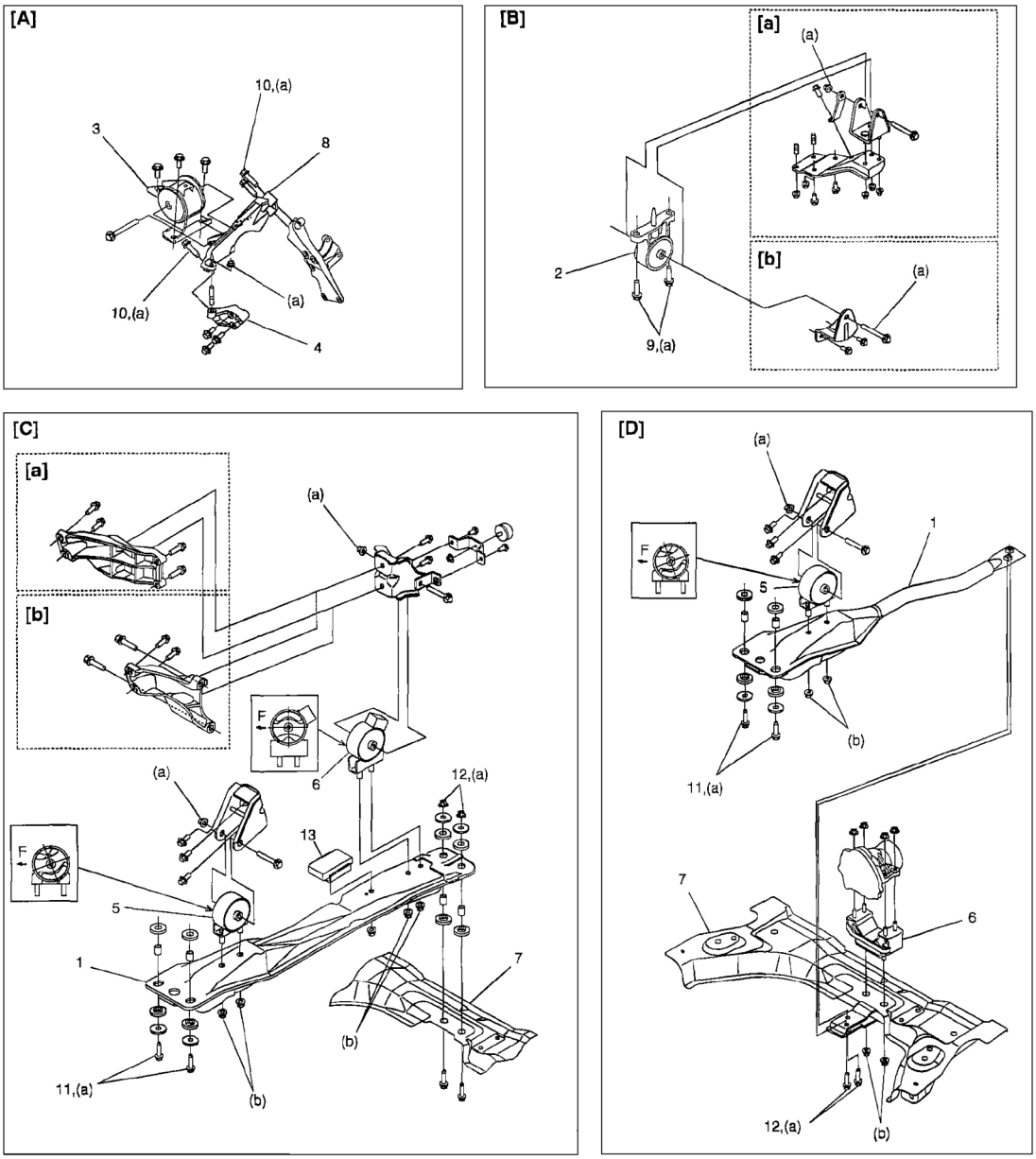
Tightening torque

Engine mounting bolts and nut (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

Engine front and rear mounting nut (b): 45 N.m (4.5 kg-m, 32.5 lb-ft)

10. Remove lifting device.
11. Reverse removal procedures for installation of reminder.
    - Push in each drive shaft joint fully so that snap ring engages with differential gear or center bearing support. Use care not to damage oil seal lip when inserting.
    - Clamp electric wire securely.

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[A]: Engine right mounting assembly	[a]: For M/T model	6. Engine rear mounting
[B]: Engine left mounting assembly	[b]: For A/T model	F: Forward
[C]: Engine front and rear mounting assemblies for 2WD model	2. Engine left mounting	
[D]: Engine front and rear mounting assemblies for 4WD model	5. Engine front mounting	

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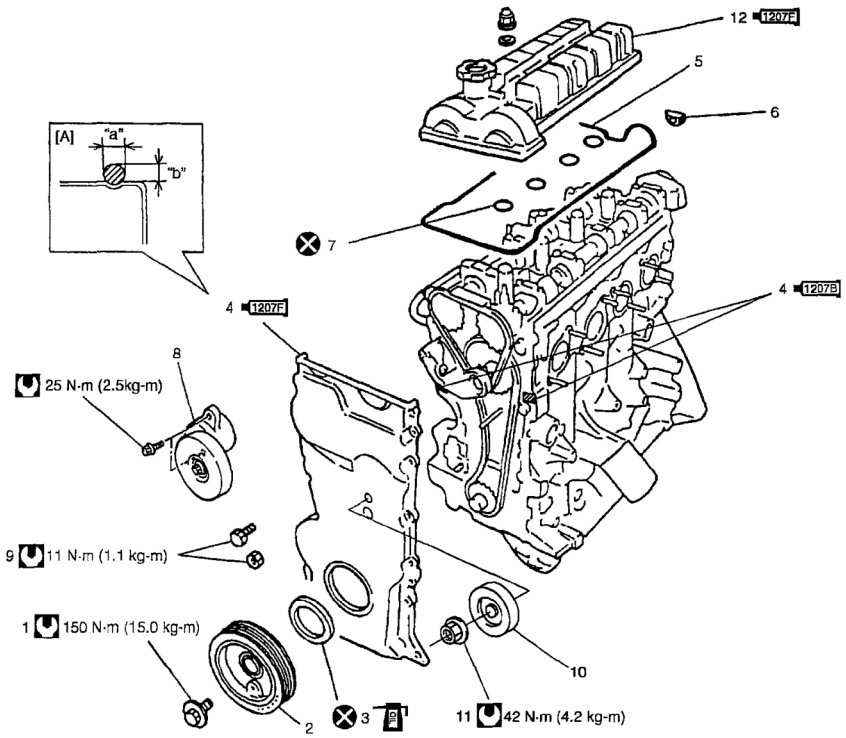
Fig. 52: Identifying Engine Assembly Mountings
Courtesy of SUZUKI OF AMERICA CORP.

12. For 4WD model, connect propeller shaft. Refer to Propeller Shaft Removal and Installation .
13. Adjust gear shift control cable. Refer to Gear Shift Lever and Cable Removal and Installation .

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14. Install generator belt (Power steering pump drive belt). Refer to **GENERATOR DRIVE BELT** .
15. Refill transaxle with A/T fluid or gear oil. Refer to**DRAINING & REFILLING** (A/T) or **CHANGING FLUID** (M/T).
16. For 4WD model, refill transfer with transfer oil. Refer to **TRANSFER OIL CHANGE** .
17. Refill engine with engine oil.
18. Refill cooling system. Refer to **COOLING SYSTEM FLUSH AND REFILL** .
19. Upon completion of installation, check to make sure that there is no fuel leakage, coolant leakage, transaxle oil leakage, transfer oil leakage or exhaust gas leakage at each connection.
20. Adjust accelerator cable play. Refer to **Accelerator Cable Adjustment**.

Timing Chain Cover Components



[A]: Sealant application amount	1207B 1207F 4. Timing chain cover : See "A" : See "B"	10. Generator belt idler pulley
"a": 3 mm (0.12 in.)	5. Cylinder head cover gasket	11. Generator belt idler pulley nut
"b": 2 mm (0.08 in.)	6. Cylinder head side seal	1207F 12. Cylinder head cover : See "C"
1. Crankshaft pulley bolt	7. O-ring	: Tightening torque
2. Crankshaft pulley	8. Generator belt tensioner	: Do not reuse.
3. Oil seal : Apply engine oil to oil seal lip.	9. Timing chain cover bolt and nut	
"A": Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head.		
"B": Apply sealant 99000-31250 to the mating surface of timing chain cover referring to the figure of Step 1) in "Timing Chain Cover Removal and Installation: ".		
"C": Apply sealant 99000-31250 to the sealing point for timing chain cover mating surface and cylinder head sealing point. Refer to "Cylinder Head Cover Removal and Installation: ".		

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Fig. 53: Identifying Timing Chain Cover Components

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Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Cover Removal and Installation

Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
3. Remove cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
4. Remove crankshaft pulley bolt.

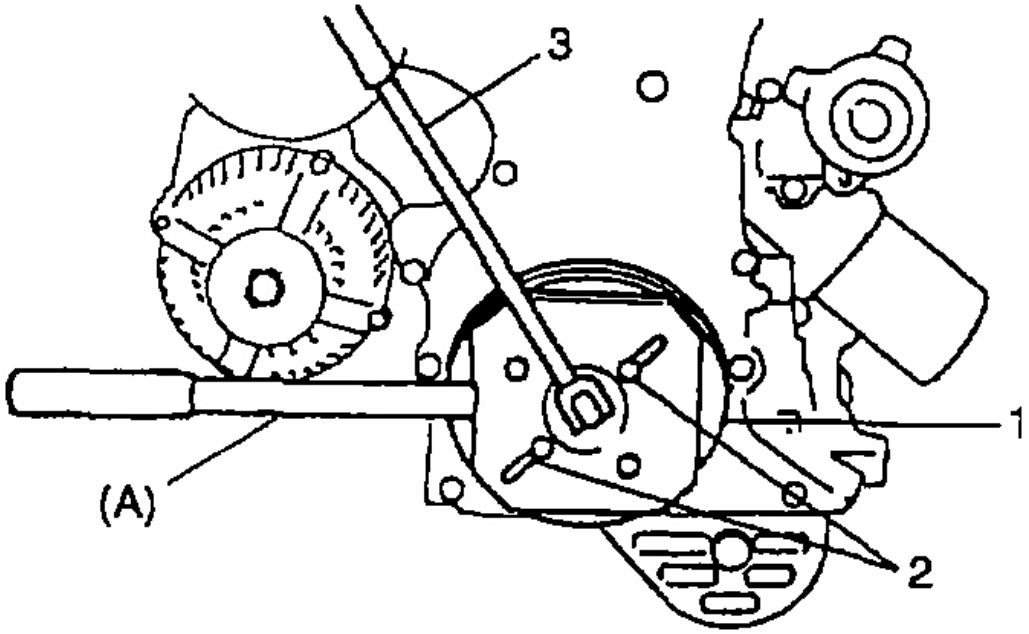
   To lock crankshaft pulley (1), use special tool (camshaft pulley holder) with it as shown in figure.

   Special tool

   (a): 09917-68221

   NOTE: Be sure to use the following bolts instead of pins for fixing special tool to crankshaft pulley.
   Bolt size: M8, P1.25 L = 25 mm (0.98 in.)
   Strength: 7T

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2.	Bolt
3.	Wrench

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Fig. 54: Removing Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove crankshaft pulley (1).

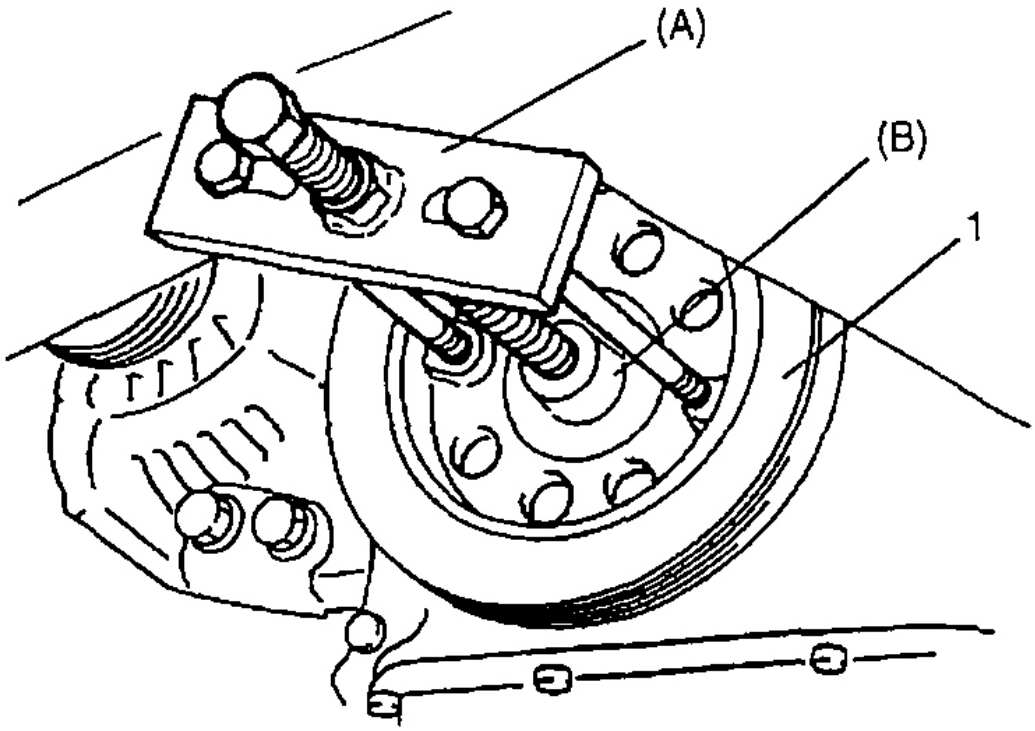
   To remove crankshaft pulley, use special tools (Steering wheel remover, Bearing puller attachment) with it as shown in figure.

   Special tool

   (A): 09944-36011

   (B): 09926-58010

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Fig. 55: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove A/C compressor bracket (1).

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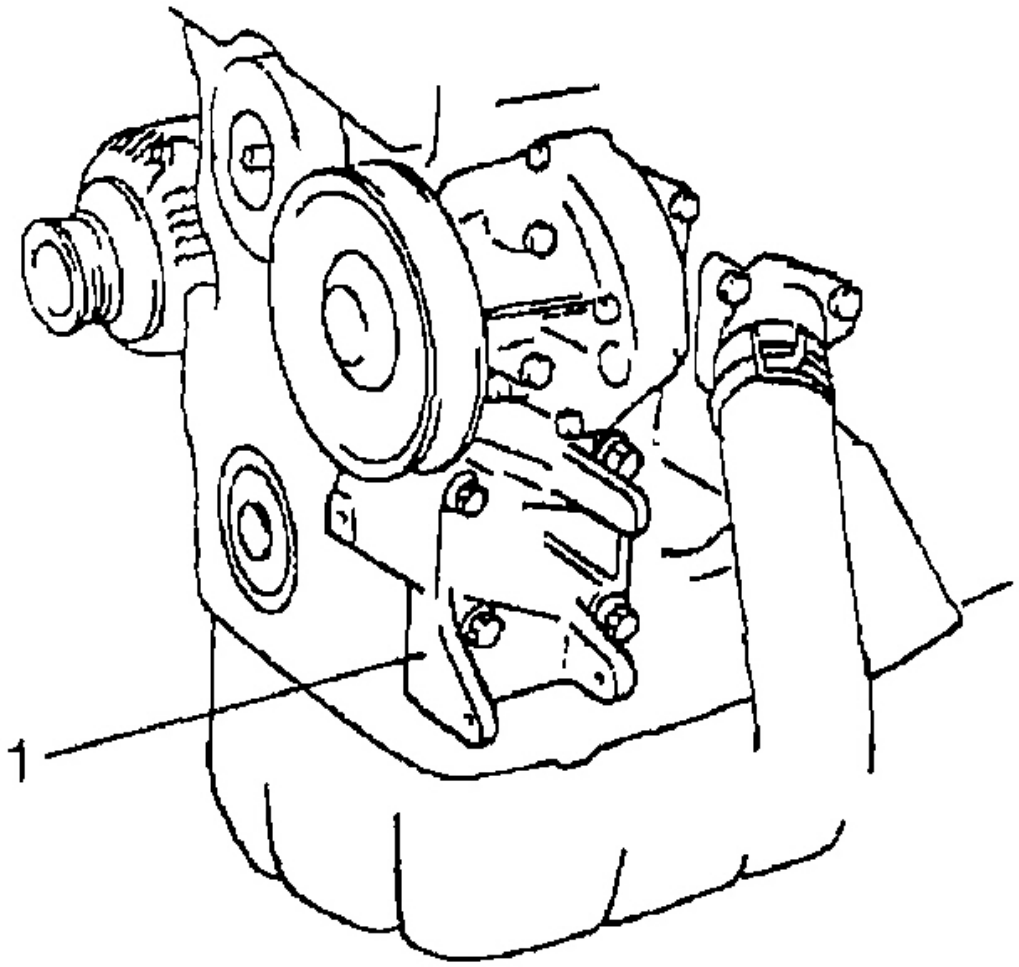


Fig. 56: Removing A/C Compressor Bracket
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove generator belt idler pulley (1), water pump pulley (2) and generator belt tensioner (3).

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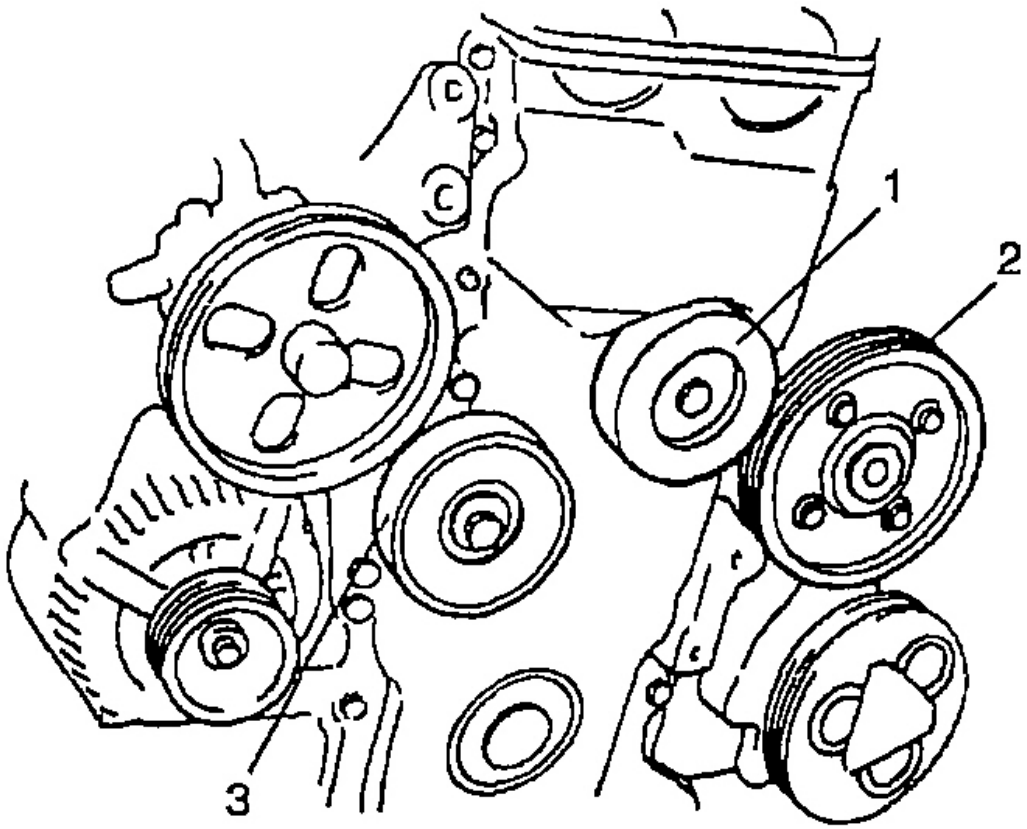


Fig. 57: Removing Generator Belt Idler Pulley, Water Pump Pulley & Generator Belt Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove timing chain cover (1) bolts (3) and nut (2).

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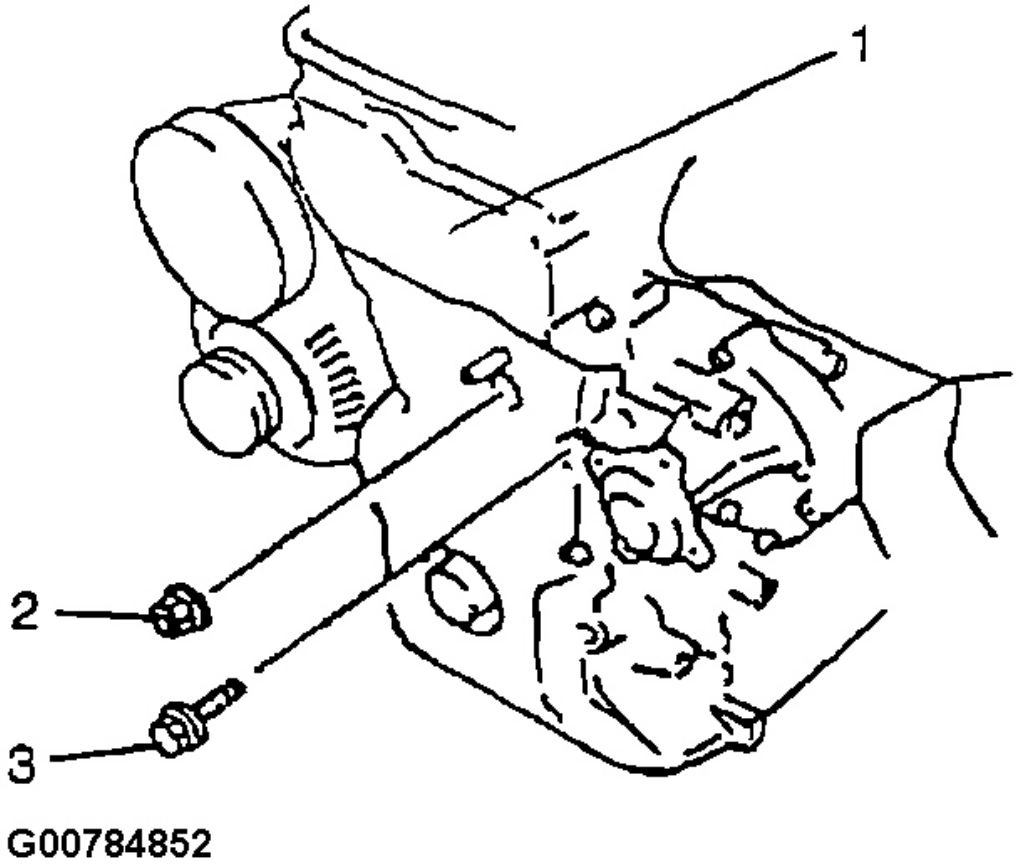


Fig. 58: Removing Timing Chain Cover Bolt & Nut
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reverse removal sequence to install timing chain cover (1) noting the following points.

1. Apply sealant "A" and "B" to area as shown in figure.

   "A": Sealant 99000-31250

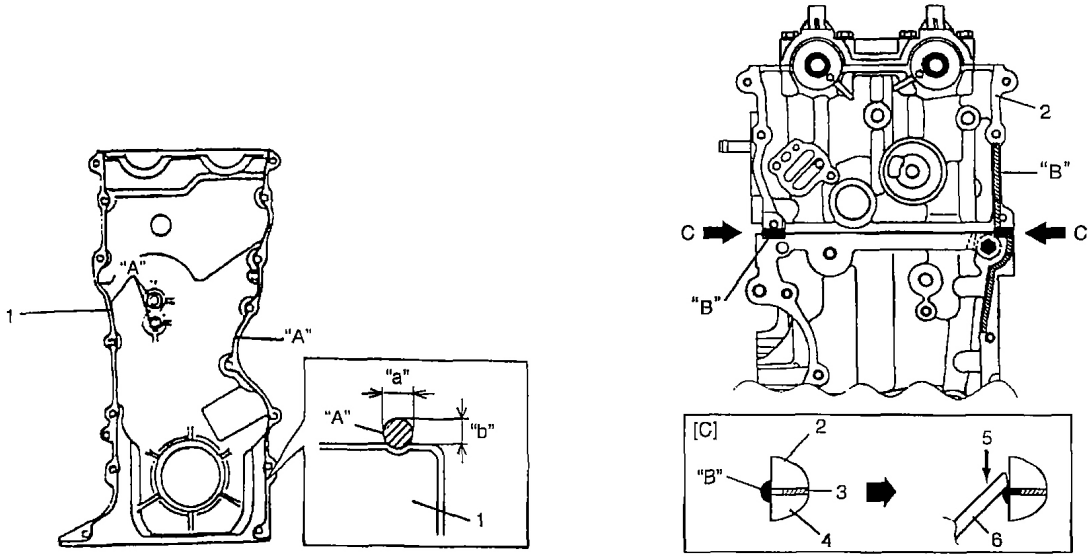
   "B": Sealant 99000-31140

   Sealant amount for timing chain cover

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

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



2. Cylinder head	5. Rub into
3. Cylinder head gasket	6. Jig
4. Cylinder block	[C]: View C

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Fig. 59: Installing Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

2. Apply engine oil to oil seal lip, then install timing chain cover (1). Tighten bolts and nut to specified torque.

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

Tightening torque

Timing chain cover bolt and nut (a): 11 N.m (1.1 kg-m 8.0 lb-ft)

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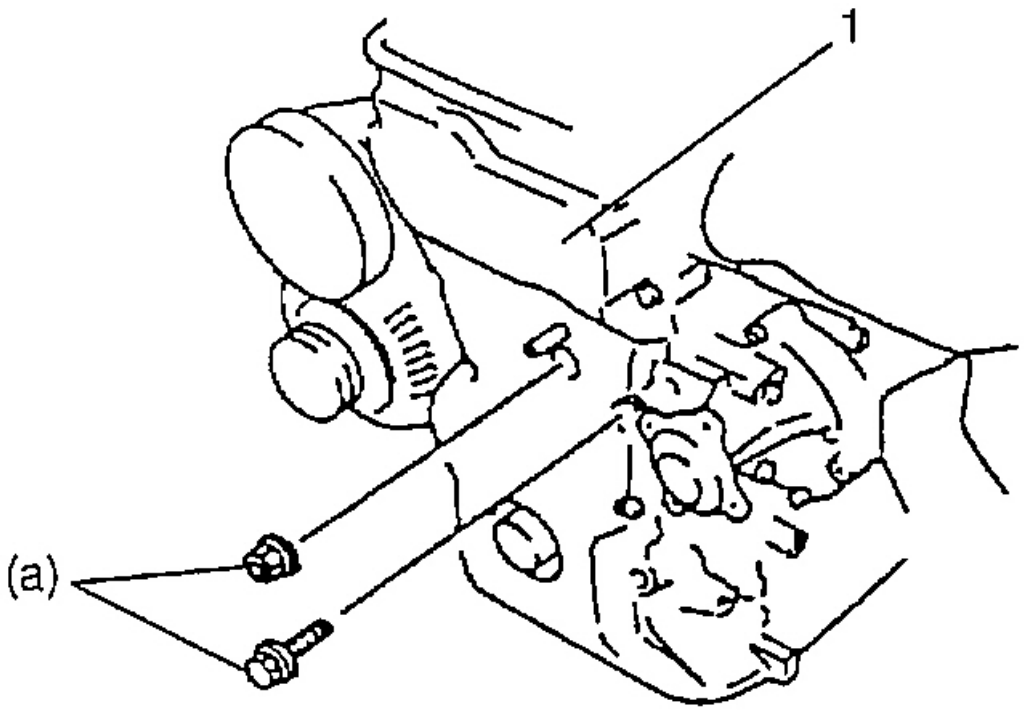


Fig. 60: Installing Timing Chain Bolt & Nut
Courtesy of SUZUKI OF AMERICA CORP.

3. Install generator belt idler pulley (1). Tighten nut to specified torque.

   Tightening torque

   Generator belt idler pulley nut (a): 42 N.m (4.2 kg-m, 30.5 lb-ft)

4. Install generator belt tensioner (2). Tighten bolts to specified torque.

   Tightening torque

   Generator belt tensioner bolt (b): 25 N.m (2.5 kg-m, 18.5 lb-ft)

5. Install water pump pulley (3).

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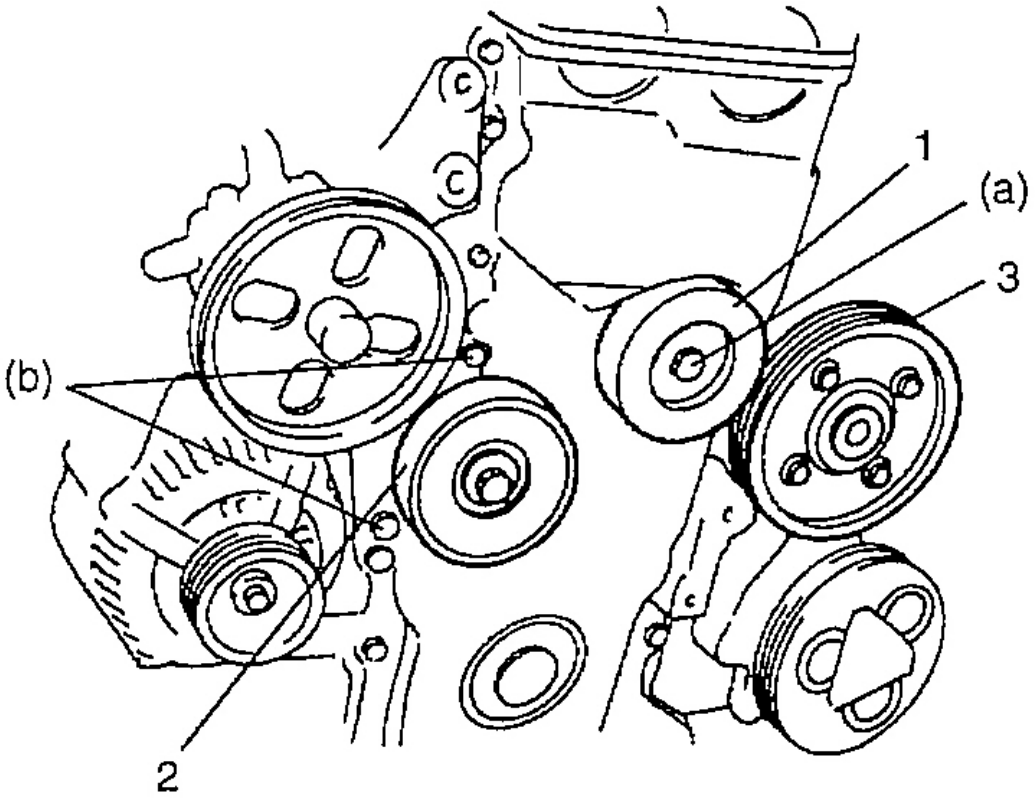


Fig. 61: Installing Water Pump Pulley
Courtesy of SUZUKI OF AMERICA CORP.

6. Install A/C compressor bracket (1) if equipped. Tighten bracket bolts to specified torque.

   Tightening torque

   A/C compressor bracket bolt (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

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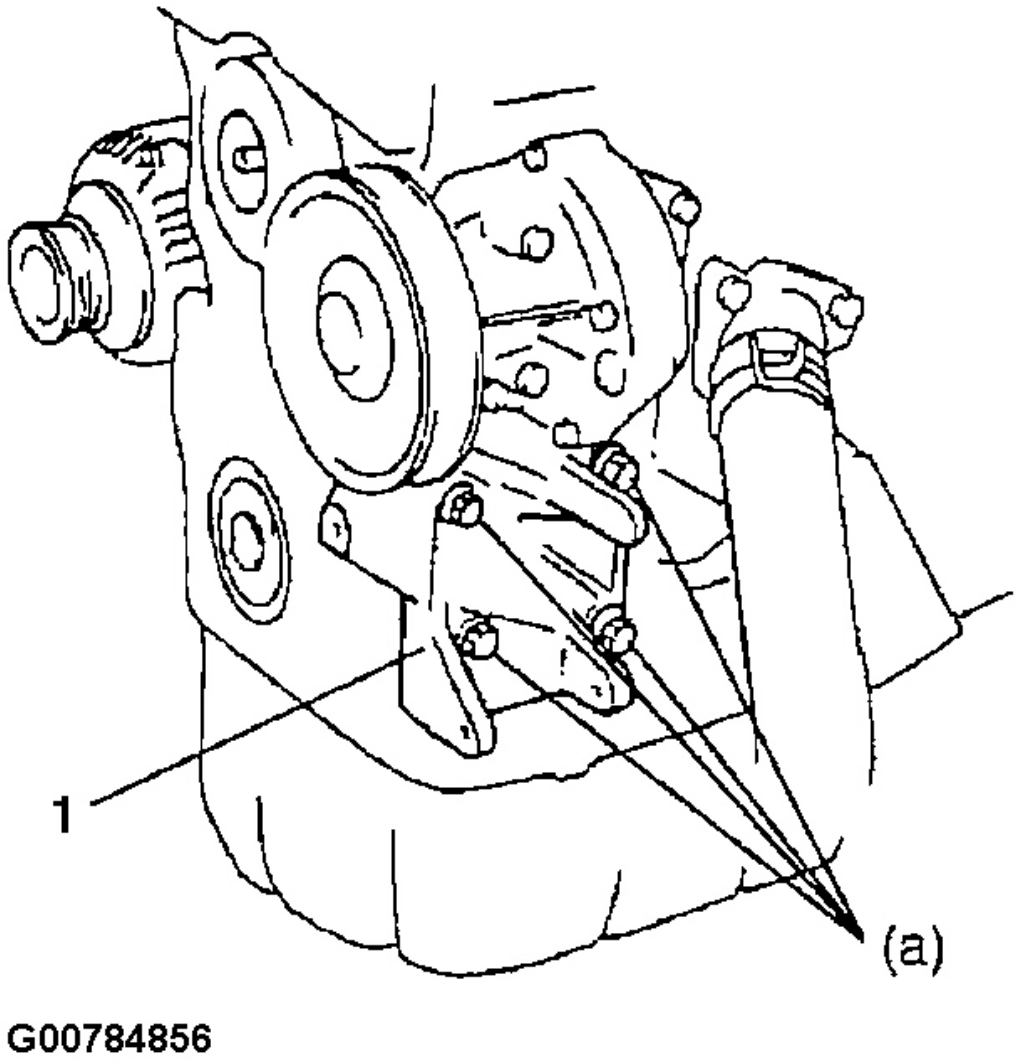


Fig. 62: Installing A/C Compressor Bracket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install cylinder head cover. Refer to**Cylinder Head Cover Removal and Installation**.
8. Install oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
9. Install crankshaft pulley. To lock crankshaft pulley (1), use special tool (camshaft pulley holder) with it as shown in figure.

Special tool

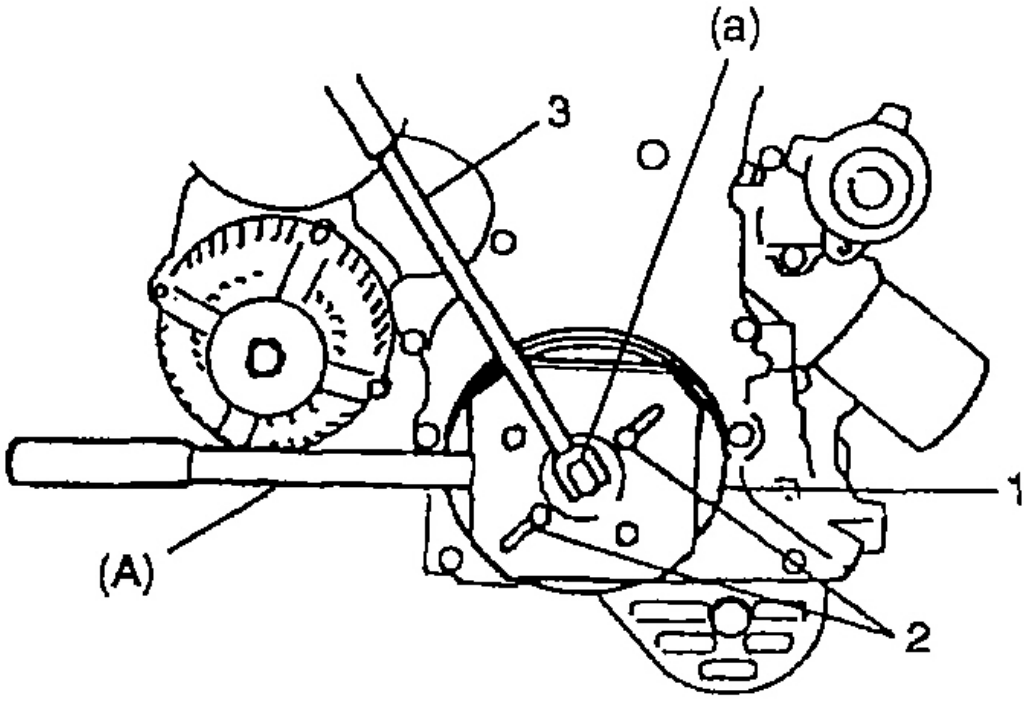
(A): 09917-68221

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**NOTE: Be sure to use the following bolts instead of pins for fixing special tool to crank pulley. Bolt size: M8, P1.25 L = 25 mm (0.98 in.)
Strength: 7T**

Tightening torque

Crankshaft pulley bolt (a): 150 N.m (15.0 kg-m, 108.5 lb-ft)



2.	Bolt
3.	Wrench

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Fig. 63: Installing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

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Timing Chain Cover Cleaning and Inspection

Clean

Clean sealing surface on timing chain cover, crank case, cylinder block and cylinder head. Remove oil, old sealant, and dust from sealing surface.

Inspection

Check oil seal lip for fault or other damage. Replace as necessary.

NOTE: When installing new oil seal (2), drive it in until its surface is flash with edge of timing chain cover (1). To install oil seal, use special tool (bearing installer).

Special tool

(A): 09913-75510

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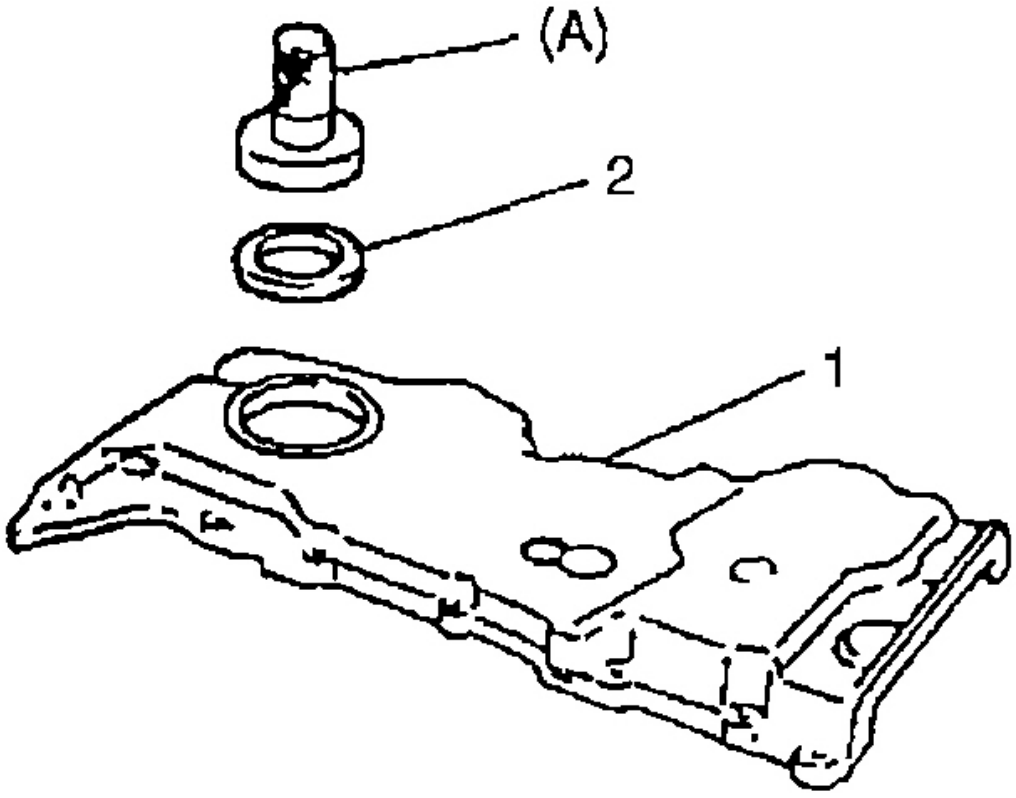
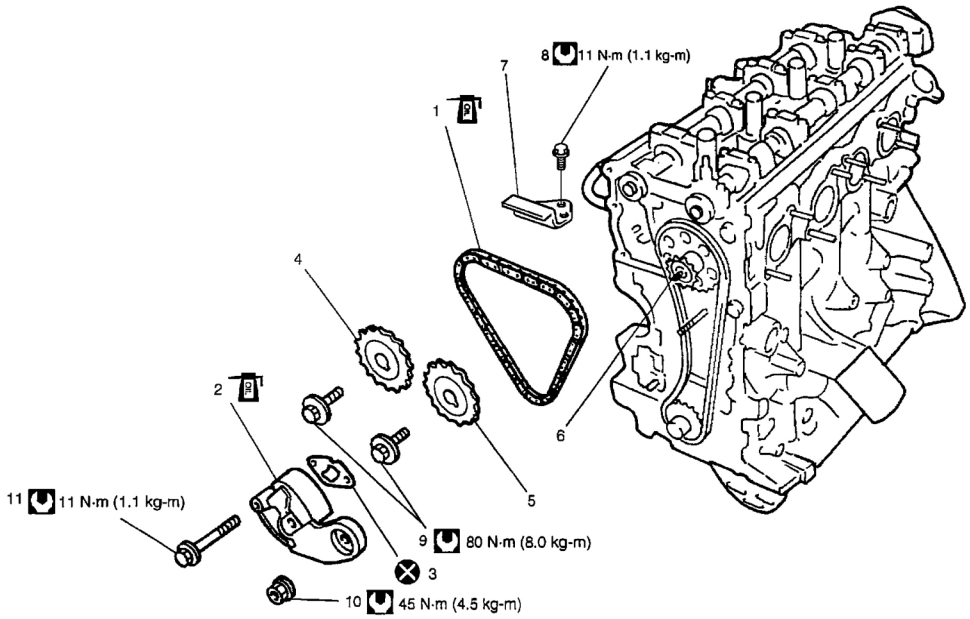


Fig. 64: Inspecting Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

2nd Timing Chain and Chain Tensioner Components

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1. 2nd timing chain : Apply engine oil	6. Idler sprocket	11. Timing chain tensioner adjuster No.2 bolt
2. Timing chain tensioner adjuster No.2 : Apply engine oil to sliding surface.	7. Timing chain guide No.2	: Do not reuse.
3. Tensioner adjuster No.2 gasket	8. Camshaft housing bolt	: Tightening torque
4. Intake camshaft timing sprocket	9. Camshaft timing sprocket bolt	
5. Exhaust camshaft timing sprocket	10. Timing chain tensioner adjuster No.2 nut	

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Fig. 65: Identifying 2nd Timing Chain & Chain Tensioner Components
Courtesy of SUZUKI OF AMERICA CORP.

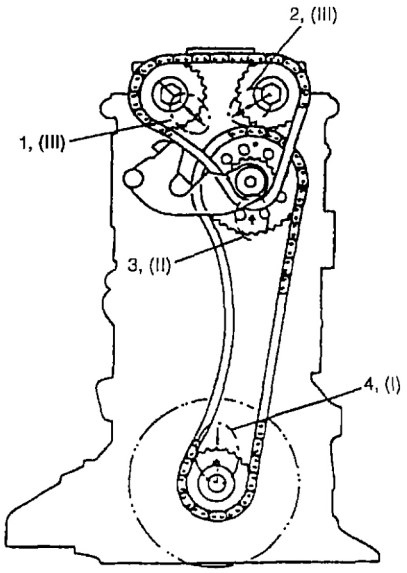
2nd Timing Chain and Chain Tensioner Removal and Installation

Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
3. Remove cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
4. Remove timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
5. Turn crankshaft to meet following conditions.
   - Key (I) on crankshaft is positioned as shown.
   - Arrow mark on idler sprocket (II) points upward.
   - Marks on sprockets (III) match with marks on cylinder head.

   Note that this step must be followed for reinstallation of timing chain.

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1. Timing marks of intake camshaft timing sprocket	3. Arrow mark on idler sprocket
2. Timing marks of exhaust camshaft timing sprocket	4. Key on crankshaft

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Fig. 66: Aligning Timing Components
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove timing chain tensioner adjuster No.2 (1) and gasket. To remove them, slacken 2nd timing chain by turning intake camshaft counterclockwise a little while pushing back pad.

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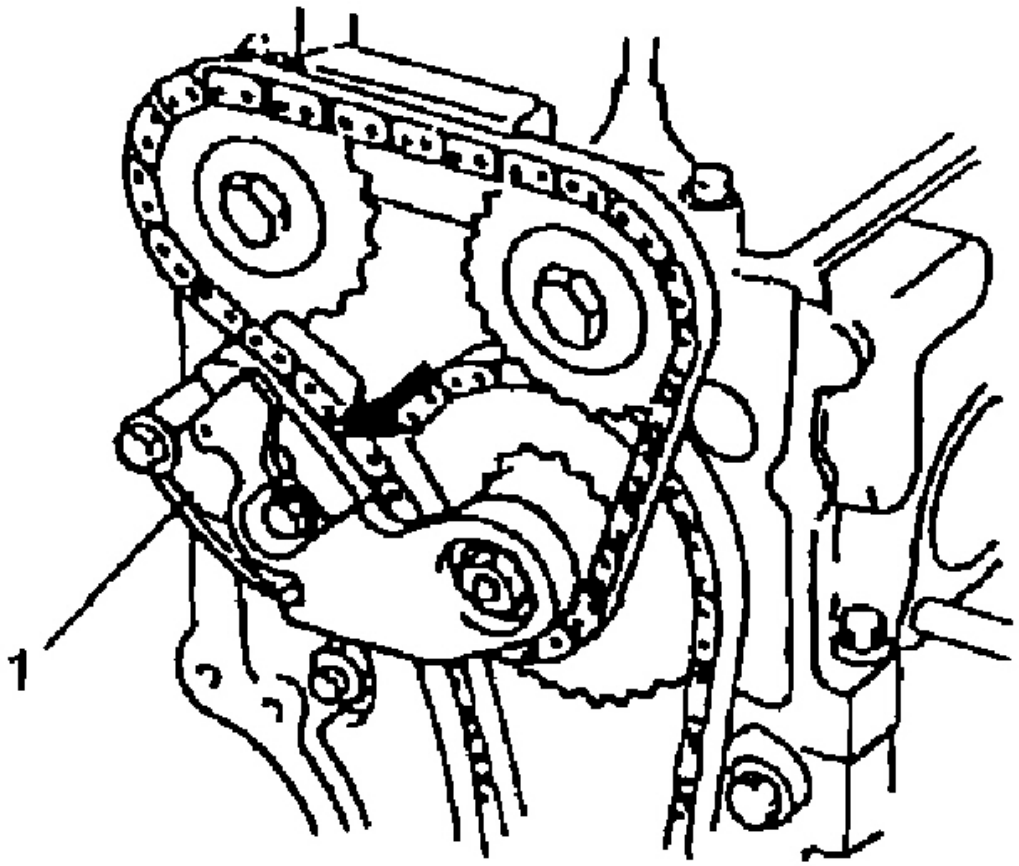


Fig. 67: Removing Timing Chain Tensioner Adjuster No.2 & Gasket
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove intake (1) and exhaust (2) camshaft timing sprocket bolts. To remove them, fit a spanner to hexagonal part (3) at the center of camshaft to hold it stationary.
8. Remove camshaft timing sprockets and 2nd timing chain (4).

CAUTION: After 2nd timing chain is removed, never turn intake camshaft, exhaust camshaft and crankshaft independently more than such an extent as shown. If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

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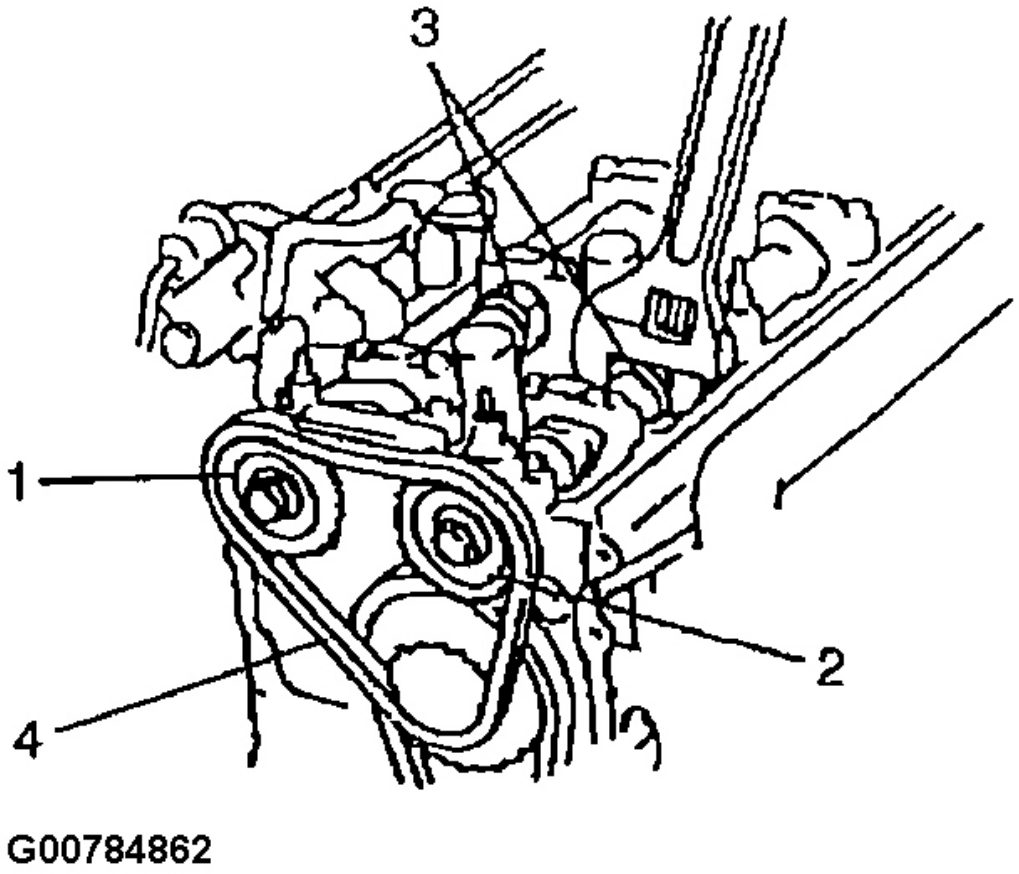
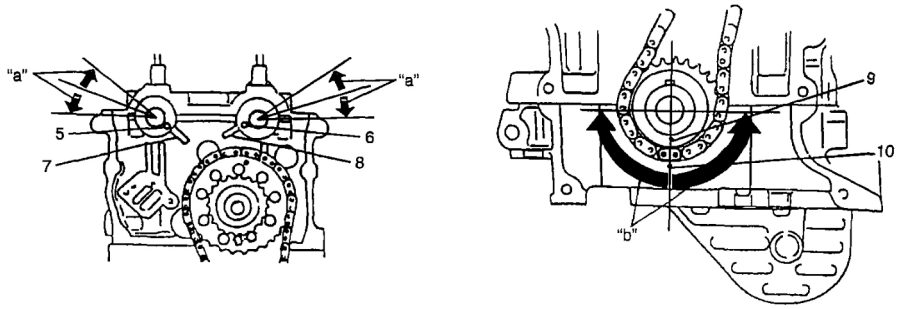


Fig. 68: Removing Camshaft Timing Sprockets & 2nd Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

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5. Knock pin of intake camshaft	9. Match mark on crank timing sprocket
6. Knock pin of exhaust camshaft	10. Timing mark on lower crankcase
7. Timing mark of intake side	"a": Camshafts (IN & EX) allowable turning range..... Within 20° on both right and left
8. Timing mark of exhaust side	"b": Crankshaft allowable turning range..... Within 90° on both right and left

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Fig. 69: Identifying Timing Markings
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Check that match mark (1) on crank timing sprocket is in match with timing mark (2) on lower crankcase as shown in figure.

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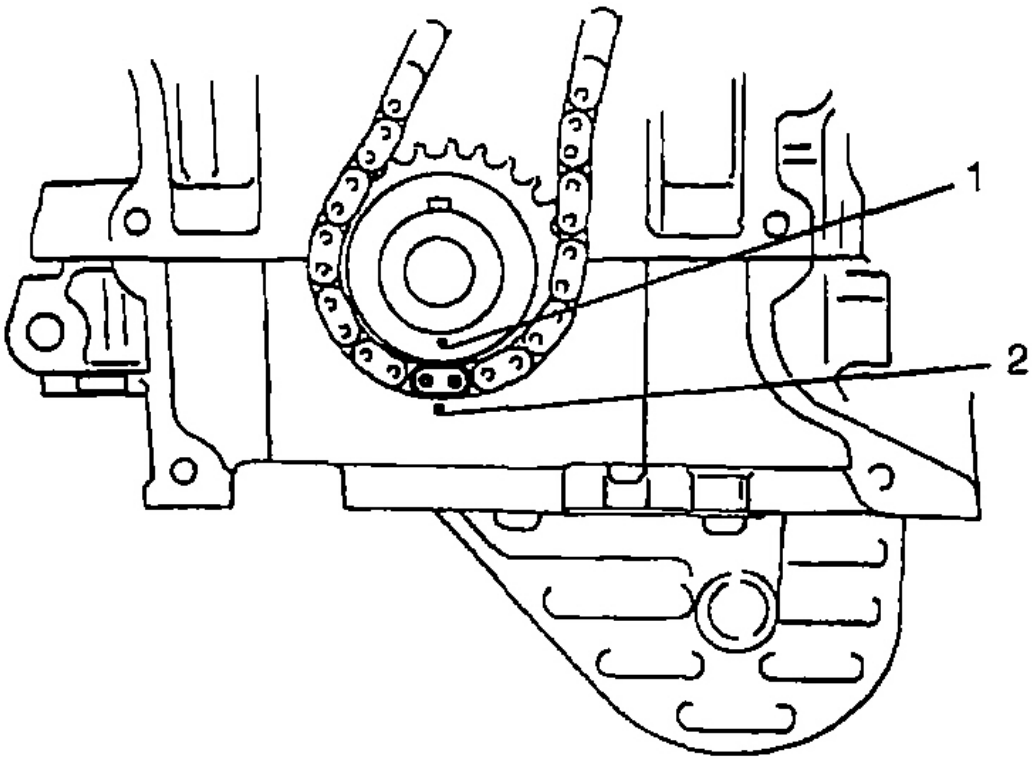


Fig. 70: Checking Match Mark On Crank Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

2. Check that arrow mark (1) on idler sprocket faces upward as shown in figure.
3. Check that knock pins of intake (2) and exhaust (3) camshafts are aligned with timing marks on cylinder head as shown in figure.

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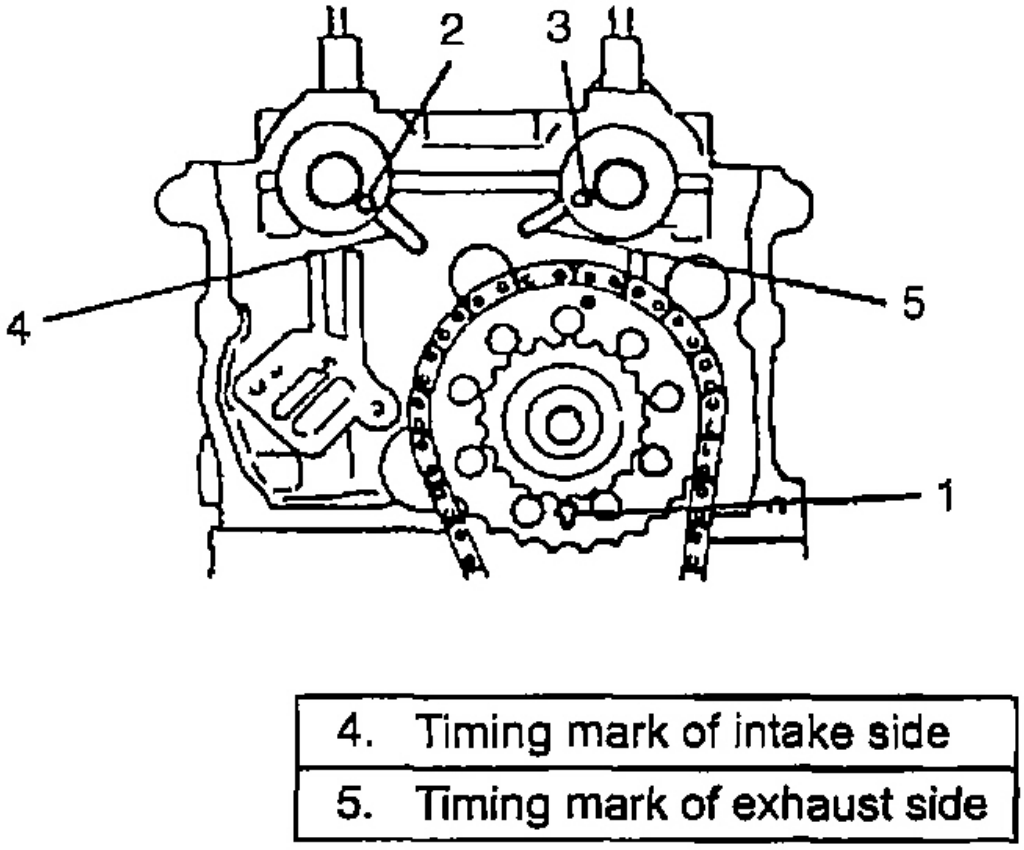
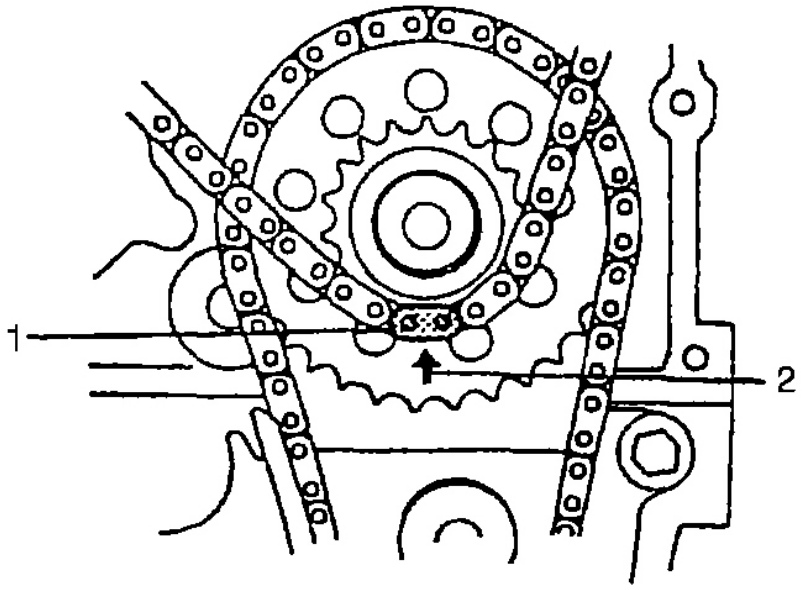


Fig. 71: Aligning Knock Pins Of Intake & Exhaust Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

4. Install 2nd timing chain by aligning yellow plate (1) of 2nd timing chain and match marks on idler sprocket.

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2. Match mark of 2nd timing chain (Arrow mark)

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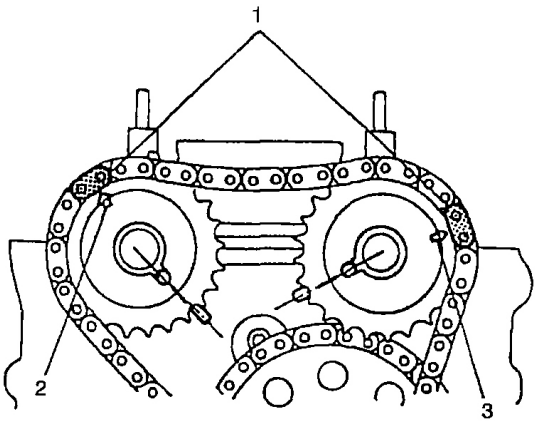
Fig. 72: Installing 2nd Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

5. Install sprockets to intake and exhaust camshafts by aligning dark blue plate of 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

CAUTION: Do not turn more than allowable turning range.
If turned excessively, valve and piston may get damaged.

NOTE: As an arrow mark is provided on both sides, camshaft timing sprocket has no specific installation direction.

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1. Dark blue	3. Arrow mark on exhaust camshaft timing sprocket
2. Arrow mark on intake camshaft timing sprocket	

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Fig. 73: Installing Sprockets To Intake & Exhaust Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

6. Install intake (1) and exhaust (2) camshaft timing sprocket bolts. To install it, fit a spanner to hexagonal part (3) at the center of camshaft to hold it stationary.

Tightening torque

Camshaft timing sprocket bolt (a): 80 N.m (8.0 kg-m, 57.5 lb-ft)

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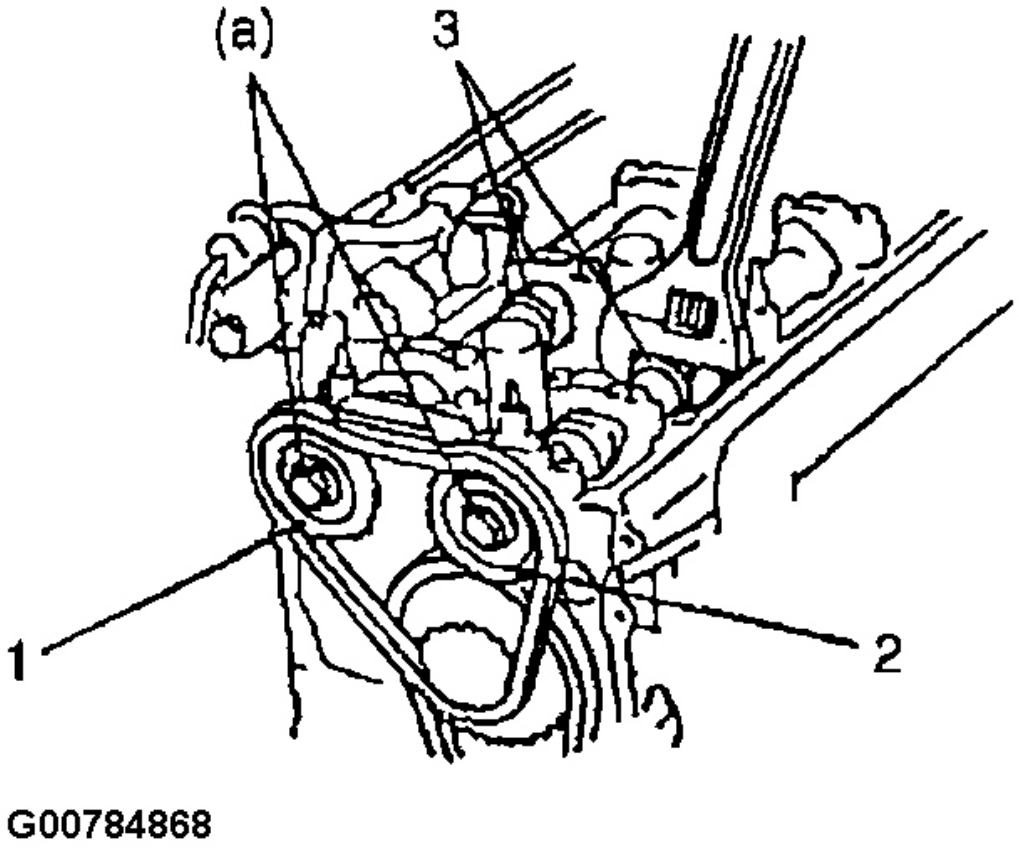


Fig. 74: Installing Intake & Exhaust Camshaft Timing Sprocket Bolts
Courtesy of SUZUKI OF AMERICA CORP.

7. Push back plunger (1) into tensioner body (2) and hold it at the position by inserting stopper (3) into body.

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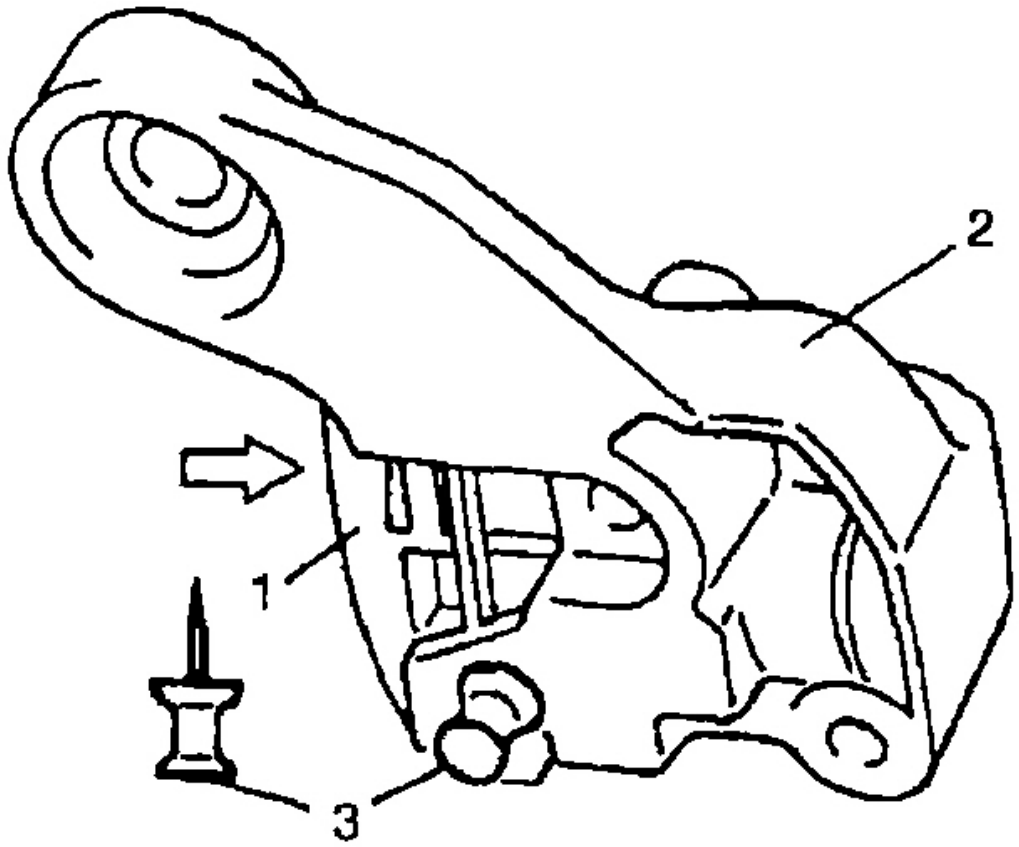


Fig. 75: Pushing Back Plunger Into Tensioner Body
Courtesy of SUZUKI OF AMERICA CORP.

8. Install timing chain tensioner adjuster No.2 (1) with new gasket.

   Tightening torque

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

   Timing chain tensioner adjuster No.2 nut (b): 45 N.m (4.5 kg-m, 33.0 lb-ft)

9. Pull out stopper (2) from timing chain tensioner adjuster No.2.

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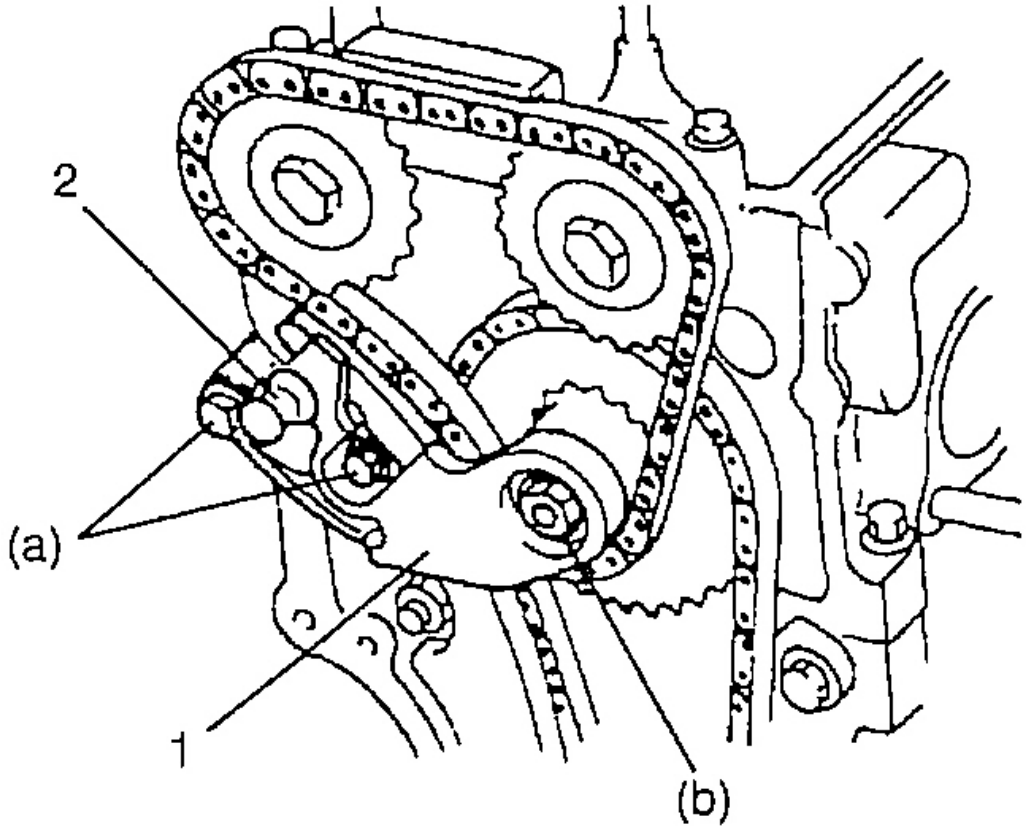
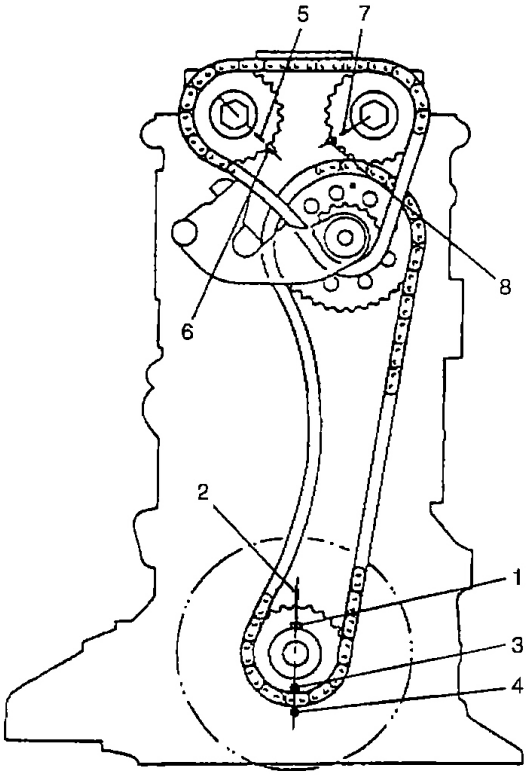


Fig. 76: Pulling Out Stopper From Timing Chain Tensioner Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

10. Turn crankshaft two rotations clockwise then align timing mark on crankshaft and timing mark on cylinder block as shown in figure.

    Check that timing marks of cylinder head and cylinder block are in match with match marks on sprockets respectively.

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1. Crankshaft timing sprocket key	5. Timing mark on intake camshaft timing sprocket
2. Timing mark of crank timing sprocket key	6. Timing mark of intake camshaft timing sprocket
3. Match mark on crank timing sprocket	7. Timing mark on exhaust camshaft timing sprocket
4. Timing mark on lower crankcase	8. Timing mark of exhaust camshaft timing sprocket

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Fig. 77: Aligning Timing Mark On Crankshaft & Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

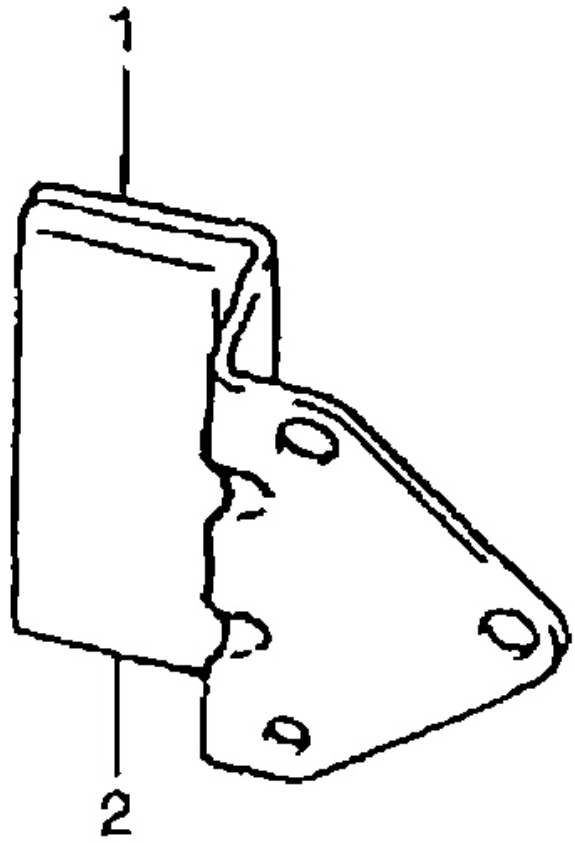
11. Apply oil to timing chains, tensioner, tensioner adjusters, sprockets, and guides.
12. Install timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
13. Install cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
14. Install oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
15. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation**.

2nd Timing Chain and Chain Tensioner Inspection

Timing Chain Guide No.2

Check shoe for wear or damage.

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1.	Timing chain guide No.2
2.	Shoe

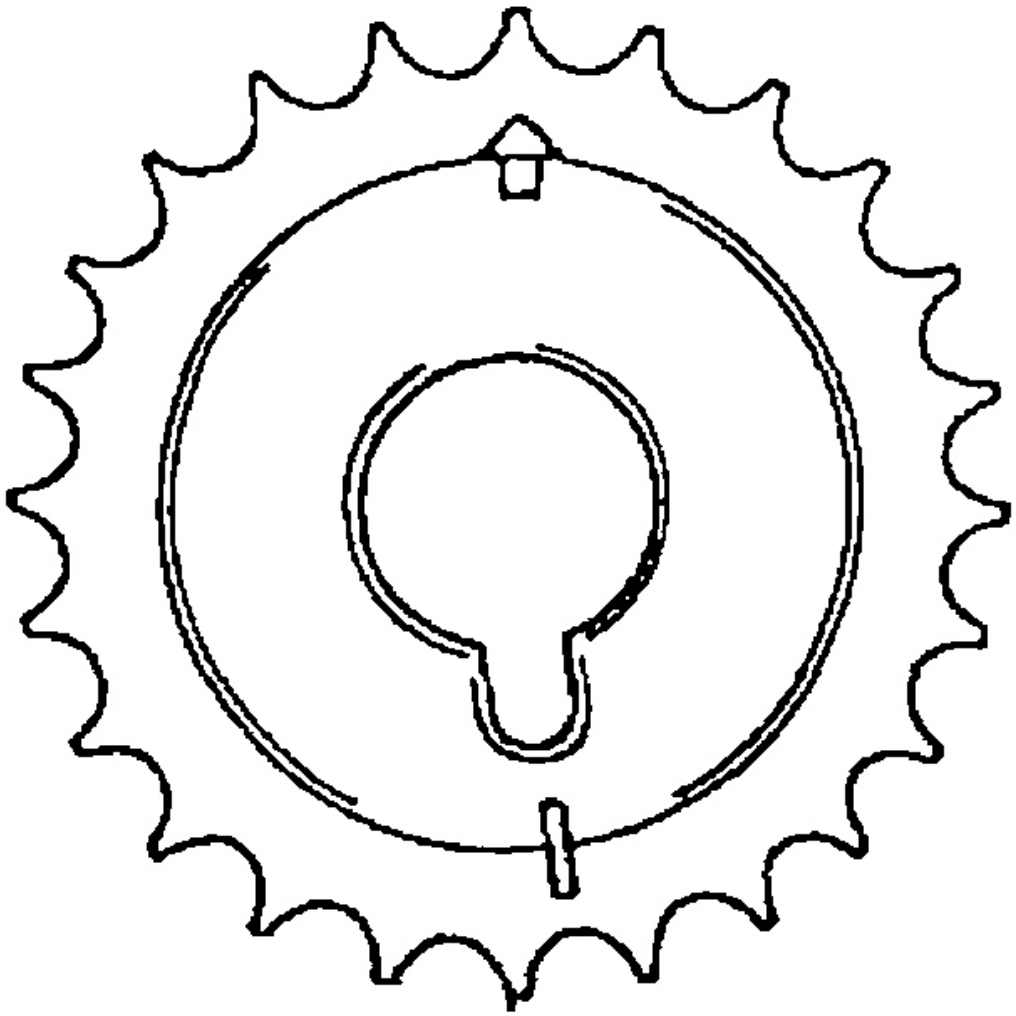
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Fig. 78: Inspecting Timing Chain Guide No.2 Shoe
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Sprocket

Check teeth of sprocket for wear or damage.

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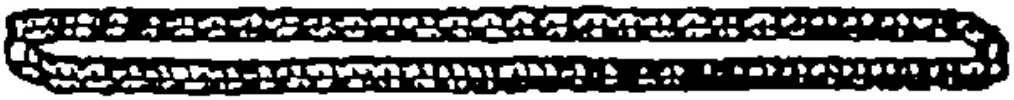
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Fig. 79: Inspecting Teeth Of Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain

Check timing chain for wear or damage.

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Fig. 80: Inspecting Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

Tensioner Adjuster No.2

Check shoe (1) for wear or damage and latch functions properly.

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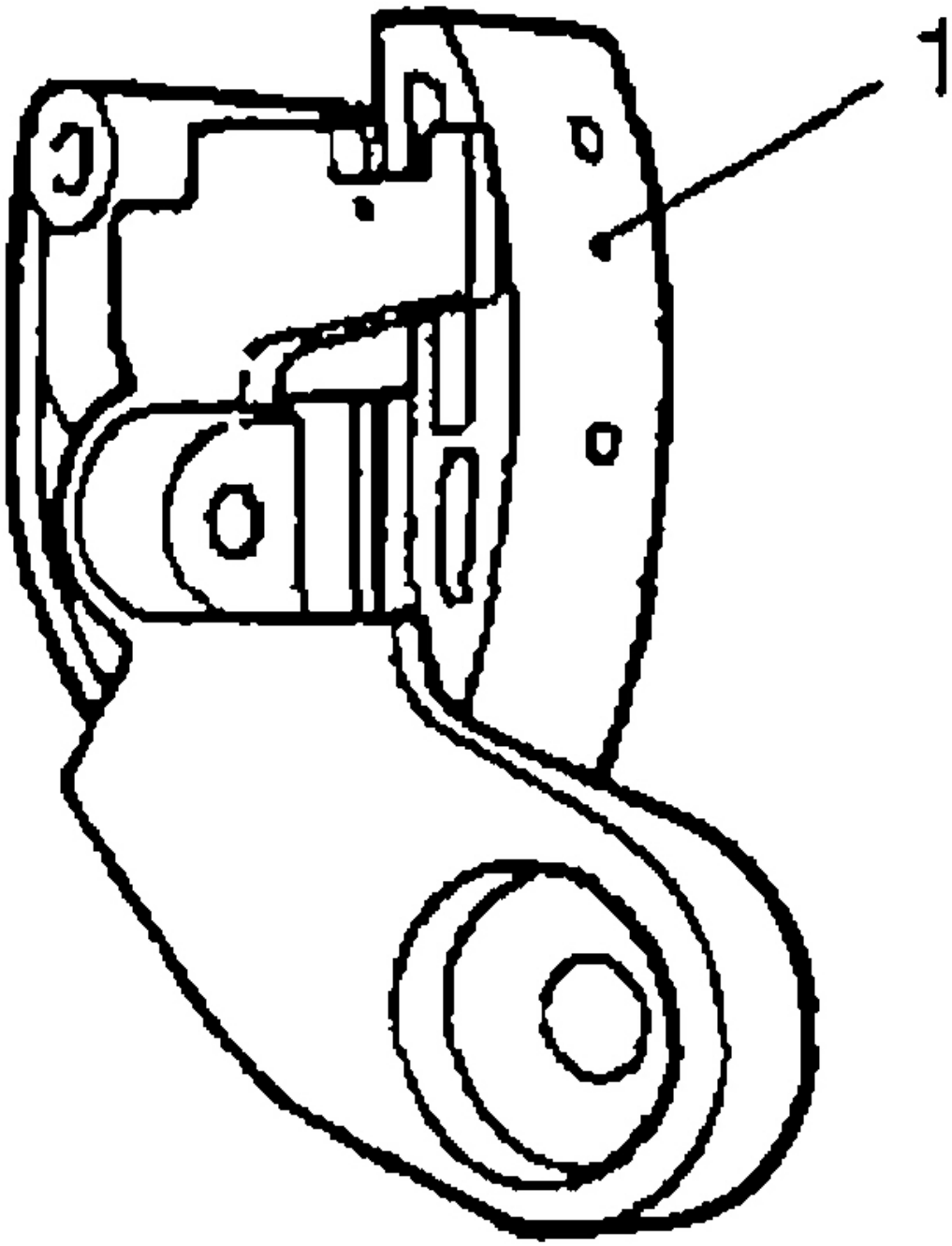
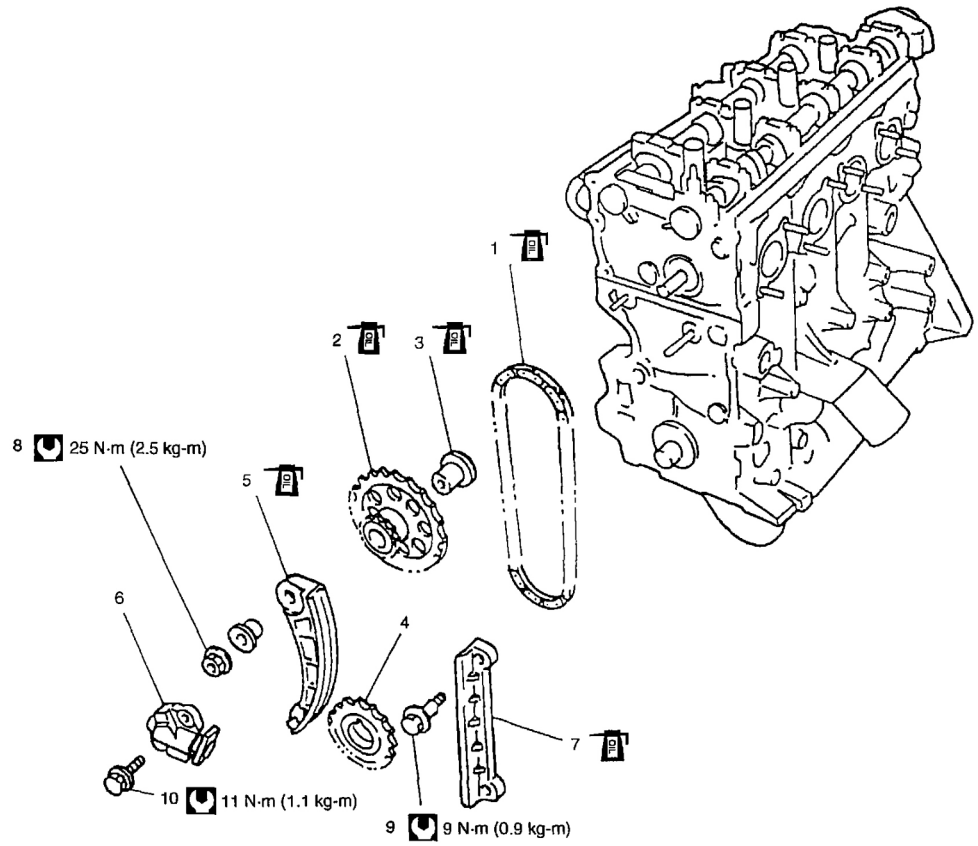


Fig. 81: Inspecting Tensioner Adjuster No.2 Shoe & Latch Functions
Courtesy of SUZUKI OF AMERICA CORP.

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1st Timing Chain and Chain Tensioner Components



1. 1st timing chain	5. Timing chain tensioner	9. Timing chain guide No.1 bolt
2. Idler sprocket	6. Timing chain tensioner adjuster No.1	10. Timing chain tensioner adjuster No.1 bolt
3. Idler sprocket shaft	7. Timing chain guide No.1	: Tightening torque
4. Crankshaft timing sprocket	8. Timing chain tensioner nut	: Apply engine oil to sliding surface.

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

1st Timing Chain and Chain Tensioner Removal and Installation

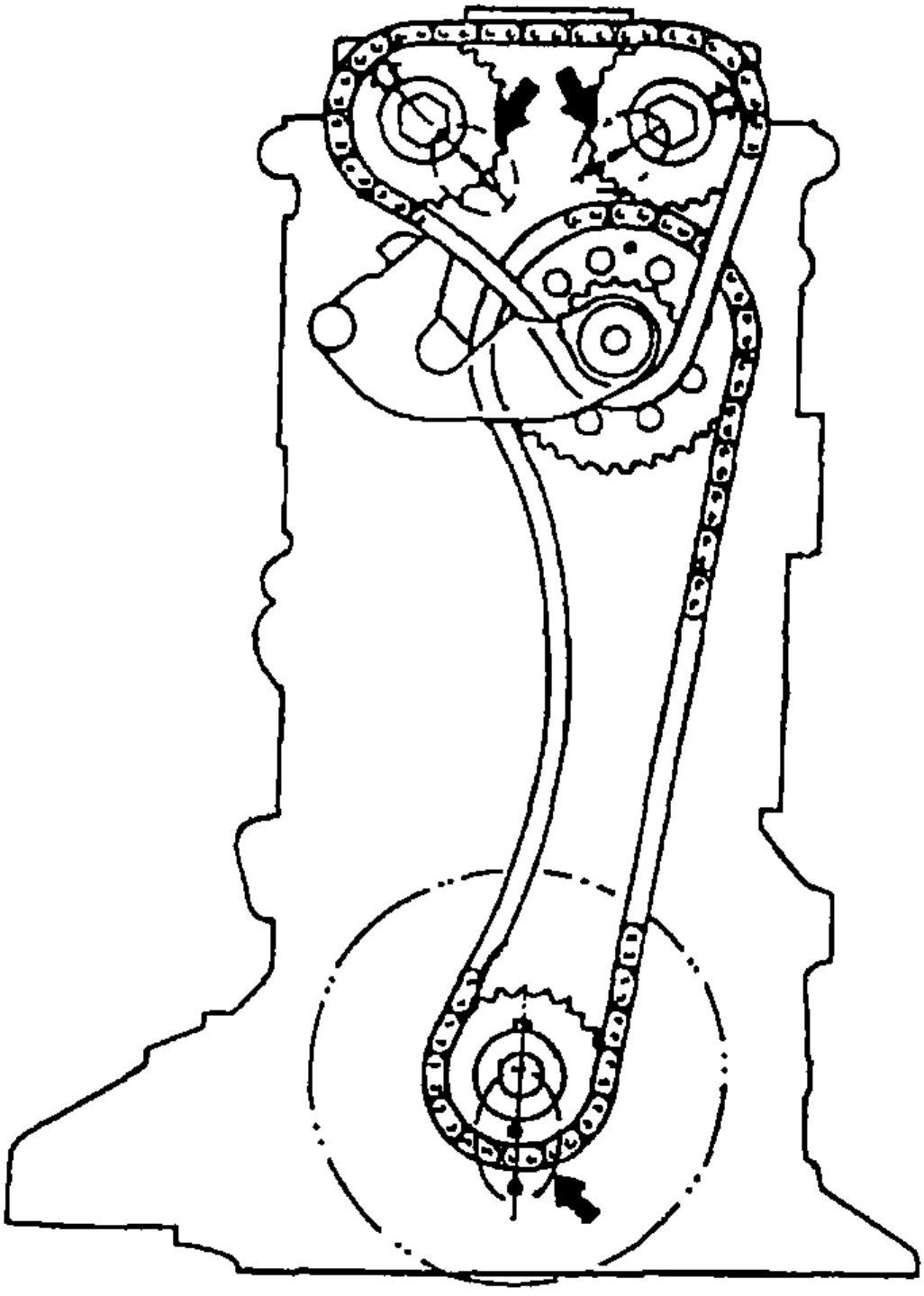
Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
3. Remove cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
4. Remove timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
5. For reinstallation of timing chain, turn crankshaft so that timing marks on cylinder head and lower crankcase match with those on sprockets as shown in figure.
6. Remove 2nd timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and**

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Installation.

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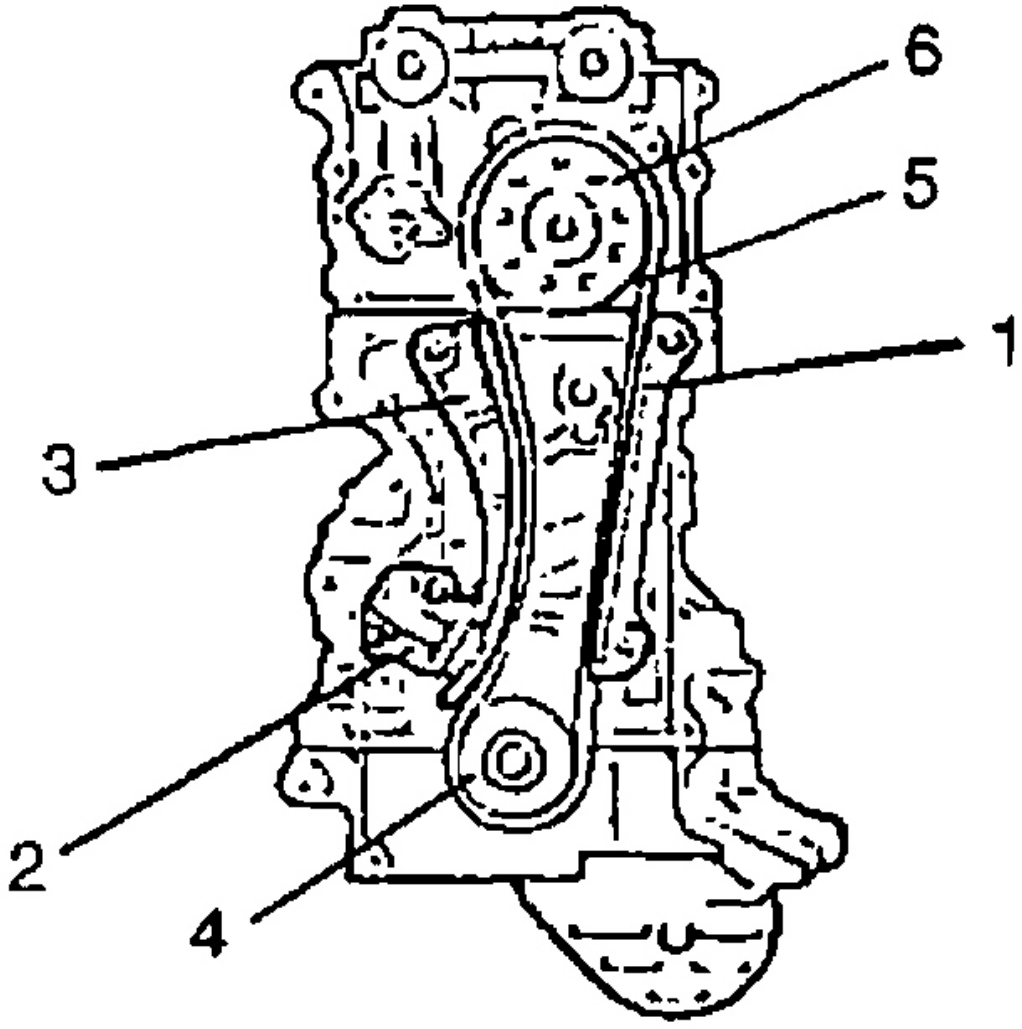


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Fig. 83: Removing 2nd Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove timing chain guide No.1 (1).
8. Remove timing chain tensioner adjuster No.1 (2).
9. Remove timing chain tensioner (3).
10. Remove idler sprocket (4) and 1st timing chain (5).
11. Remove crankshaft timing sprocket (6).



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Fig. 84: Identifying Timing Chain Removal Components
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Check that match mark (1) on crankshaft timing sprocket is in match with timing mark (2) on lower crankcase.

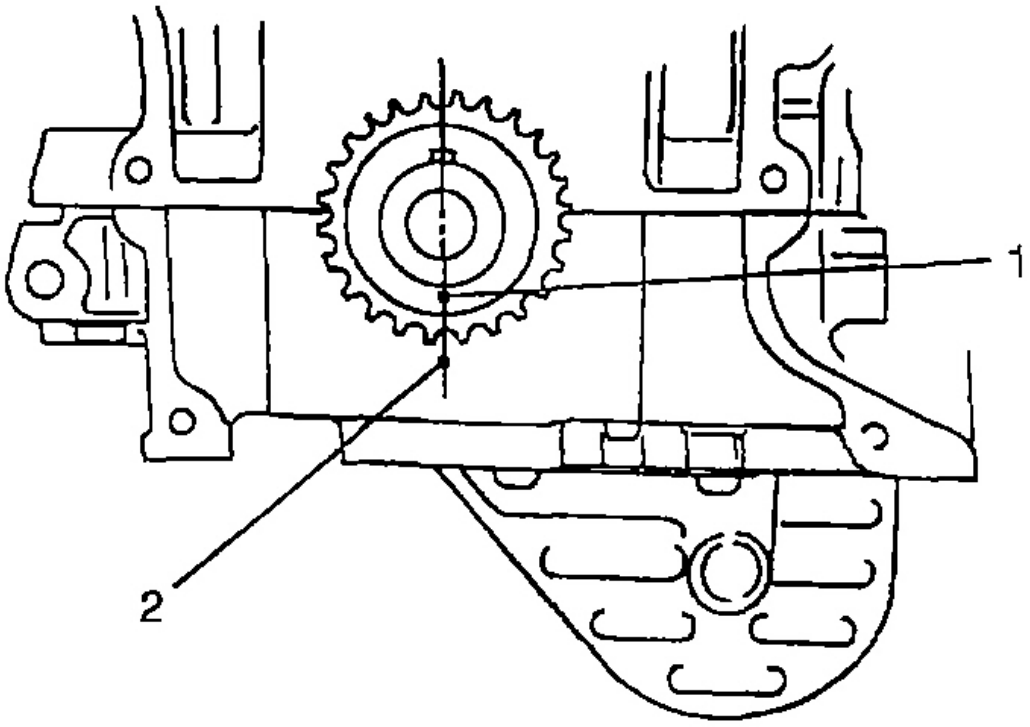
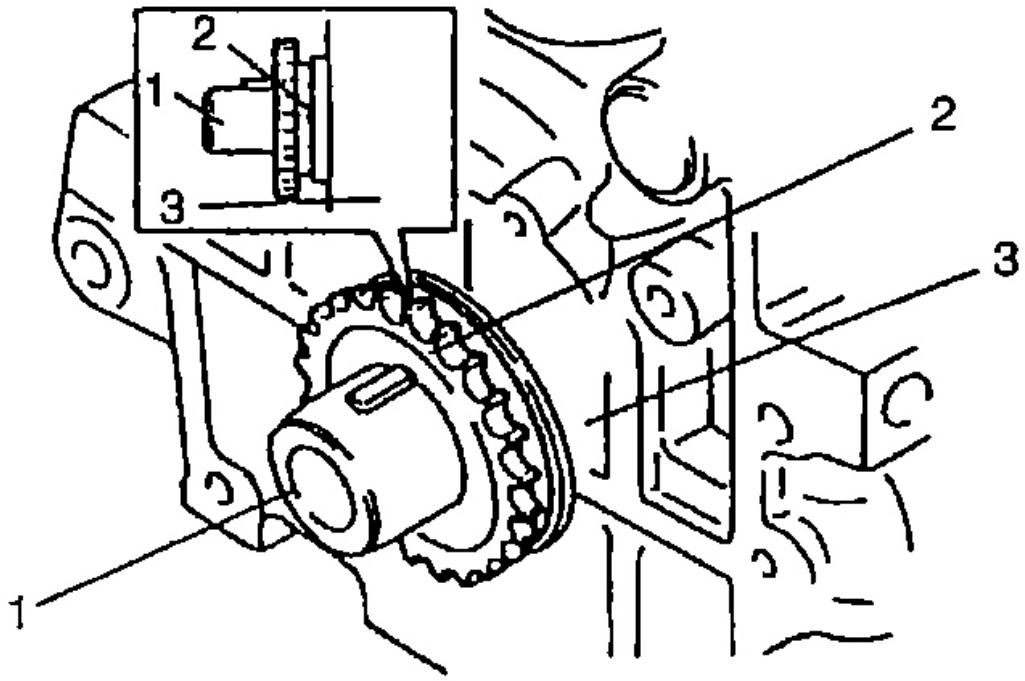


Fig. 85: Checking Match Mark On Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

2. Install crankshaft timing sprocket (2) as shown in figure.

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1.	Crankshaft
3.	Cylinder block

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Fig. 86: Installing Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

3. Apply oil to bush of idler sprocket (1).
4. Install idler sprocket and sprocket shaft.
5. Install 1st timing chain by aligning Dark Blue plate (4) of 1st timing chain (3) and match mark (2) on idler sprocket (1).

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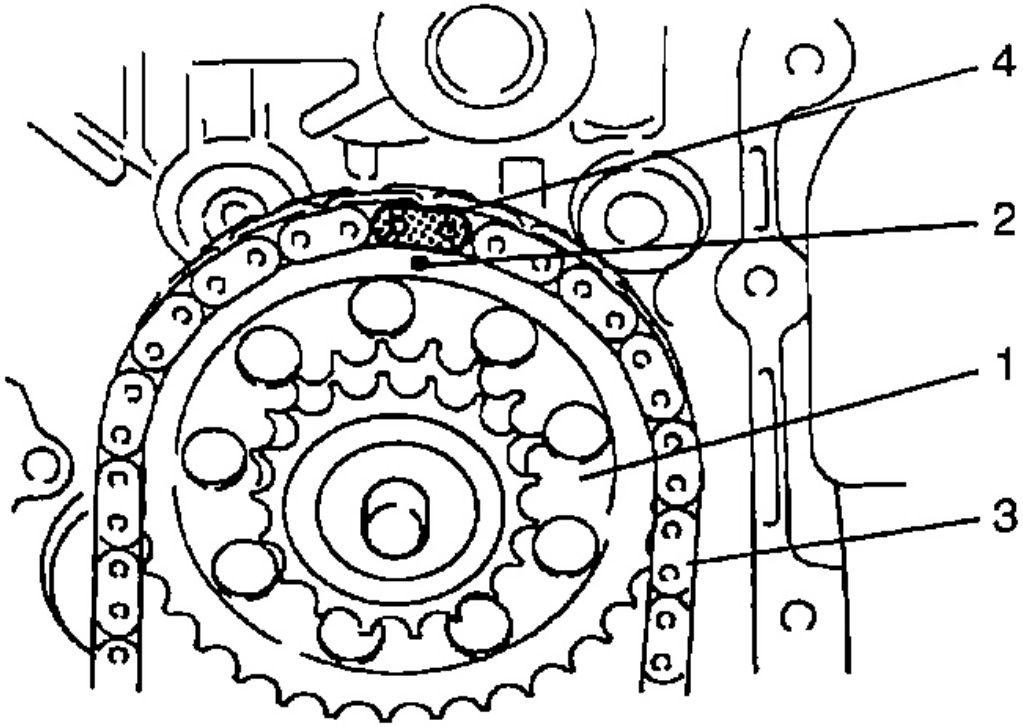
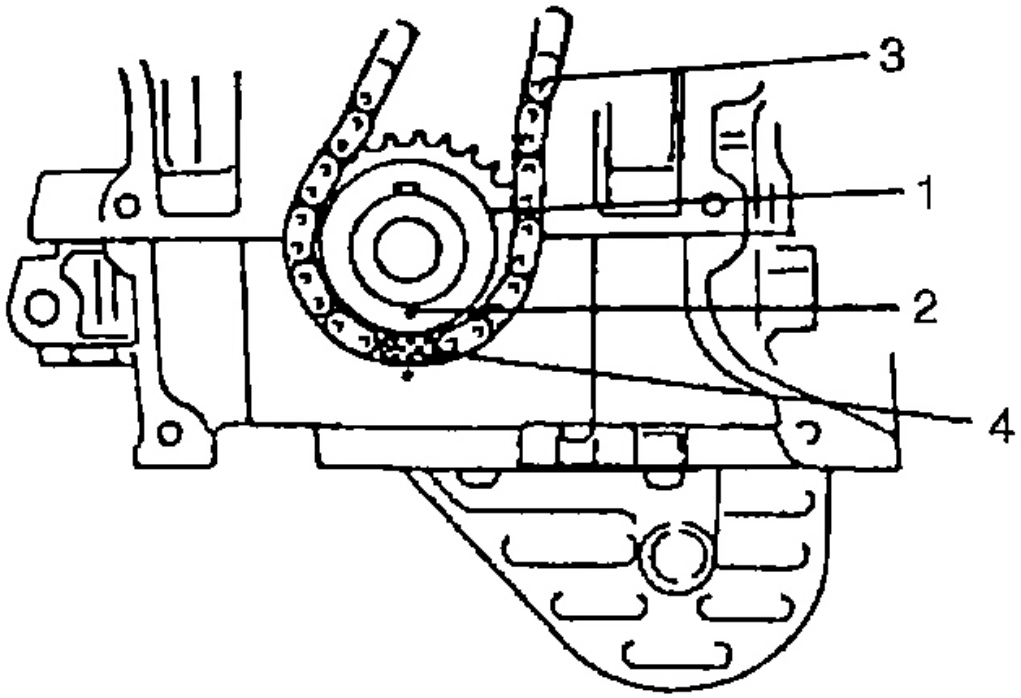


Fig. 87: Installing 1st Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

6. Bring Yellow plate (4) of 1st timing chain (3) into match with match mark (2) on crankshaft timing sprocket (1).

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Fig. 88: Aligning 1st Timing Chain With Crankshaft Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

7. Apply engine oil to sliding surface of timing chain tensioner (1) and then install it as shown in figure. Tighten tensioner nut to specified torque.

Tightening torque

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

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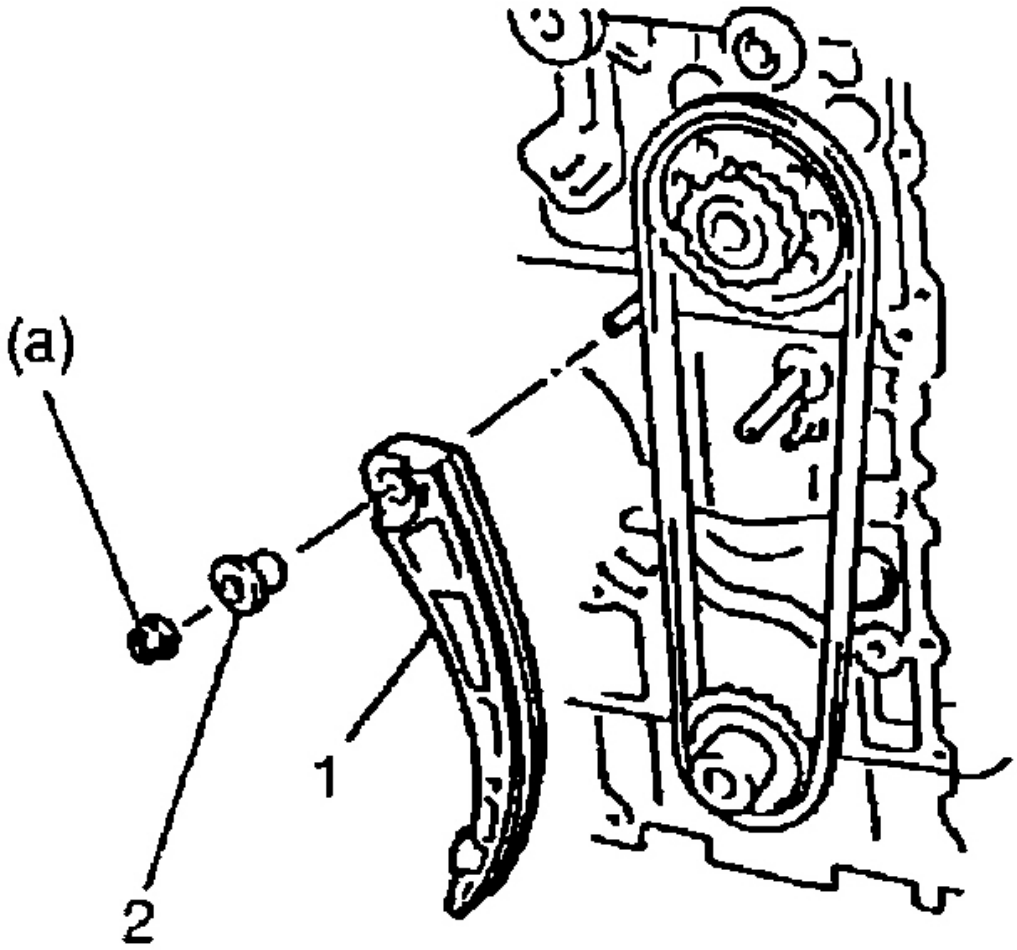
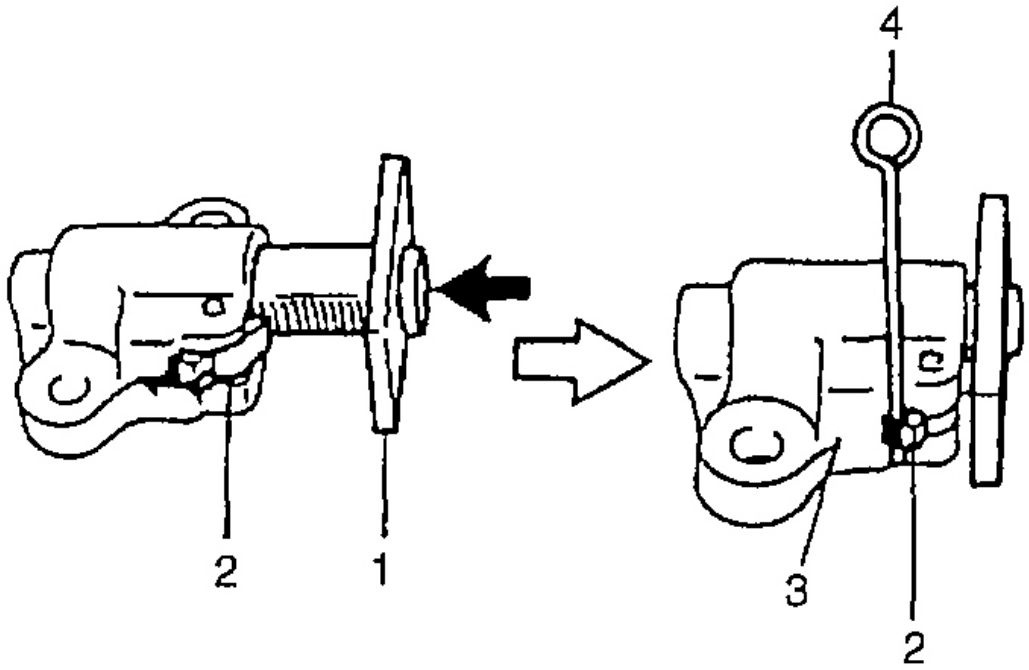


Fig. 89: Installing Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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Fig. 90: Inserting Stopper Into Latch And Body
Courtesy of SUZUKI OF AMERICA CORP.

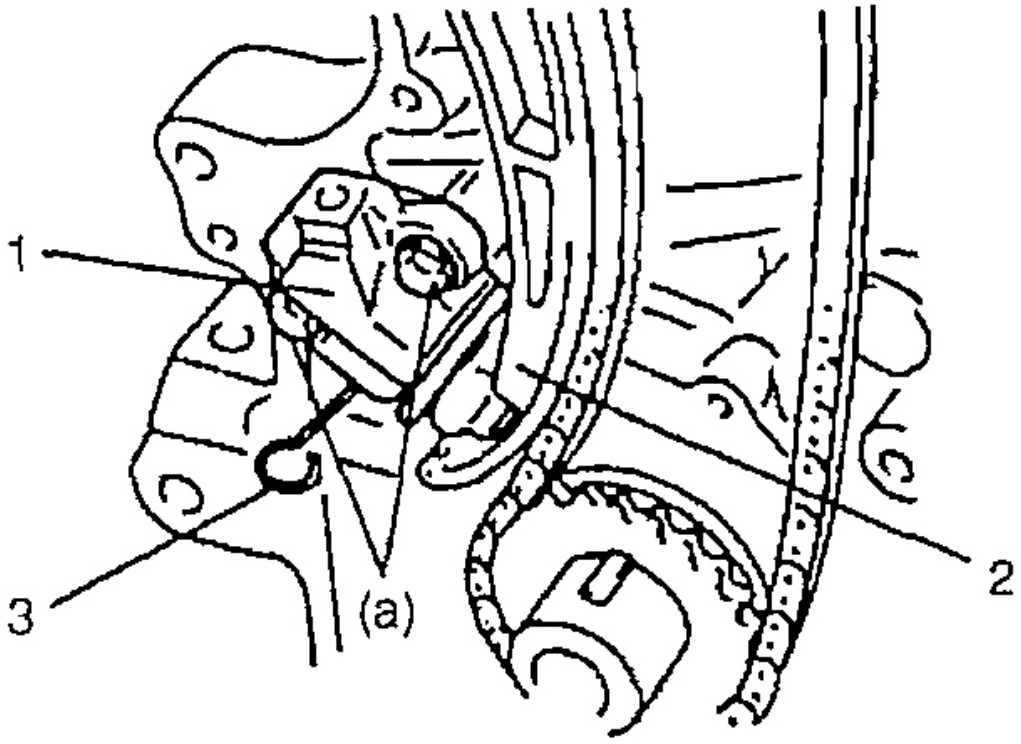
9. Install timing chain tensioner (2) adjuster No.1 (1).

   Tightening torque

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

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

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Fig. 91: Pulling Out Stopper
Courtesy of SUZUKI OF AMERICA CORP.

11. Apply engine oil to sliding surface of timing chain guide No.1 (1) and then install it.

    Tighten guide bolts to specified torque.

    Tightening torque

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

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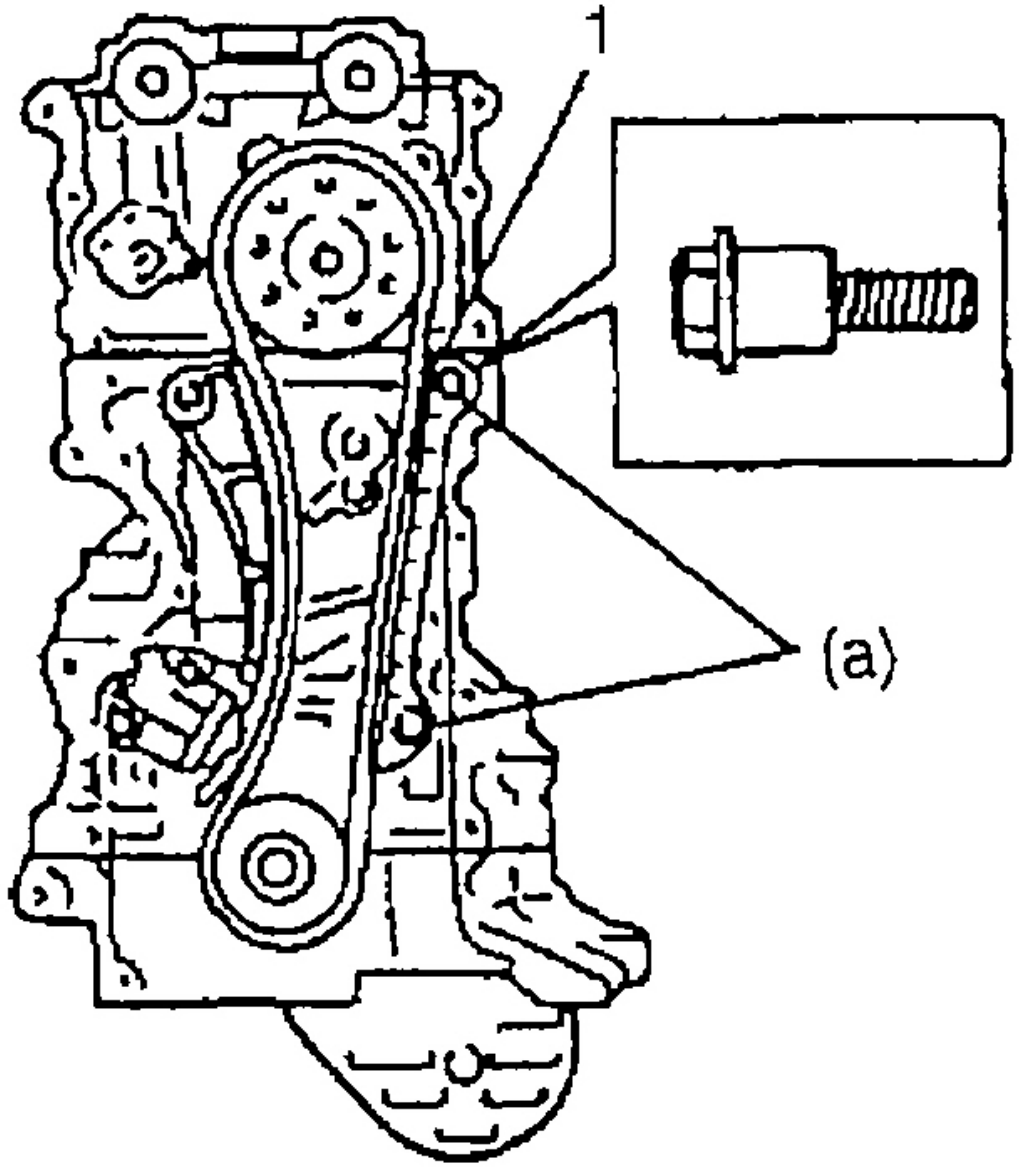
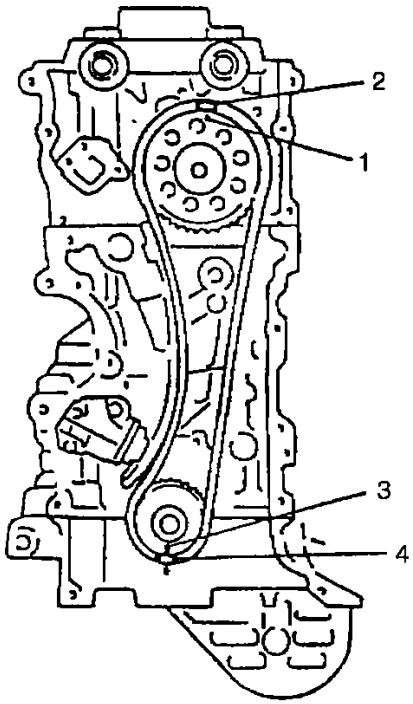


Fig. 92: Installing Timing Chain Guide No.1
Courtesy of SUZUKI OF AMERICA CORP.

12. Check that Dark Blue and Yellow plates of 1st timing chain are in match with match marks on sprockets respectively.

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1. Match mark on idler sprocket	3. Match mark on crank timing sprocket
2. Dark blue plate	4. Yellow plate

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Fig. 93: Identifying Sprocket Match Marks
Courtesy of SUZUKI OF AMERICA CORP.

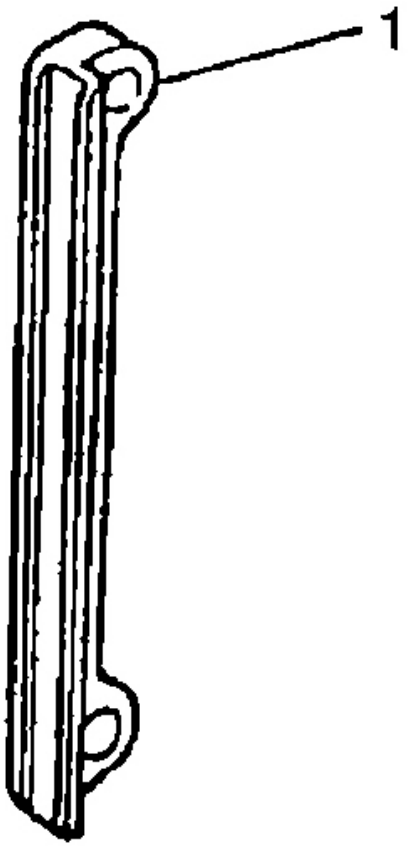
13. Install 2nd timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and Installation**.
14. Install timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
15. Install cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
16. Install oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
17. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation**.

1st Timing Chain and Chain Tensioner Inspection

Timing Chain Guide No.1

Check shoe for wear or damage.

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1. Timing chain guide No.1

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Fig. 94: Inspecting Timing Chain Guide No.1 Shoe
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Timing Chain Tensioner

Check shoe (1) for wear or damage.

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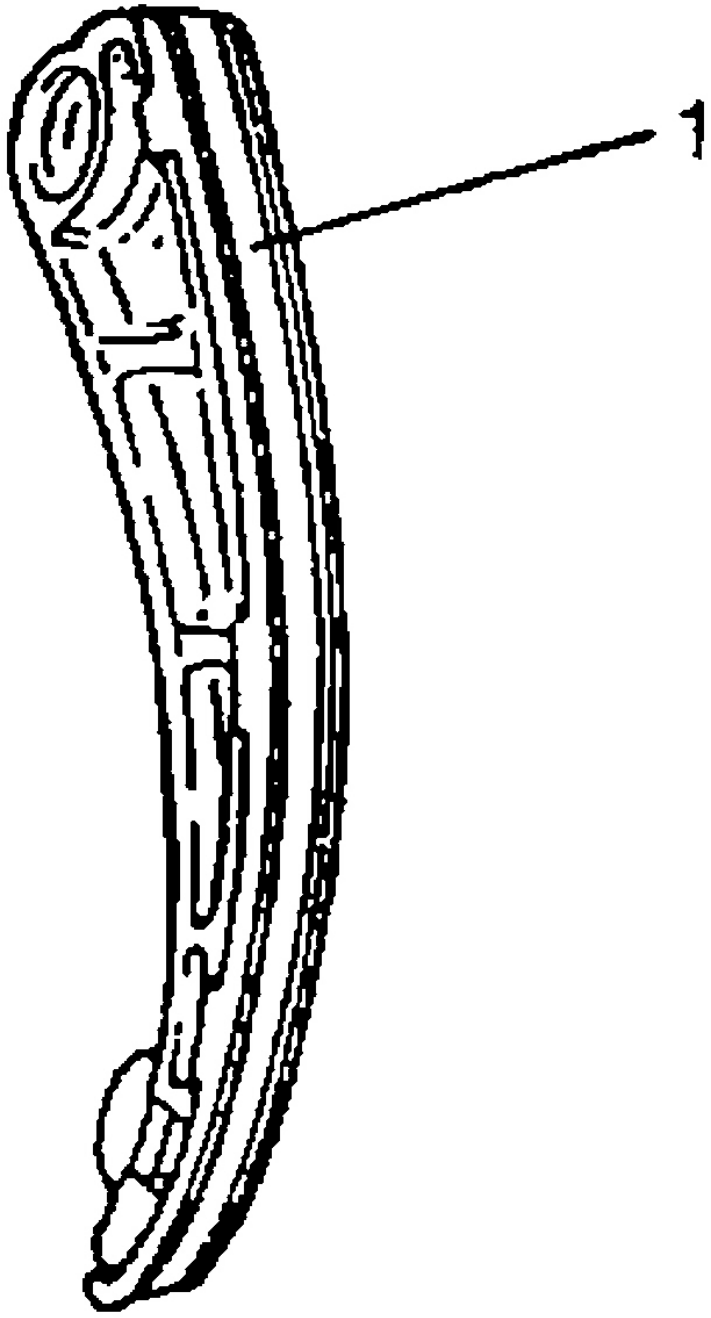


Fig. 95: Inspecting Timing Chain Tensioner Shoe
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Timing Sprocket

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Check teeth of sprocket for wear or damage.

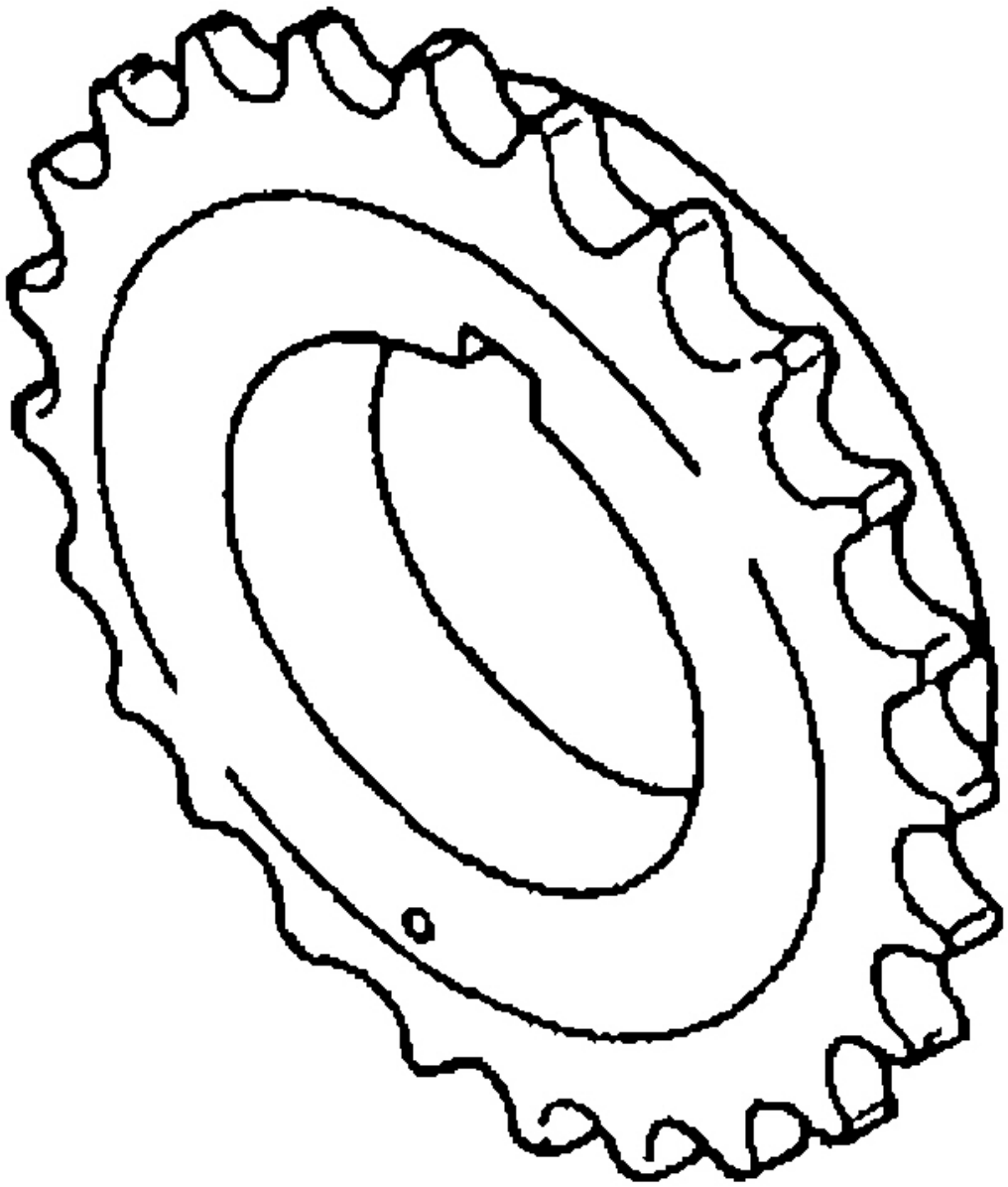


Fig. 96: Inspecting Crankshaft Timing Sprocket Teeth
Courtesy of SUZUKI OF AMERICA CORP.

Idler Sprocket

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Check teeth and bush (1) of sprocket for wear or damage.

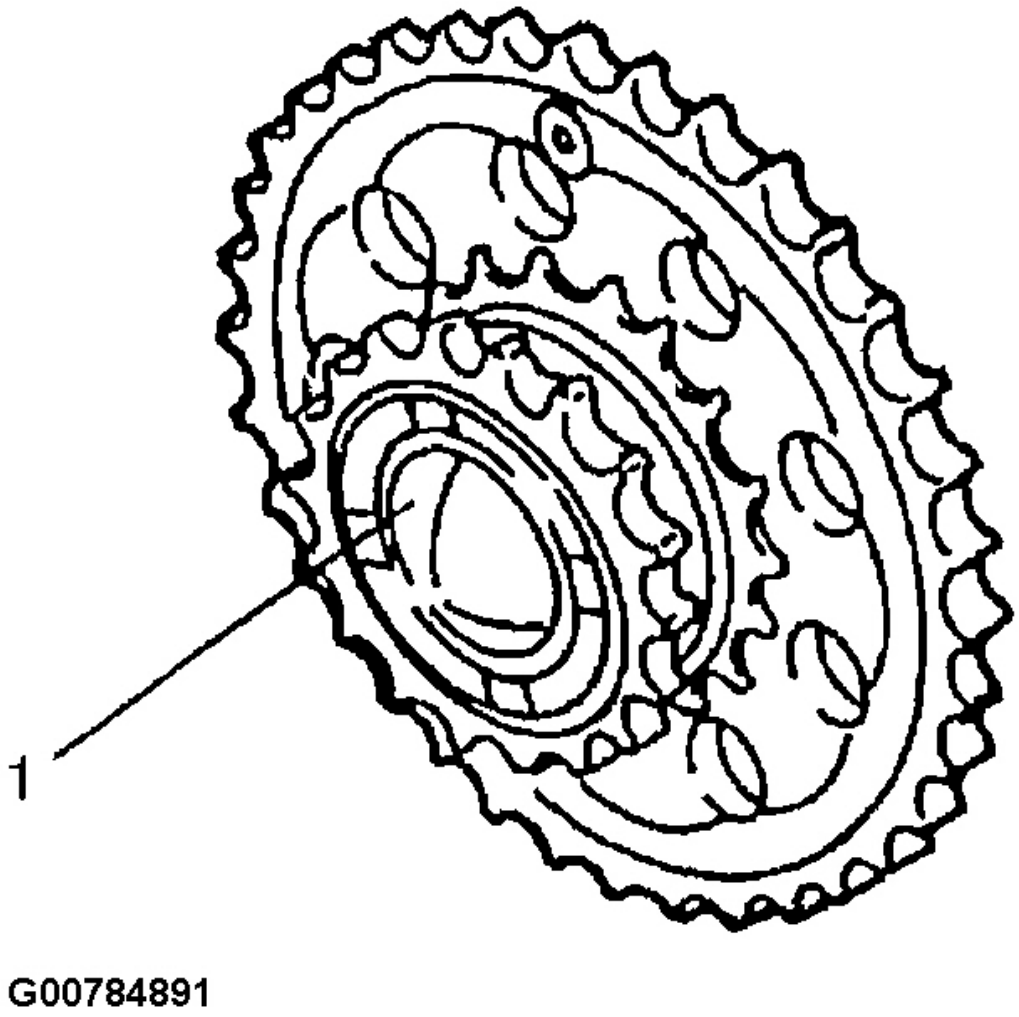
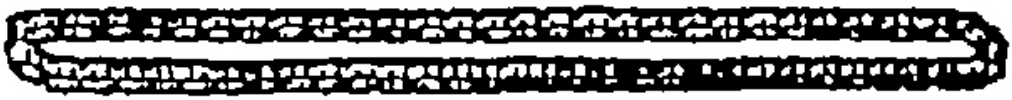


Fig. 97: Inspecting Idler Sprocket Teeth & Bush
Courtesy of SUZUKI OF AMERICA CORP.

1st Timing Chain

Check timing chain for wear or damage.

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Fig. 98: Inspecting Timing Chain
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Timing Chain Tensioner Adjuster No.1

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

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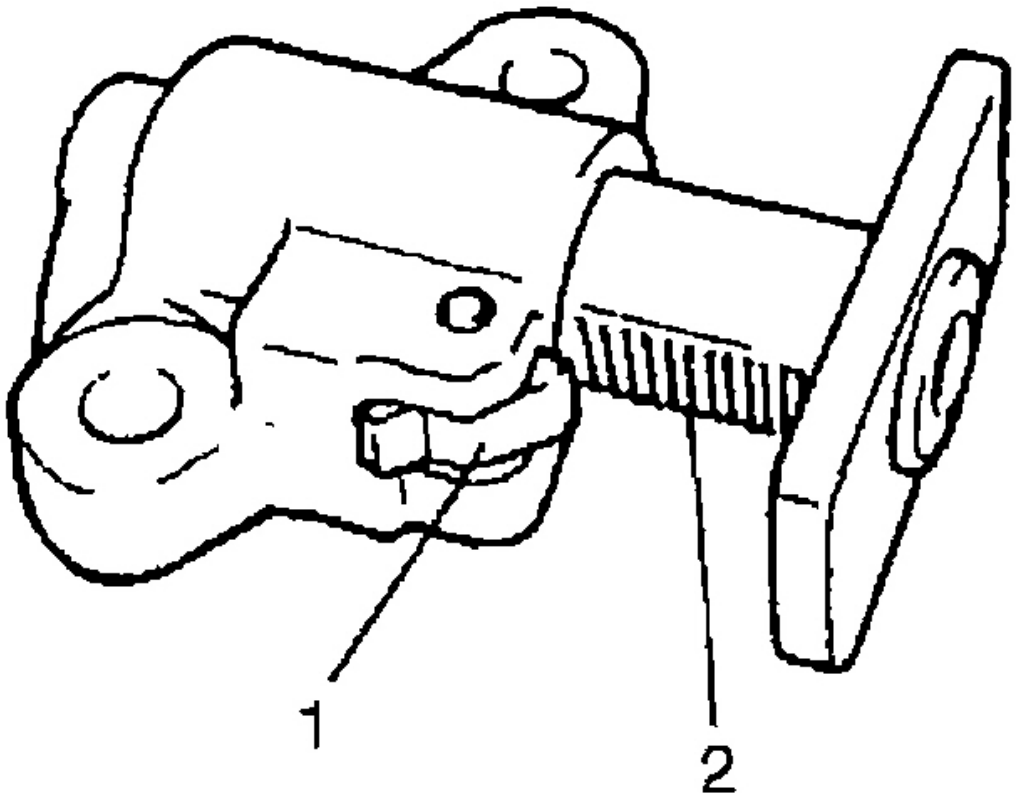
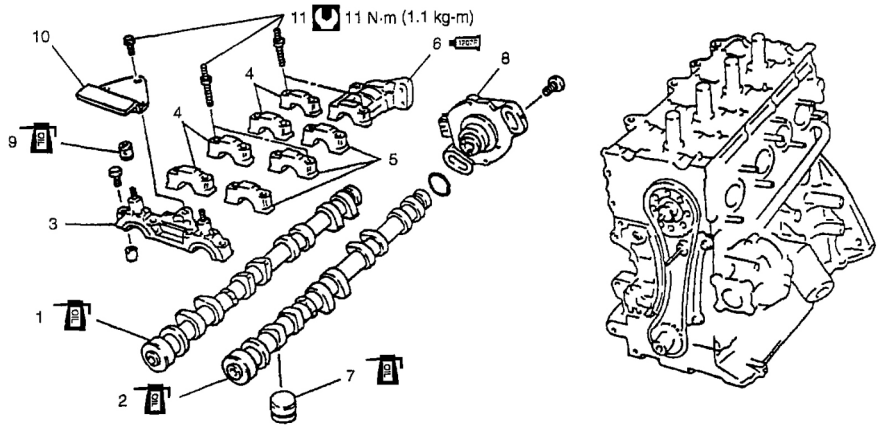


Fig. 99: Inspecting Timing Chain Tensioner Adjuster No.1 Latch & Tooth Surface
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Camshafts and Valve Lash Adjusters Components

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1. Intake camshaft	6. Exhaust camshaft end housing :See "A"	11. Camshaft housing bolt
2. Exhaust camshaft	7. Valve lash adjuster	: Tightening torque
3. Camshaft housing	8. CMP sensor	: Apply engine oil to sliding surface of each part
4. Intake camshaft housing	9. Oil relief valve	
5. Exhaust camshaft housing	10. Timing chain guide No.2	
"A": Apply sealant 1207F to the mating surface between exhaust camshaft end housing and cylinder head referring to the figure of Step 6) in "Camshafts and Valve Lash Adjusters Removal and installation: ".		

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Fig. 100: Identifying Camshafts & Valve Lash Adjusters Components
Courtesy of SUZUKI OF AMERICA CORP.

Camshafts and Valve Lash Adjusters Removal and installation

Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
3. Remove cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
4. Remove timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
5. Remove 2nd timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and Installation**.
6. Remove CMP sensor. Refer to CMP (Camshaft Position) Sensor Removal and Installation .
7. To secure work in the following steps, reinstall mounting member, engine front torque bush, rear mounting and rear mounting No.2 bracket.
8. Set key on crankshaft in position as shown by turning crankshaft. This is to prevent interference between valves and piston.

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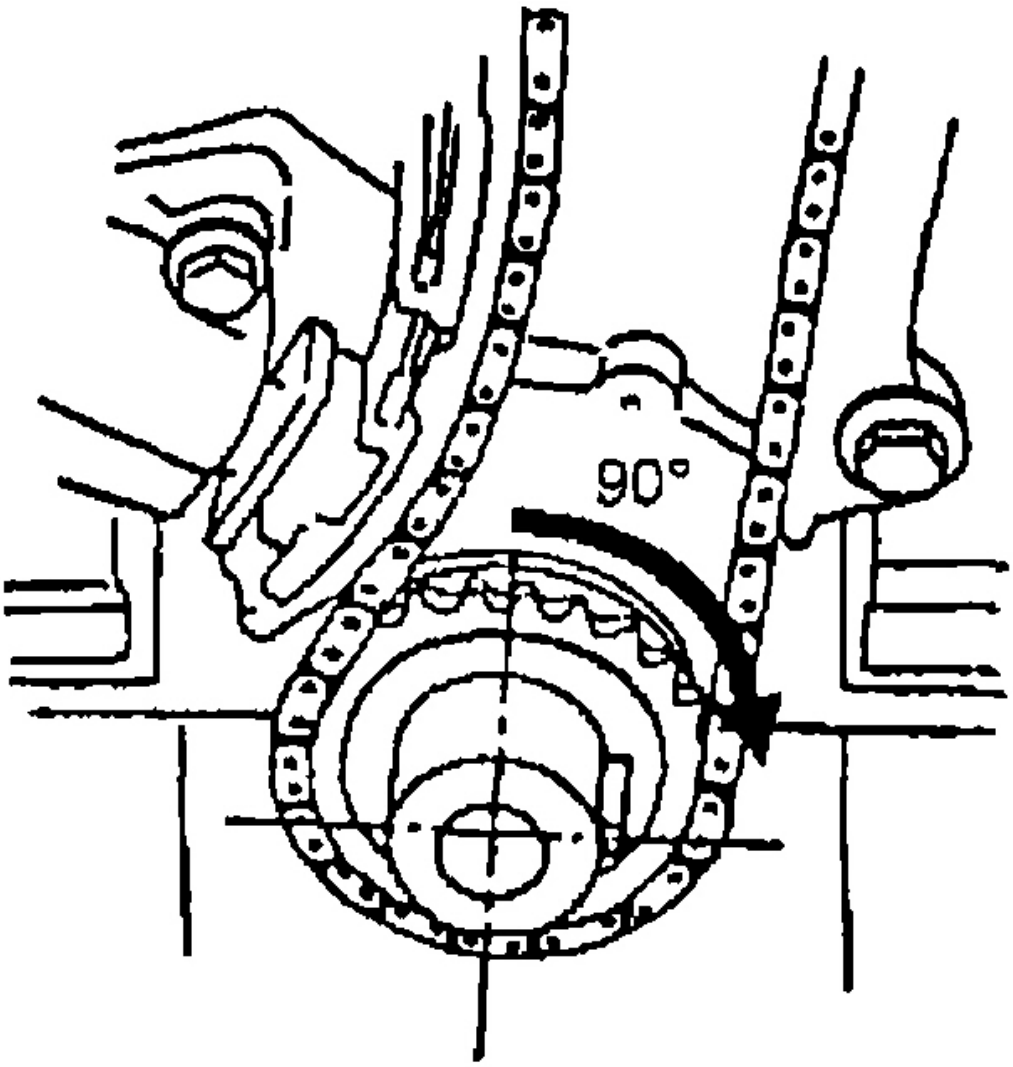


Fig. 101: Setting Key On Crankshaft In Position
Courtesy of SUZUKI OF AMERICA CORP.

9. Loosen camshaft housing bolts in such order as indicated in figure and remove them.

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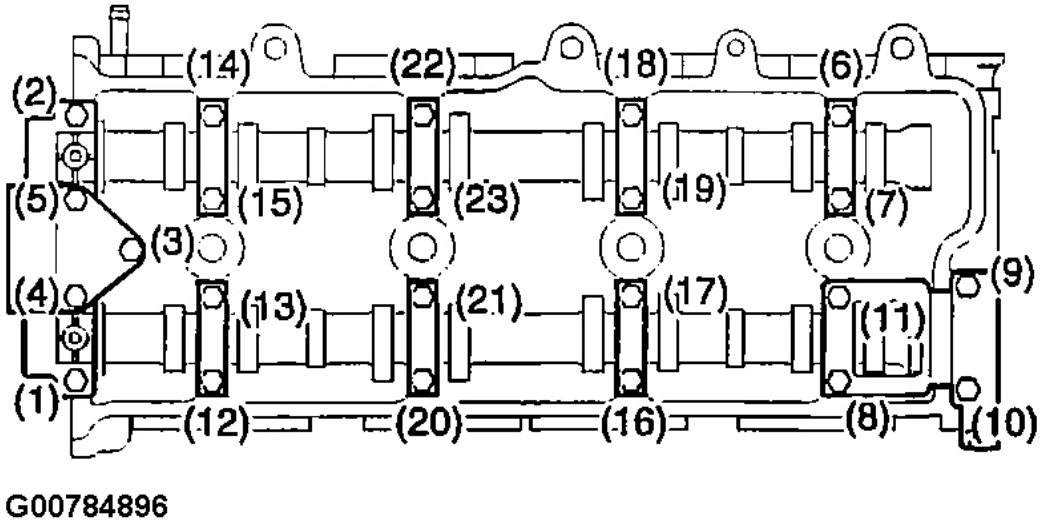


Fig. 102: Identifying Camshaft Housing Bolt Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove camshaft housings.
11. Remove camshafts.
12. Remove valve lash adjusters (2).

NOTE:

- **Never disassemble hydraulic valve lash adjuster.**
- **Don't apply force (1) to body of adjuster, oil in high pressure chamber in adjuster will leak.**

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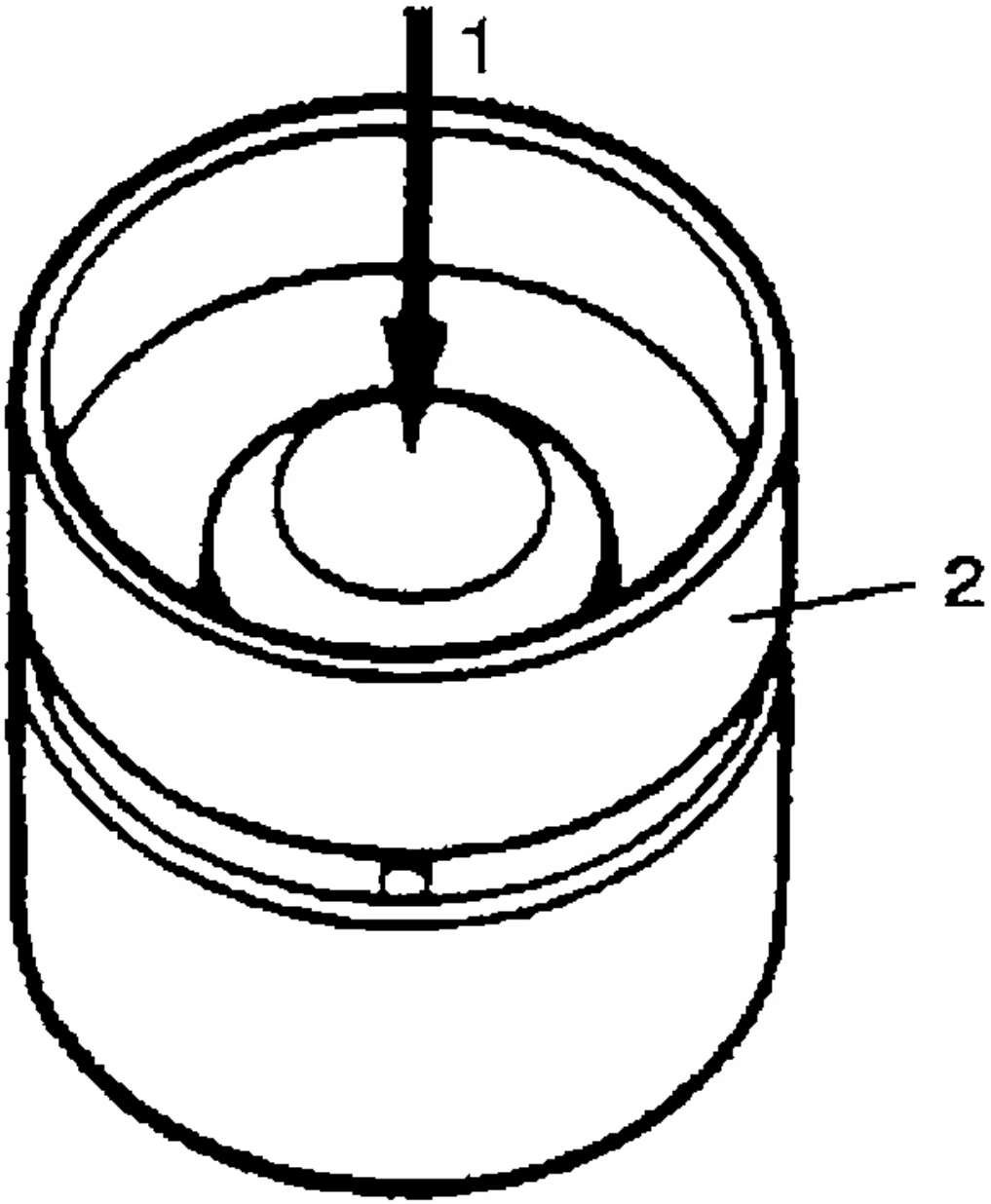
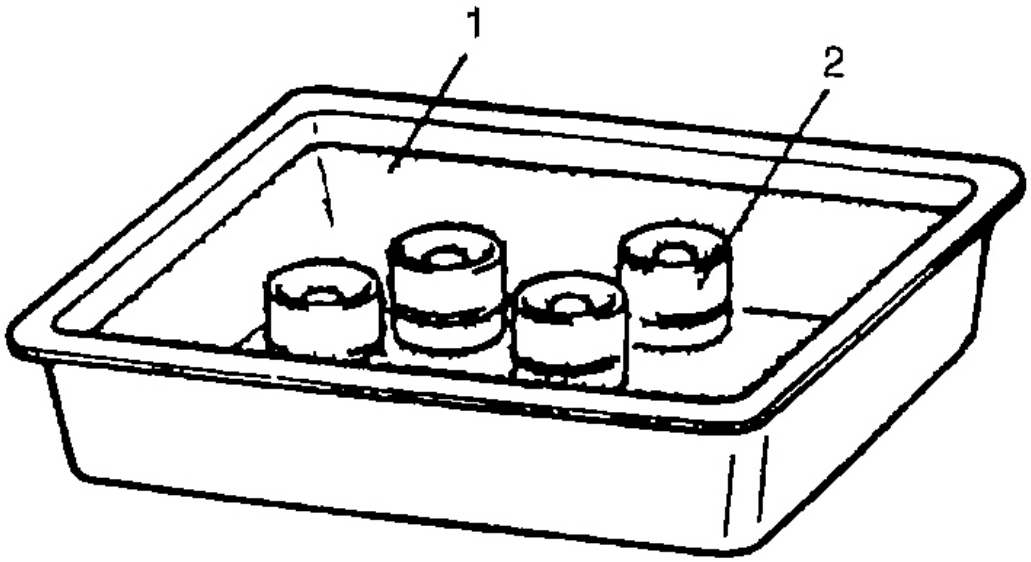


Fig. 103: Identifying Valve Lash Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

- **Immerse removed adjuster (2) in clean engine oil (1) and keep it there till**

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reinstalling it so as to prevent oil leakage. If it is left in air, place it with its bucket body facing down. Don't place on its side or with bucket body facing up.



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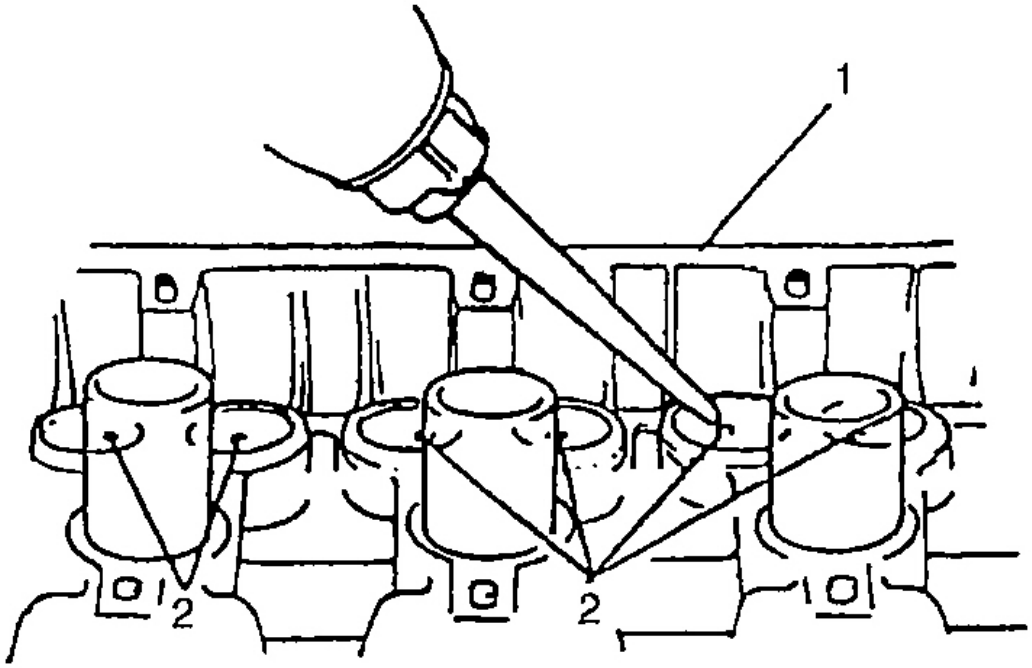
Fig. 104: Immersing Removed Adjusters
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Before installing valve lash adjuster to cylinder head (1), fill oil passage of cylinder head with engine oil according to following procedure.

   Pour engine oil through oil holes (2) and check that oil comes out from oil holes in sliding part of valve lash adjuster. Perform this check on both intake and exhaust sides.

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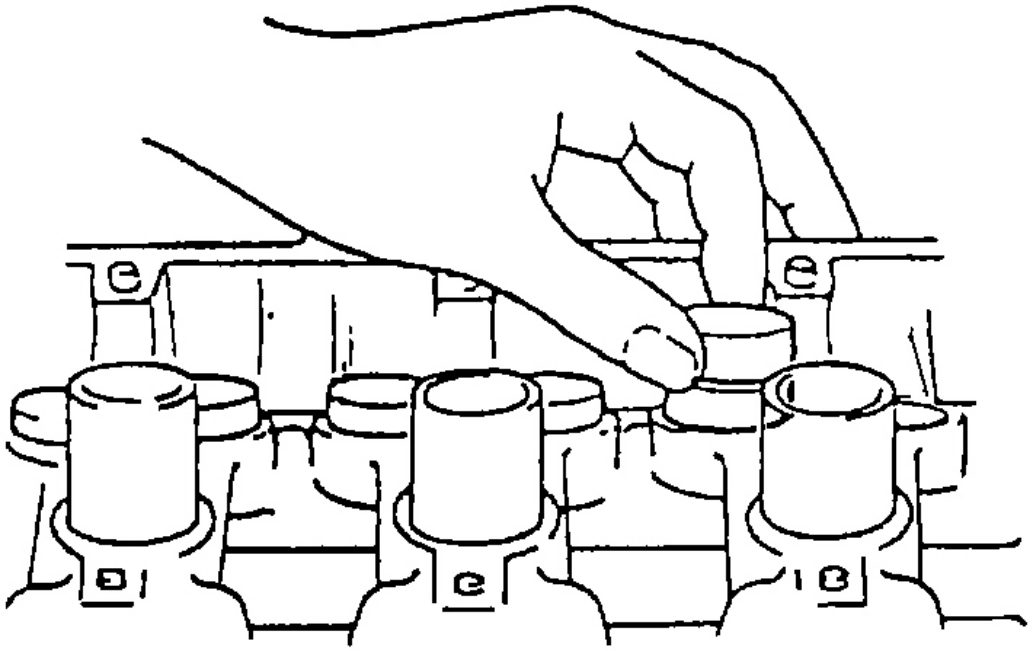
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Fig. 105: Adding Engine Oil Through Oil Holes
Courtesy of SUZUKI OF AMERICA CORP.

2. Install valve lash adjusters to cylinder head.

   Apply engine oil around valve lash adjuster and then install it to cylinder head.

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Fig. 106: Installing Valve Lash Adjusters
Courtesy of SUZUKI OF AMERICA CORP.

3. Match match mark (1) on crank timing sprocket and mating surface of cylinder block and lower crankcase (2).

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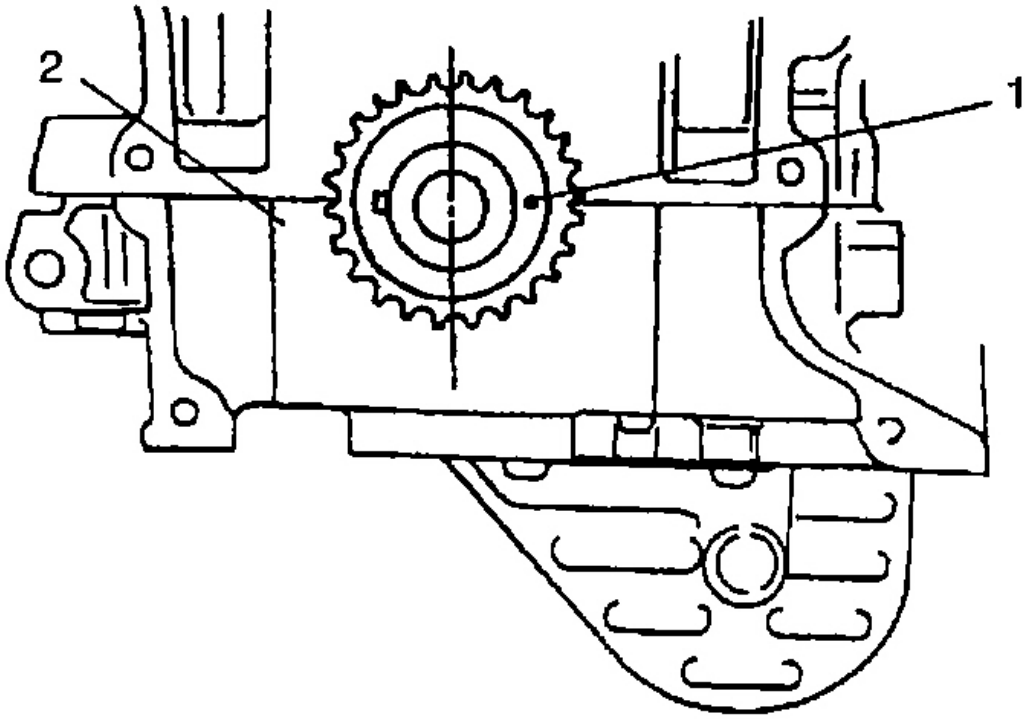


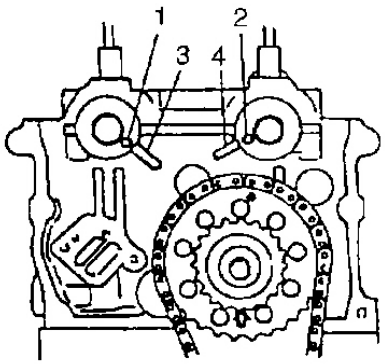
Fig. 107: Matching Match Mark On Crank Timing Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

4. Install camshafts.

   Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks on cylinder head and camshafts as shown in figure.

   NOTE: Install camshaft in such direction that its end with groove for CMP sensor installation comes to exhaust side.

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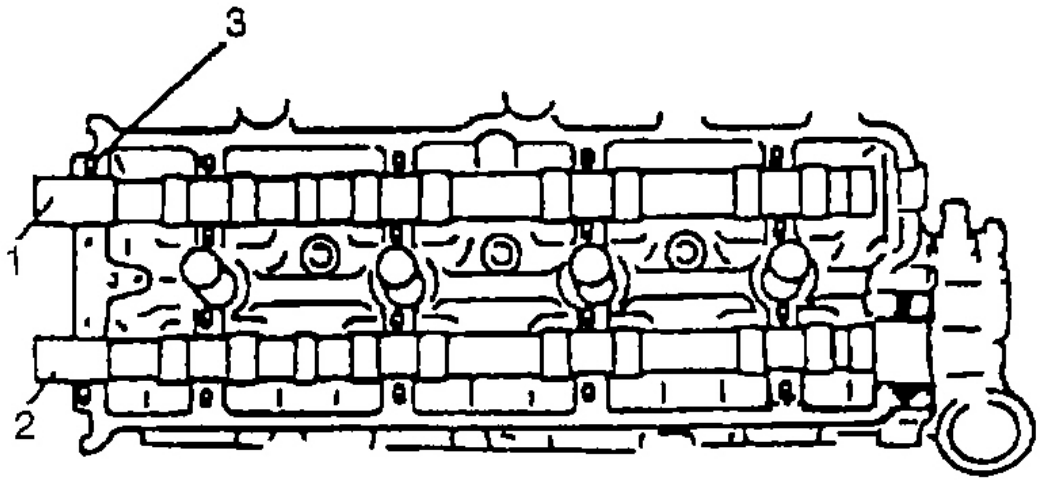
1. Knock pin of intake camshaft	3. Match mark of intake camshaft
2. Knock pin of exhaust camshaft	4. Match mark of exhaust camshaft

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Fig. 108: Installing Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

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

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1.	Intake camshaft
2.	Exhaust camshaft

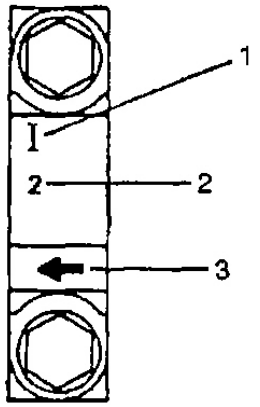
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Fig. 109: Installing Camshaft Housing Pins
Courtesy of SUZUKI OF AMERICA CORP.

6. Check position of camshaft housings.

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

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1. I: Intake side or E: Exhaust side	3. Pointing to timing chain side
2. Position from timing chain side	

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Fig. 110: Installing Camshaft Housing
Courtesy of SUZUKI OF AMERICA CORP.

7. Apply sealant "A" to exhaust camshaft end housing (1) sealing surface area as shown in figure.

   "A": Sealant 99000-31250

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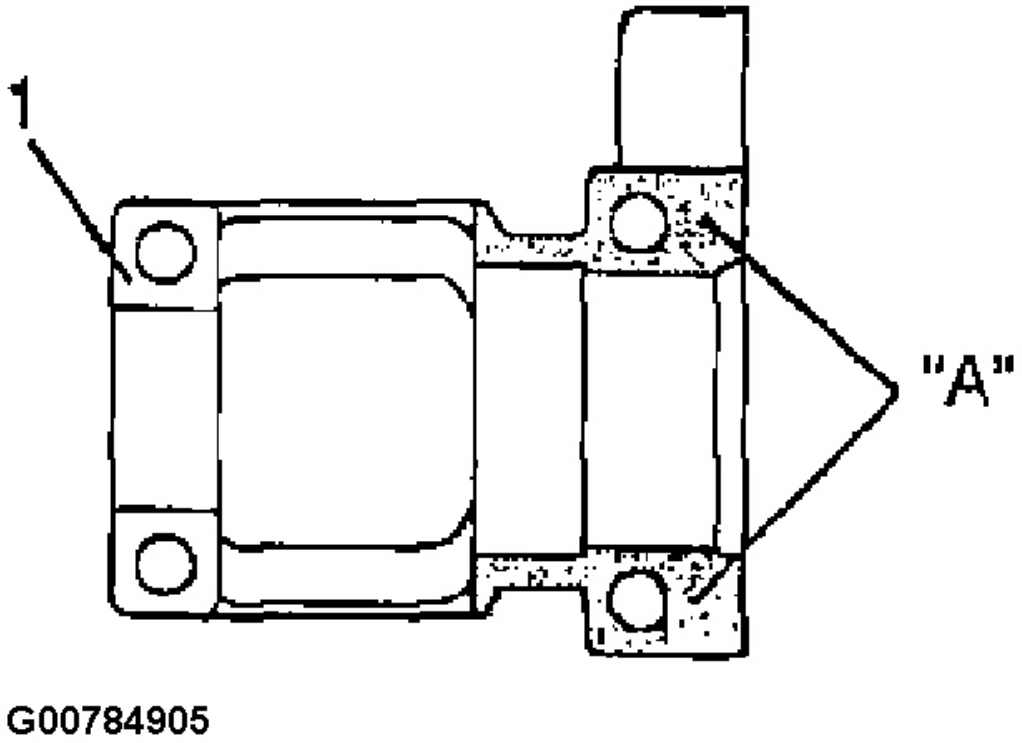


Fig. 111: Applying Sealant To Exhaust Camshaft End Housing Sealing Surface Area
Courtesy of SUZUKI OF AMERICA CORP.

8. After applying oil to housing bolts, tighten them temporarily first. Then tighten them by following numerical order in figure.

   Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque.

   Tightening torque

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

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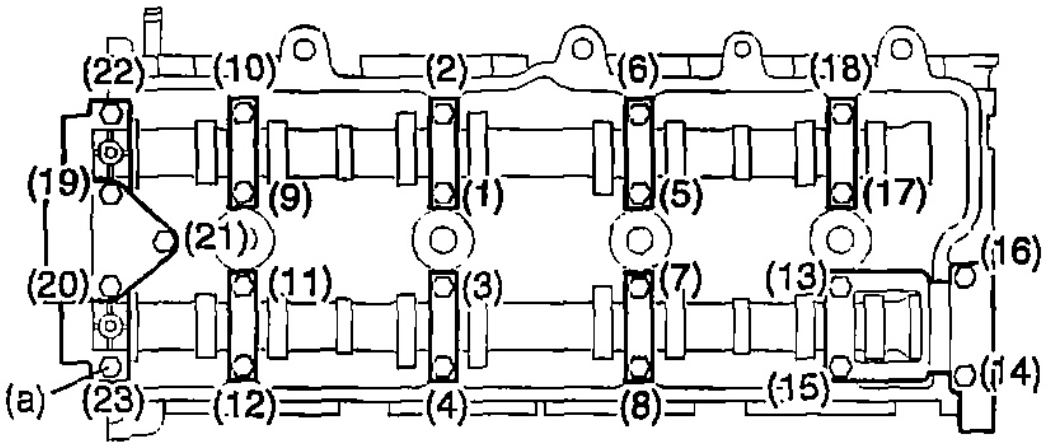


Fig. 112: Camshaft Housing Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

9. Install CMP sensor. Refer to CMP (Camshaft Position) Sensor Removal and Installation for installation.
10. Install 2nd timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and Installation**.
11. Install timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
12. Install cylinder head cover. Refer to **Cylinder Head Cover Removal and Installation**.
13. Install oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
14. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation**.

CAUTION:

- **Don't turn camshafts or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshafts. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves themselves or valves and piston.**
- **If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 to 3,000 RPM, and then air will be purged and tapping sound will cease. Should tapping sound not cease, it is possible that valve lash adjuster is defective. Replace it if defective. If defective adjuster can't be located by hearing among 16 of them, check as follows.**
  - **Stop engine and remove cylinder head cover.**
  - **Push adjuster downward by hand (with less than 20 kg or 44 lbs**

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force) when cam crest is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

Camshaft and Valve Lash Adjuster Inspection

Cam Wear

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

Cam height	Standard	Limit
Intake cam	40.410 – 40.570 mm (1.5910 – 1.5972 in.)	40.210 mm (1.5831 in.)
Exhaust cam	39.917 – 40.077 mm (1.5716 – 1.5778 in.)	39.725 mm (1.5640 in.)

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Fig. 113: Identifying Cam Height Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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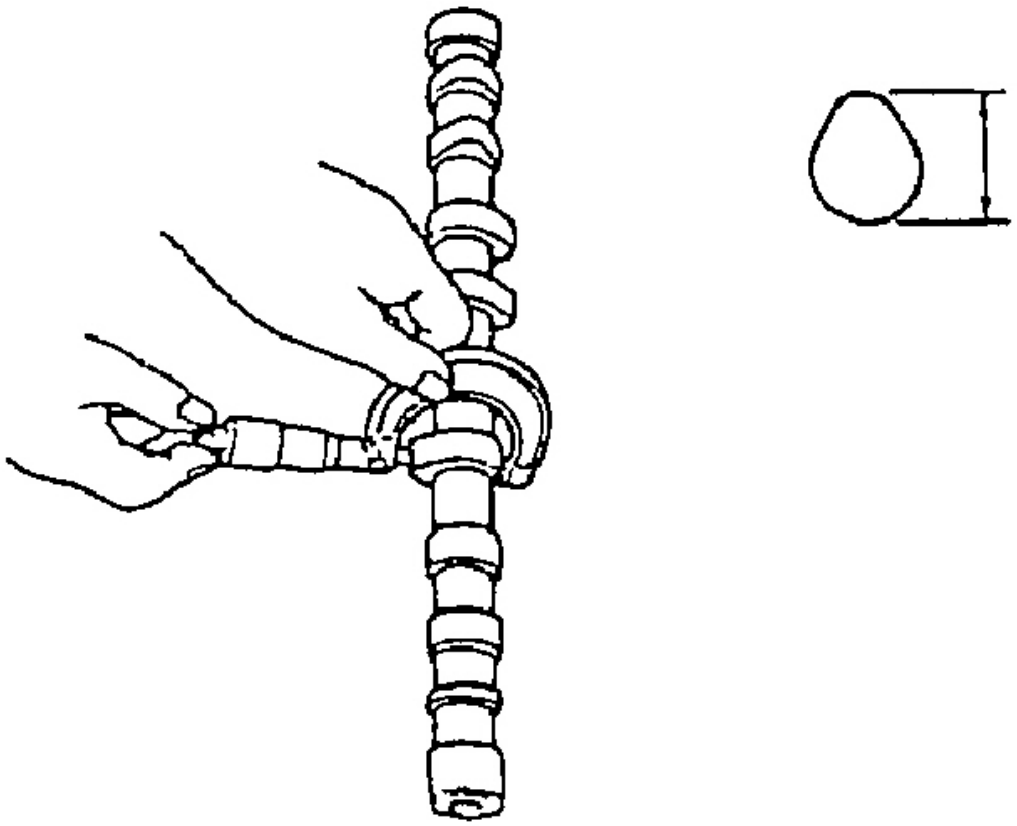


Fig. 114: Measuring Cam Height
Courtesy of SUZUKI OF AMERICA CORP.

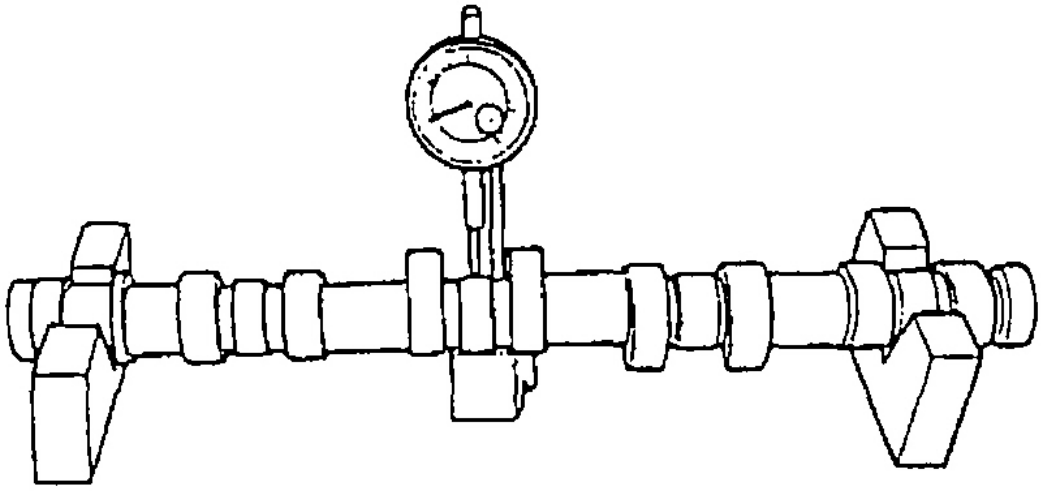
Camshaft Runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge. If measured runout exceeds the specified limit, replace camshaft.

Runout limit

0.03 mm (0.0012 in.)

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G00784909

Fig. 115: Measuring Camshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Journal Wear

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

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

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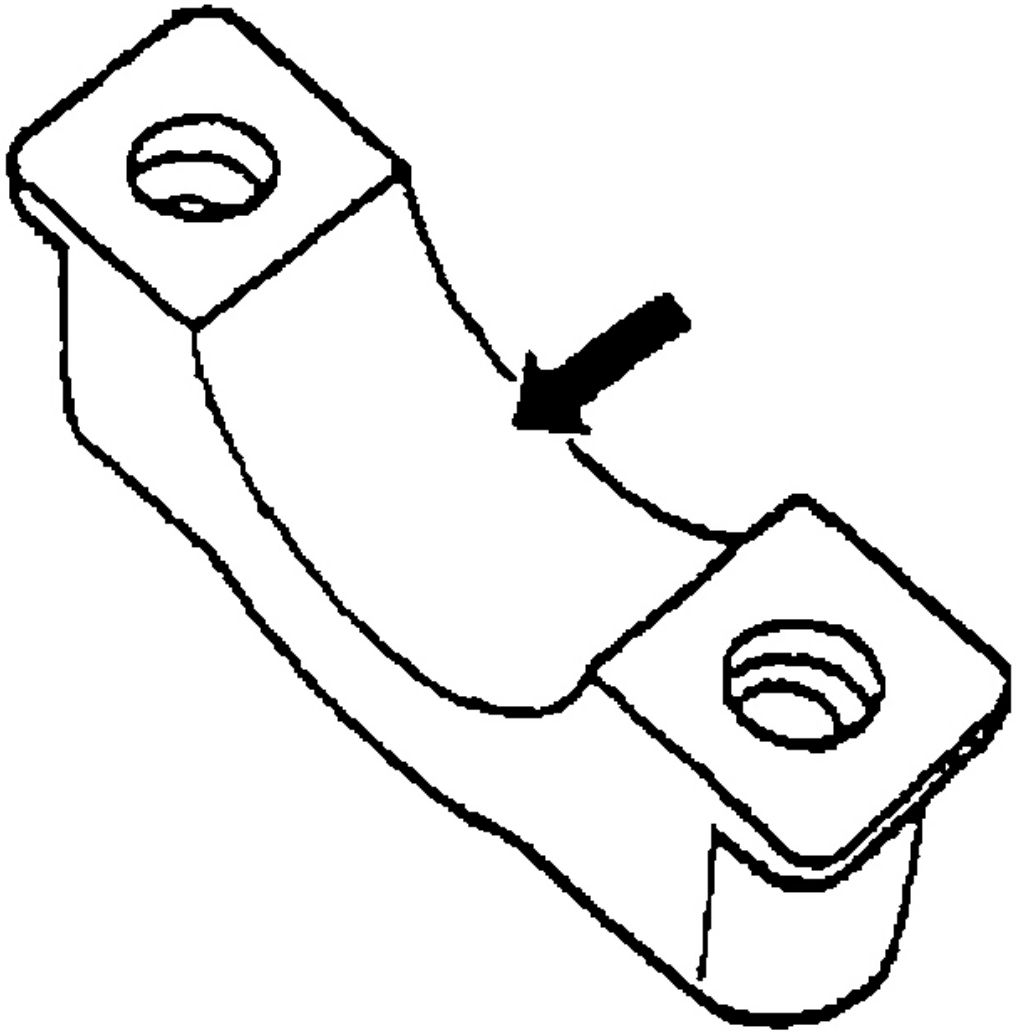


Fig. 116: Checking Camshaft Journal & Camshaft Housing
Courtesy of SUZUKI OF AMERICA CORP.

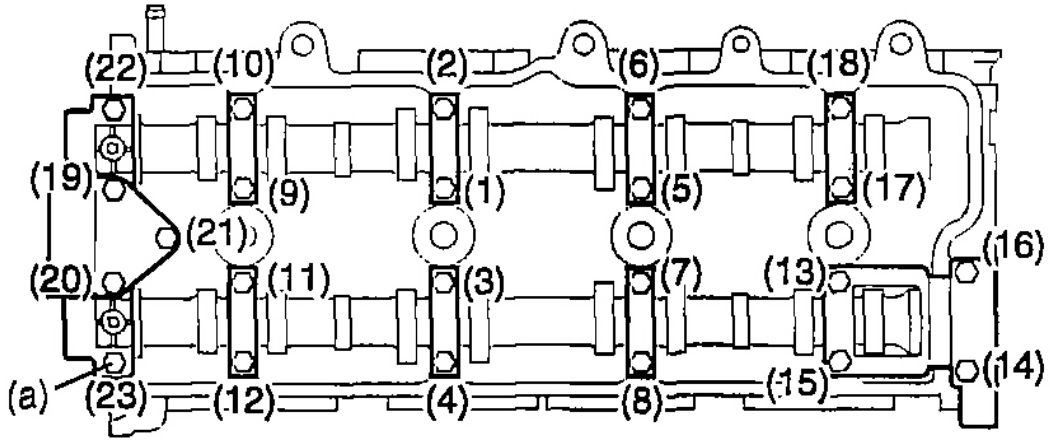
Check clearance by using gauging plastic. Checking procedure is as follows.

1. Clean housings and camshaft journals.
2. Make sure that all valve lash adjusters are removed and install camshaft to cylinder head.
3. Place a piece of gauging plastic to full width of journal of camshaft (parallel to camshaft).
4. Install camshaft housing.

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5. Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

NOTE: Do not rotate camshaft while gauging plastic is installed.
Tightening torque
Camshaft housing bolt (a): 11 N.m (1.1 kg-m, 8.0 lb-ft)



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Fig. 117: Camshaft Housing Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

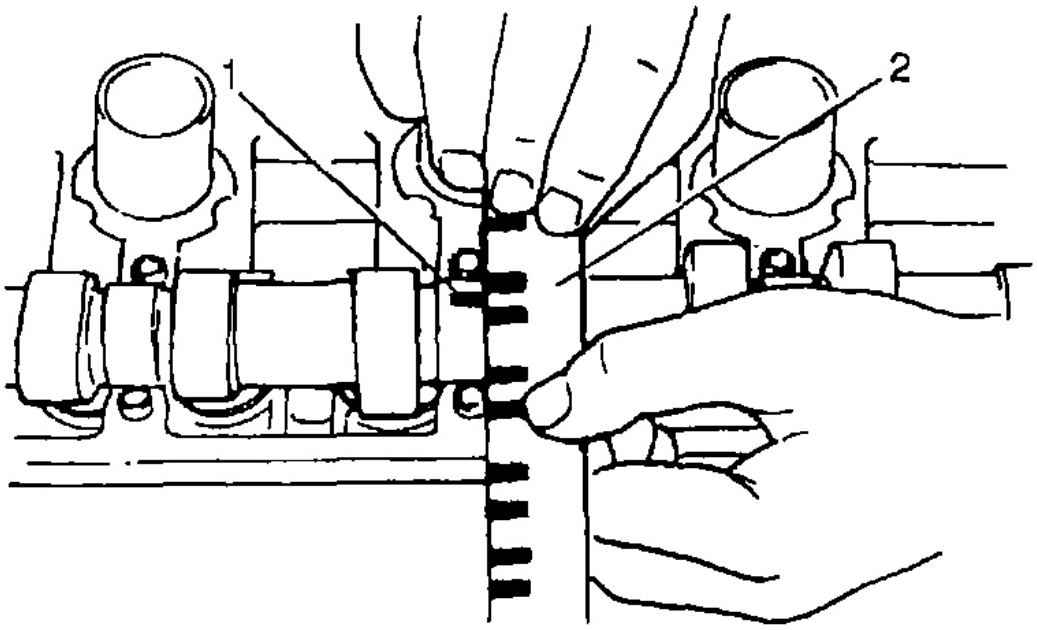
6. Remove housing, and using scale (2) on gauging plastic envelop (1), measure gauging plastic width at its widest point.

Standard	Limit
0.020 – 0.074 mm (0.0008 – 0.0029 in.)	0.12 mm (0.0047 in.)

G00784912

Fig. 118: Identifying Journal Clearance Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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G00784913

Fig. 119: Measuring Journal Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Journal clearance

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

Item	Standard
Camshaft journal bore diameter. (IN & EX)	26.000 – 26.033 mm (1.0236 – 1.0249 in.)
Camshaft journal O.D. (IN & EX)	25.959 – 25.980 mm (1.0221 – 1.0228 in.)

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Fig. 120: Identifying Camshaft Journal Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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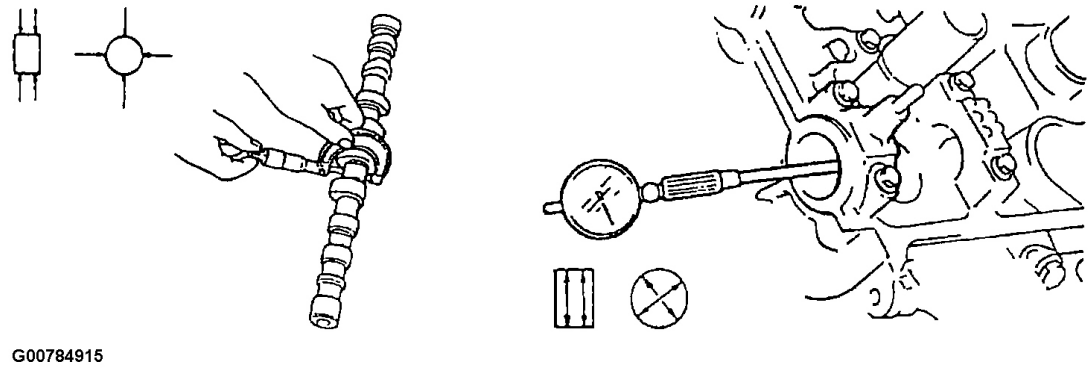


Fig. 121: Measuring Camshaft Journal
Courtesy of SUZUKI OF AMERICA CORP.

Wear of Hydraulic Valve Lash Adjuster

Check adjuster for pitting, scratches, or damage.

If any malcondition is found, replace.

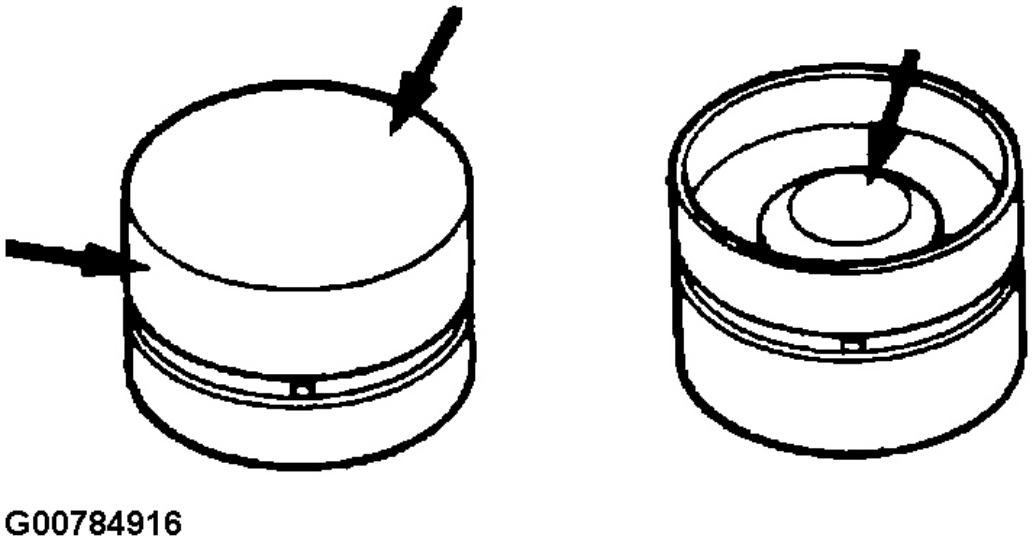


Fig. 122: Checking Hydraulic Valve Lash Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

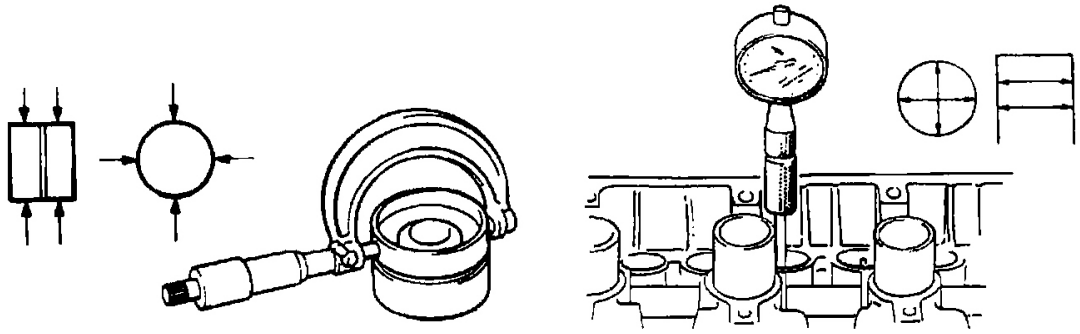
Measure cylinder head bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head.

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Item	Standard	Limit
Hydraulic valve lash adjuster	30.959 – 30.975 mm (1.2189 – 1.2194 in.)	—
Cylinder head bore	31.000 – 31.025 mm (1.2205 – 1.2214 in.)	—
Cylinder head to adjuster clearance	0.025 – 0.066 mm (0.0010 – 0.0025 in.)	0.15 mm (0.0059 in.)

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Fig. 123: Identifying Cylinder Head Bore & Adjuster Outside Diameter Specifications
Courtesy of SUZUKI OF AMERICA CORP.



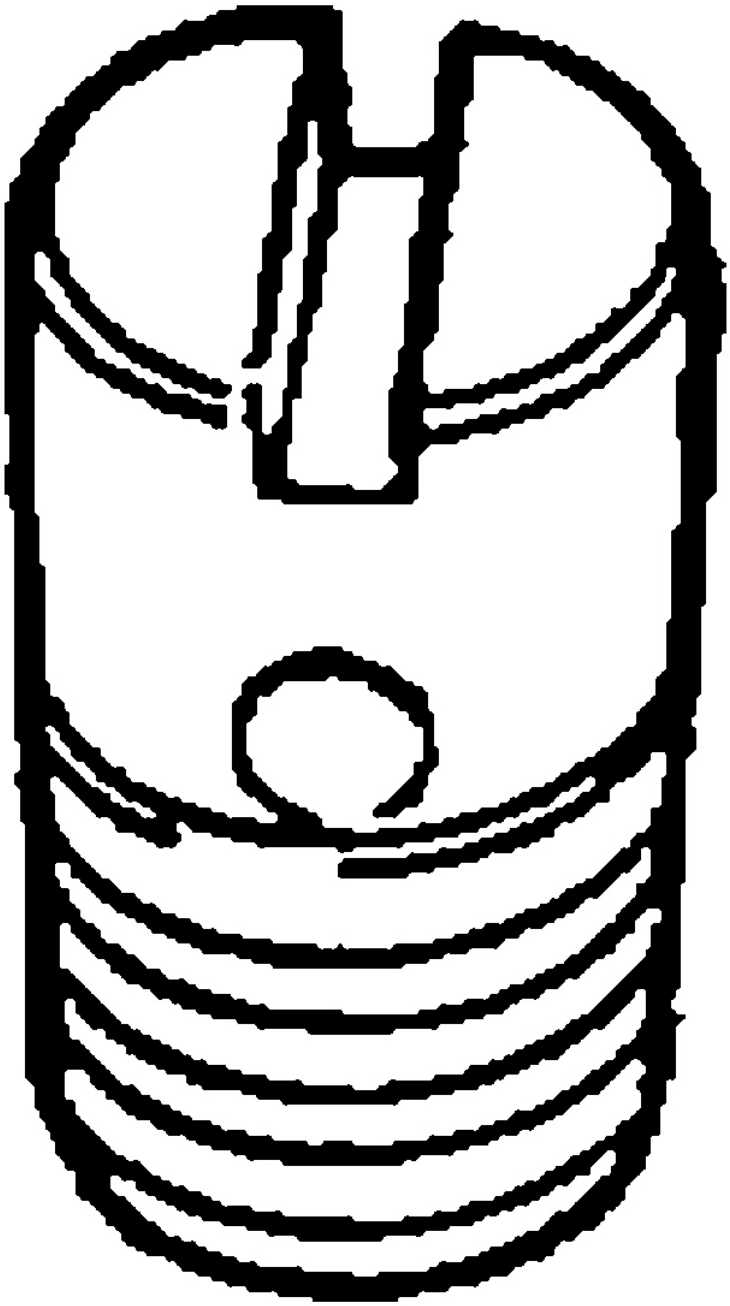
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Fig. 124: Measuring Cylinder Head Bore & Adjuster Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Oil Relief Valve

Check oil relief valve for clogging and ball for being stuck.

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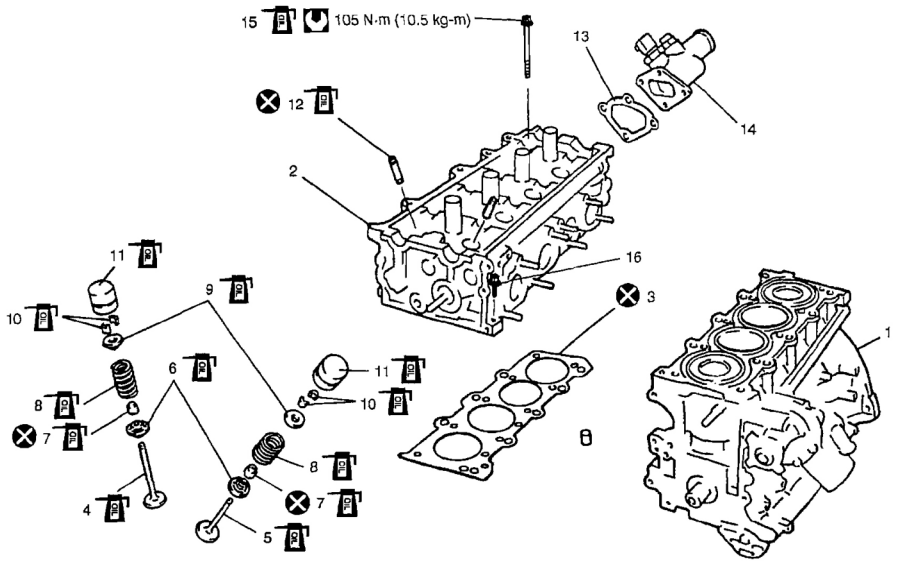


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Fig. 125: Checking Oil Relief Valve
Courtesy of SUZUKI OF AMERICA CORP.

Valves and Cylinder Head Components

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1. Cylinder block	6. Valve spring seat	11. Hydraulic valve lash adjuster	16. Cylinder head bolt (hex hole bolt)
2. Cylinder head	7. Valve stem seal	12. Valve guide	: Tightening torque
3. Cylinder head gasket	8. Valve spring	13. Water outlet cap gasket	: Do not reuse.
4. Intake valve	9. Valve spring retainer	14. Water outlet cap	: Apply engine oil to sliding surface of each part.
5. Exhaust valve	10. Valve cotter	15. Cylinder head bolt	

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Fig. 126: Identifying Valves & Cylinder Head Components
Courtesy of SUZUKI OF AMERICA CORP.

Valves and Cylinder Head Removal and Installation

Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
3. Remove 2nd timing chain and 1st timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and Installation** & **1st Timing Chain and Chain Tensioner Removal and Installation**.
4. Remove camshafts and valve lash adjuster. Refer to **Camshafts and Valve Lash Adjusters Removal and installation**.
5. Remove intake manifold rear stiffener (1).

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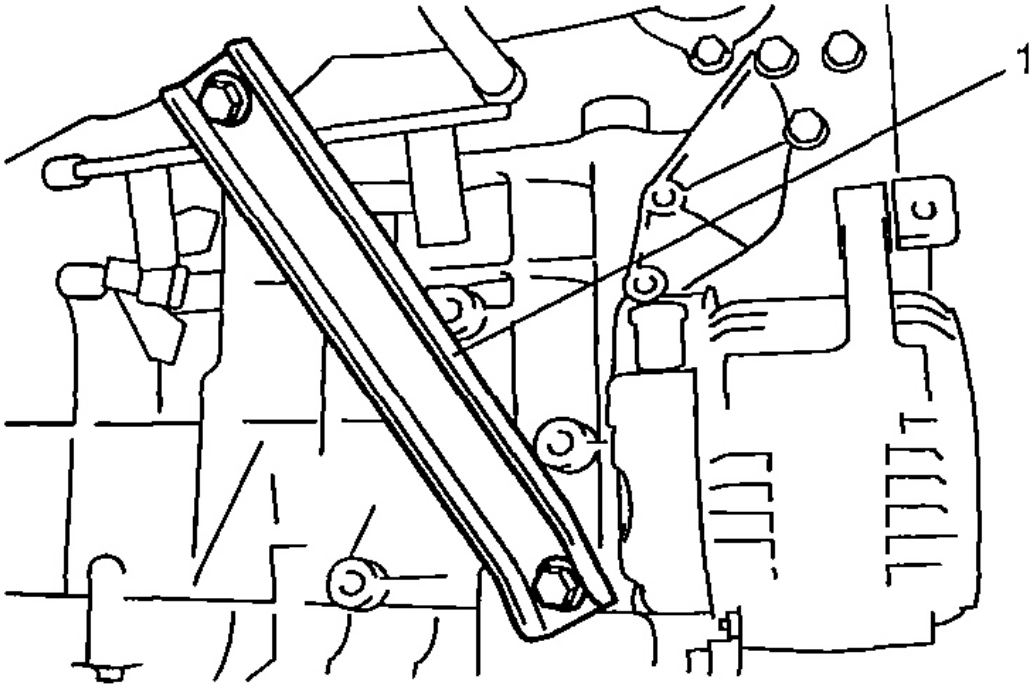


Fig. 127: Removing Intake Manifold Rear Stiffener
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect coolant pipe (1) from intake manifold.

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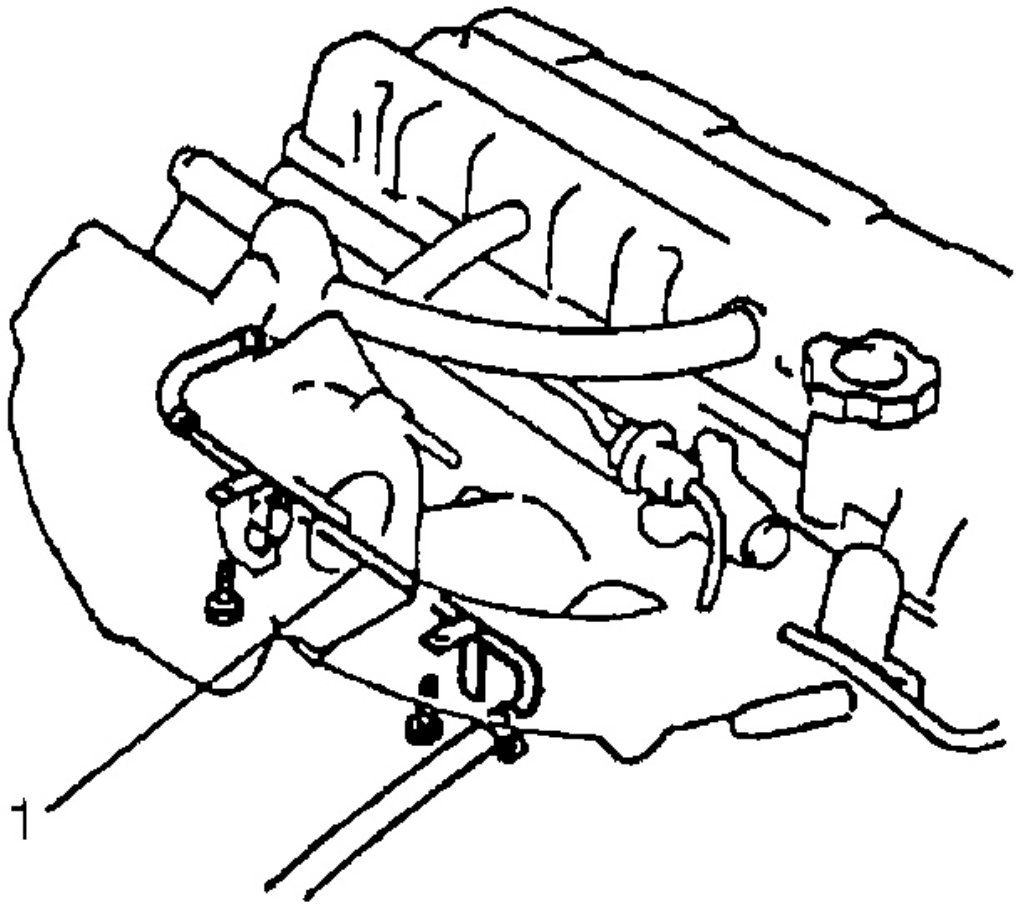


Fig. 128: Disconnecting Coolant Pipe From Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove engine RH mounting bracket (1).

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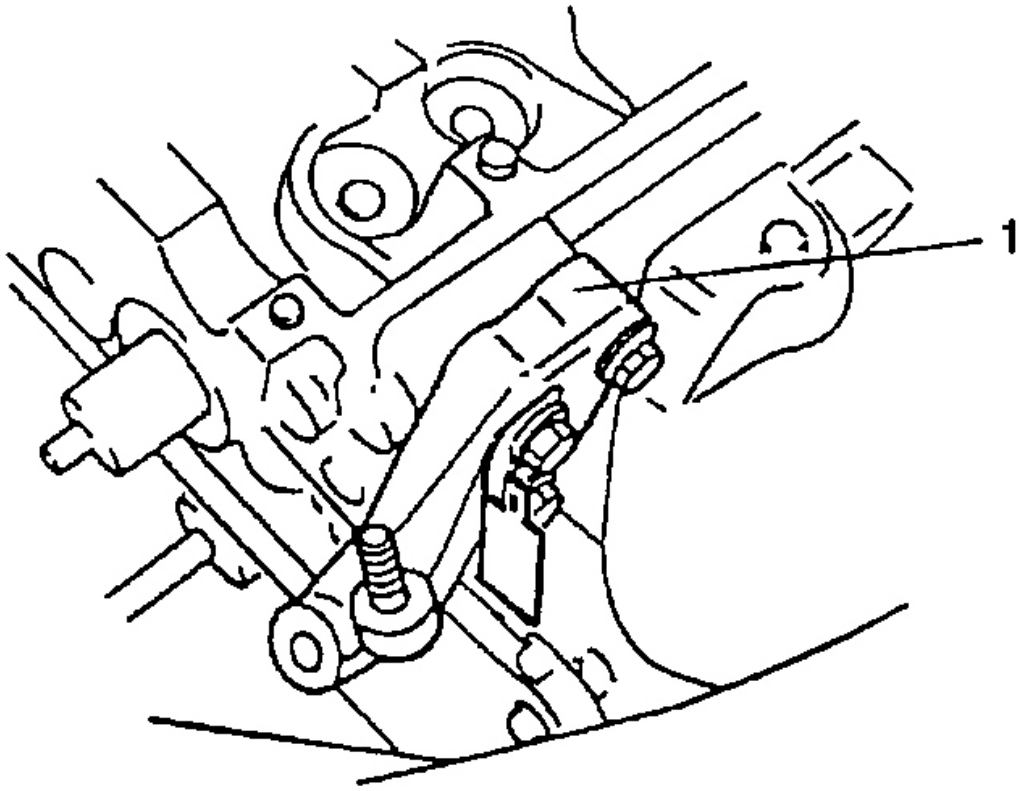


Fig. 129: Removing Engine RH Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove P/S pump bracket (1).

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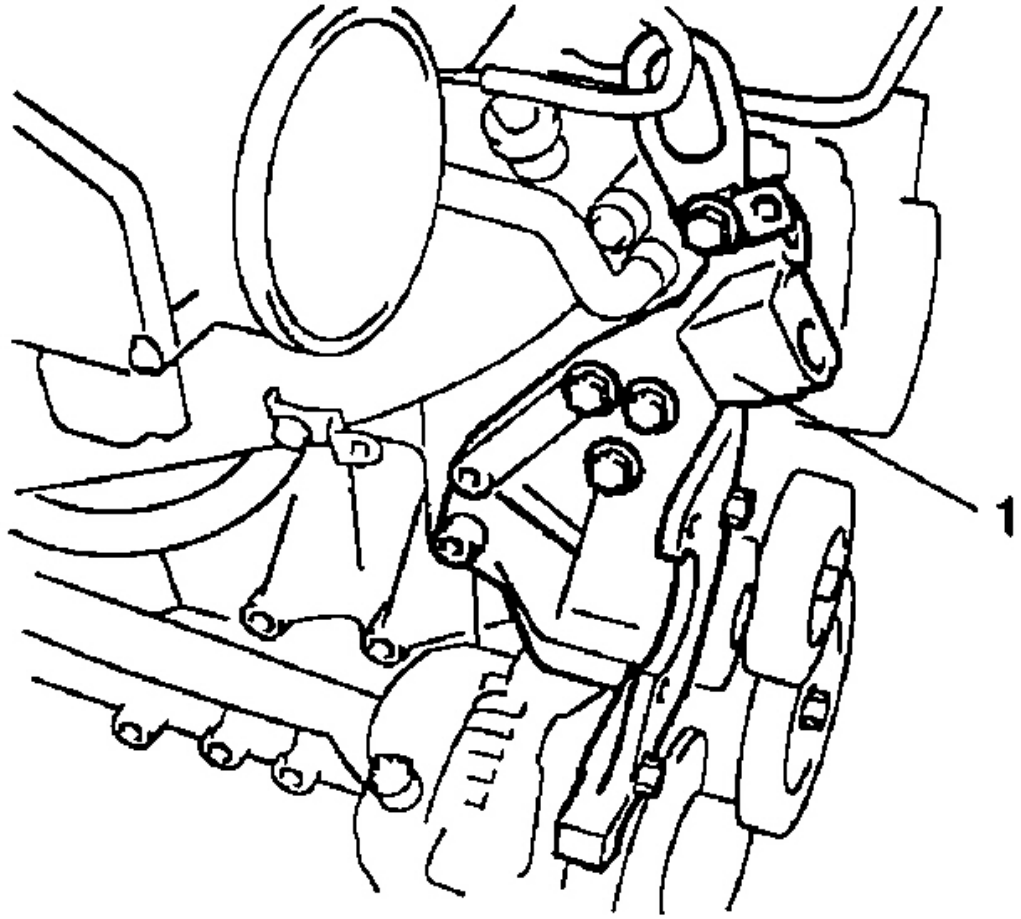
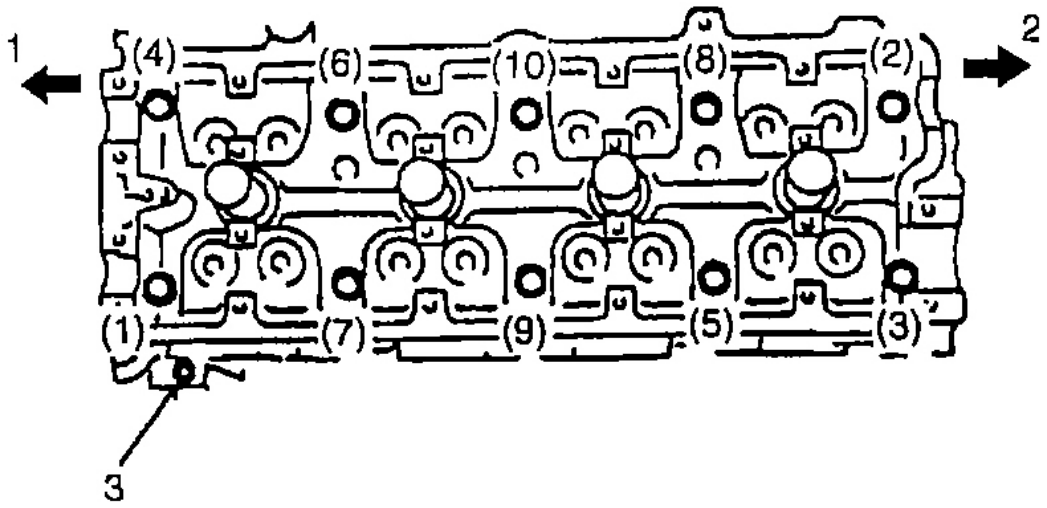


Fig. 130: Removing P/S Pump Bracket
Courtesy of SUZUKI OF AMERICA CORP.

9. Loosen cylinder head bolts in such order as numbered in figure and remove them.

NOTE: Don't forget to remove bolt (M6) (3) as shown in figure.

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1.	Crankshaft pulley side
2.	Flywheel side

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Fig. 131: Cylinder Head Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
11. Remove cylinder head with intake manifold, exhaust manifold and water outlet cap. Use lifting device, if necessary.

Installation

1. Match match mark (1) on crank timing sprocket and mating surface (2) of cylinder block and lower crankcase.

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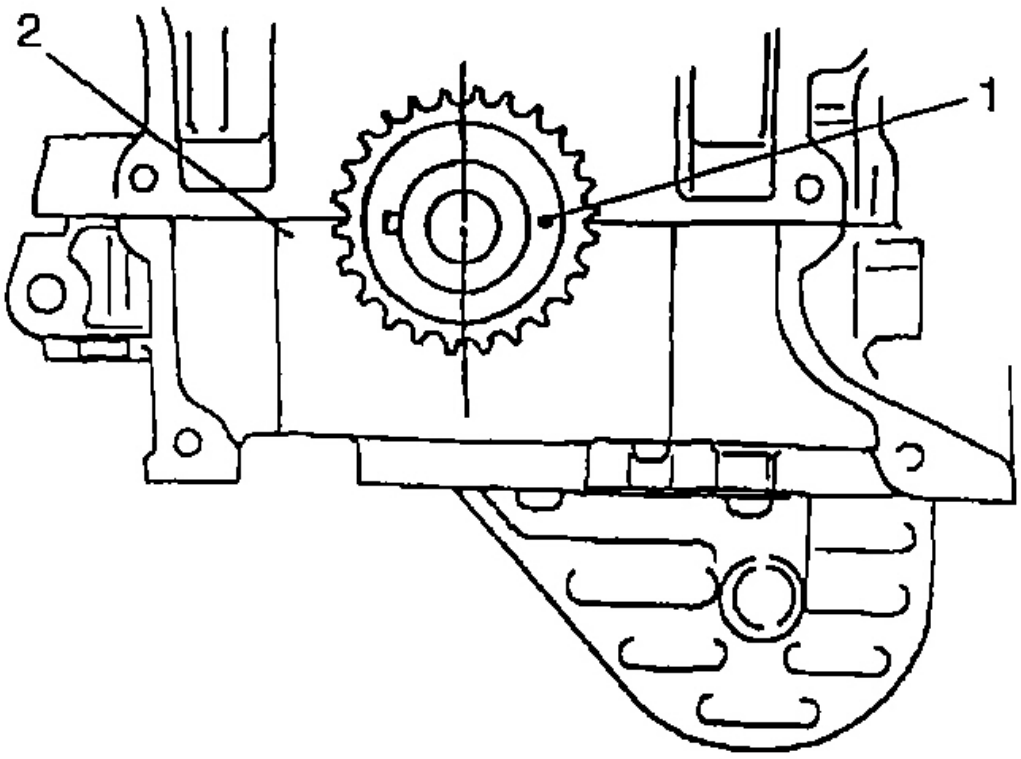


Fig. 132: Matching Match Mark On Crank Timing Sprocket And Mating Surface
Courtesy of SUZUKI OF AMERICA CORP.

2. Clean mating surface of cylinder head and cylinder block (2). Remove oil, old gasket and dust from mating surface.
3. Install knock pins (3) to cylinder block.
4. Install new cylinder head gasket (1) to cylinder block. Top mark (6) provided on gasket comes to crankshaft pulley side (4), facing up (toward cylinder head side).

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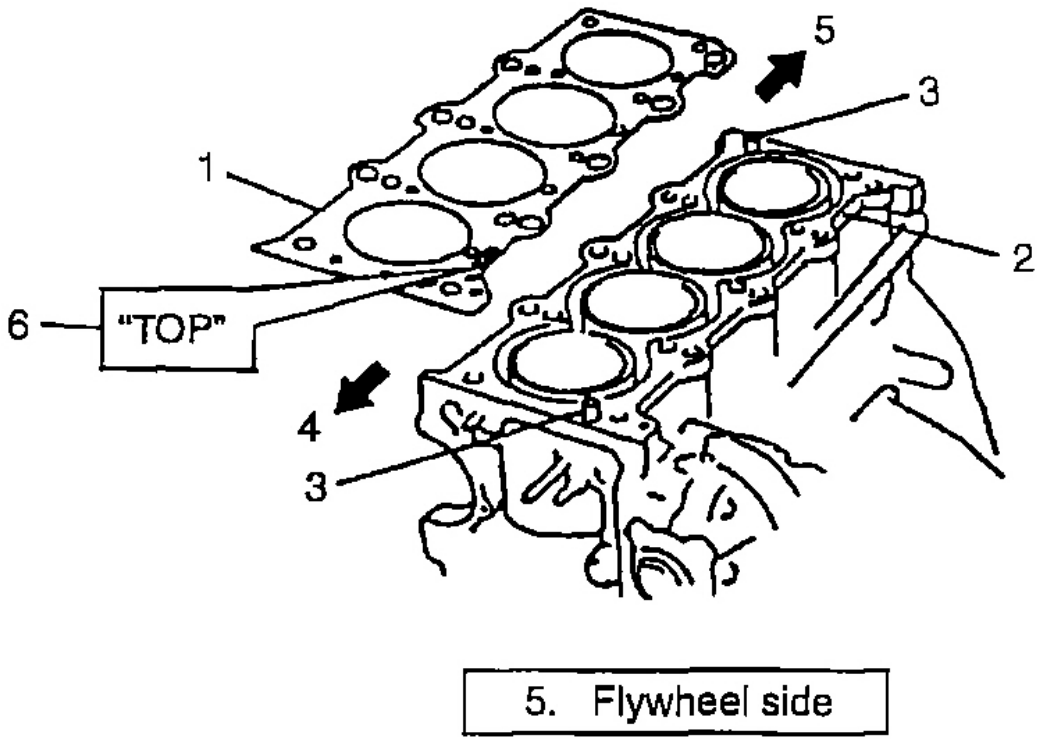


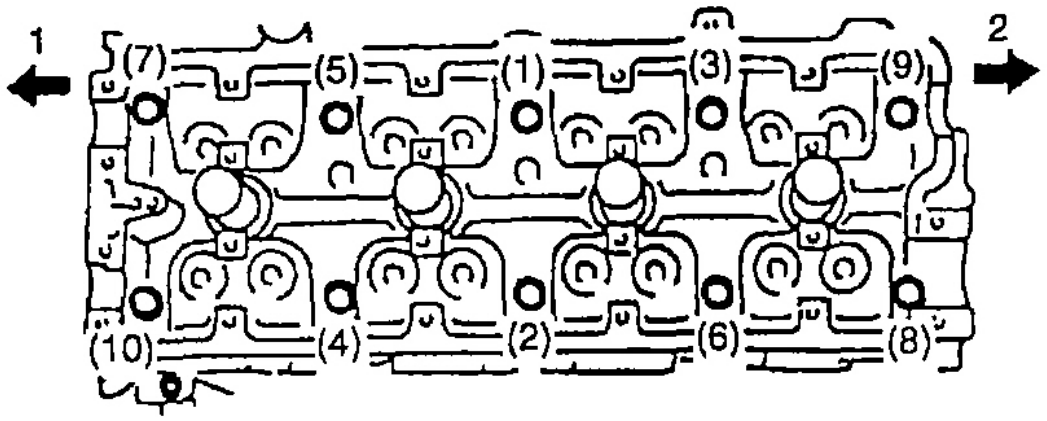
Fig. 133: Install New Cylinder Head Gasket
Courtesy of SUZUKI OF AMERICA CORP.

5. Install cylinder head to cylinder block.

   Apply engine oil to cylinder head bolts and tighten them gradually as follows.

   a. Tighten all bolts to 53 N.m (5.3 kg-m, 38.5 lb-ft) according to numerical order in figure.
   b. In the same manner as in step a), retighten them to 84 N.m (8.4 kg-m, 61.0 lb-ft).

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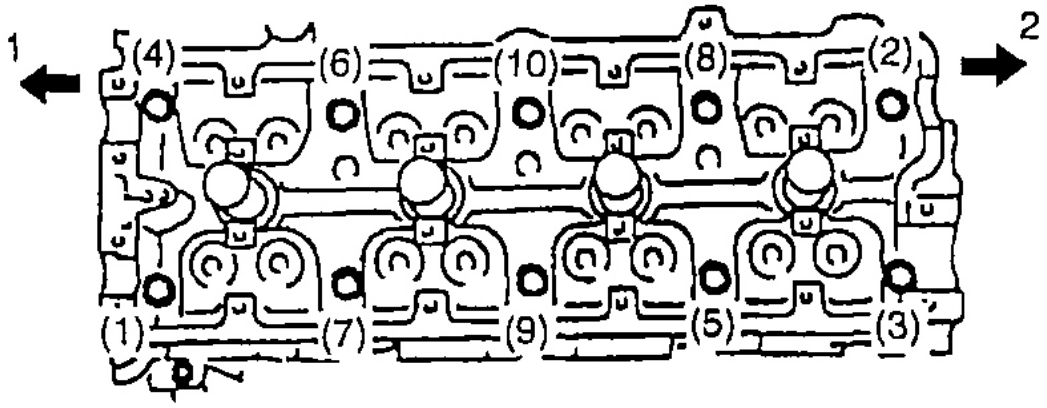
1.	Crankshaft pulley side
2.	Flywheel side

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Fig. 134: Cylinder Head Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

c. Loosen all bolts until tightening torque is reduced to 0 according to numerical order in figure.

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1.	Crankshaft pulley side
2.	Flywheel side

G00784929

Fig. 135: Cylinder Head Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

d. Tighten all bolts to 53 N.m (5.3 kg-m, 38.5 lb-ft) according to numerical order in figure.
e. In the same manner as in step b), retighten them to specified torque.

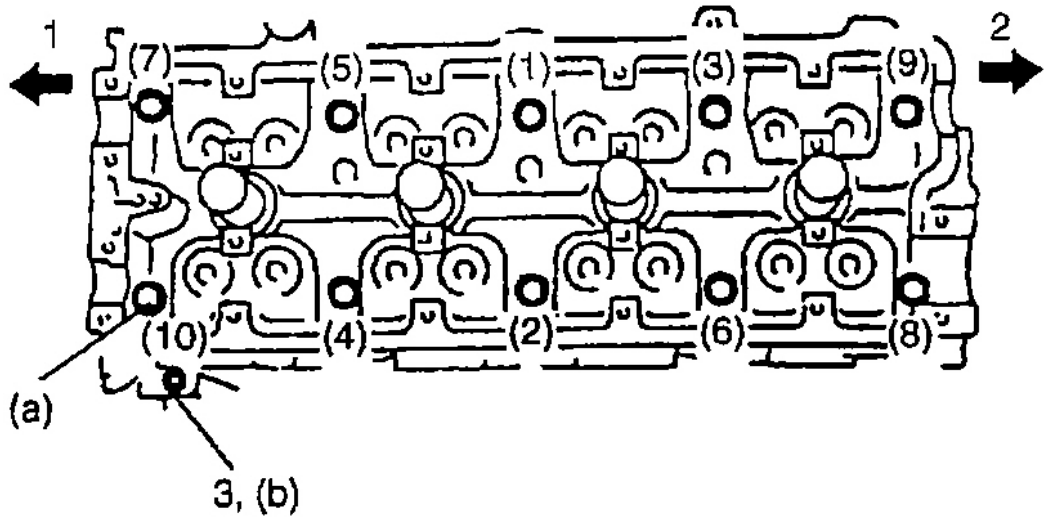
Tightening torque

Cylinder head bolt (a): 105 N.m (10.5 kg-m, 76.0 lb-ft)

Cylinder head bolt (hex hole bolt) (b): 11 N.m (1.1 kg-m, 8.0 lb-ft)

NOTE: Be sure to tighten M6 bolt (3) after securing other bolts.

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1.	Crankshaft pulley side
2.	Flywheel side

G00784930

Fig. 136: Cylinder Head Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

6. Install engine RH mounting bracket (1) using new bracket bolts. Tighten bracket bolts to specified torque.

   Tightening torque

   Engine RH mounting bracket bolt (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

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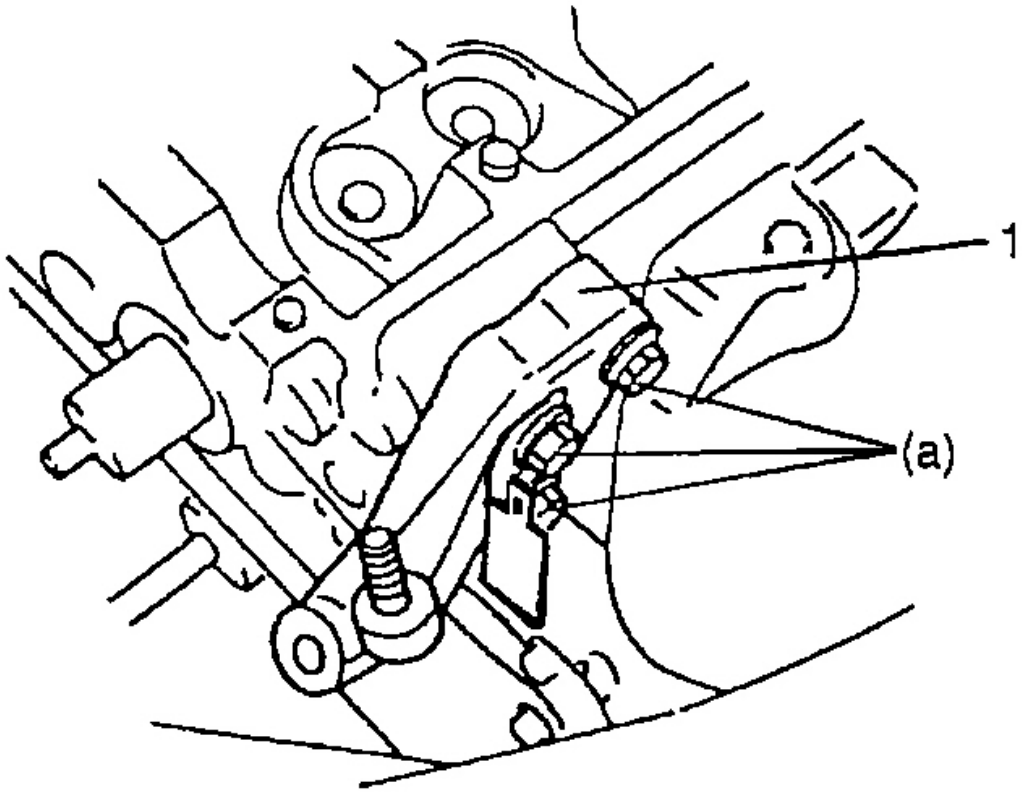


Fig. 137: Installing Engine RH Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install P/S pump bracket.
8. Install camshafts and valve lash adjuster. Refer to **Camshafts and Valve Lash Adjusters Removal and installation**.
9. Install 1st timing chain. Refer to **1st Timing Chain and Chain Tensioner Removal and Installation**.
10. Install 2nd timing chain. Refer to **2nd Timing Chain and Chain Tensioner Removal and Installation**.
11. Install timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
12. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation**.

Valves and Cylinder Head Disassembly and Assembly

Disassembly

1. When servicing cylinder head, remove intake manifold, injectors, exhaust manifold and water outlet cap

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from cylinder head.

2. Using special tools, compress valve springs and then remove valve cotters (1) also by using special tool.

Special tool

(A): 09916-14510

(B): 09916-16510

(C): 09919-28610

(D): 09916-84511

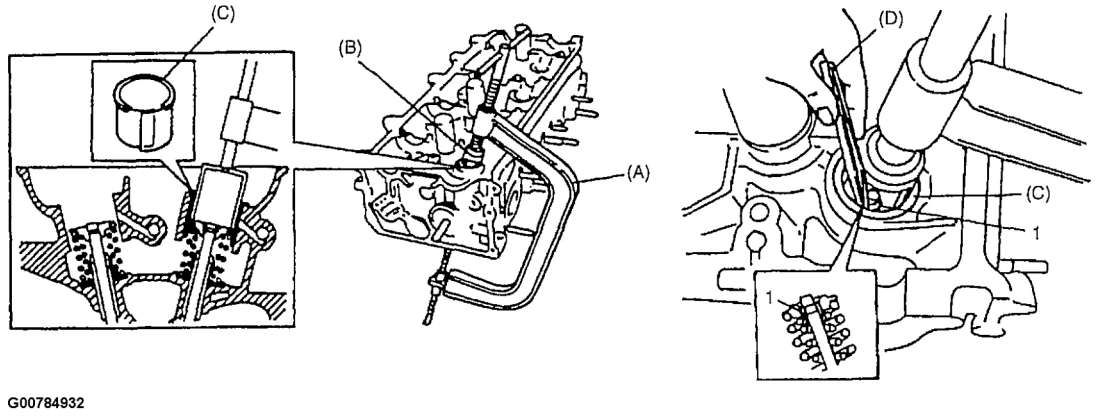
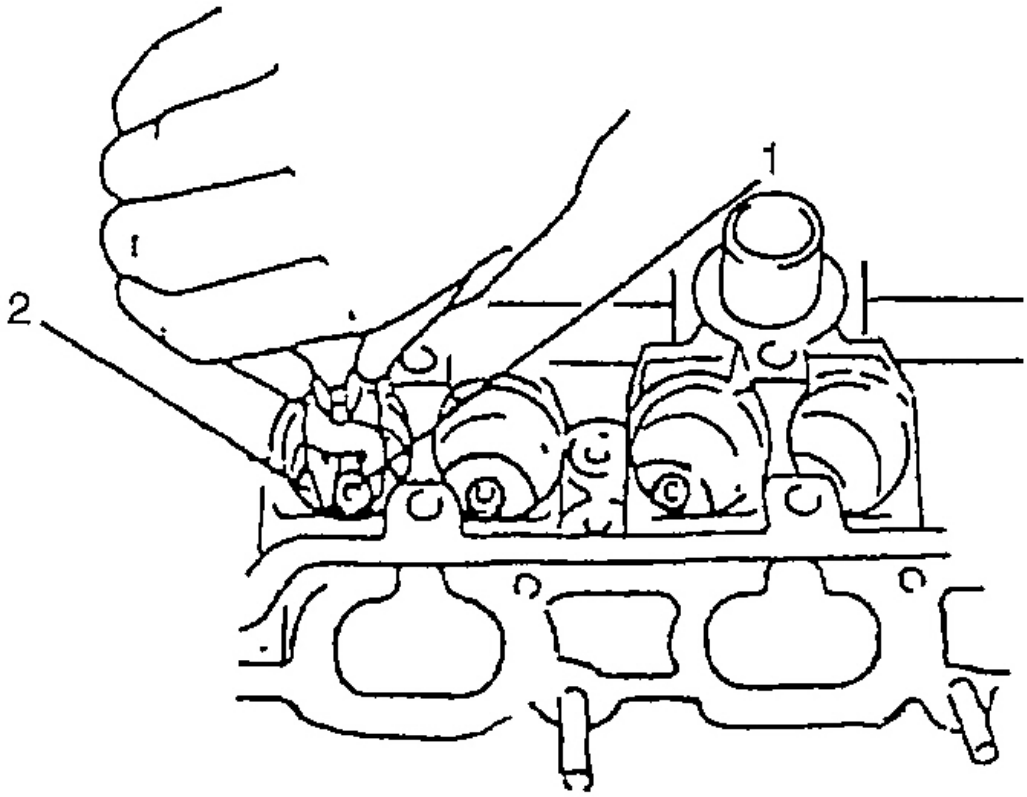


Fig. 138: Removing Valve Cotters
Courtesy of SUZUKI OF AMERICA CORP.

3. Release special tool, and remove spring retainers and valve springs.
4. Remove valve from combustion chamber side.
5. Remove valve stem seal (1) from valve guide, and then valve spring seat (2).

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

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Fig. 139: Removing Valve Stem Seal & Valve Spring Seat
Courtesy of SUZUKI OF AMERICA CORP.

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

Special tool

(A): 09916-46020

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

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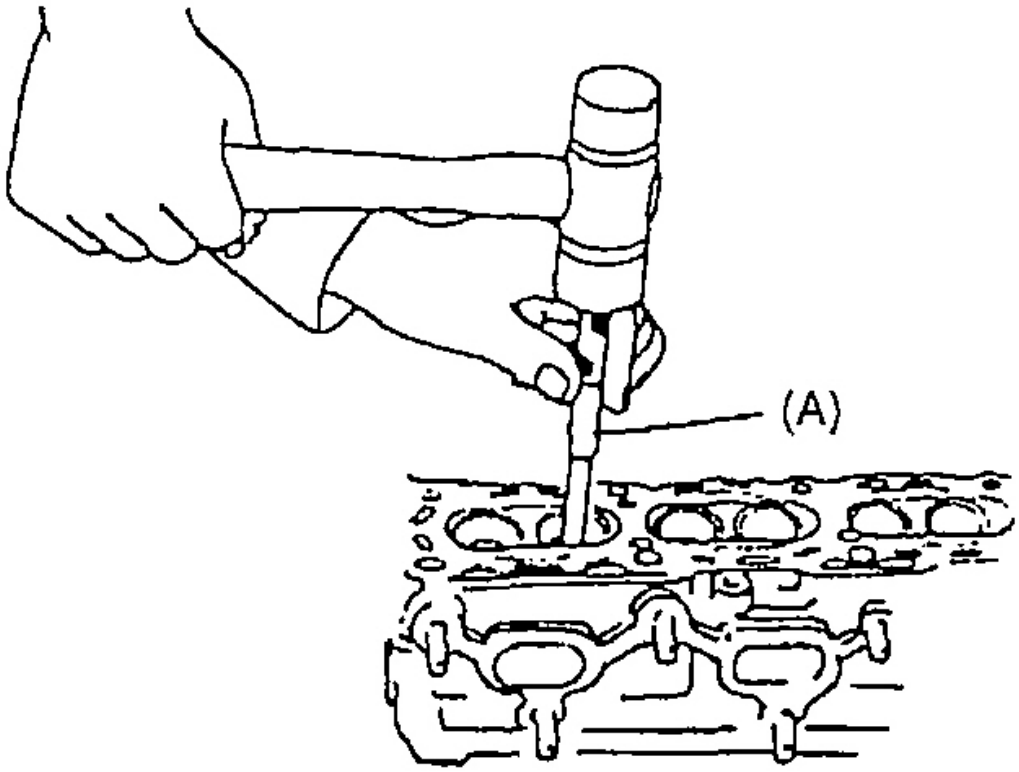


Fig. 140: Driving Valve Guide Out By Using Valve Guide Remover
Courtesy of SUZUKI OF AMERICA CORP.

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

Assembly

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

   Special tool

   (A): 09916-34542

   (B): 09916-38210

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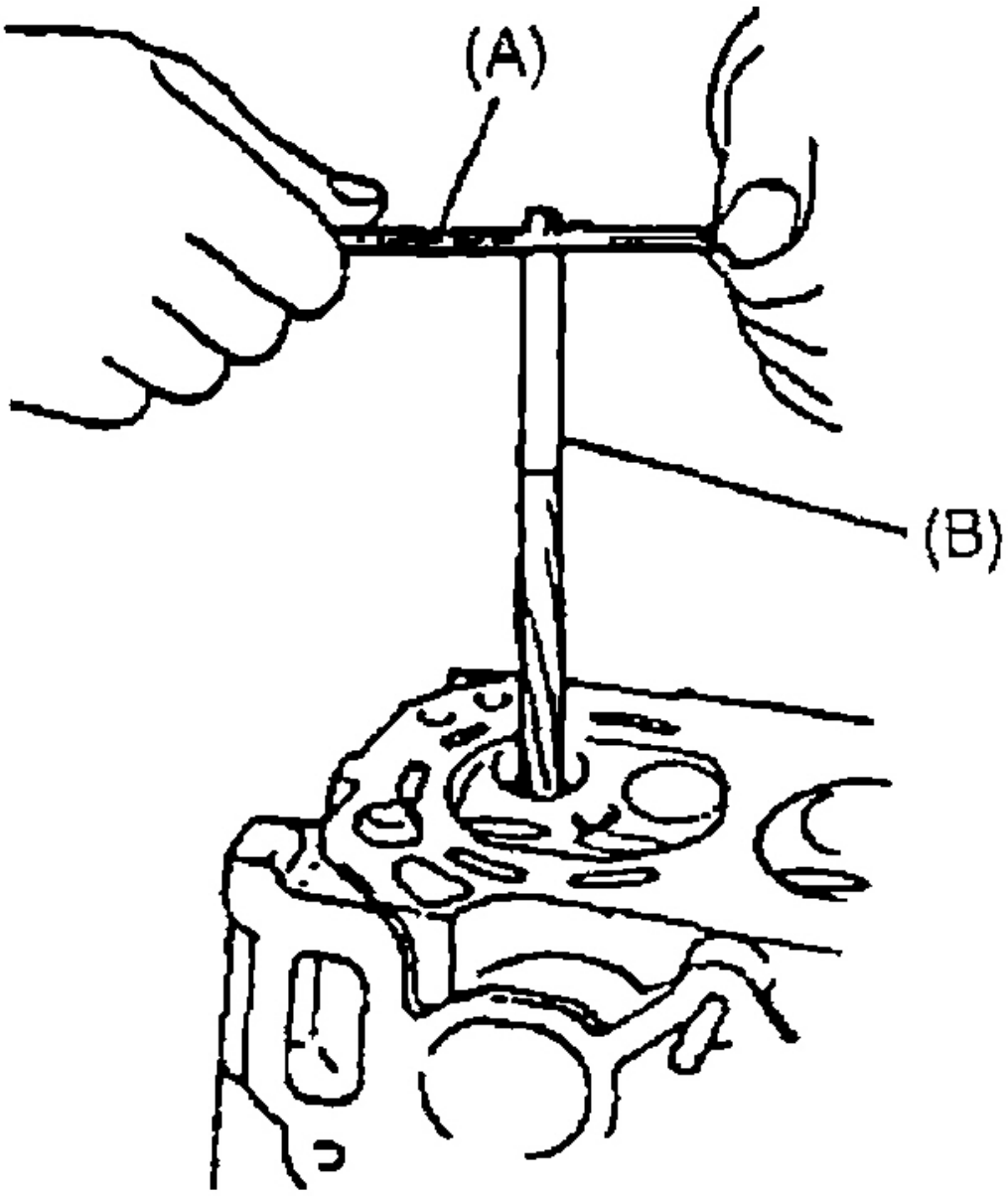


Fig. 141: Installing Ream Guide With Reamer
Courtesy of SUZUKI OF AMERICA CORP.

2. Install valve guide to cylinder head.

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

Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.

After installing, make sure that valve guide protrudes by 13.5 mm (0.53 in.) from cylinder head.

Special tool

(A): 09916-57350

(B): 09916-57340

NOTE:

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

Valve guide oversize

0.03 mm (0.0012 in.)

Valve guide protrusion "A" (In and Ex)

13.0 mm (0.51 in.)

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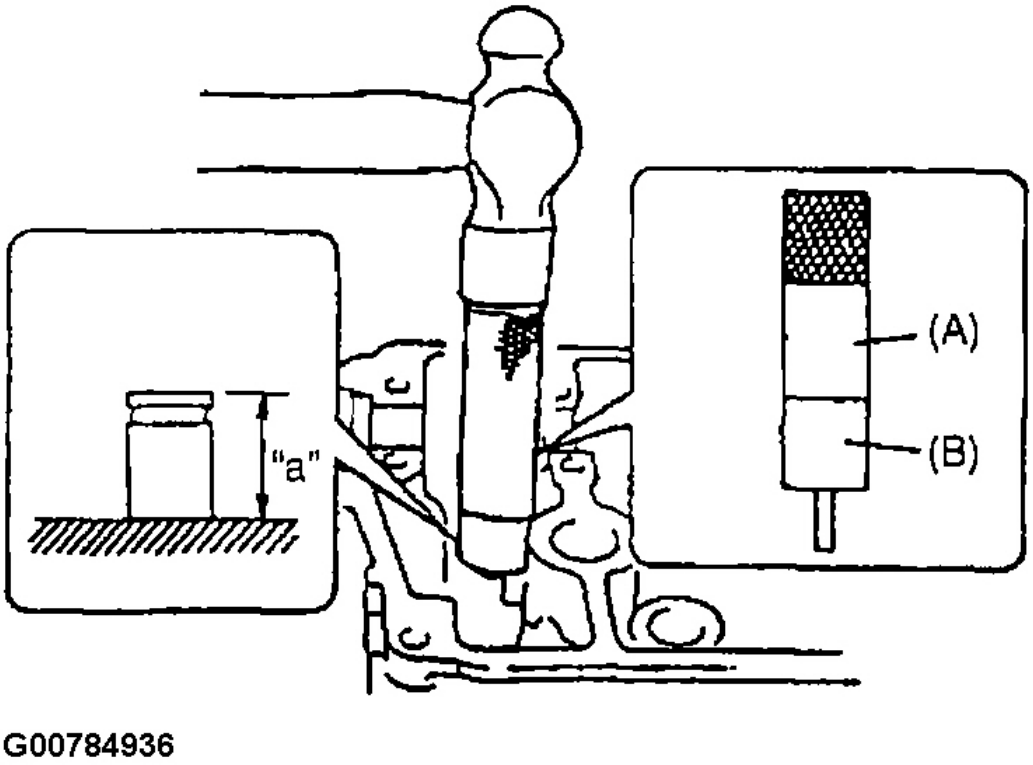


Fig. 142: Install Valve Guide To Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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

   Special tool

   (A): 09916-34542

   (B): 09916-37810

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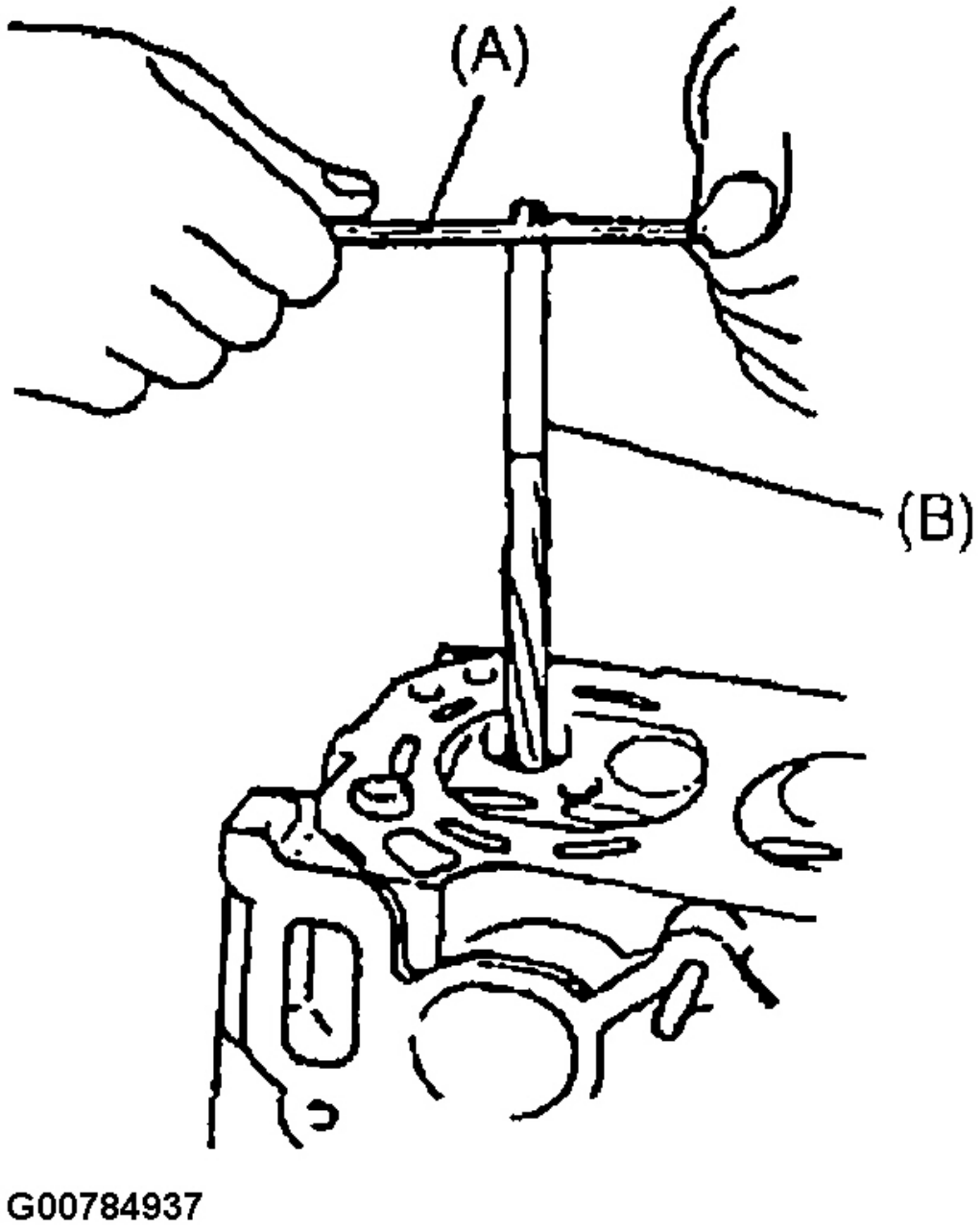


Fig. 143: Reaming Valve Guide Bore With Reamer
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

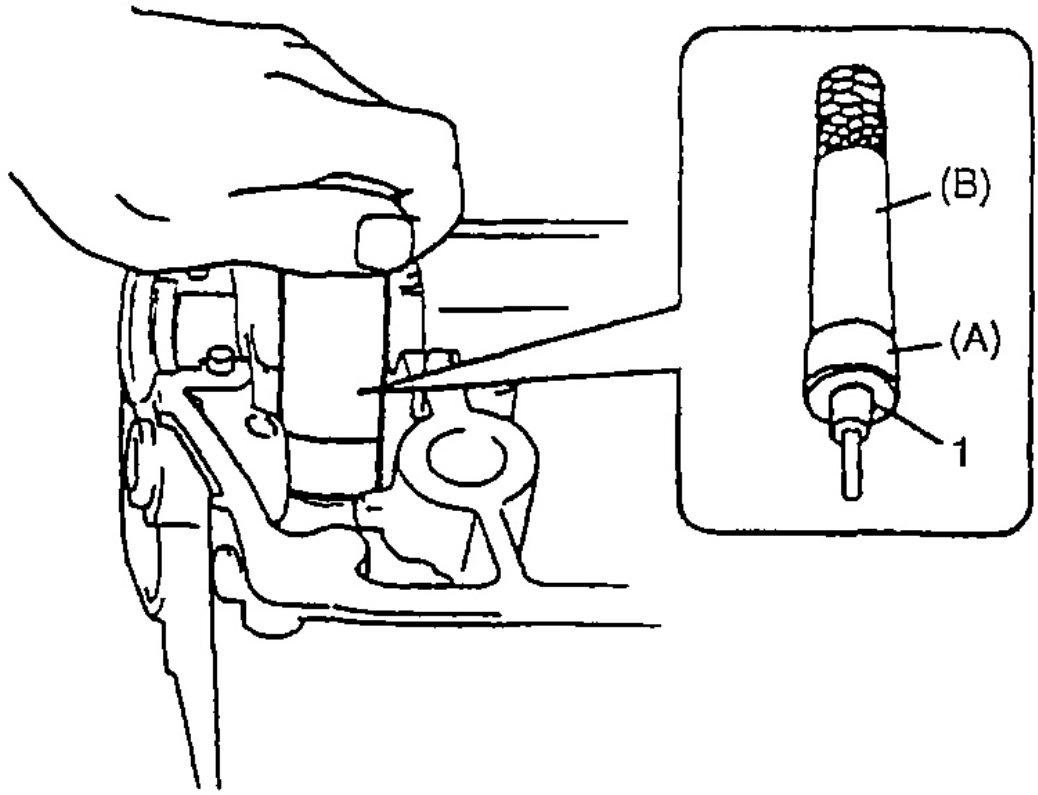
Special tool

(A): 09917-98221

(B): 09916-57350

NOTE:

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



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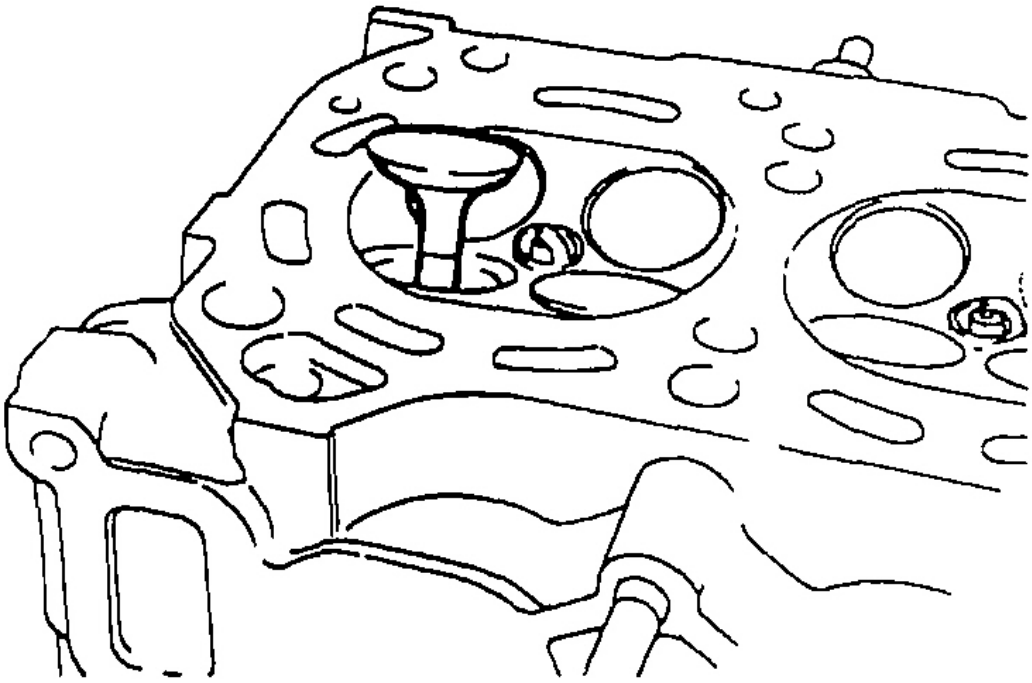
Fig. 144: Installing New Valve Stem Seal

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Courtesy of SUZUKI OF AMERICA CORP.

6. Install valve to valve guide.

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



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Fig. 145: Installing Valve To Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

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

   Special tool

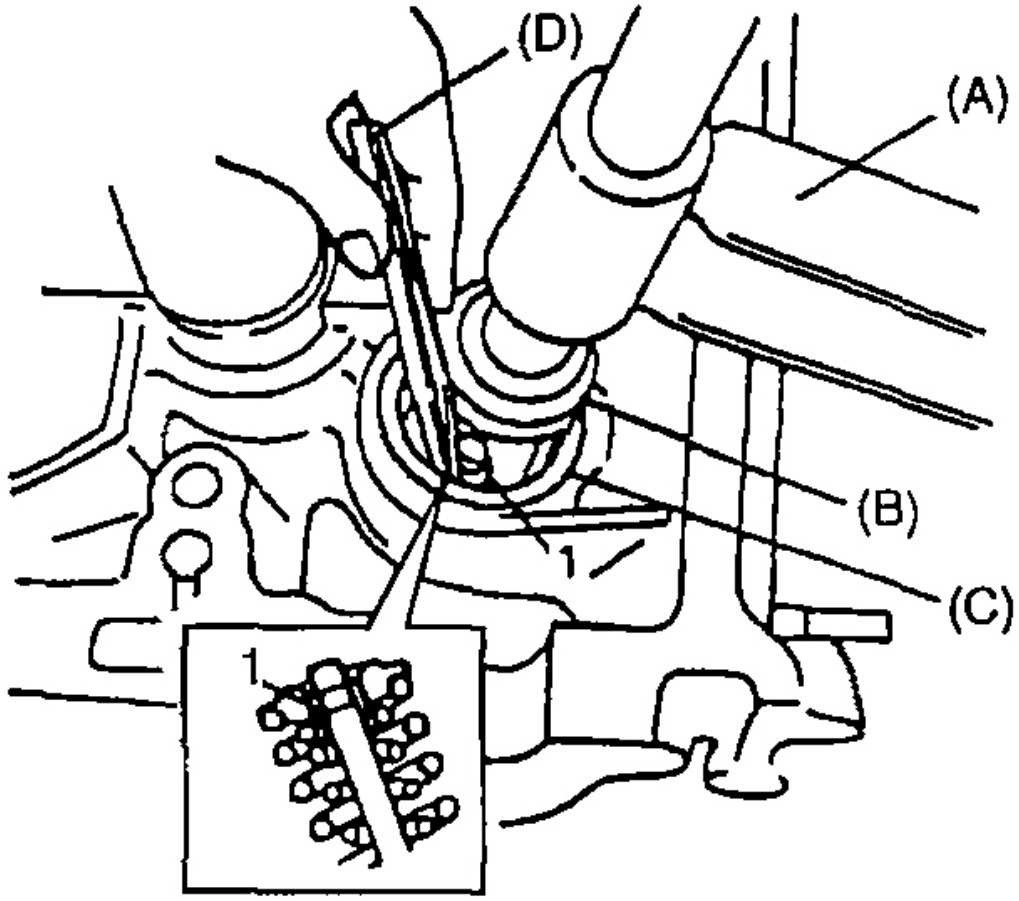
   (A): 09916-14510

   (B): 09916-16510

   (C): 09919-28610

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(D): 09916-84511



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Fig. 146: Installing Valve Spring & Spring Retainer
Courtesy of SUZUKI OF AMERICA CORP.

9. Install intake manifold, injectors, exhaust manifold and water outlet cap to cylinder head.

Valves and Cylinder Head Inspection

Valve Guides

Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.

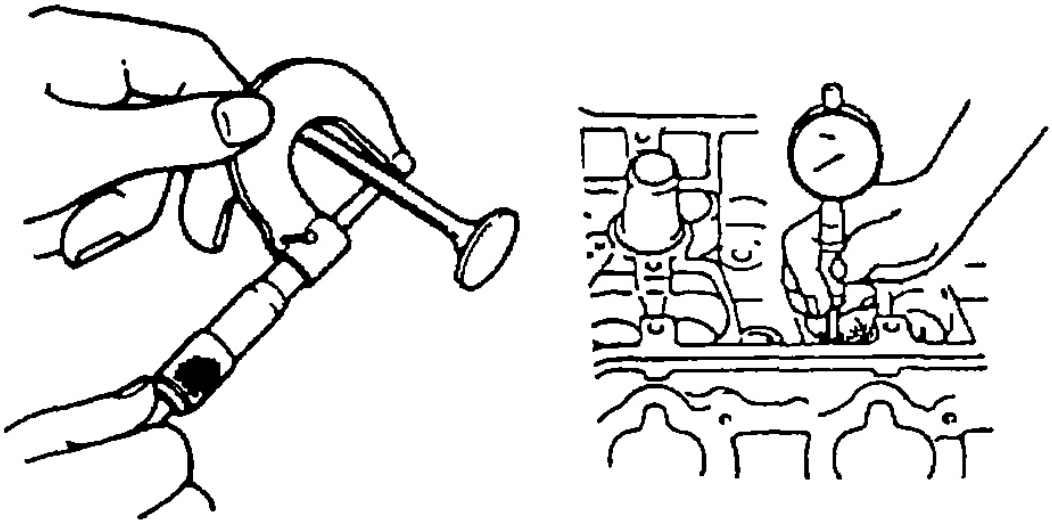
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Be sure to take reading at more than one place along the length of each stem and guide. If clearance exceeds limit, replace valve and valve guide.

Item		Standard	Limit
Valve stem diameter	In	5.965 – 5.980 mm (0.2348 – 0.2354 in.)	—
	Ex	5.940 – 5.955 mm (0.2339 – 0.2344 in.)	—
Valve guide I.D.	In & Ex	6.000 – 6.012 mm (0.2362 – 0.2366 in.)	—
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)

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Fig. 147: Identifying Valve Stem & Valve Guide Specifications
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 148: Measuring Valve Stem & Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

Valves

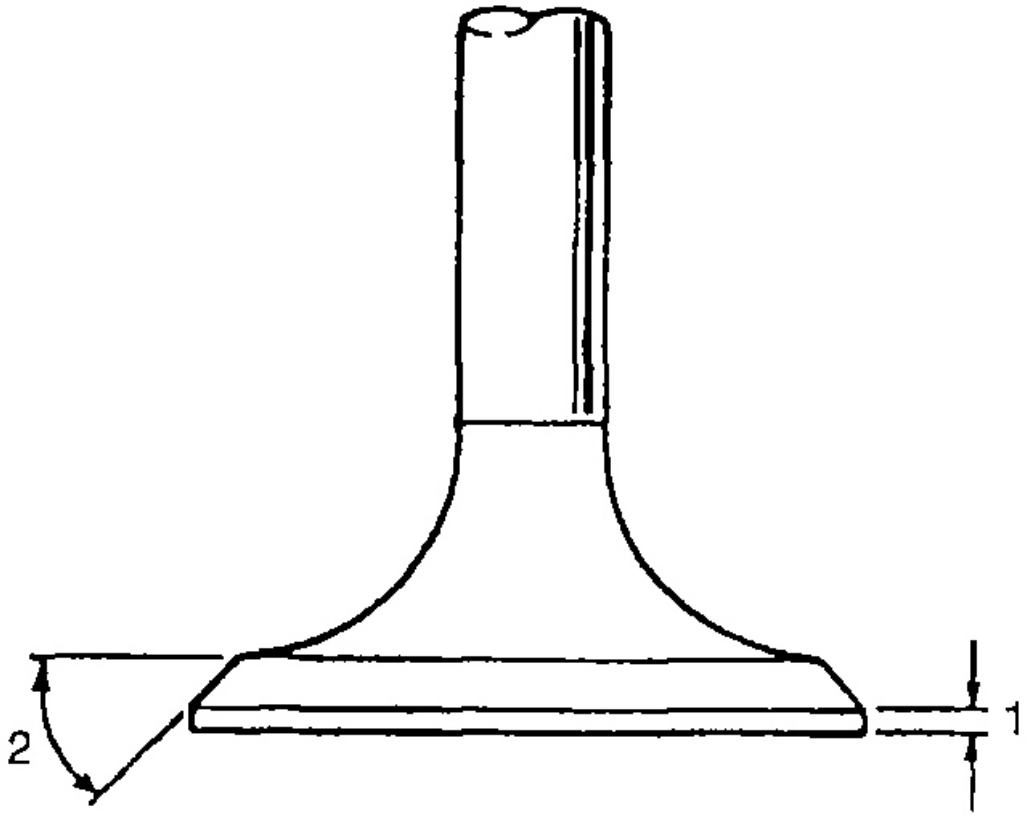
- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem and, as necessary, replace it.
- Measure thickness (1) of valve head. If measured thickness exceeds limit, replace valve.

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Item	Standard	Limit
In	1.0 mm (0.039 in.)	0.6 mm (0.024 in.)
Ex	1.2 mm (0.047 in.)	0.7 mm (0.028 in.)

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Fig. 149: Identifying Valve Specifications
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 150: Measuring Valve Head
Courtesy of SUZUKI OF AMERICA CORP.

- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamber. When it is worn out so much that its chamber is gone, replace valve.

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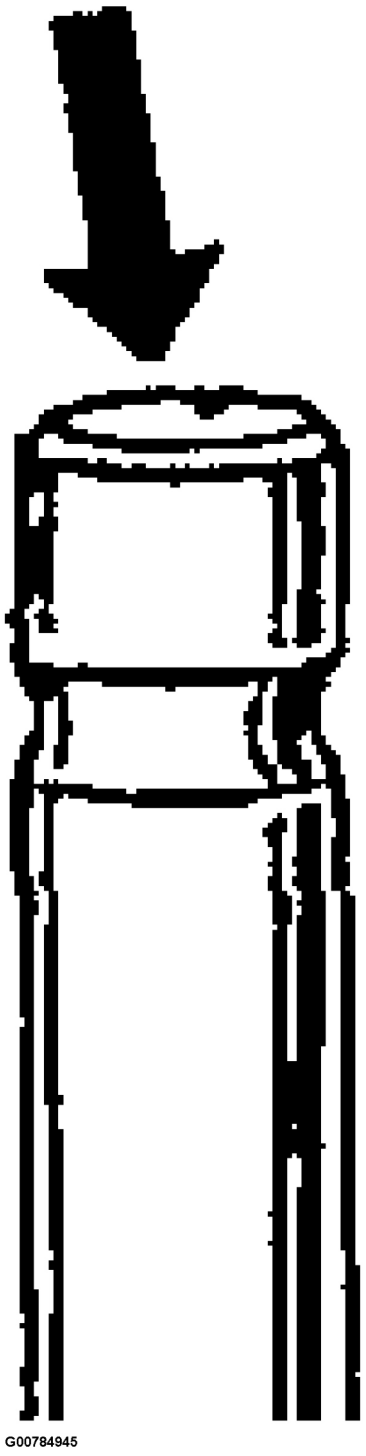


Fig. 151: Inspecting Valve Stem End Face
Courtesy of SUZUKI OF AMERICA CORP.

- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

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Limit on valve head radial runout

0.08 mm (0.003 in.)

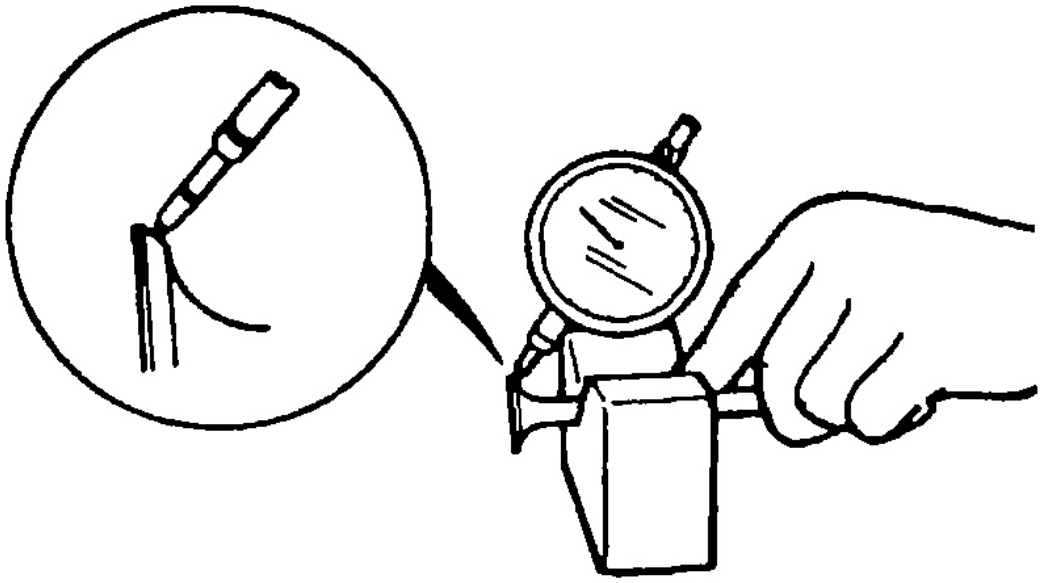


Fig. 152: Checking Valve For Radial Runout
Courtesy of SUZUKI OF AMERICA CORP.

- 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 face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

  Standard seating width revealed by contact pattern on valve face

  Intake: 0.9 - 1.1 mm (0.0355 - 0.0433 in.)

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

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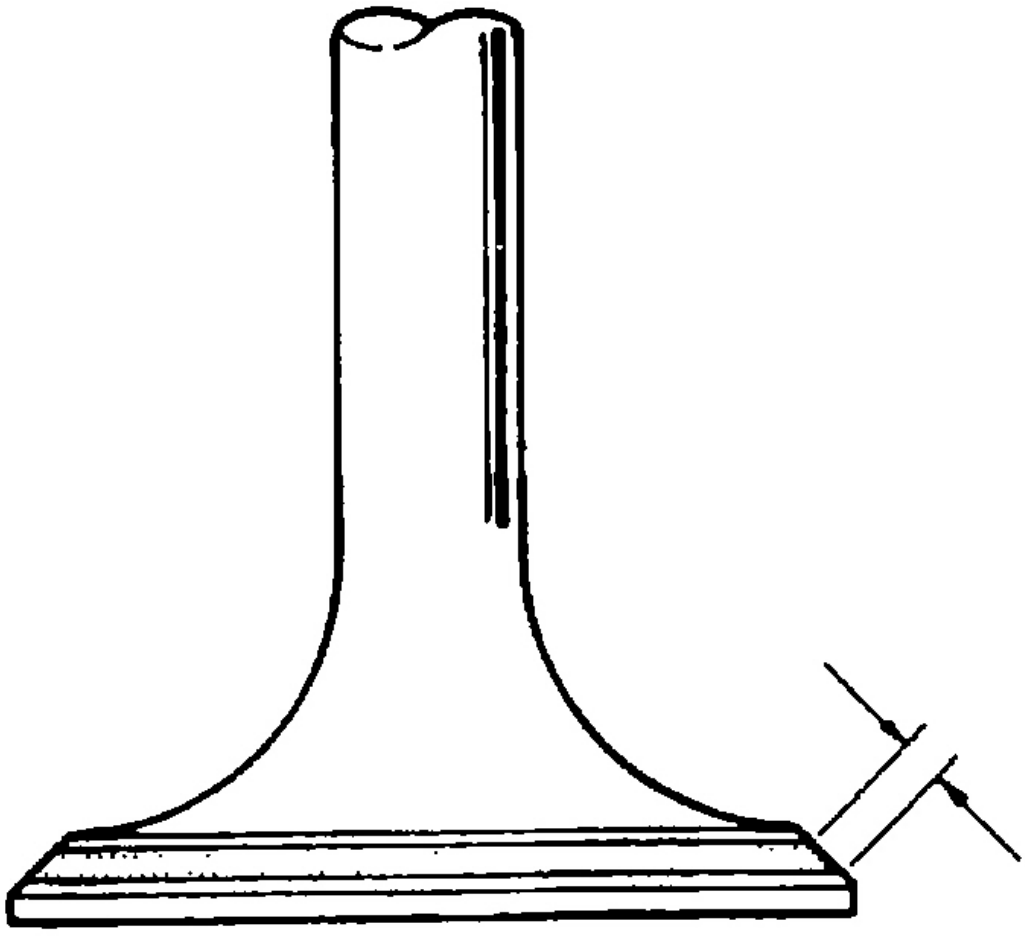


Fig. 153: Identifying Seating Contact Width
Courtesy of SUZUKI OF AMERICA CORP.

- Valve seat repair:

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

  a. VALVE SEAT: Use valve seat cutters (1) to make three cuts as illustrated in figure. Three cutters must be used:

     the 1st for making 30° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must

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be made to produce desired seat width.

Seat width for intake valve seat

0.9 - 1.1 mm (0.0355 - 0.0433 in.)

Seat width for exhaust valve seat

1.1 - 1.3 mm (0.0433 - 0.0512 in.)

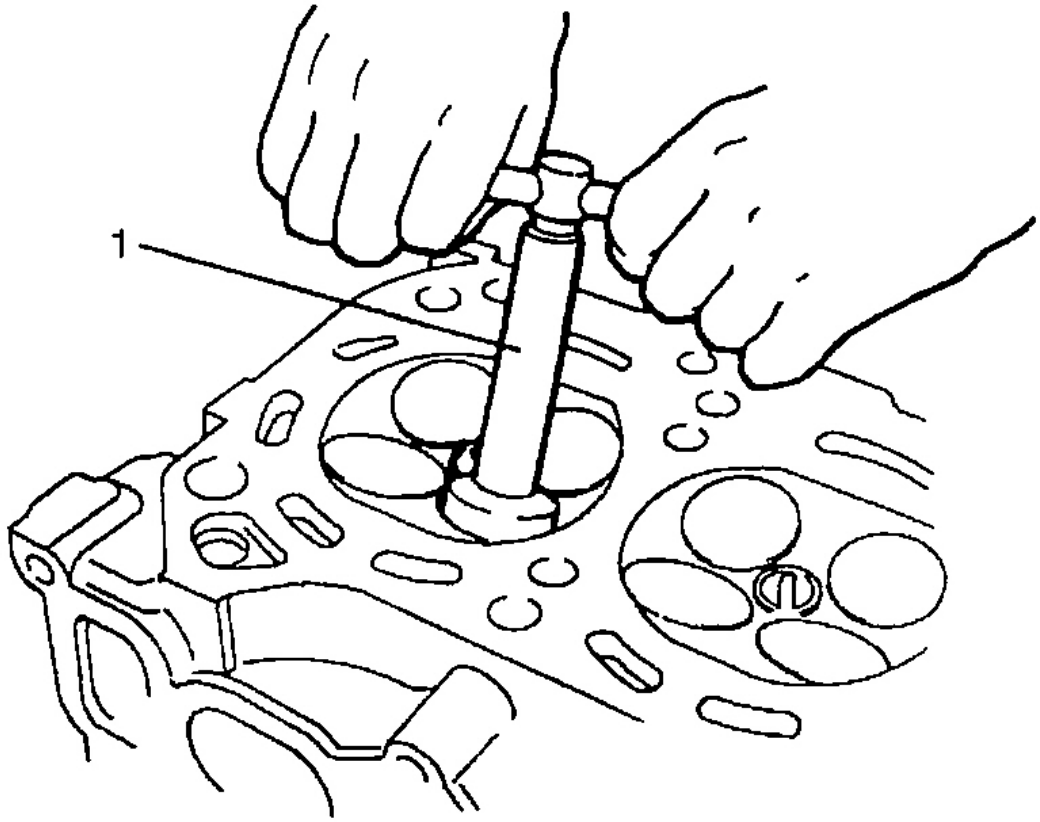


Fig. 154: Cutting Valve Seat
Courtesy of SUZUKI OF AMERICA CORP.

b. 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.

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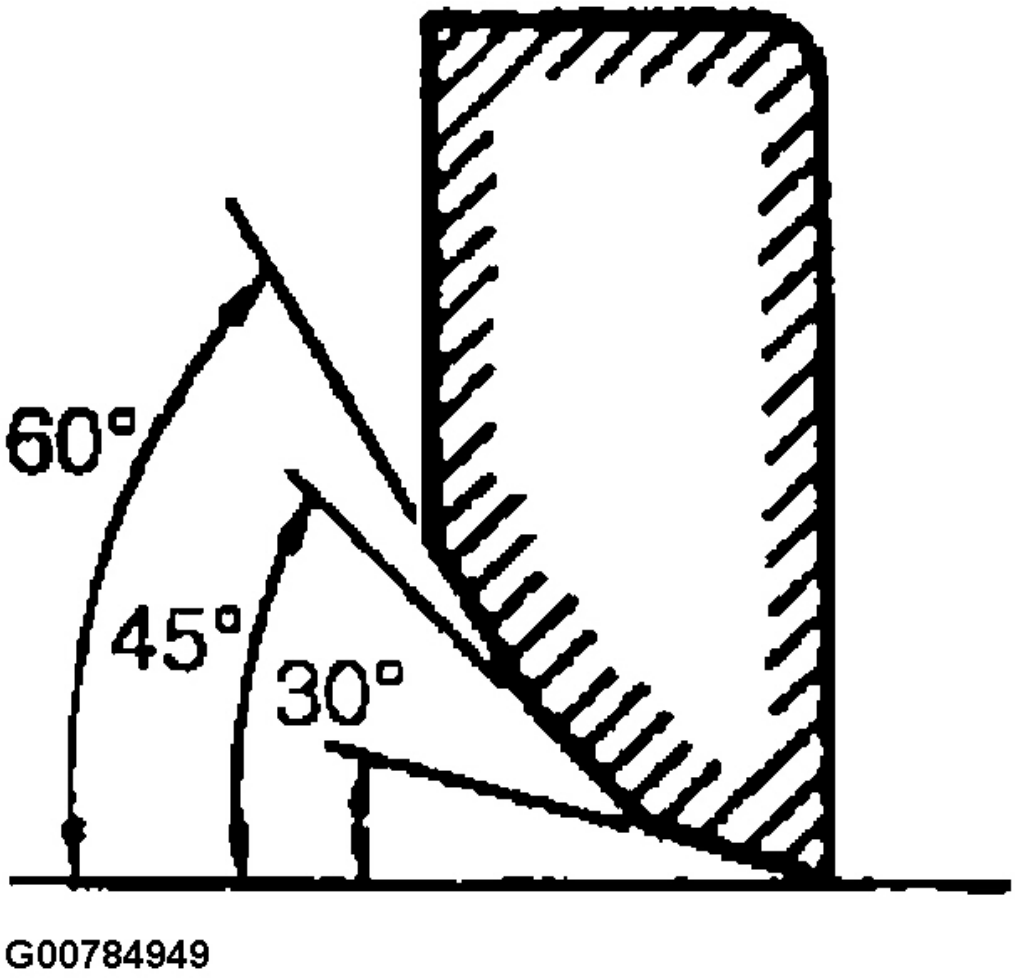


Fig. 155: Identifying Valve Seat Angles
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head

- Remove all carbon from combustion chambers.

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

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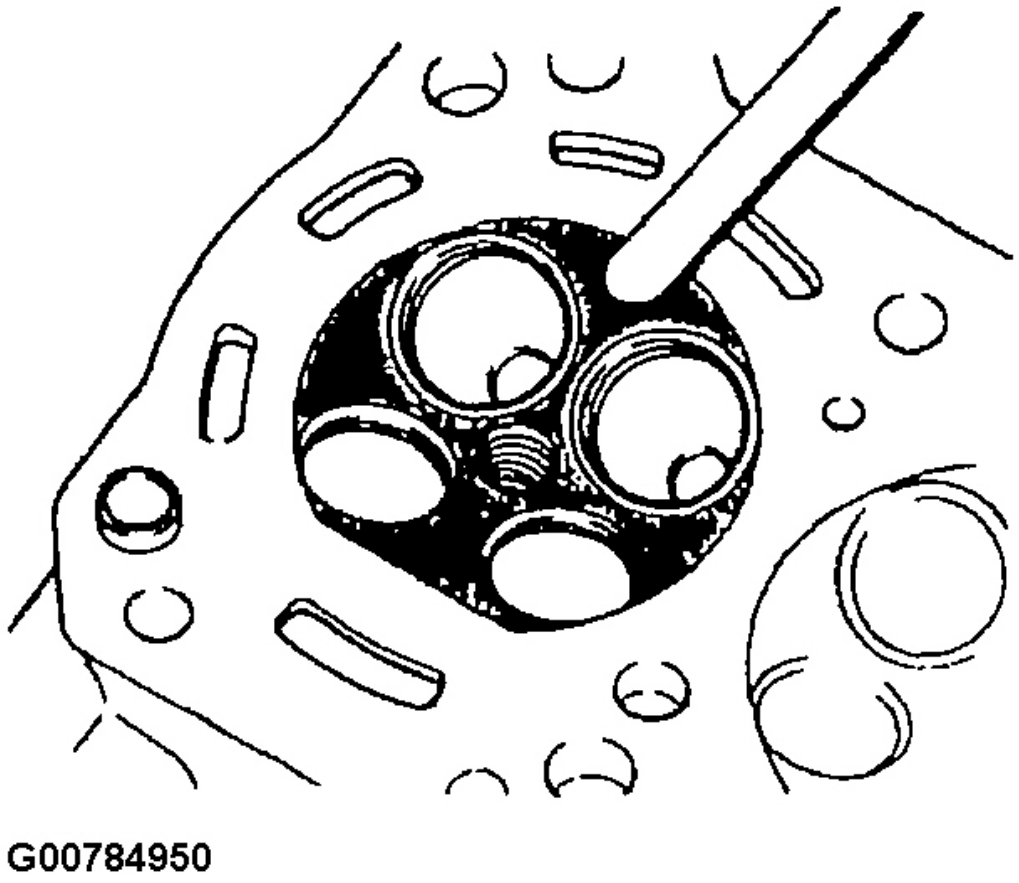


Fig. 156: Removing All Carbon From Combustion Chambers
Courtesy of SUZUKI OF AMERICA CORP.

- Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface at a total of 6 locations. If distortion limit is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper)

  Place paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.

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

  Limit of distortion

  0.05 mm (0.002 in.)

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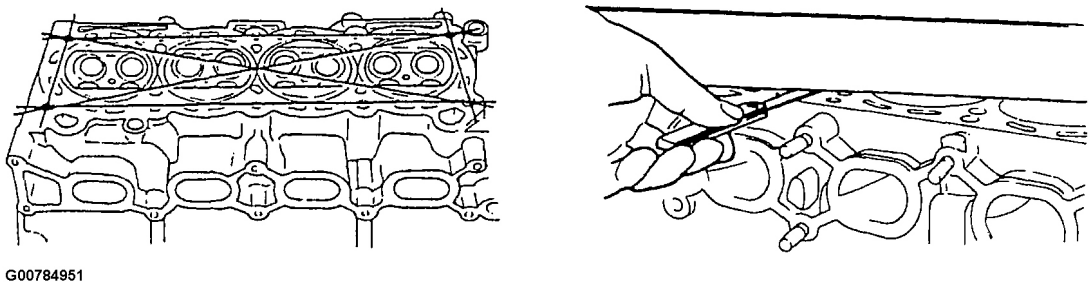


Fig. 157: Inspecting Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

- Distortion of manifold seating faces:

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

  Limit of distortion

  0.10 mm (0.004 in.)

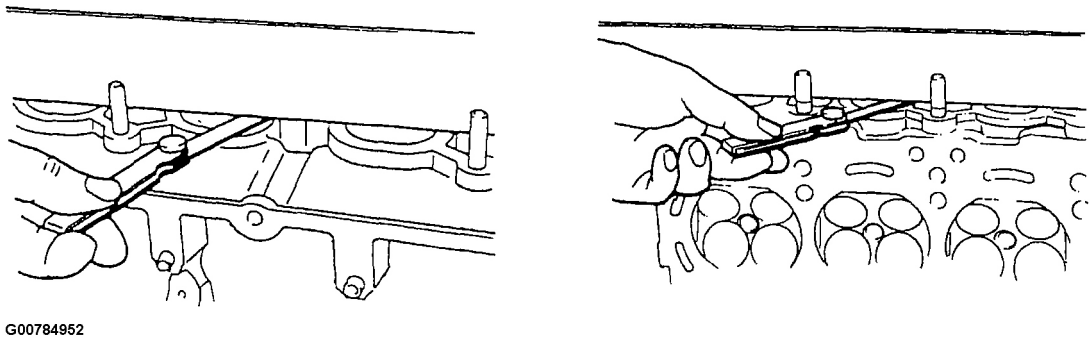


Fig. 158: Checking Seating Faces Of Cylinder Head For Manifolds
Courtesy of SUZUKI OF AMERICA CORP.

Valve Springs

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

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Standard	Limit
44.29 mm (1.7437 in.)	42.60 mm (1.6772 in.)

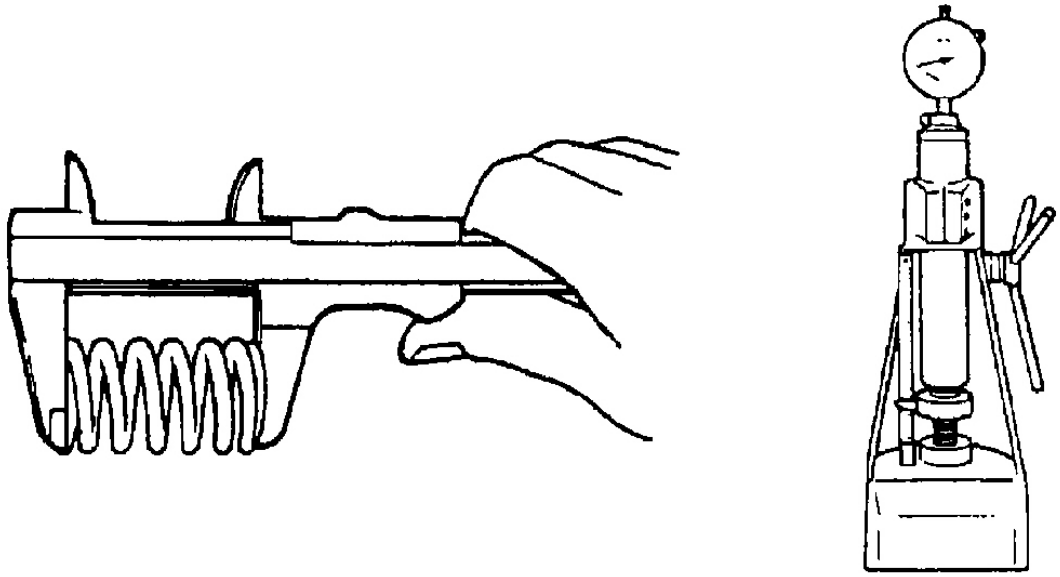
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Fig. 159: Identifying Valve Spring Free Length Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Standard	Limit
22.3 – 25.6 kg for 33.8 mm (49.2 – 56.4 lb / 1.33 in.)	24.0 kg for 33.8 mm (52.91 lb / 1.33 in.)

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Fig. 160: Identifying Valve Spring Preload Specifications
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 161: Measuring Valve Spring Preload
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

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valve spring and square. Valve springs found to exhibit a larger clearance than limit must be replaced.

Valve spring squareness limit

2.0 mm (0.079 in.)

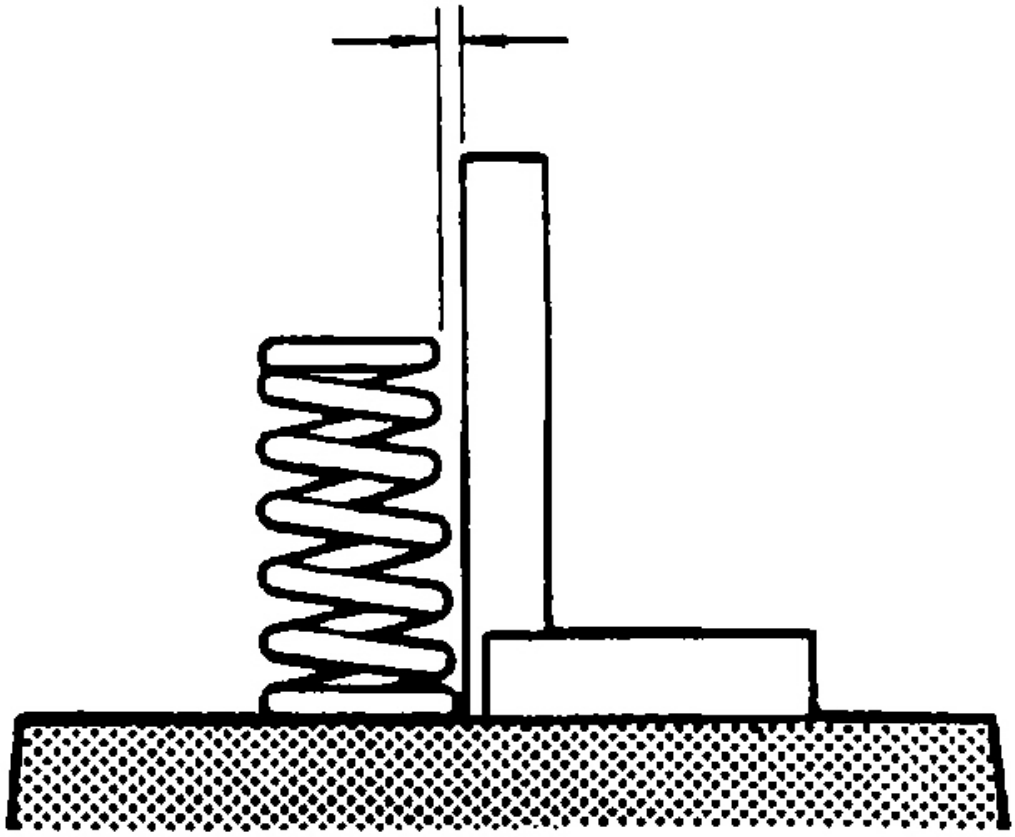
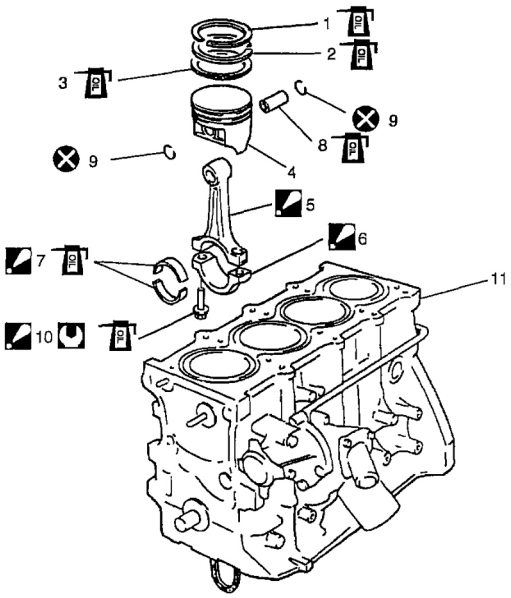


Fig. 162: Checking Each Spring For Squareness
Courtesy of SUZUKI OF AMERICA CORP.

Pistons, Piston Rings, Connecting Rods and Cylinders Components

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1. Top ring	10. Connecting rod bolt Tighten 15 N·m (1.5 kg-m, 11.0 lb-ft), 45° and 45° by the specified procedure.
2. 2nd ring	11. Cylinder block
3. Oil ring	12. Oil pump
4. Piston	13. Oil pump sprocket cover
5. Connecting rod : See "A"	: Tightening torque
6. Connecting rod bearing cap : See "B"	: Apply engine oil to sliding surface of each part.
7. Connecting rod bearing : See "C"	: Do not reuse.
8. Piston pin	
9. Piston pin circlip	
"A": Apply engine oil to sliding surface except inner surface of big end, and rod bolts. Check of rod bolt diameter when reuse it due to plastic deformation tightening. Refer to "Pistons, Piston Rings, Connecting Rods and Cylinders Inspection and Cleaning: ".	
"B": Point arrow mark on cap to crankshaft pulley side. Do not apply engine oil to inner surface of bearing cap.	
"C": Do not apply engine oil between con-rod big end and bearing, between cap and bearing.	

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Fig. 163: Identifying Pistons, Piston Rings, Connecting Rods & Cylinders Components
Courtesy of SUZUKI OF AMERICA CORP.

Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation

Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove oil pump with oil pump strainer. Refer to **Oil Pump Removal and Installation** for removal.
3. Remove cylinder head. Refer to **Valves and Cylinder Head Removal and Installation**.
4. Mark cylinder number on all pistons, connecting rods and connecting rod caps.
5. Remove connecting rod bearing caps.
6. Clean carbon from top of cylinder bore before removing piston from cylinder.
7. Push piston and connecting rod assembly out through the top of cylinder bore.

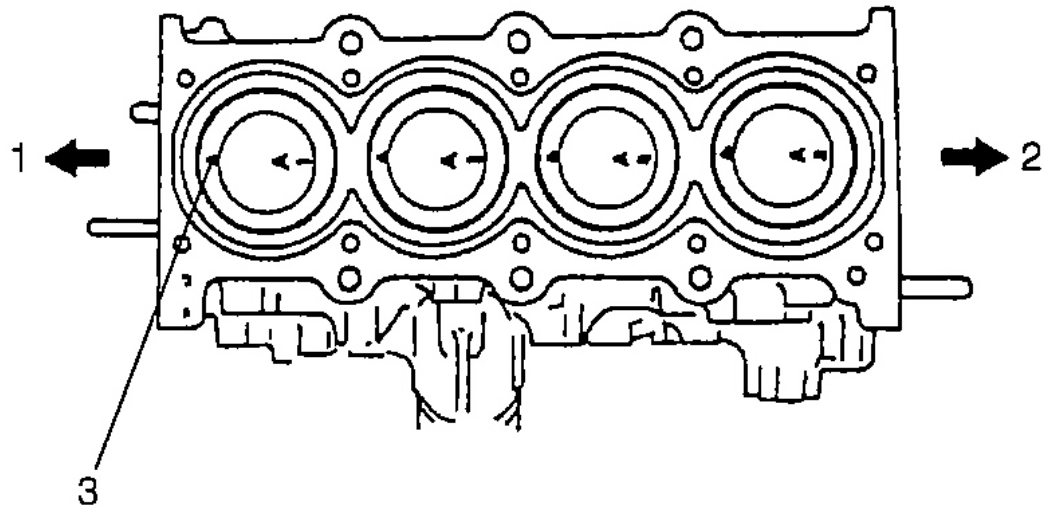
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Installation

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

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

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



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Fig. 164: Pointing Front Mark On Piston Head
Courtesy of SUZUKI OF AMERICA CORP.

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

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

   Special tool

   (A): 09916-77310

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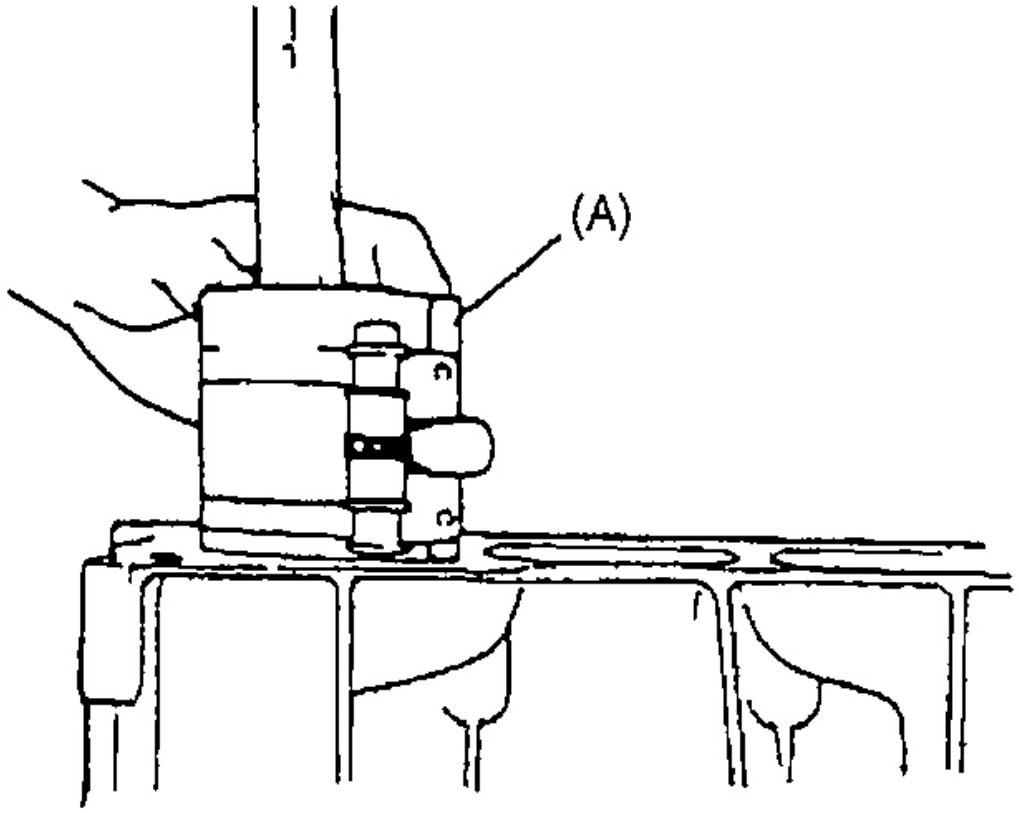


Fig. 165: Installing Piston & Connecting Rod Assembly
Courtesy of SUZUKI OF AMERICA CORP.

4. Install connecting rod bearing cap (1) as follows.
   a. Point arrow mark (2) on cap to crankshaft pulley side.
   b. Apply engine oil to connecting rod bolts (3).
   c. Tighten all connecting rod bolts/nuts to specification.

   Tightening torque

   Connecting rod bolt/nut (a): For 2002 and 2003 models, tighten nuts to 33 ft. lbs. (45 N.m). For 2004 models, tighten bolts to 15 N.m (1.5 kg-m, 11.0 lb-ft), then, 45° and an additional 45° by the specified procedure.

NOTE: If connecting rod bolt is reused, make sure to check connecting rod bolt

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for deformation. Refer to Pistons, Piston Rings, Connecting Rods and Cylinders Inspection and Cleaning.

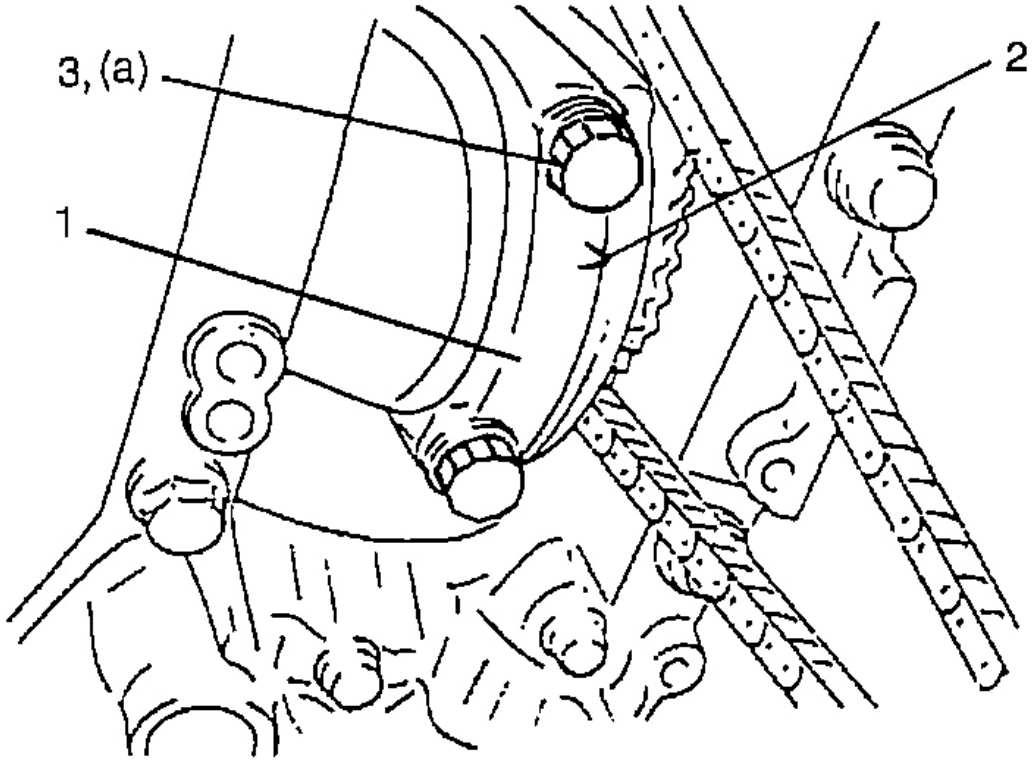


Fig. 166: Installing Connecting Rod Bearing Cap
Courtesy of SUZUKI OF AMERICA CORP.

5. Install cylinder head. Refer to **Valves and Cylinder Head Removal and Installation**.
6. Install oil pan. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
7. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation**.

Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly

Disassembly

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

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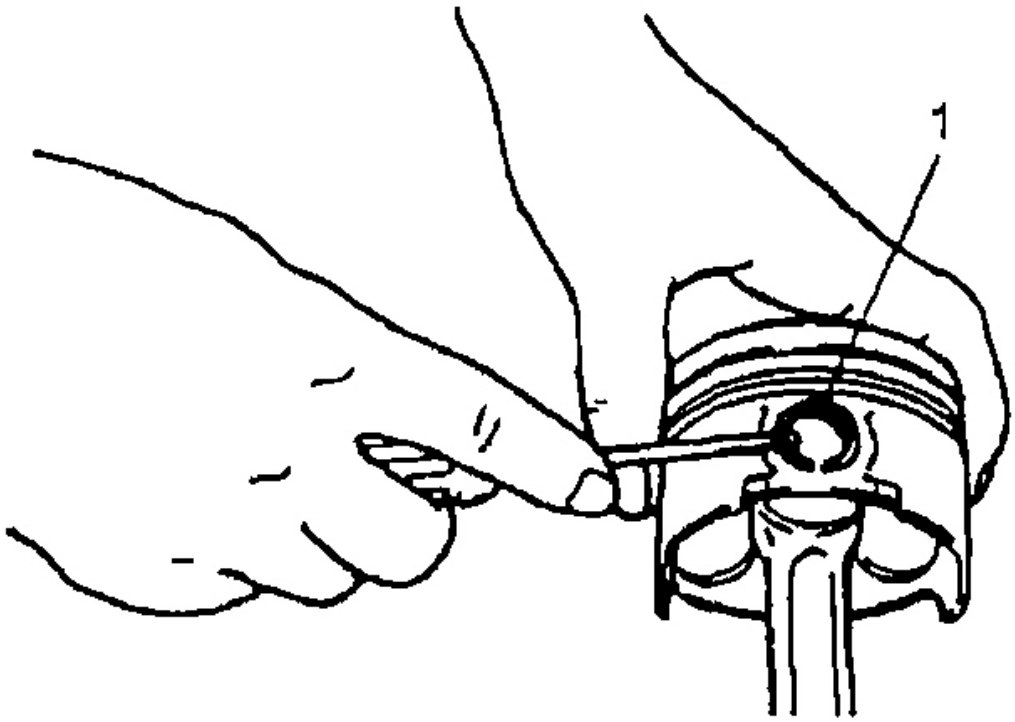


Fig. 167: Removing Piston Pin From Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

- Force piston pin out.

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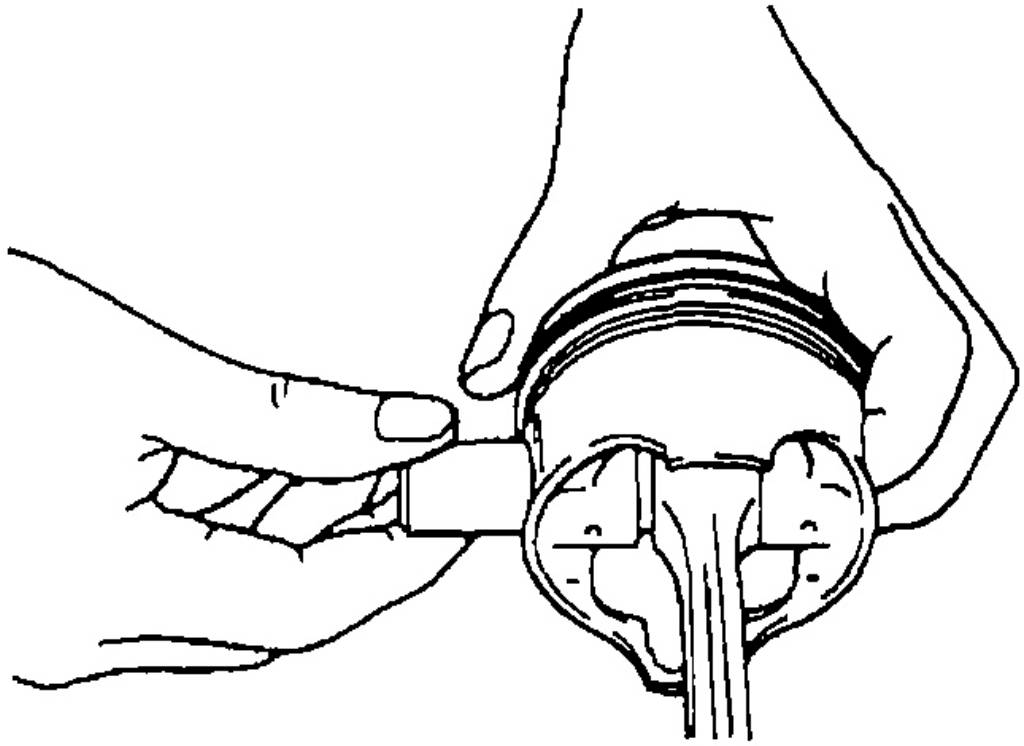


Fig. 168: Pulling Out Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

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

1. Each piston (1) has stamped number 1 or 2 as shown. It represents outer diameter of piston.
2. There are also painted color (3) of red and blue on cylinder block (2) as shown.

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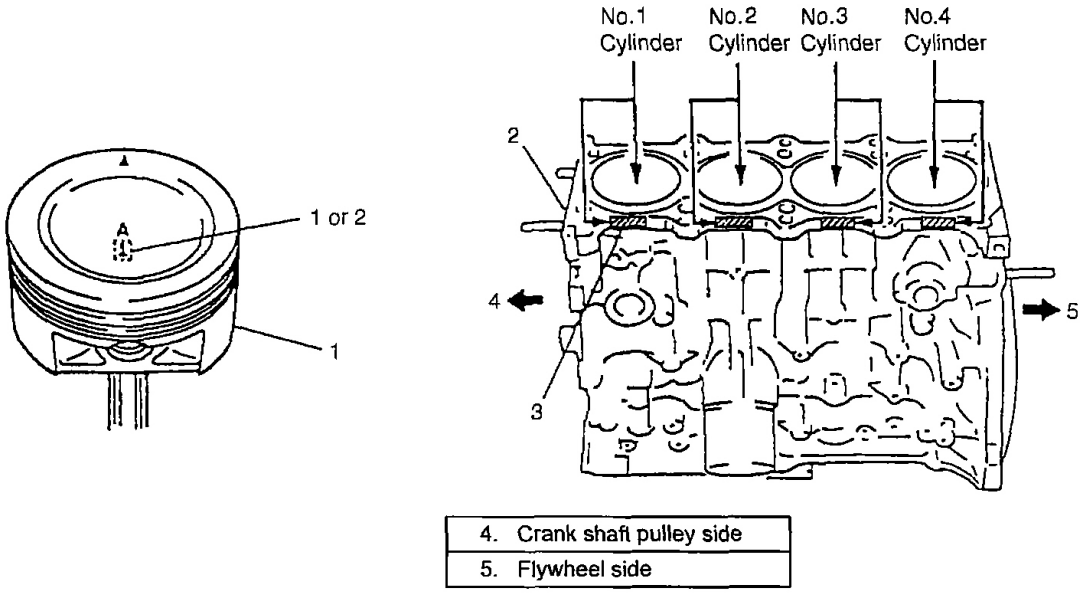


Fig. 169: Identifying Cylinder Block Markings
Courtesy of SUZUKI OF AMERICA CORP.

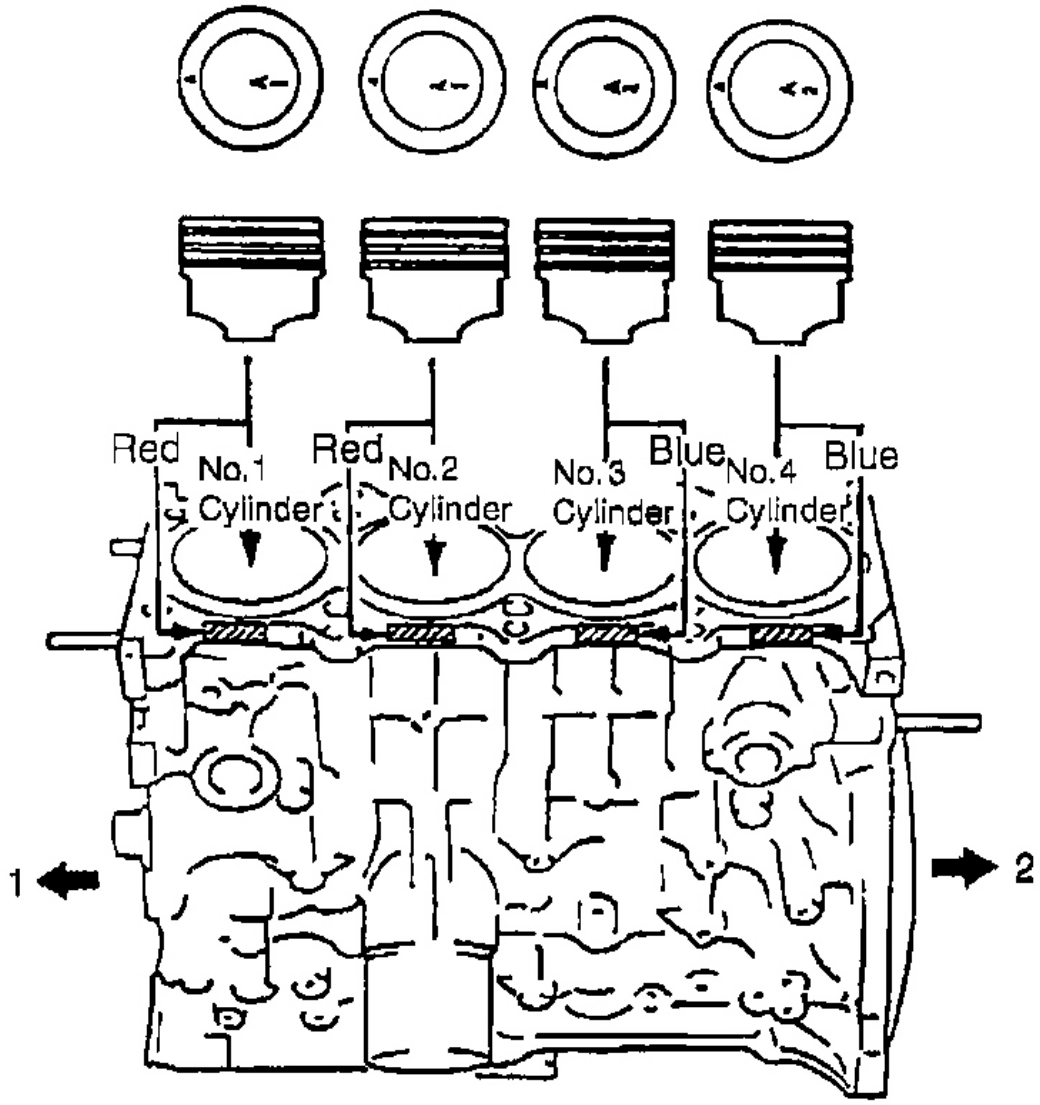
3. Stamped number on piston and stamped mark on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with mark blue and a number 1 piston to cylinder with mark red. Also, a letter A or B is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Mark	Bore diameter	
1	89.98 – 89.99 mm (3.5426 – 3.5429 in.)	Red	90.01 – 90.02 mm (3.5438 – 3.5440 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	89.97 – 89.98 mm (3.5422 – 3.5425 in.)	Blue	90.00 – 90.01 mm (3.5434 – 3.5437 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

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Fig. 170: Identifying Piston & Cylinder Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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1.	Crankshaft pulley side
2.	Flywheel side

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Fig. 171: Identifying Piston & Cylinder Arrangement
Courtesy of SUZUKI OF AMERICA CORP.

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4. Install piston pin to piston (1) and connecting rod (3):

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

   NOTE: Oil hole (4) come on intake side.

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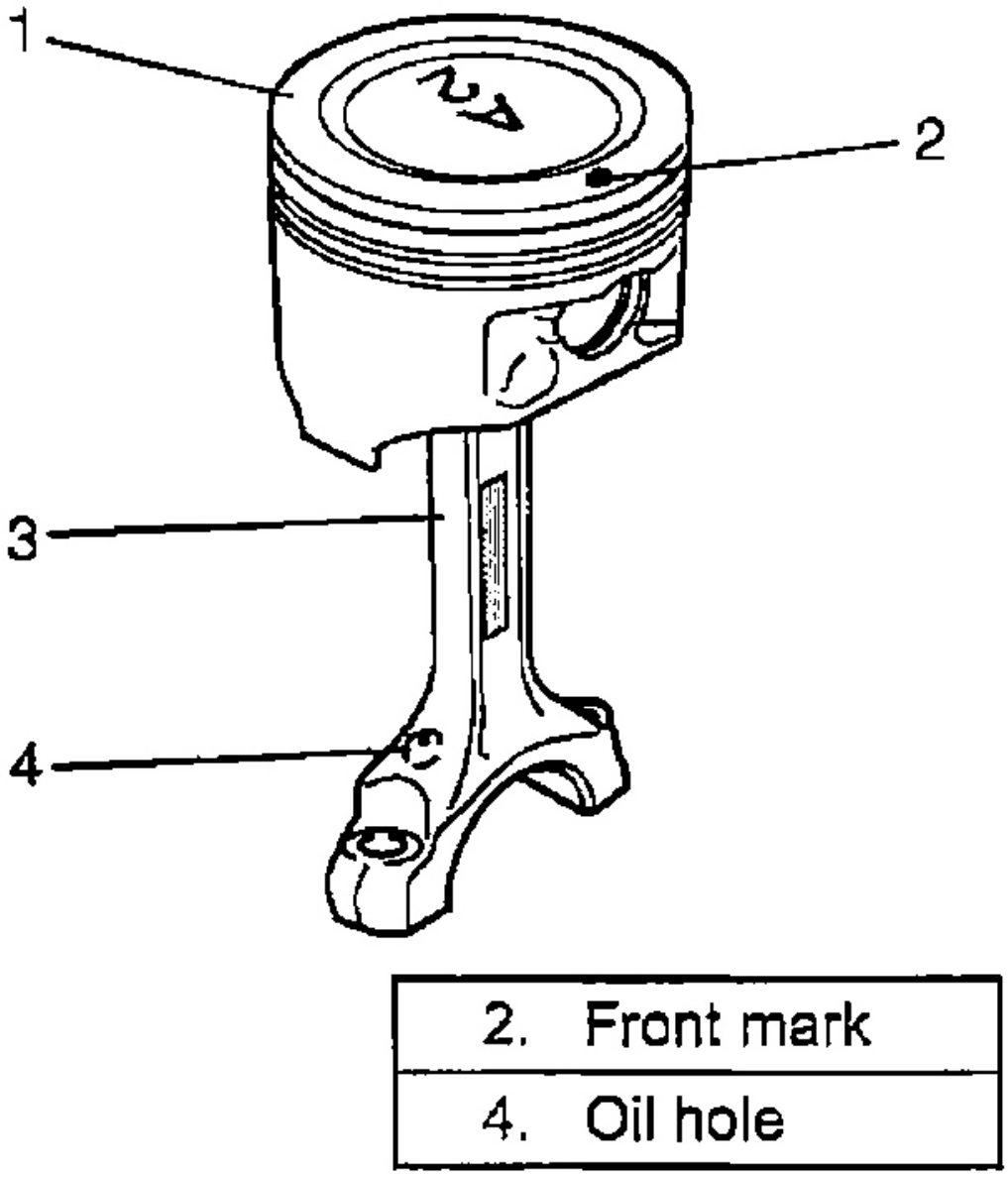
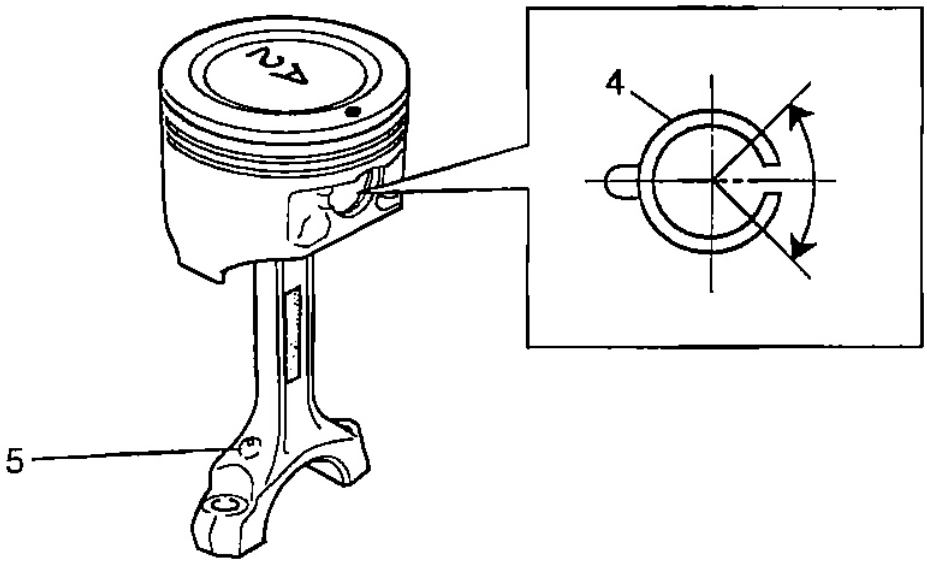


Fig. 172: Installing Piston Pin To Piston & Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Circlip (4) should be installed so that circlip end gap comes within such range as indicated by arrow.

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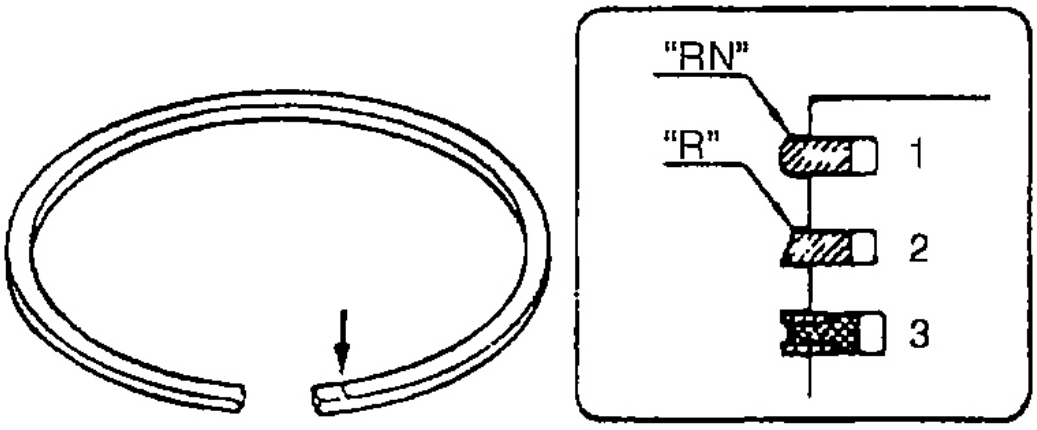
1. Piston	3. Connecting rod
2. Front mark	5. Oil hole

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Fig. 173: Identifying Circlip End Gap Range
Courtesy of SUZUKI OF AMERICA CORP.

5. Install piston rings to piston:
   - As indicated in figure at the left, 1st and 2nd rings have "RN" or "R" mark respectively. When installing the piston rings to piston, direct marked side of each ring toward top of piston.
   - 1st ring (1) differs from 2nd ring (2) in thickness, shape and color of surface contacting cylinder wall. Distinguish 1st ring from 2nd ring by referring to figure.
   - When installing oil ring (3), install spacer first and then two rails.

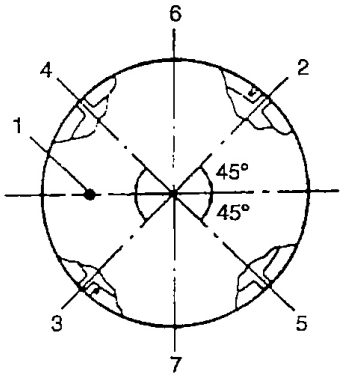
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Fig. 174: Installing Piston Rings
Courtesy of SUZUKI OF AMERICA CORP.

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



1. Front mark	4. Oil ring upper rail gap	7. Exhaust side
2. 1st ring end gap	5. Oil ring lower rail gap	
3. 2nd ring end gap and oil ring spacer gap	6. Intake side	

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Fig. 175: Identifying Distribution Of Piston Ring End Gaps
Courtesy of SUZUKI OF AMERICA CORP.

Pistons, Piston Rings, Connecting Rods and Cylinders Inspection and Cleaning

Inspection

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Cylinder

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use over size piston.
- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure. If any of following conditions is noted, rebore cylinder.
    1. Cylinder bore diameter exceeds limit.
    2. Difference of measurements at two positions exceeds taper limit.
    3. Difference between thrust and axial measurements exceeds out-of-round limit.

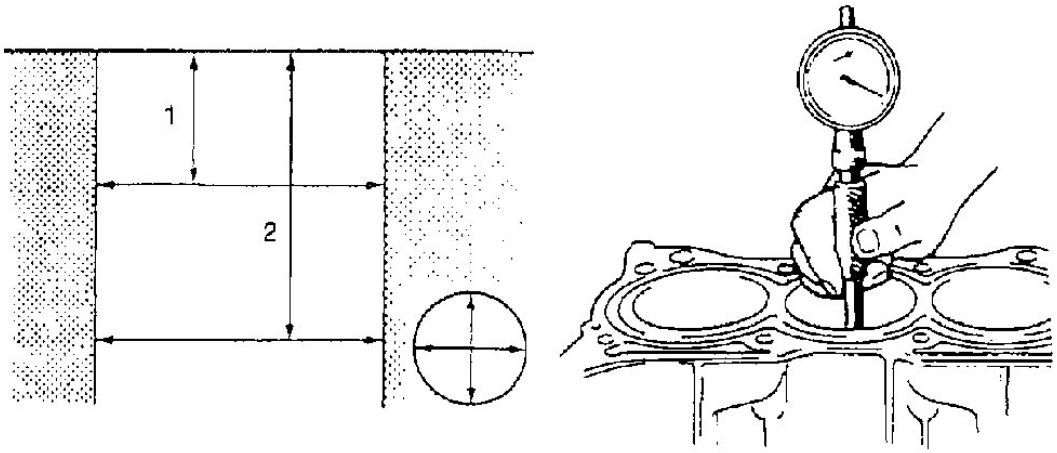
Cylinder bore diameter limit

90.050 mm (3.5433 in.)

Taper and out-of-round limit

0.10 mm (0.004 in.)

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



1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)

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Fig. 176: Measuring Cylinder Bore
Courtesy of SUZUKI OF AMERICA CORP.

Pistons

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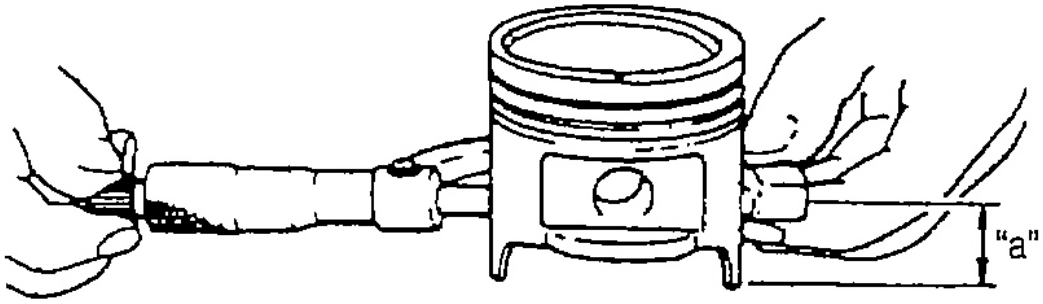
- Inspect piston for faults, cracks or other damages. Damaged or faulty piston should be replaced.
- Piston diameter:

  As indicated in figure, piston diameter should be measured at a position 27.5 mm (1.08 in.) ("A") from piston skirt end in the direction perpendicular to piston pin.

Standard	89.970 – 89.990 mm (3.5422 – 3.5429 in.)
Oversize: 0.50 mm (0.0196 in.)	90.470 – 90.490 mm (3.5619 – 3.5626 in.)

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Fig. 177: Identifying Piston Diameter Specifications
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 178: Measuring Piston Diameter
Courtesy of SUZUKI OF AMERICA CORP.

- Piston clearance:

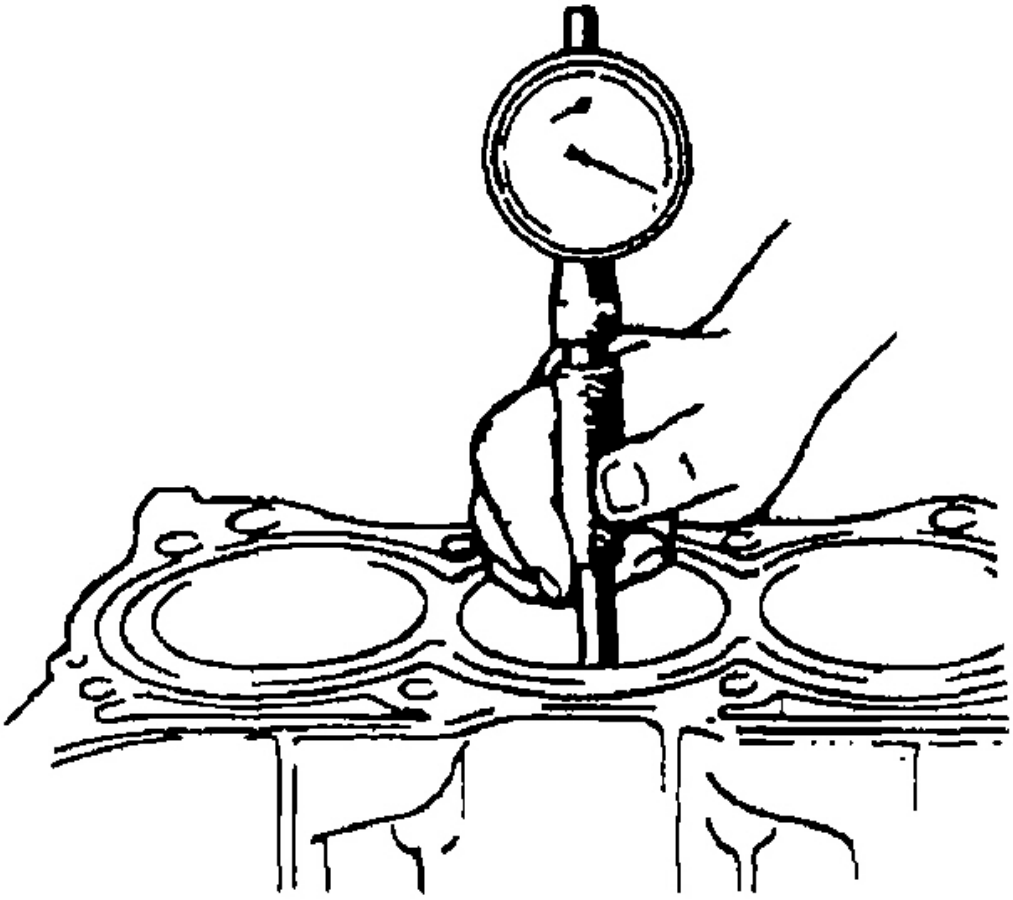
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as follows. If it is out of specification, rebore cylinder and use oversize piston.

  Piston clearance

  0.02 - 0.04 mm (0.0008 - 0.0015 in.)

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

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Fig. 179: Measuring Piston Clearance
Courtesy of SUZUKI OF AMERICA CORP.

- Ring groove clearance:

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

  Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2).

  If clearance is out of specification, replace piston.

  Ring groove clearance

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

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

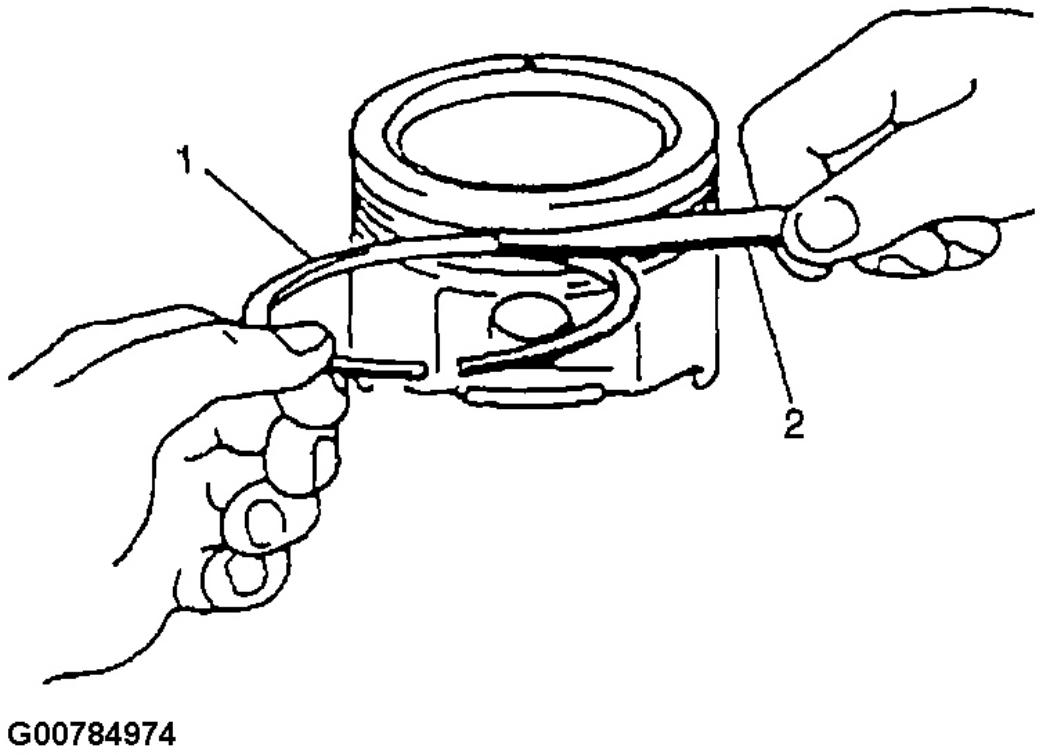


Fig. 180: Measuring Ring Groove Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Piston pin

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

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

Piston pin clearance in small end (standard)

0.003 - 0.014 mm (0.0001 - 0.0005 in.)

Small-end bore

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21.003 - 21.011 mm (0.8269 - 0.8272 in.)

Piston pin diameter

20.997 - 21.000 mm (0.8267 - 0.8268 in.)

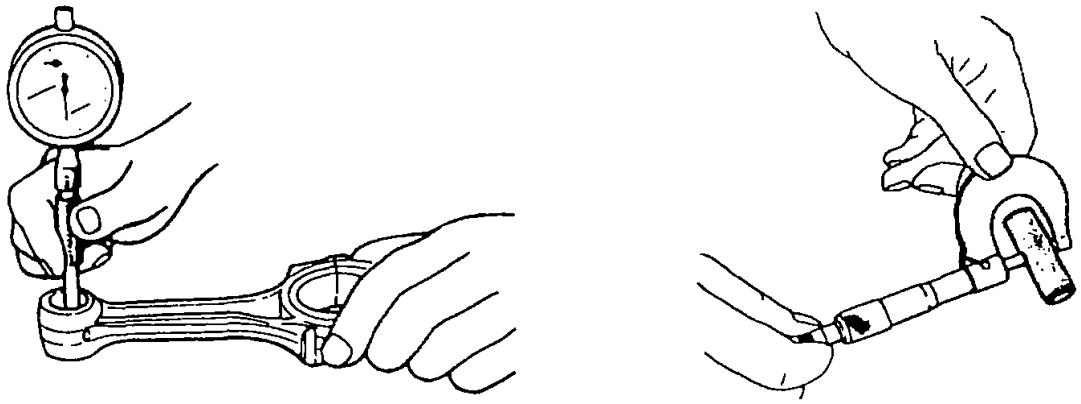


Fig. 181: Measuring Piston Ring
Courtesy of SUZUKI OF AMERICA CORP.

Piston rings

To measure end gap, insert piston ring (2) into cylinder bore and then measure the gap by using thickness gauge (1). If measured gap is out of specification, replace ring.

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

Item	Standard	Limit
Top ring	0.20 – 0.32 mm (0.0079 – 0.0125 in.)	0.7 mm (0.0276 in.)
2nd ring	0.32 – 0.47 mm (0.0126 – 0.0185 in.)	0.7 mm (0.0276 in.)
Oil ring	0.20 – 0.50 mm (0.0079 – 0.0196 in.)	1.8 mm (0.0709 in.)

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Fig. 182: Identifying Piston Ring End Gap Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Piston rings end gap

"A": 120 mm (4.72 in.)

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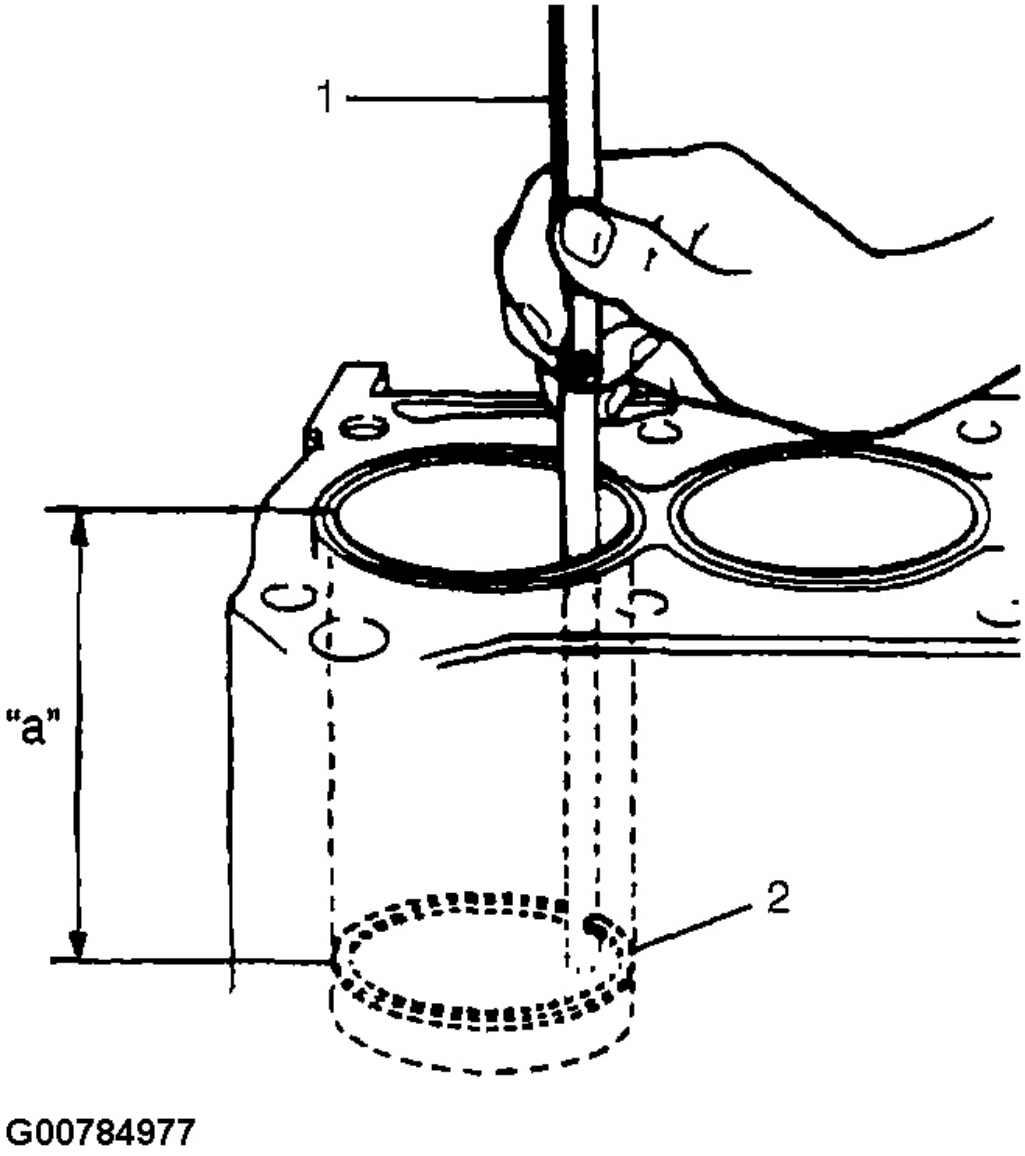


Fig. 183: Measuring Piston Ring End Gap
Courtesy of SUZUKI OF AMERICA CORP.

Connecting rod

- Big-end side clearance:

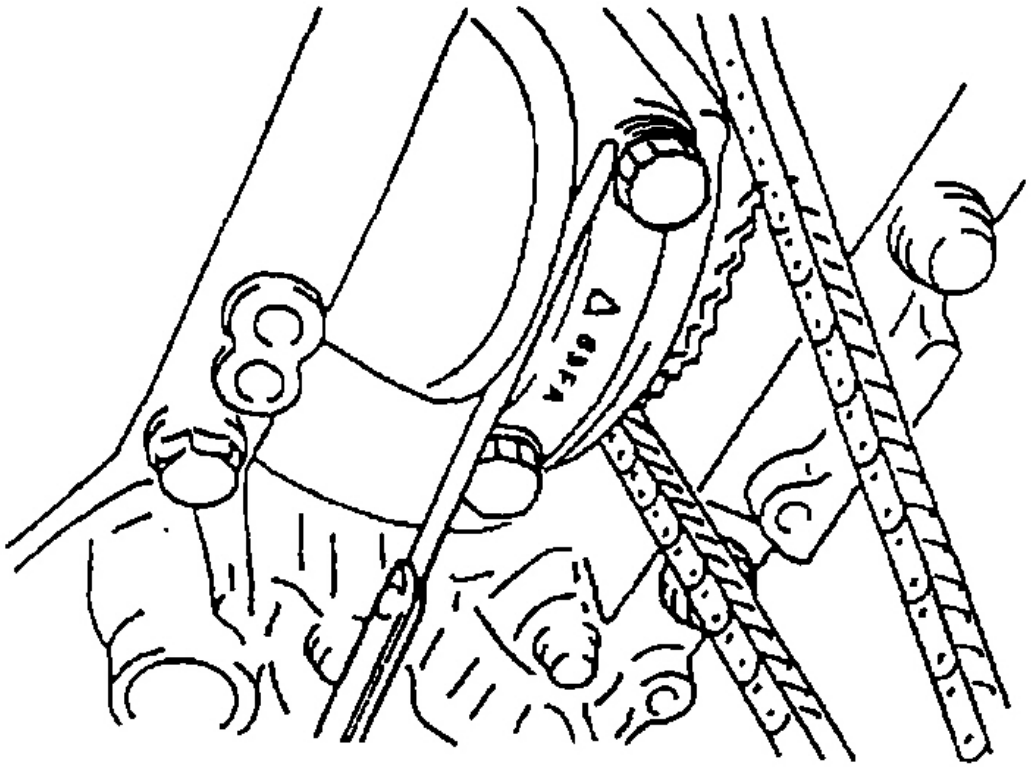
  Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

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Standard	Limit
0.25 – 0.40 mm (0.0099 – 0.0150 in.)	0.45 mm (0.0177 in.)

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Fig. 184: Identifying Big-End Side Clearance Specifications
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 185: Measuring Big-End Side Clearance
Courtesy of SUZUKI OF AMERICA CORP.

- Connecting rod alignment:

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

  Limit on bow

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0.05 mm (0.0020 in.)

Limit on twist

0.10 mm (0.0039 in.)

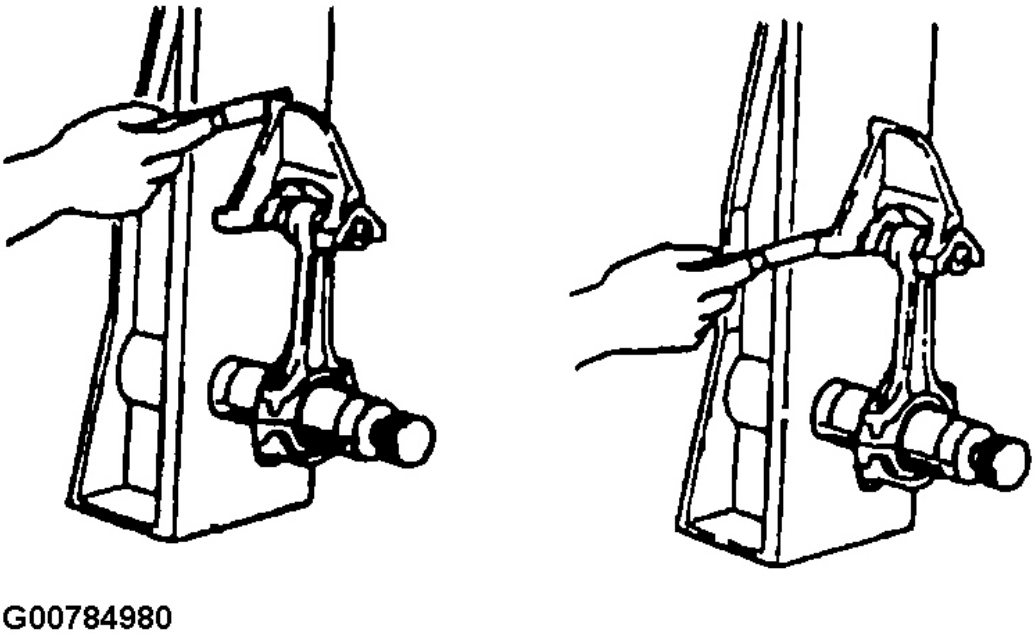


Fig. 186: Aligning Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

Crank pin and connecting rod bearings

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

Connecting rod bearing size	Crank pin diameter
Standard	49.982 – 50.000 mm (1.9768 – 1.9685 in.)
0.25 mm (0.0098 in.) undersize	49.732 – 49.750 mm (1.9580 – 1.9586 in.)

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Fig. 187: Identifying Connecting Rod Bearing & Crank Pin Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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Out-of-round

"A" - "B"

Taper

"A" - "b"

Out-of-round and taper limits

0.01 mm (0.0004 in.)

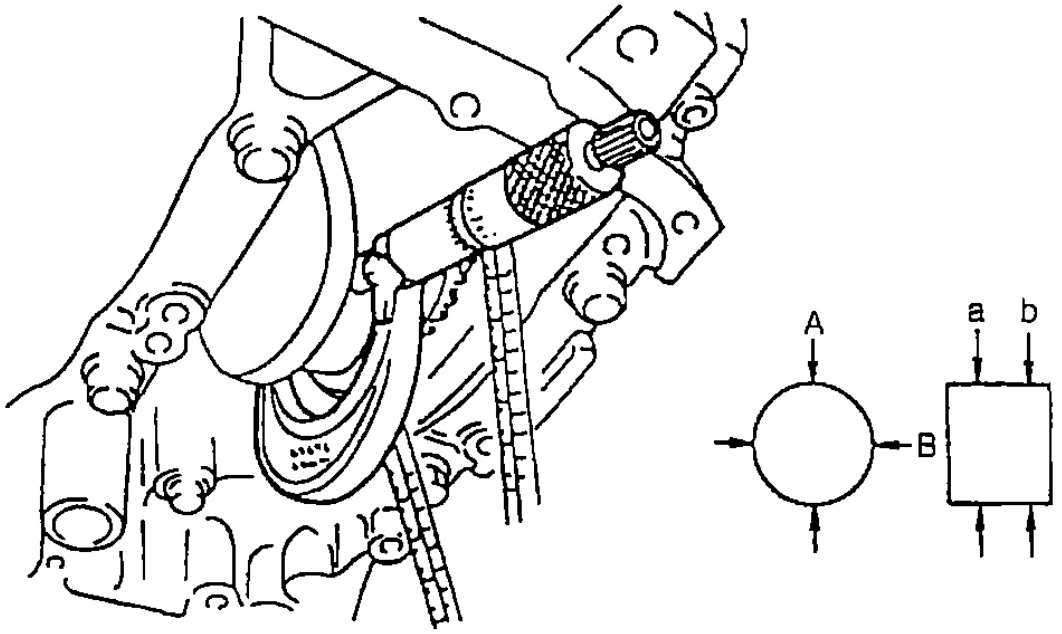


Fig. 188: Measuring Connecting Rod Bearing & Crank Pin
Courtesy of SUZUKI OF AMERICA CORP.

- **Connecting rod bearing general information:**

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

  Two kinds of connecting rod bearings are available; standard size bearing and 0.25 mm (0.0098 in.) undersize bearing. For identification of undersize bearing, it is painted red (1) at the position as indicated in the figure, undersize bearing thickness is 1.605 - 1.615 mm (0.0632 - 0.0635 in.) at the center of it.

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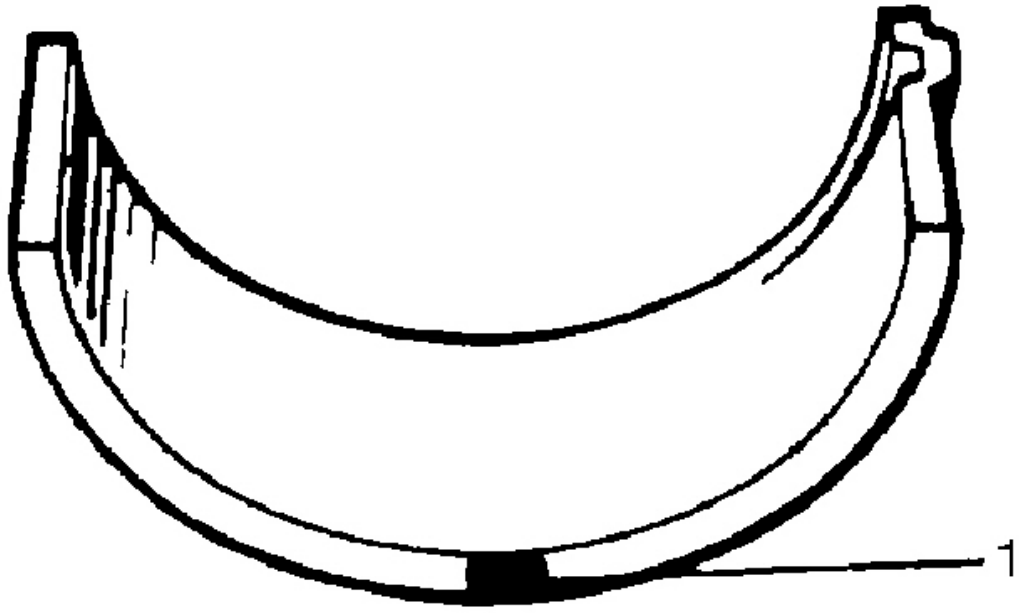


Fig. 189: Identifying Undersize Connecting Rod Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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

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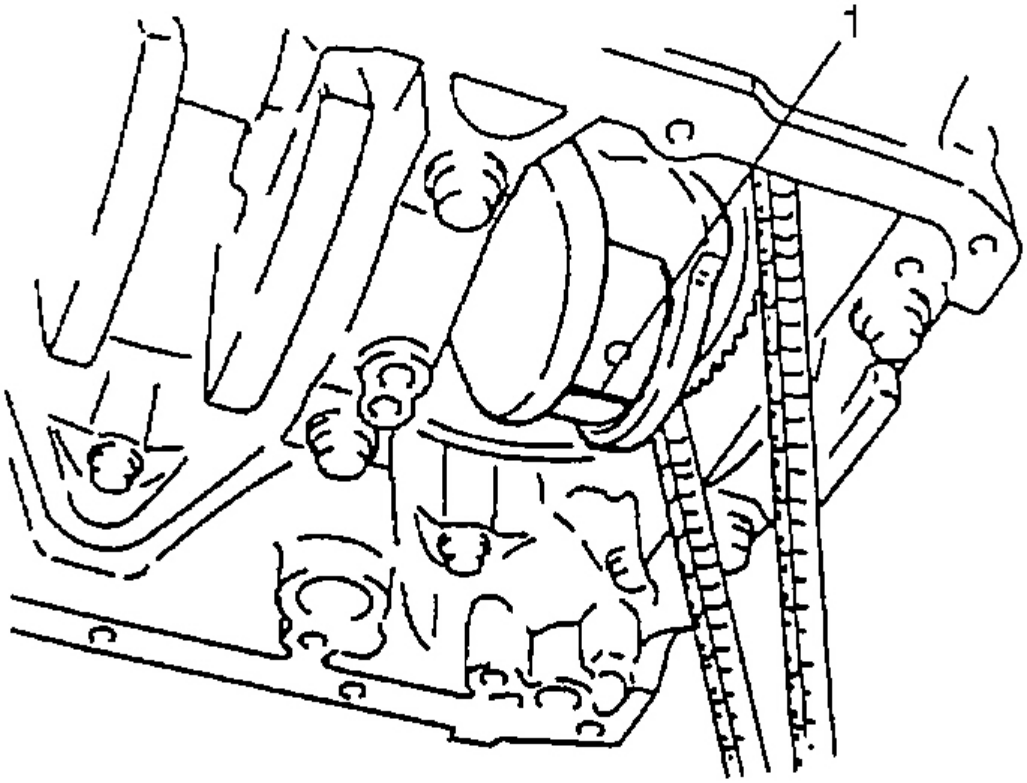


Fig. 190: Placing Gauging Plastic Parallel To Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

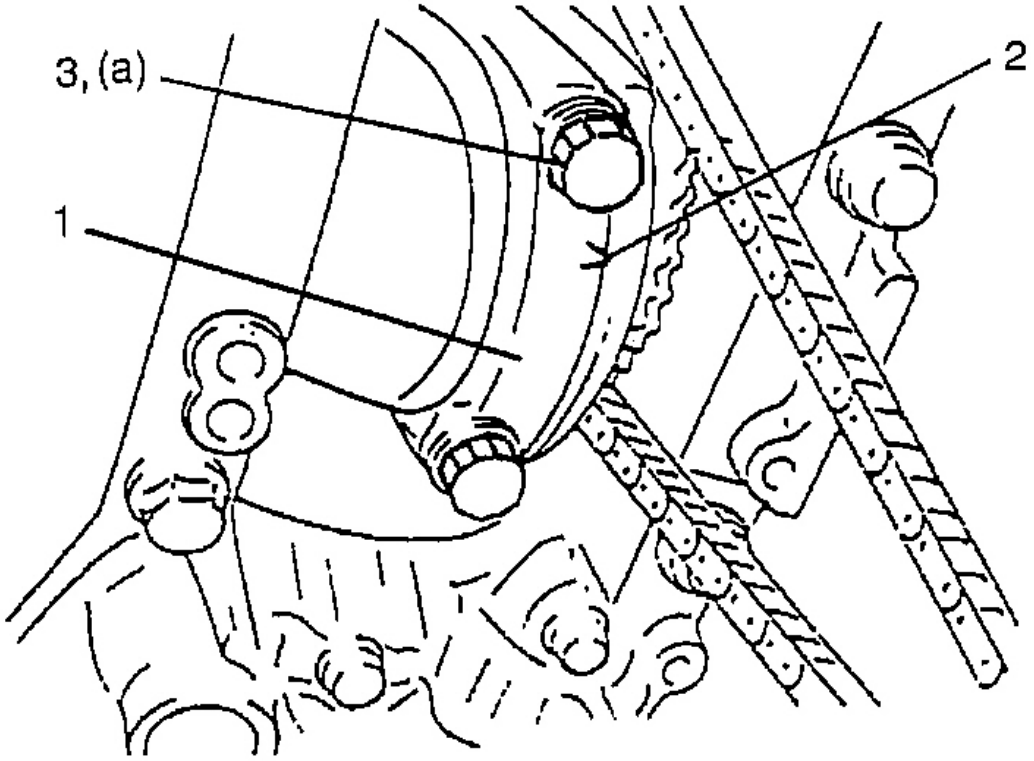
d. Install connecting rod bearing cap (1) as follows.
   i. Point arrow mark (2) on cap to crankshaft pulley side.
   ii. Apply engine oil to connecting rod bolts (3).
   iii. Tighten all connecting rod bolts/nuts to specification.

Tightening torque

Connecting rod bolt/nut (a): For 2002 and 2003 models, tighten nuts to 33 ft. lbs. (45 N.m). For 2004 models, tighten bolts to 15 N.m (1.5 kg-m, 11.0 lb-ft), then, 45° and an additional 45° by the specified procedure.

NOTE: DO NOT turn crankshaft with gauging plastic installed.

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Fig. 191: Installing Connecting Rod Bearing Cap
Courtesy of SUZUKI OF AMERICA CORP.

e. Remove connecting rod bearing cap, and using a scale (2) on gauging plastic envelope, measure gauging plastic (1) width at the widest point (clearance).

If clearance exceeds its limit, select connecting rod bearing referring to "Pistons, Piston Rings, Connecting Rods and Cylinders Inspection and Cleaning:" below mentioned item.

After selecting new bearing, recheck clearance.

Standard	Limit
0.045 – 0.063 mm (0.0018 – 0.0025 in.)	0.08 mm (0.0031 in.)

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Fig. 192: Identifying Bearing Clearance Specifications
Courtesy of SUZUKI OF AMERICA CORP.

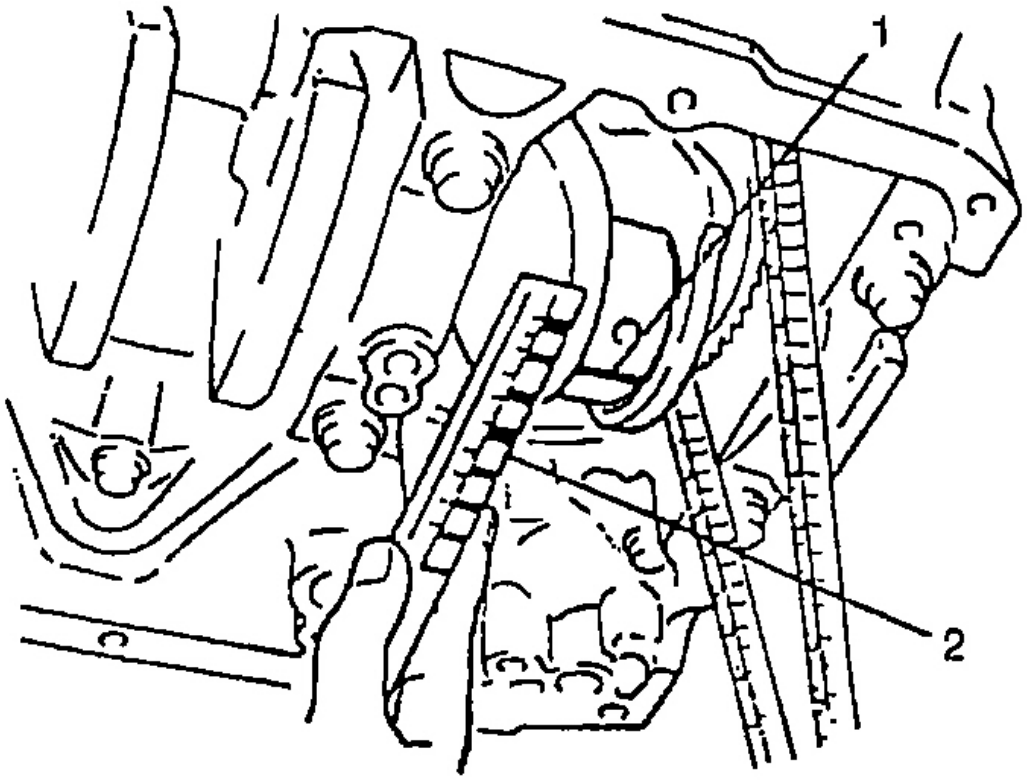


Fig. 193: Measuring Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

f. If clearance can not be brought to within its limit even by using a new standard size bearing, replace crankshaft or regrind crankpin to undersize as follows.
   - Install 0.25 mm undersize bearing to connecting rod big end.
   - Measure bore diameter of connecting rod big end.
   - Regrind crankpin to the following finished diameter.

     Finished crankpin diameter = Measured big end bore diameter (including undersize bearing

   - 0.054 mm (0.0021 in.)
   - Confirm that bearing clearance is within the standard value.

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NOTE: **After checking the connecting rod bearing clearance, make sure to check for CONNECTING ROD BOLT DEFORMATION.**

- **Selection of connecting rod bearings:**

NOTE:

- **If bearing is in malcondition or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.**
- **When replacing crankshaft or connecting rod and its bearing due to any reason, select new standard bearings to be installed referring to numbers stamped on connecting rod and its cap and/or alphabets stamped on crank web of No. 3 cylinder.**

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

Three kinds of numbers ("1", "2" and "3") represent the following connecting rod big end inside diameters. For example, stamped number "1" indicates that corresponding connecting rod big-end inside diameter is 53.0000 - 53.0060 mm (2.0867 - 2.0868 in.).

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

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Fig. 194: Identifying Connecting Rod Big-End Inside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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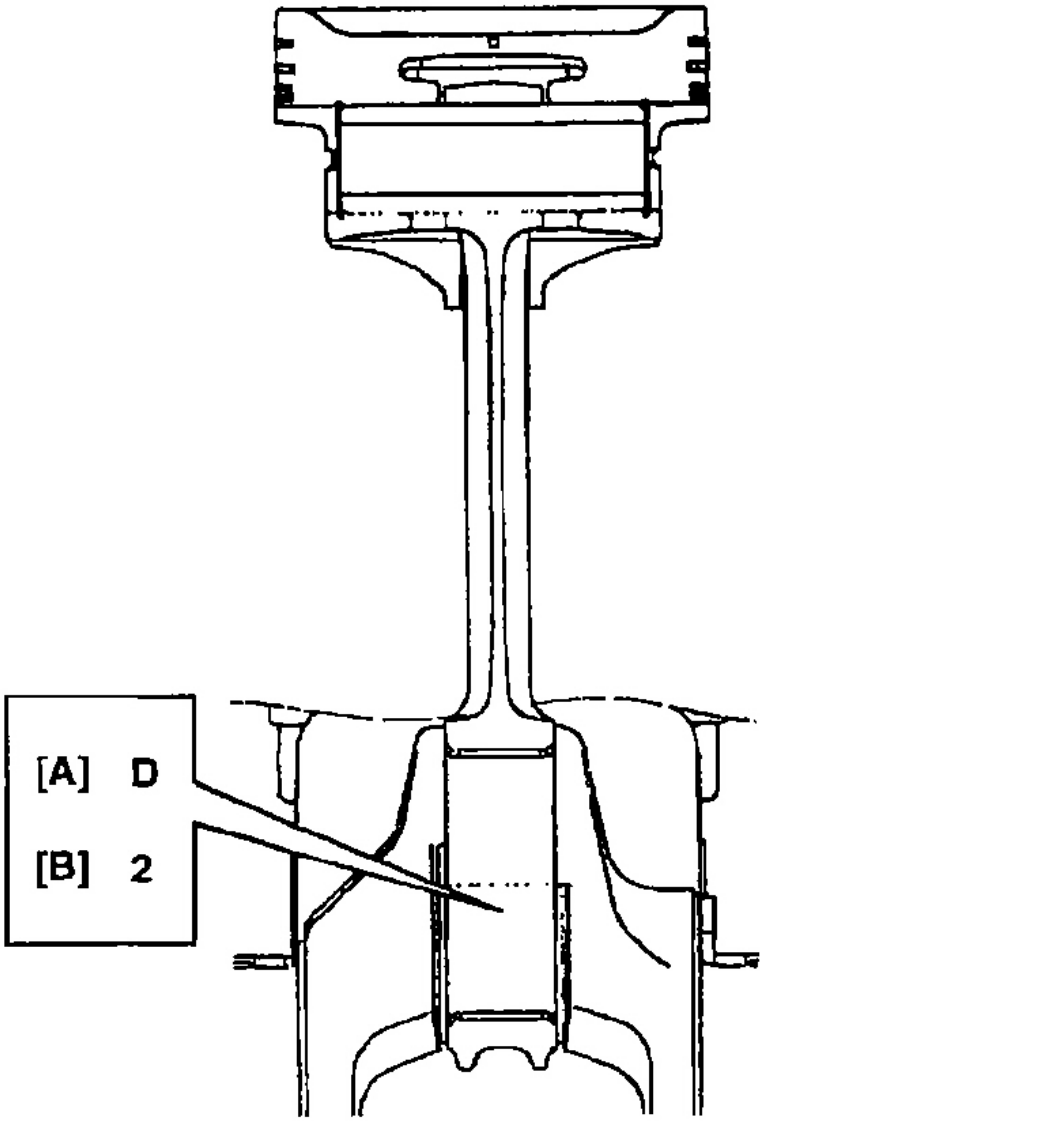


Fig. 195: Identifying Connecting Rod Markings
Courtesy of SUZUKI OF AMERICA CORP.

b. Next, check crank pin diameter. On crank web of No. 3 cylinder, four alphabets are stamped as shown in the figure.

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Three kinds of alphabet ("A", "B" and "C") represent the following crank pin diameter respectively.

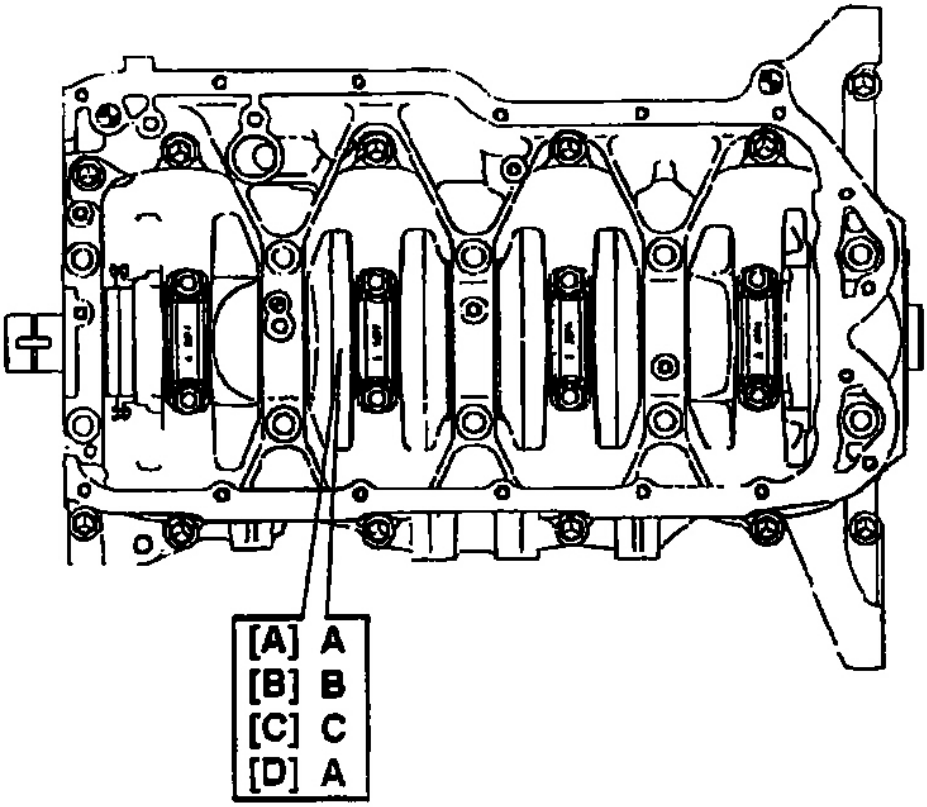
For example, stamped "A" indicates that corresponding crank pin diameter is 49.9940 - 50.0000 mm (1,9683 - 1.9685 in.).

Stamped alphabet	Crank pin diameter (without bearing)
A	49.9940 – 50.0000 mm (1.9683 – 1.9685 in.)
B	49.9880 – 49.9939 mm (1.9681 – 1.9682 in.)
C	49.9820 – 49.9879 mm (1.9677 – 1.9680 in.)

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Fig. 196: Identifying Crank Pin Diameter Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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[A]:	Crankshaft pin diameter for No.1 cylinder
[B]:	Crankshaft pin diameter for No.2 cylinder
[C]:	Crankshaft pin diameter for No.3 cylinder
[D]:	Crankshaft pin diameter for No.4 cylinder

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Fig. 197: Identifying Crankshaft Marking
Courtesy of SUZUKI OF AMERICA CORP.

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

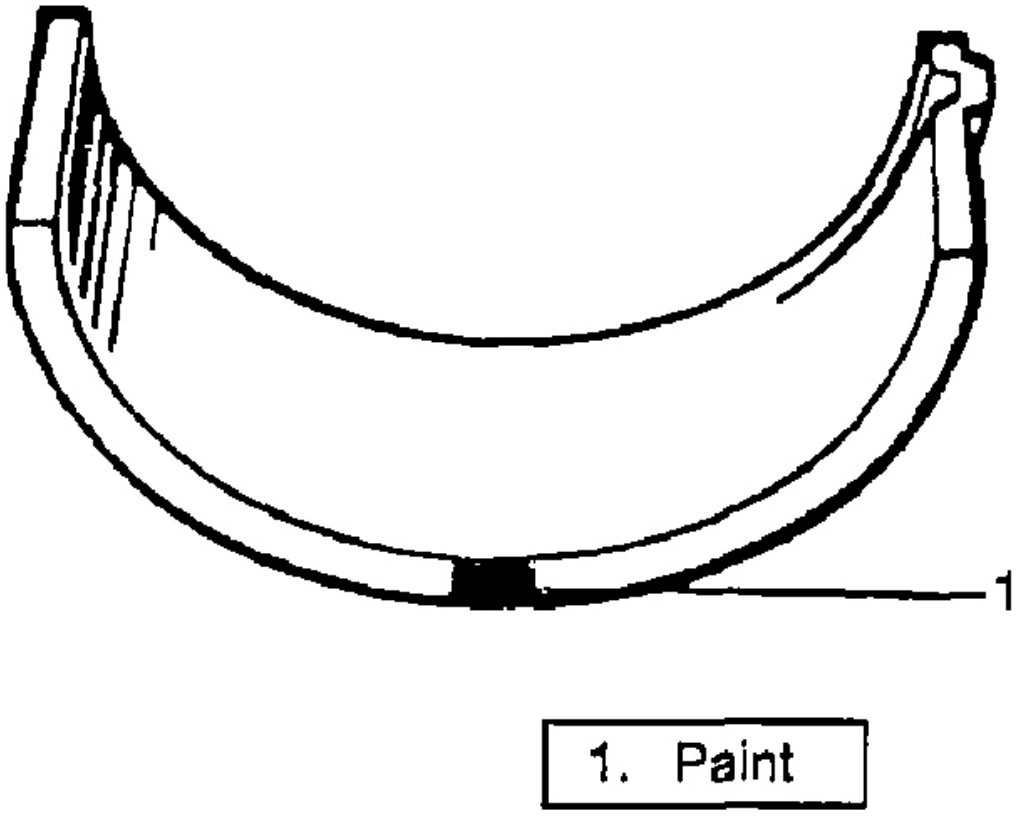
   Each color indicated the following thickness at the center of bearing.

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Color painted	Bearing thickness
Blue	1.494 – 1.497 mm (0.05882 – 0.05893 in.)
Yellow	1.491 – 1.494 mm (0.05871 – 0.05881 in.)
Nothing	1.488 – 1.491 mm (0.05859 – 0.05870 in.)
Black	1.485 – 1.488 mm (0.05847 – 0.05858 in.)
Green	1.482 – 1.485 mm (0.05835 – 0.05846 in.)

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Fig. 198: Identifying Standard Size Of Connecting Rod Bearing Thickness
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 199: Identifying Undersize Connecting Rod Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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d. From number stamped on connecting rod and its cap and alphabet stamped on crank web No. 3 cylinder, determine new standard bearing to be installed to connecting rod big-end inside, by referring to the table. For example, if number stamped on connecting rod and its cap is "1" and alphabet stamped on crank web No. 3 cylinder is "B", install a new standard bearing painted in "Black" to its connecting rod big-end inside.

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

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Fig. 200: Identifying New Standard Connecting Rod Bearing Size Specifications
Courtesy of SUZUKI OF AMERICA CORP.

e. Check bearing clearance with newly selected standard bearing referring to **Crank Pin And Connecting Rod Bearings**.

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

- **Connecting rod bolt deformation**

Measure each thread diameter of connecting rod bolts (1) at "A" on 28.5 mm (1.12 in.) from bolt mounting surface and "B" on 42.0 mm (1.65 in.) from bolt mounting surface by using a micrometer (2).

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

Connecting rod bolt measurement points

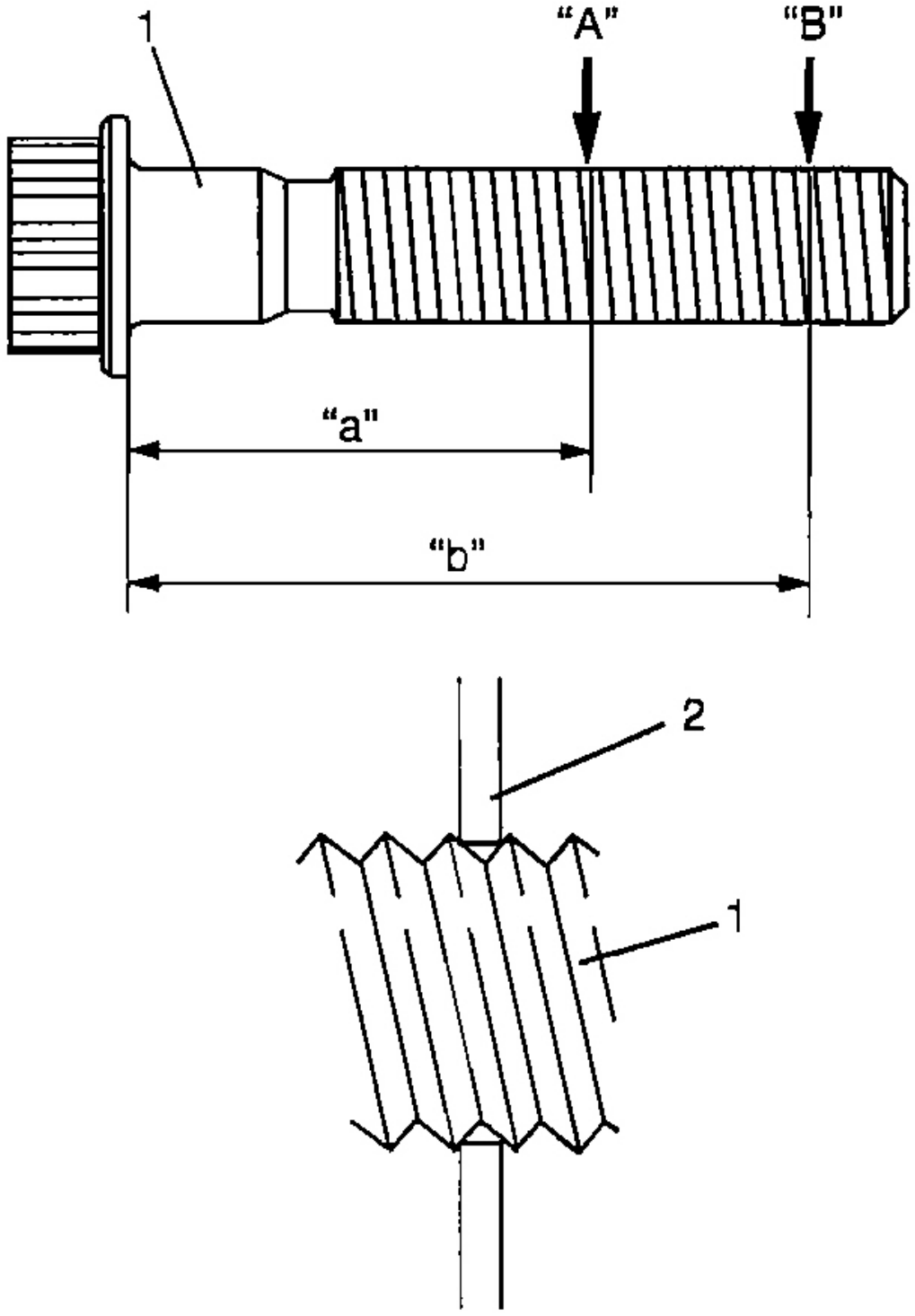
"A": 28.5 mm (1.12 in.)

"B": 42.0 mm (1.65 in.)

Connecting rod bolt diameter difference

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

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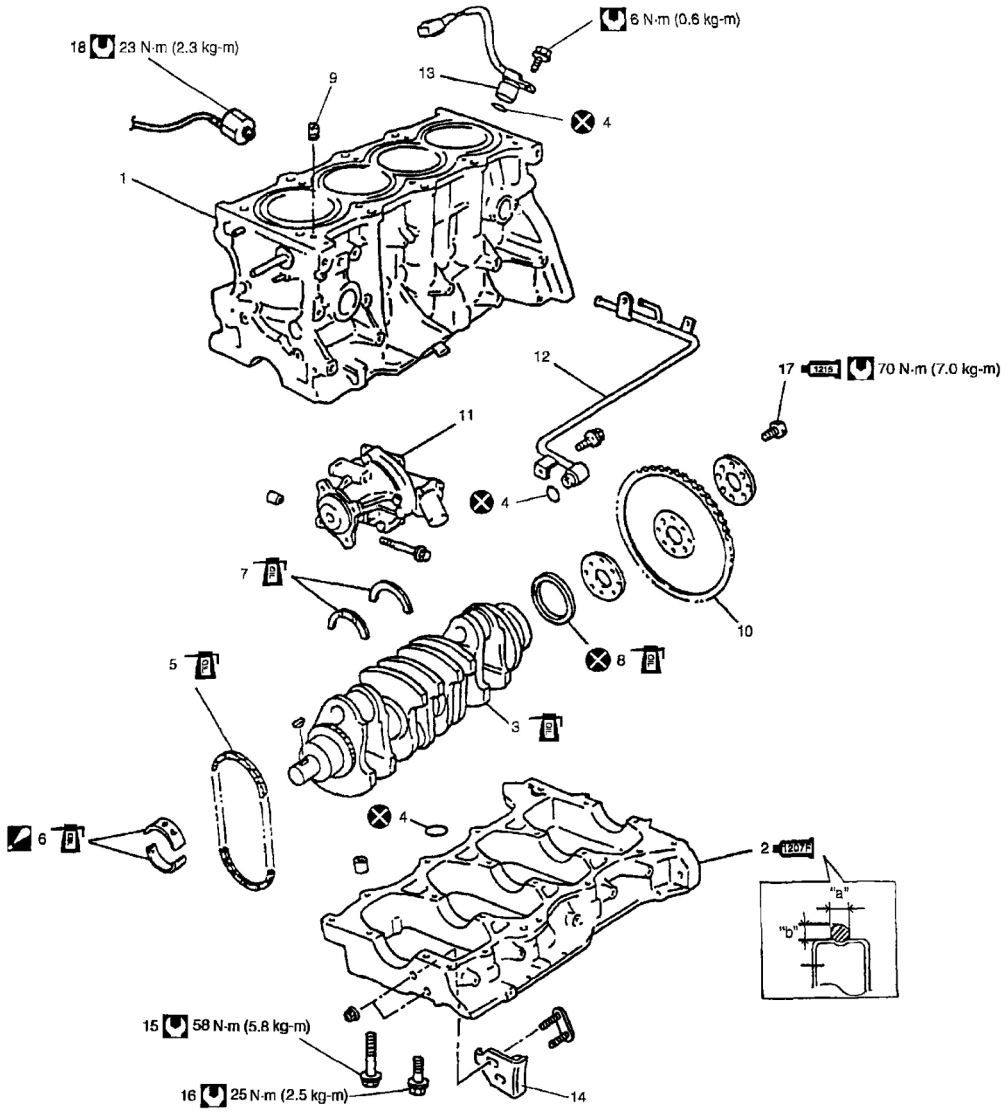
Fig. 201: Measuring Connecting Rod Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Cleaning

Clean carbon from piston head and ring grooves, using a suitable tool.

Main Bearings, Crankshaft and Cylinder Block Components

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"a": 3 mm (0.12 in.)	7. Thrust bearing	15. Crankcase bolt (10 mm thread diameter)
"b": 2 mm (0.08 in.)	8. Rear oil seal	16. Crankcase bolt (8 mm thread diameter)
1. Cylinder block	9. Check valve	1216 17. Flywheel mounting bolt : See "C"
1207F 2. Lower crankcase : See "A"	10. Flywheel	18. Knock sensor
3. Crankshaft	11. Water pump	: Tightening torque
4. O-ring	12. Heater outlet pipe	: Do not reuse.
5. Oil pump chain	13. CKP sensor	: Apply engine oil to inside / sliding surface.
6. Main bearing : See "B"	14. Oil pump chain guide	
"A": Apply sealant 99000-31250 to mating surface.		
"B": Do not apply engine oil between cylinder block and bearing, between lower crankcase and bearing.		
"C": Apply sealant 99000-31110 to thread part.		

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Fig. 202: Identifying Main Bearings, Crankshaft & Cylinder Block Components
Courtesy of SUZUKI OF AMERICA CORP.

Main Bearings, Crankshaft and Cylinder Block Removal and Installation

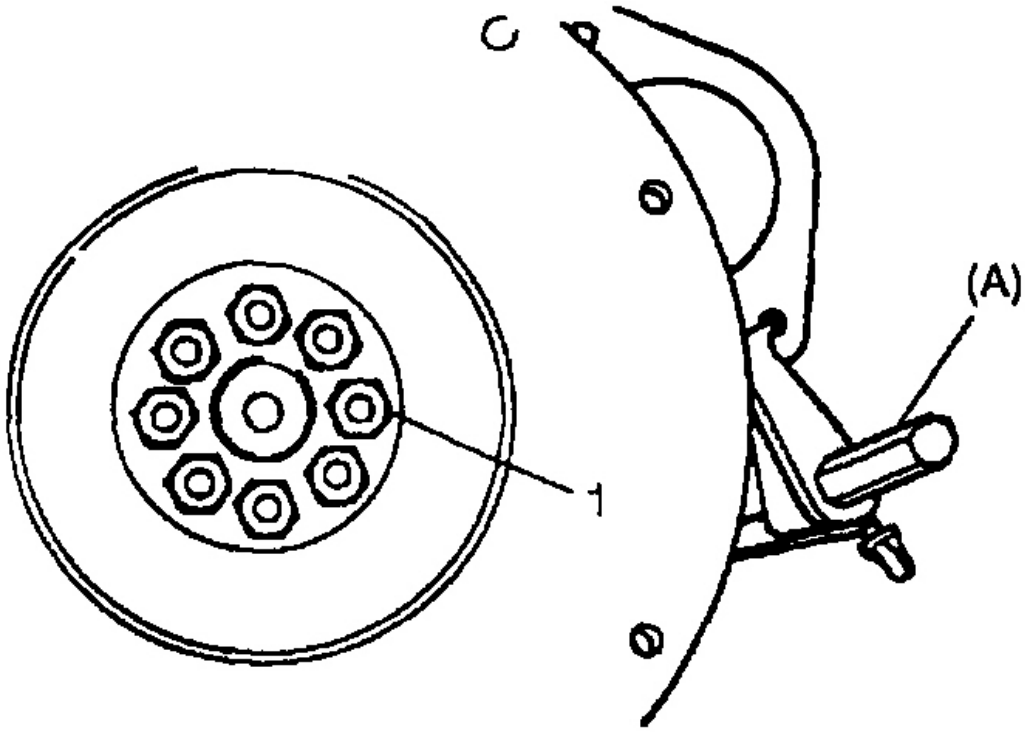
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Removal

1. Remove engine assembly from vehicle. Refer to **Engine Assembly Removal and Installation**.
2. Remove clutch and flywheel (M/T) or drive plate (A/T). For clutch removal, refer to **Clutch Cover, Clutch Disc and Flywheel Removal and Installation** .

   Special tool

   (A): 09924-17810



1. Flywheel bolt

G00784997

Fig. 203: Removing Clutch & Flywheel
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove throttle body, intake manifold, exhaust manifold.
4. Remove oil pan.

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5. Remove oil pump with oil pump strainer.
6. Remove cylinder head cover.
7. Remove timing chain cover. Refer to **Timing Chain Cover Removal and Installation**.
8. Remove timing chain guide, chain tensioner, tensioner adjusters, 2nd timing chain and 1st timing chain.
9. Remove cylinder head assembly.
10. Remove pistons and connecting rods.
11. Remove CKP sensor (1).

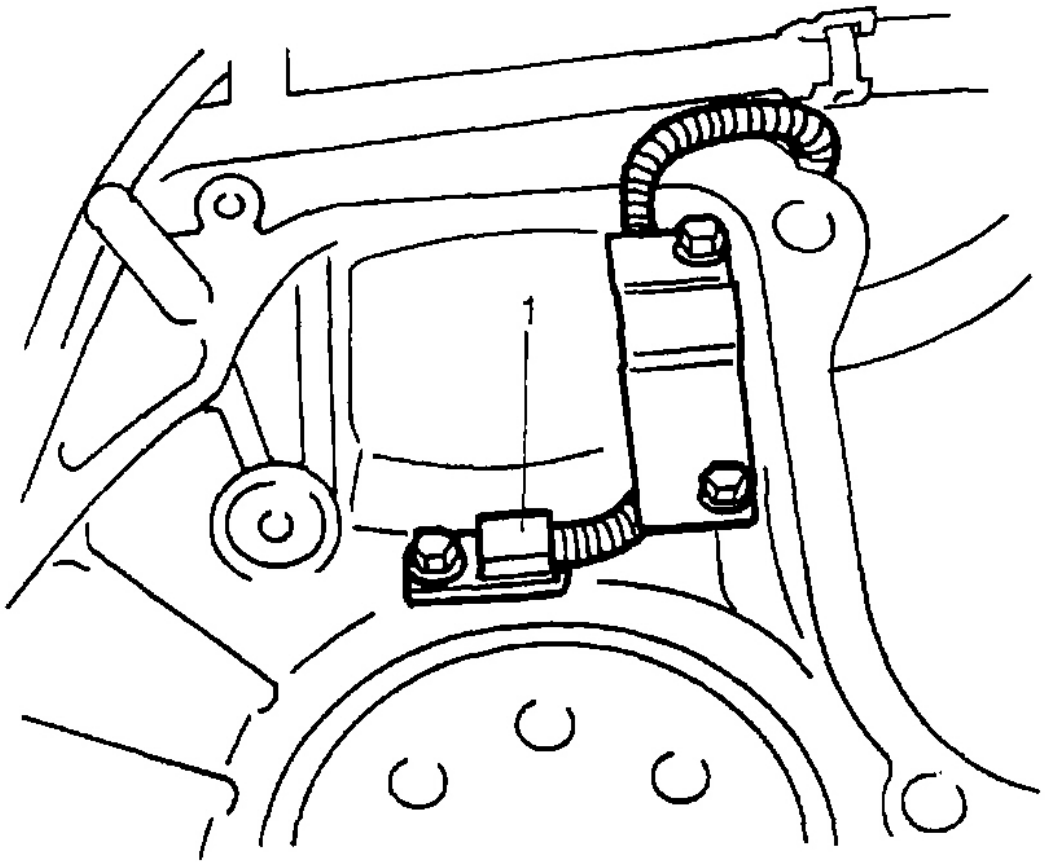


Fig. 204: Removing CKP Sensor
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove water pump (1) and heater outlet pipe.
13. Remove engine front mounting bracket (2).

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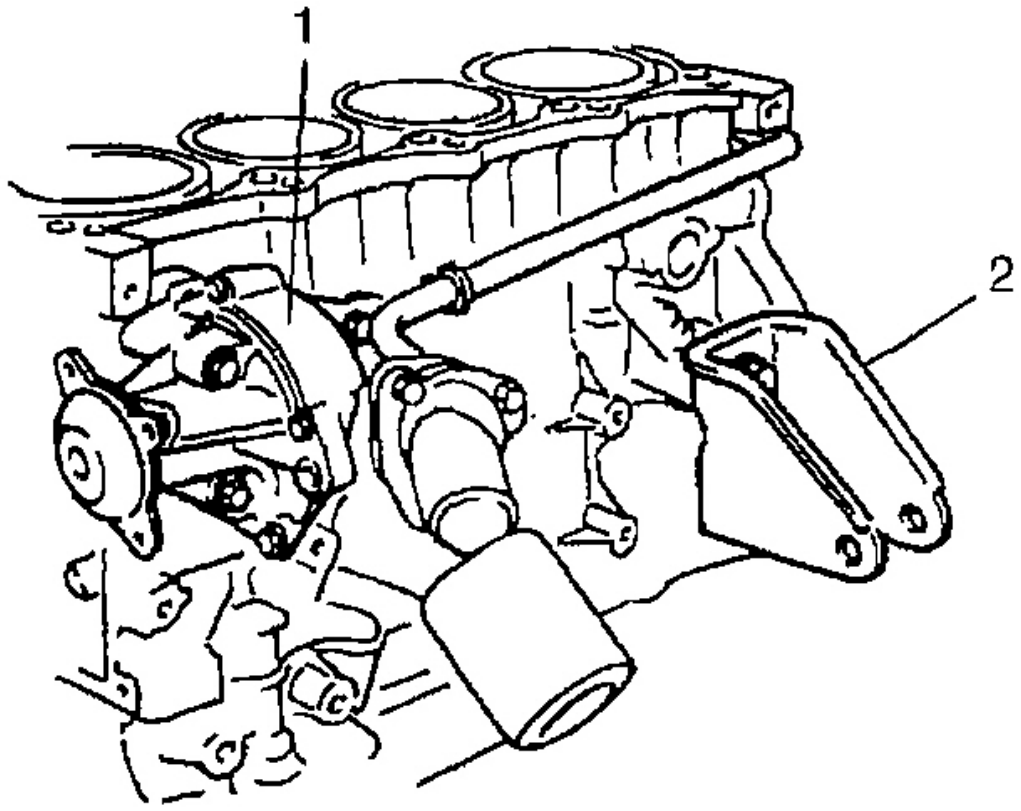
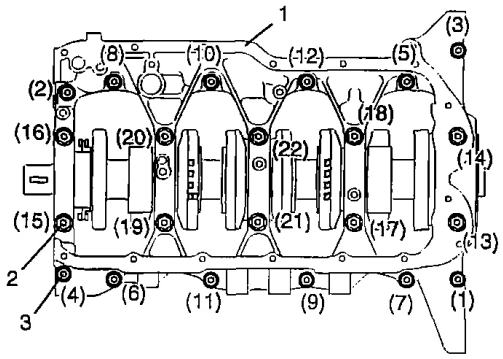


Fig. 205: Removing Water Pump, Heater Outlet Pipe & Engine Front Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

14. Loosen crankcase bolts, in sequence shown in figure and remove them.

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1. Lower crankcase	3. Crankcase bolts (8 mm thread diameter)
2. Crankcase bolts (10 mm thread diameter)	

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Fig. 206: Identifying Crankcase Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove crankshaft from cylinder block.

Installation

NOTE:

- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, crankcase (bearings caps), connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb combination and try to see that each part goes back to where it came from, when installing.**
- **Clean mating surface of cylinder block and lower crankcase, remove oil, old sealant and dust from mating surface.**

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

   One of two halves of main bearing (4) has oil groove (3).

   Install this half with oil groove to cylinder block and another half without oil groove to lower crankcase.

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

2. Install new O-ring (2) to cylinder block.
3. Install knock pins (5) to cylinder block.

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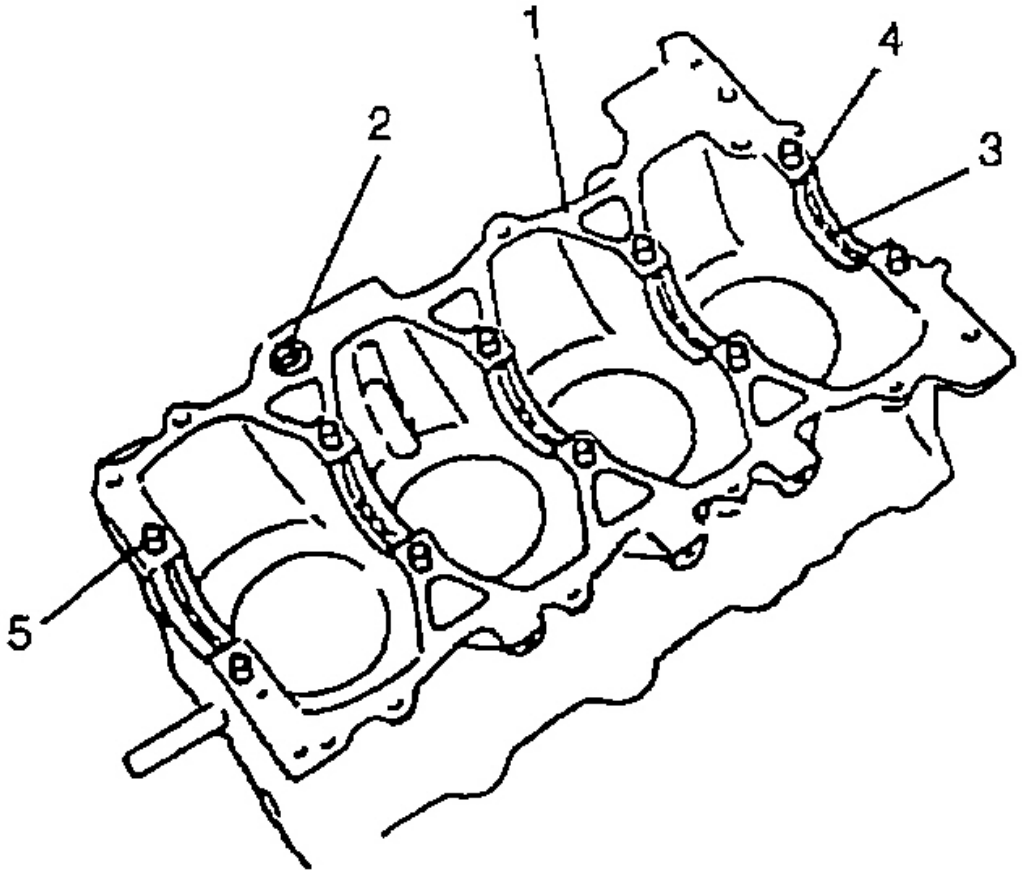


Fig. 207: Installing New O-Ring & Knock Pins
Courtesy of SUZUKI OF AMERICA CORP.

4. Fit thrust bearings (1) to cylinder block between No. 2 and No. 3 cylinders. Face oil groove (2) sides to crank webs.

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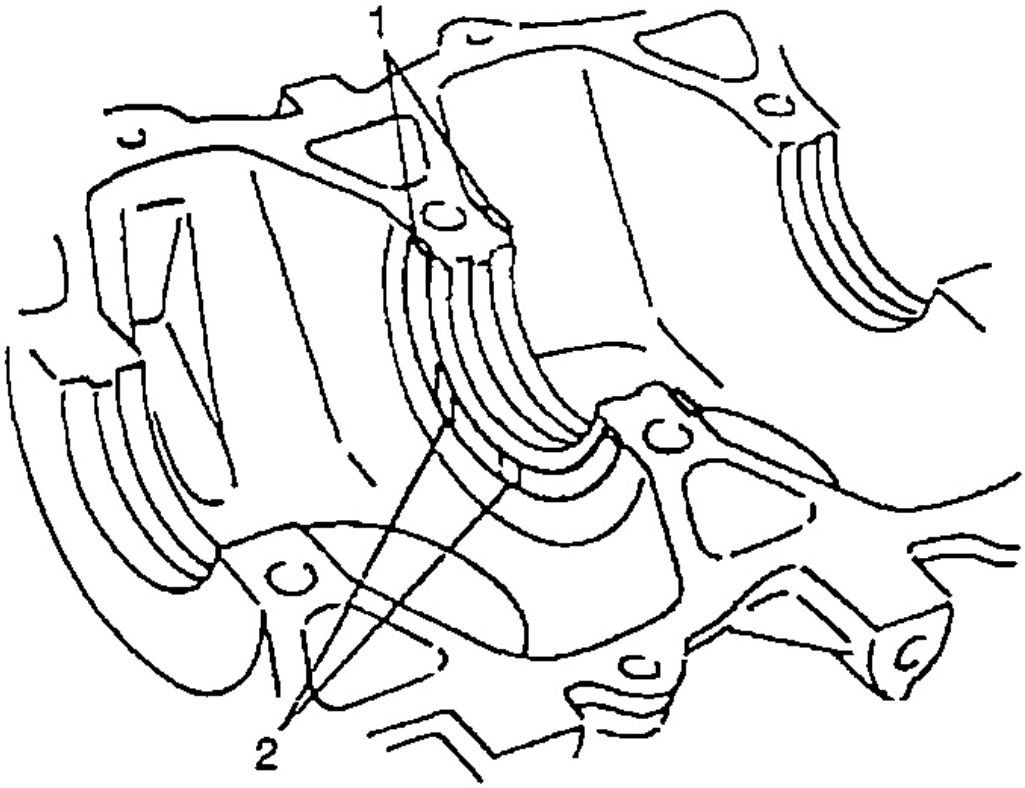


Fig. 208: Facing Oil Groove Sides To Crank Webs
Courtesy of SUZUKI OF AMERICA CORP.

5. Put crankshaft (1) with oil pump chain to cylinder block.

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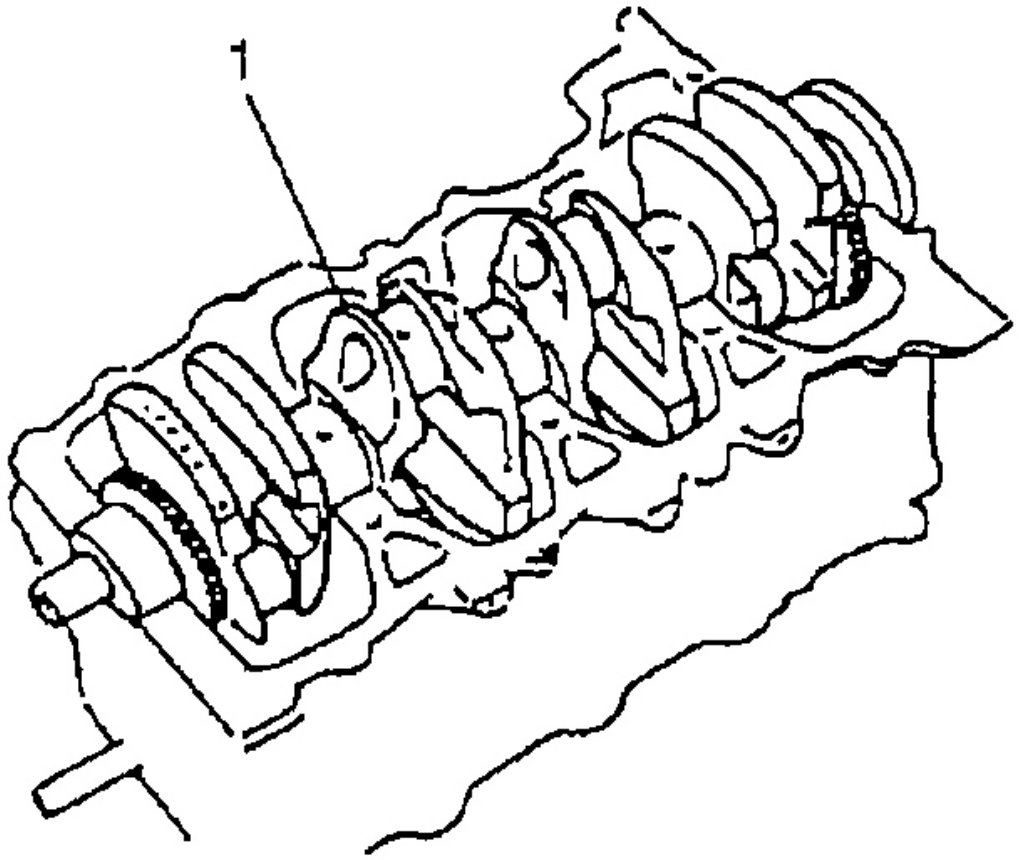


Fig. 209: Installing Crankshaft With Oil Pump Chain
Courtesy of SUZUKI OF AMERICA CORP.

6. Apply sealant "A" to lower crankcase (1) mating surface area as shown in figure.

   "A": Sealant 99000-31250

   Sealant amount for lower crankcase

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

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

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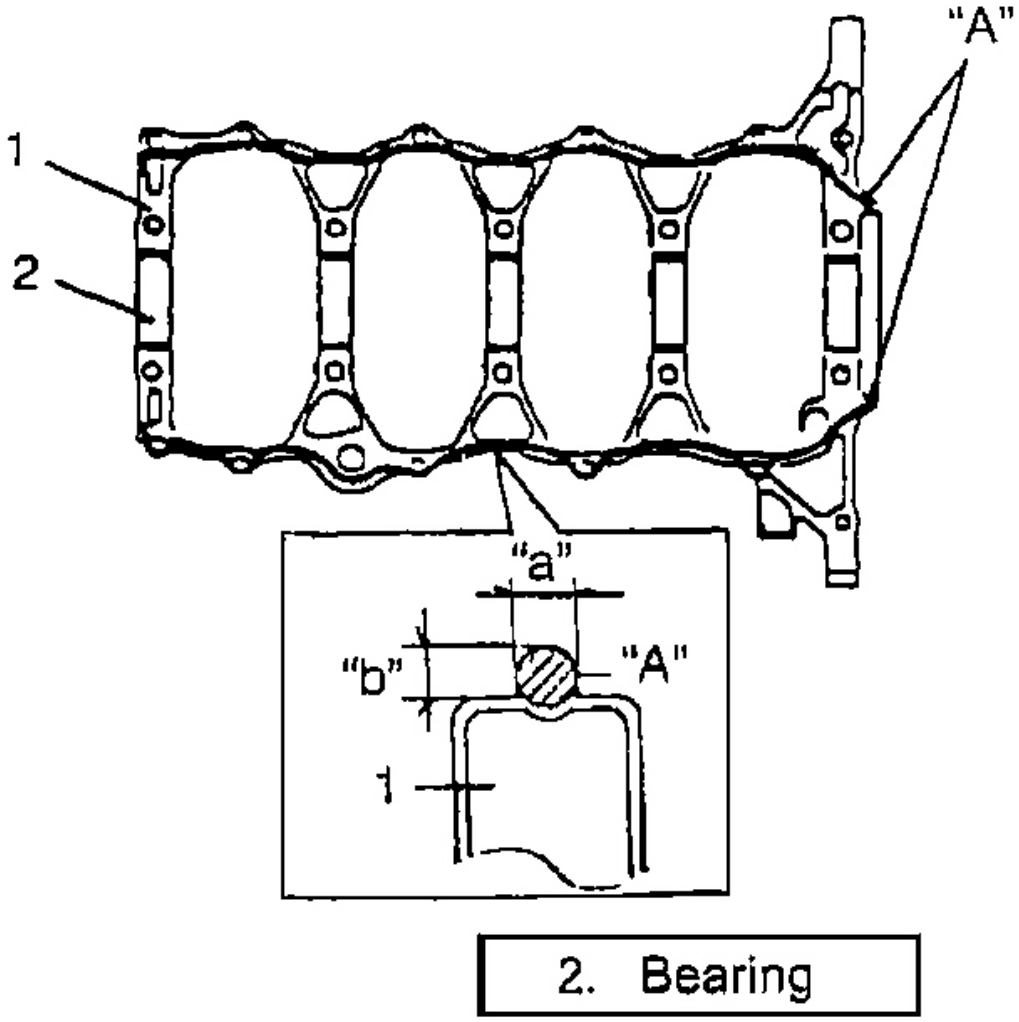


Fig. 210: Applying Sealant "A" To Lower Crankcase Mating Surface Area
Courtesy of SUZUKI OF AMERICA CORP.

7. Install lower crankcase (1) to cylinder block.

   After applying engine oil to all crankcase bolts ((1) - (22)), tighten them gradually as follows.

   a. Tighten bolts ((1) - (10)) to 40 N.m (4.0 kg-m, 29.0 lb-ft) according to numerical order as shown.
   b. Loosen bolts ((1) - (10)) until tightening torque is reduced to 0 (zero) in reverse order of tightening.
   c. In the same manner as in step a), tighten them to 40 N.m (4.0 kg-m, 29.0 lb-ft).

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d. In the same manner as in step a), tighten them to the specified torque.
e. Tighten bolts ((11) - (22)) to the specified torque according to numerical order as shown.

Tightening torque

Crankcase bolt with 10 mm thread diameter ((1) - (10)): 58 N.m (5.8 kg-m, 42.0 lb-ft)

Crankcase bolt with 8 mm thread diameter ((11) - (22)): 25 N.m (2.5 kg-m, 18.0 lb-ft)

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

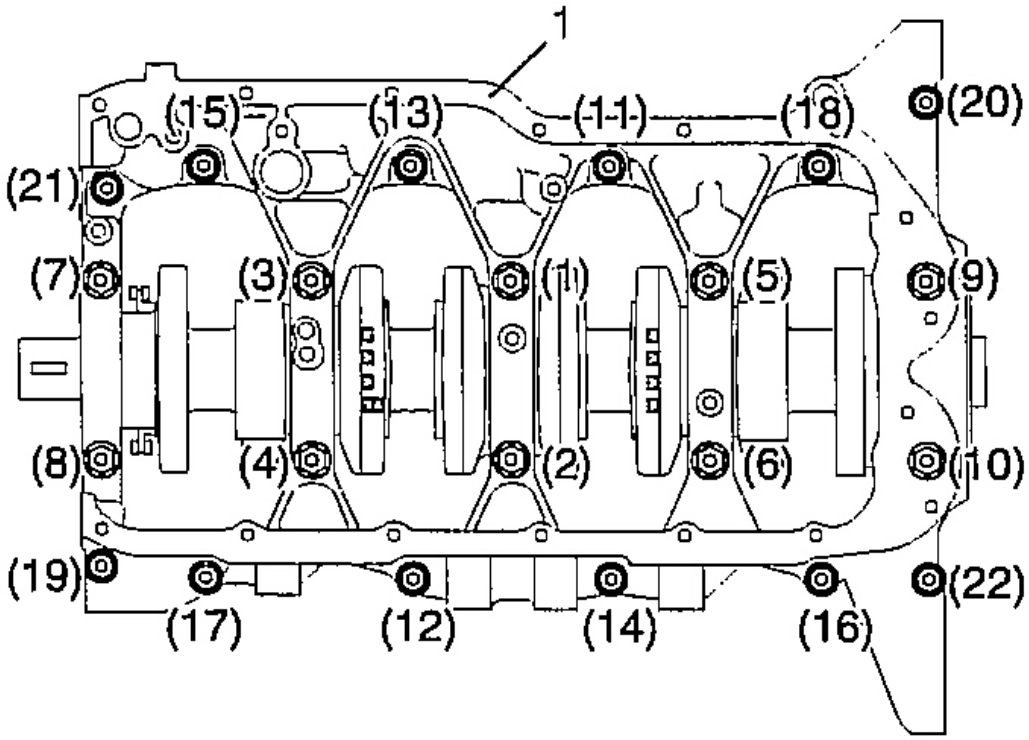


Fig. 211: Identifying Crankcase Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

8. Pull out dowel pin (2) from crankshaft (1) and then install rear oil seal (3) by using special tools and plastic hammer.

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Special tool

(A): 09911-97710

(B): 09911-97810

9. Install dowel pin.

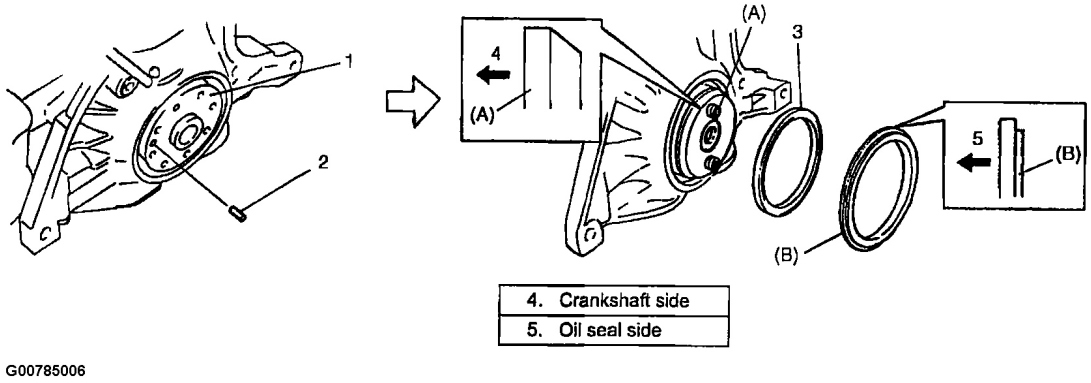


Fig. 212: Installing Dowel Pin
Courtesy of SUZUKI OF AMERICA CORP.

10. Install CKP sensor (1) and fix its wire harness with bracket.

Tightening torque

CKP sensor bolt (a): 6 N.m (0.6 kg-m, 4.5 lb-ft)

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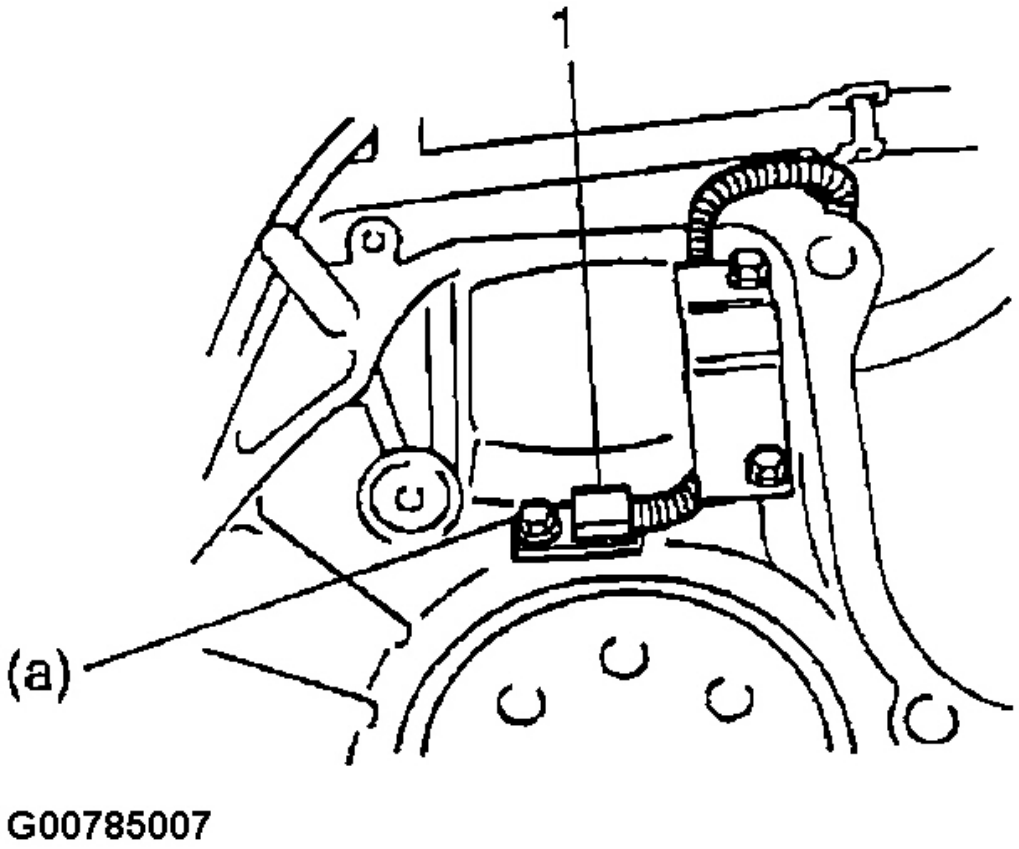


Fig. 213: Installing CKP Sensor
Courtesy of SUZUKI OF AMERICA CORP.

11. Install flywheel or drive plate.

    Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts (1) applied with sealant to specification.

    "A": Sealant 99000-31110

    Special tool

    (A): 09924-17810

    Tightening torque

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

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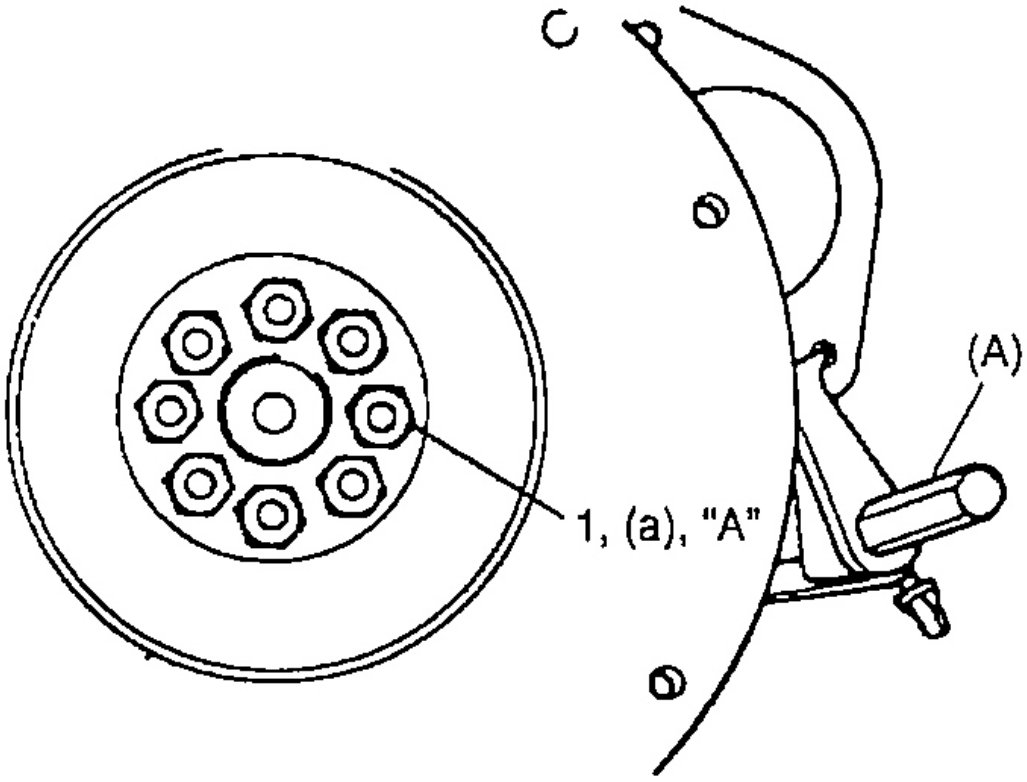


Fig. 214: Installing Flywheel
Courtesy of SUZUKI OF AMERICA CORP.

12. Install engine front mounting bracket (1). Tighten bracket bolts to specified torque.

    Tightening torque

    Engine front mounting bracket bolt (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

13. Install water pump (2) and heater outlet pipe (3). Refer to **WATER PUMP REMOVAL AND INSTALLATION** .

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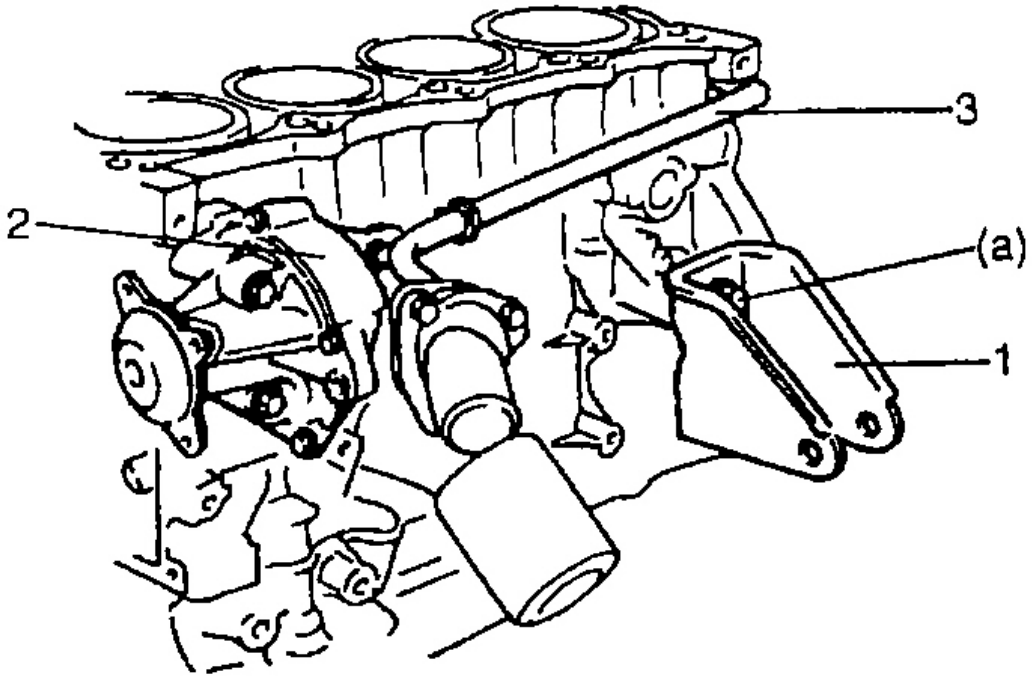


Fig. 215: Install Water Pump & Heater Outlet Pipe
Courtesy of SUZUKI OF AMERICA CORP.

14. Install pistons and connecting rods. Refer to **Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation**.
15. Install oil pump. Refer to **Oil Pump Removal and Installation**.
16. Install cylinder head assembly to cylinder. Refer to **Valves and Cylinder Head Removal and Installation**.
17. Install, timing chain sprockets, timing chains, timing chain tensioners, tensioner adjusters, timing chain guides, timing chain cover, crankshaft pulley, water pump pulley. Refer to **Timing Chain Cover Removal and Installation**, **2nd Timing Chain and Chain Tensioner Removal and Installation** and **1st Timing Chain and Chain Tensioner Removal and Installation**.
18. Install oil pump strainer and oil pan.
19. Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to **Clutch Cover, Clutch Disc and Flywheel Removal and Installation** .
20. Install engine assembly to vehicle. Refer to **Engine Assembly Removal and Installation.**.

Main Bearings, Crankshaft and Cylinder Block Inspection

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Crankshaft

Crankshaft runout

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

Limit on runout

0.06 mm (0.0023 in.)

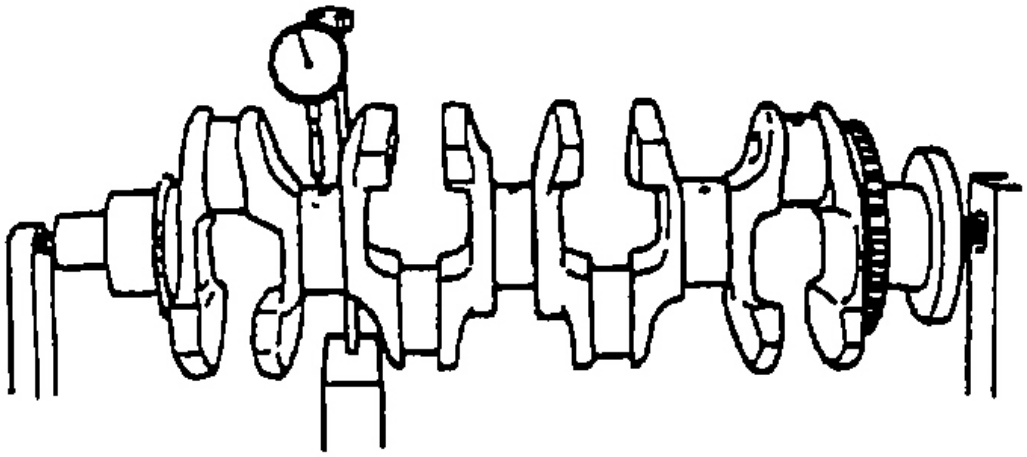


Fig. 216: Measuring Crankshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft thrust play

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and lower crankcase installed. Tighten crankcase bolts. Refer to **Main Bearings, Crankshaft and Cylinder Block Removal and Installation**.

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

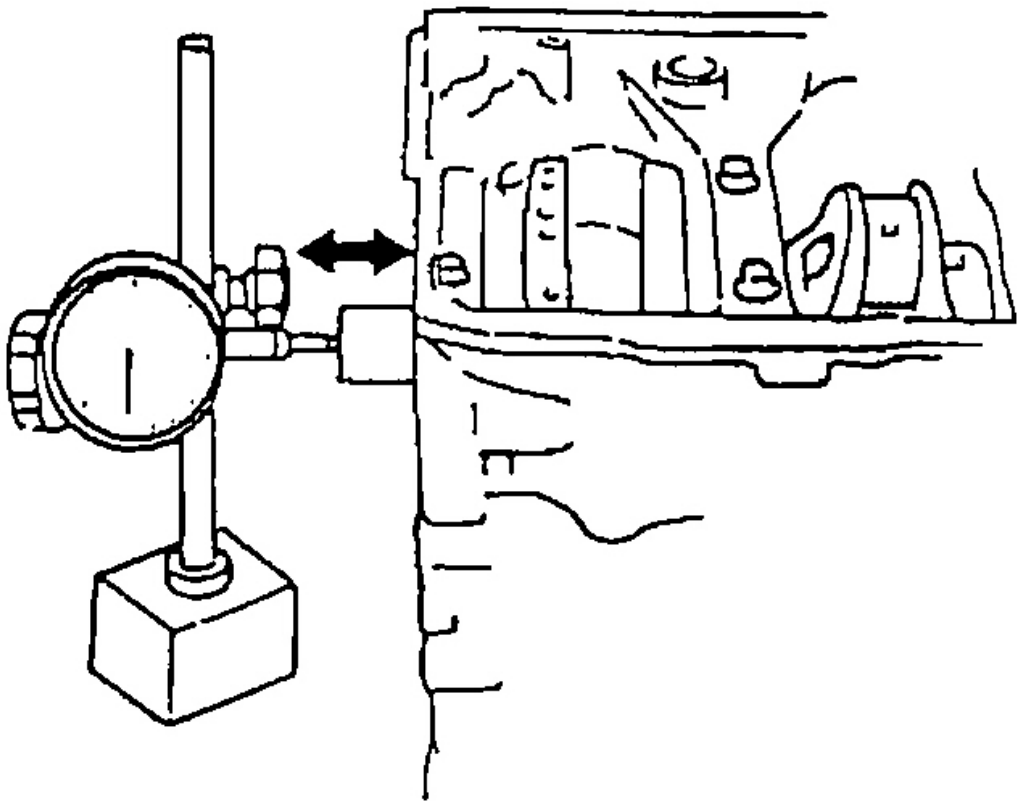
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Crankshaft Thrust Play

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Standard: 0.10 - 0.35 mm (0.0039 - 0.0138 in.)

Limit: 0.42 mm (0.0149 in.)



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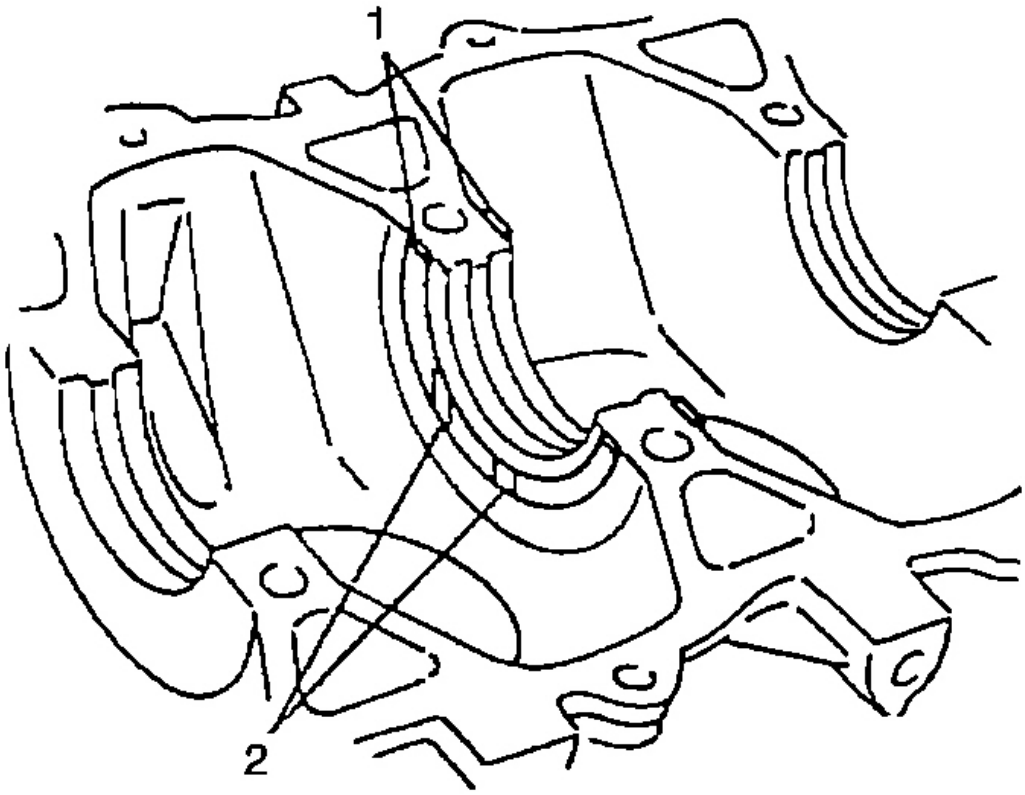
Fig. 217: Measuring Crankshaft Thrust Play
Courtesy of SUZUKI OF AMERICA CORP.

Standard	2.500 mm (0.984 in.)
Oversize: 0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)

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Fig. 218: Identifying Crankshaft Thrust Bearing Thickness Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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1.	Thrust bearing
2.	Oil groove

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Fig. 219: Measuring Crankshaft Thrust Bearing Thickness
Courtesy of SUZUKI OF AMERICA CORP.

Out-of-round and taper (uneven wear) of journals

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

Limit on out-of-round and taper

0.01 mm (0.0004 in.)

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Out-of-round

"A" - "B"

Taper

"A" - "b"

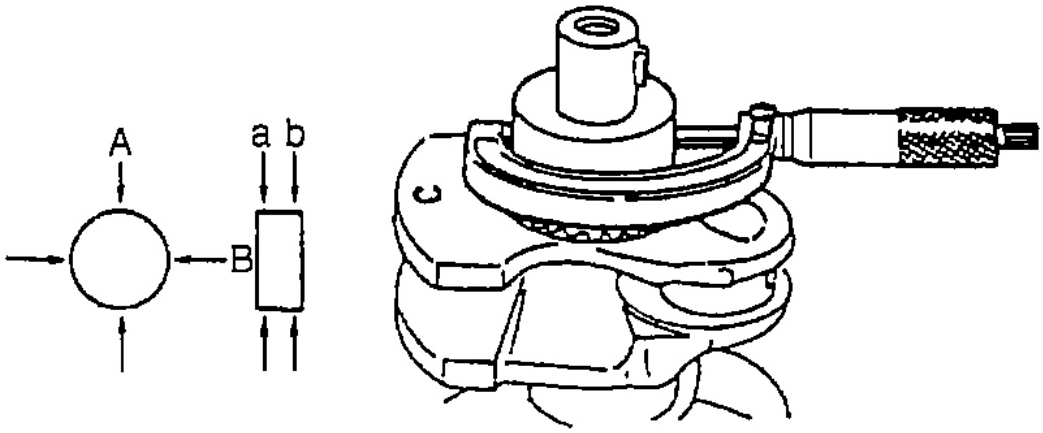


Fig. 220: Identifying Crankshaft Journals
Courtesy of SUZUKI OF AMERICA CORP.

Main Bearings

Main bearings general information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and standard size has 5 kinds of bearings differing in tolerance.
- Upper half of bearing (1) has oil groove (2) as shown in figure.

  Install this half with oil groove to cylinder block.

- Lower half of bearing does not have oil groove.

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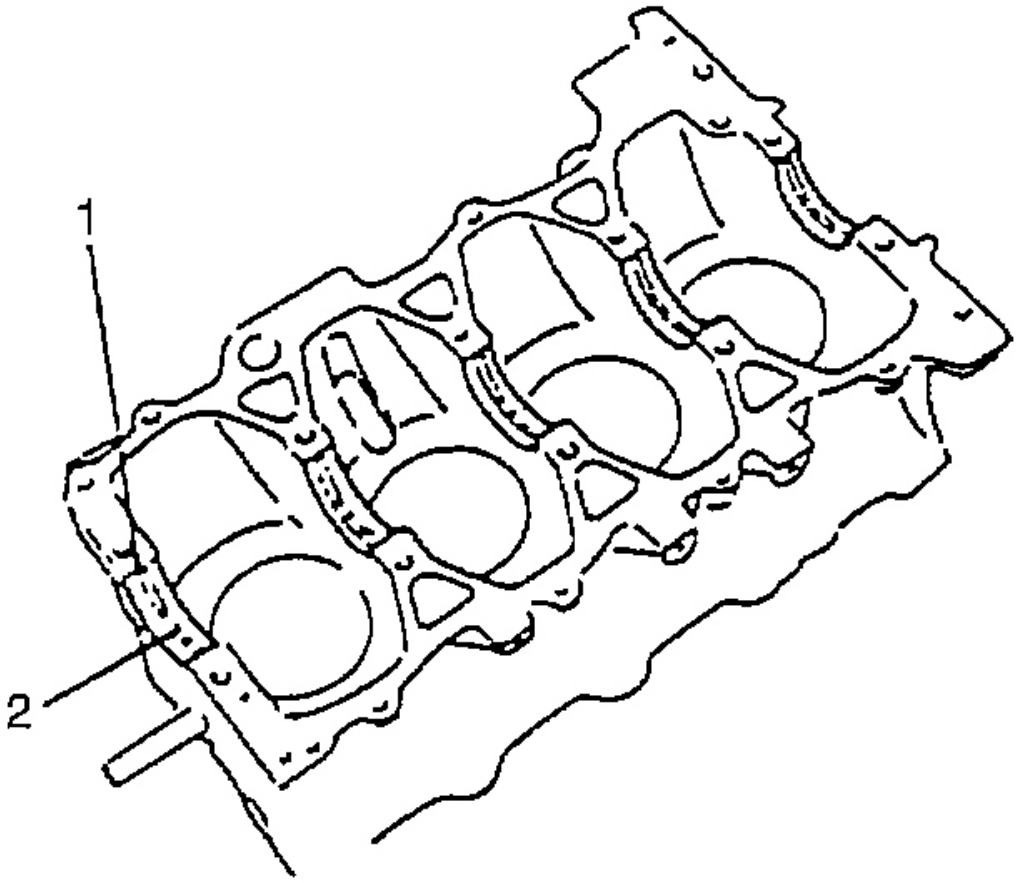


Fig. 221: Identifying Main Bearings
Courtesy of SUZUKI OF AMERICA CORP.

Main bearings inspection

Check bearings for pitting, scratches, wear or damage.

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

Main bearing clearance

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

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

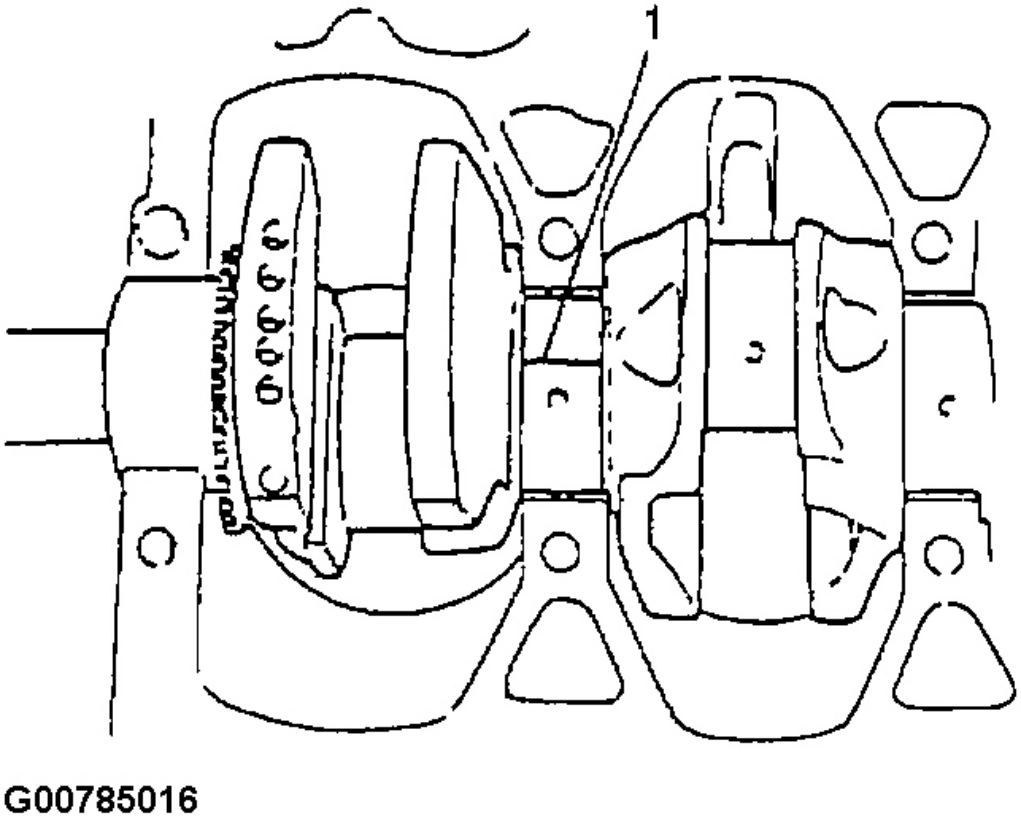


Fig. 222: Placing A Piece Of Gauging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

4. Install lower crankcase to cylinder block. Refer to **Main Bearings, Crankshaft and Cylinder Block Removal and Installation**.

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

5. Remove lower crankcase and using scale (2) on gauging plastic envelop (1), measure gauging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit. A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.

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After selecting new bearing, recheck clearance.

Main Bearing Clearance

Standard: 0.020 - 0.040 mm (0.0008 - 0.0015 in.)

Limit: 0.060 mm (0.0023 in.)

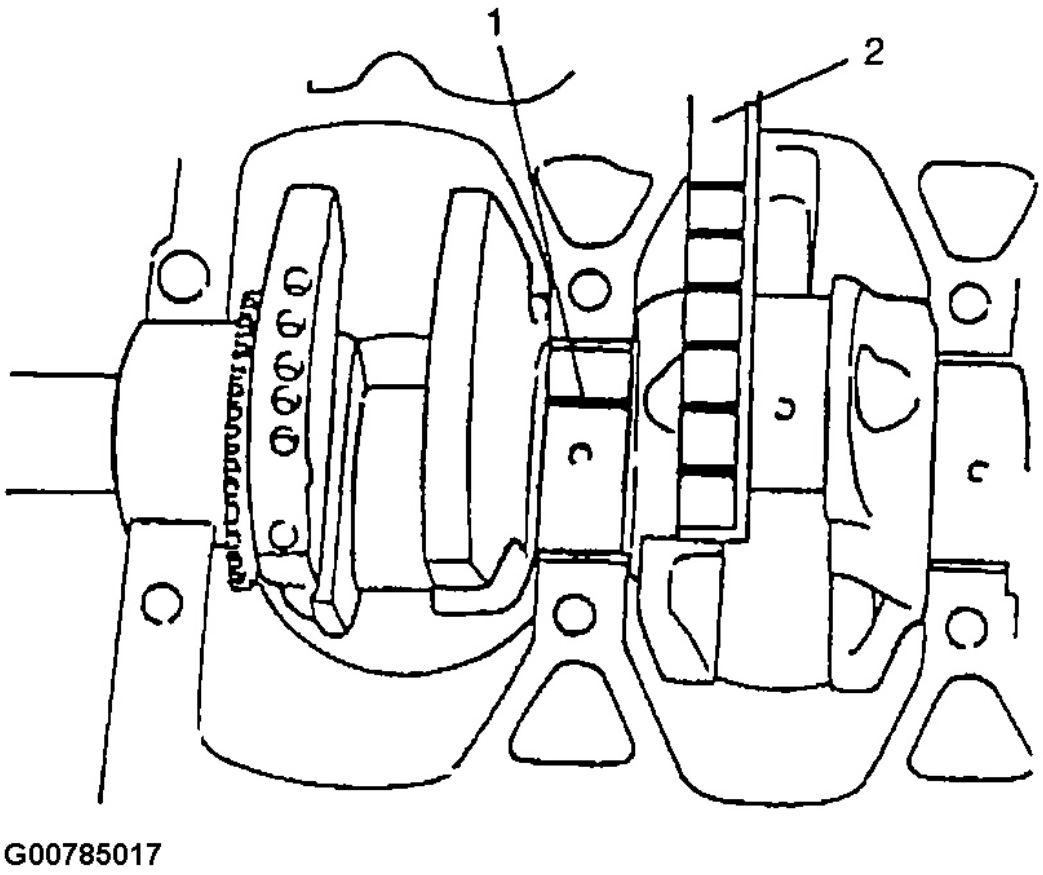


Fig. 223: Measuring Main Bearing Gauge Plastic Width
Courtesy of SUZUKI OF AMERICA CORP.

Selection of main bearings

STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.

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1. First check journal diameter. As shown in figure, crank web No.2 has stamped numbers.

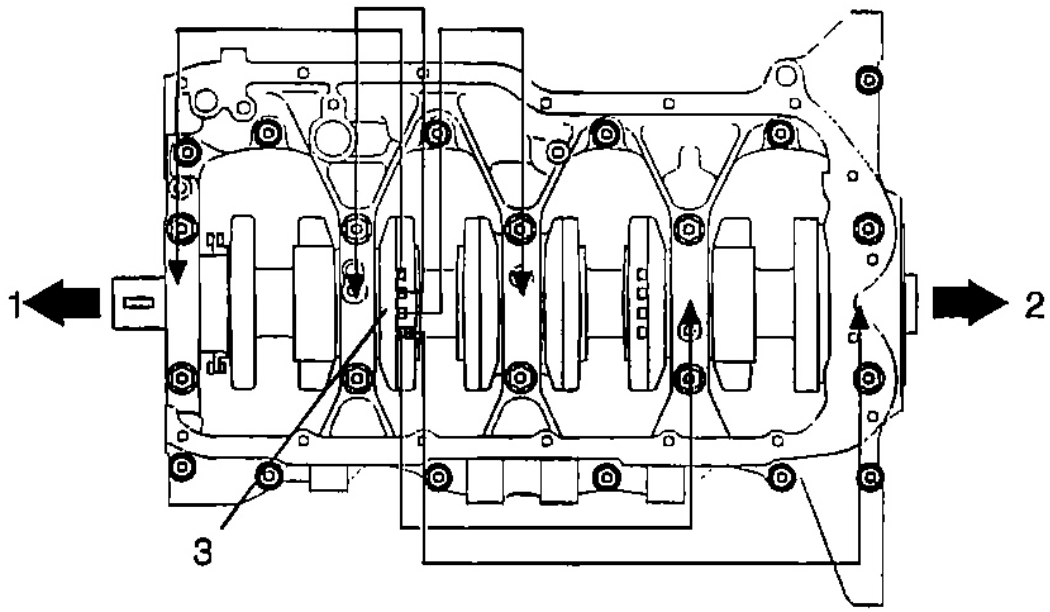
   Three kinds of numbers ("1", "2" and "3") represent following journal diameters.

Stamped numbers	Journal diameter
1	58.000 – 58.006 mm (2.2835 – 2.2837 in.)
2	57.994 – 58.000 mm (2.2832 – 2.2835 in.)
3	57.988 – 57.994 mm (2.2830 – 2.2832 in.)

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Fig. 224: Identifying Journal Diameter Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Stamped numbers on crank web No.2 (3) represent journal diameters marked with an arrow in figure respectively. For example, stamped number "1" indicates that corresponding journal diameter is 58.000 - 58.006 mm.



1.	Crankshaft pulley side
2.	Flywheel side

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Fig. 225: Identifying Crankshaft Journal Diameter Marking
Courtesy of SUZUKI OF AMERICA CORP.

2. Next, check crankcase (bearing cap) bore diameter without bearing. On lower crankcase five alphabets are stamped as shown in figure.

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

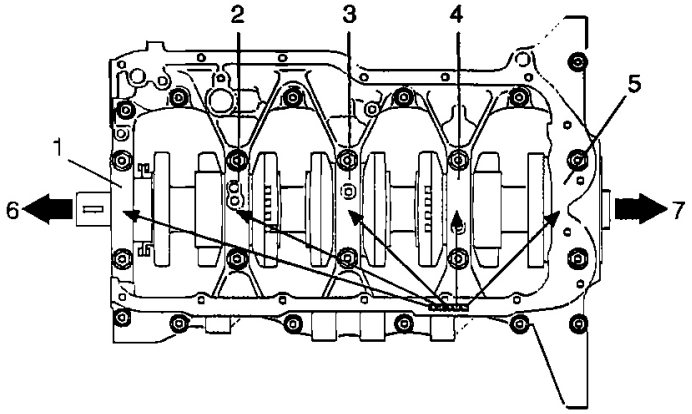
Stamped alphabet	A	61.994 – 62.000 mm (2.4407 – 2.4409 in.)
	B	62.0001 – 62.0060 mm (2.4410 – 2.4411 in.)
	C	62.0061 – 62.0120 mm (2.4412 – 2.4414 in.)

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Fig. 226: Identifying Bearing Cap Bore Diameter Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Stamped alphabets on lower crankcase represent crankcase bore diameter marked with an arrow in figure respectively.

For example, stamped alphabet "A" at bearing cap No.2 indicates that bearing cap bore diameter of bearing cap No.2 is 61.988-61.994 mm.



1. Bearing cap No.1	4. Bearing cap No.4	7. Flywheel side
2. Bearing cap No.2	5. Bearing cap No.5	
3. Bearing cap No.3	6. Crankshaft pulley side	

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Fig. 227: Identifying Crankshaft Bore Diameter Marking
Courtesy of SUZUKI OF AMERICA CORP.

3. There are 5 kinds of standard bearings differing in thickness. To distinguish them, they are painted (1) in

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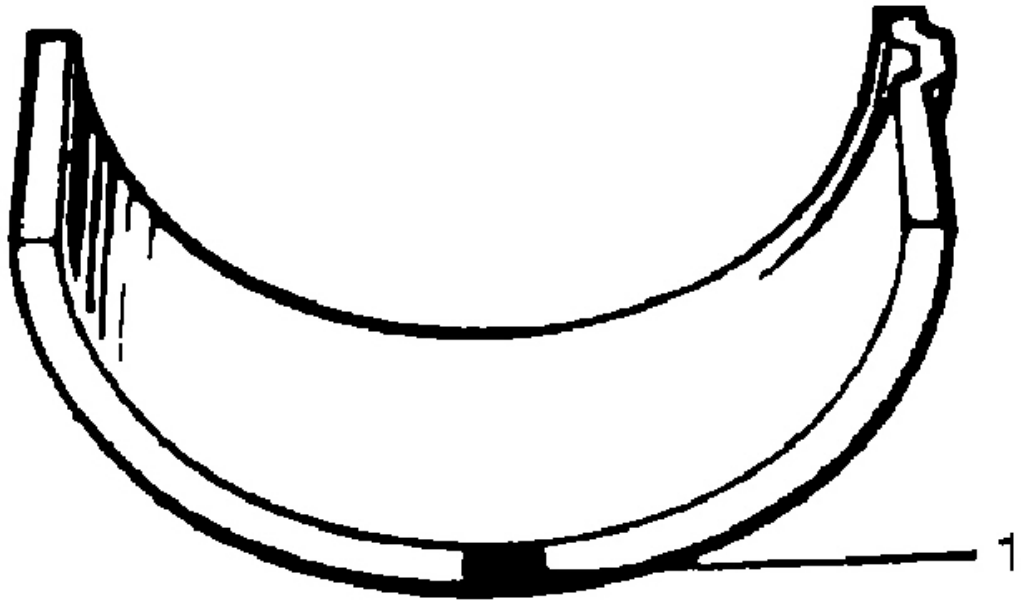
the following colors at the position as indicated in figure.

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

Color painted	Bearing thickness
Green	1.990 – 1.994 mm (0.0783 – 0.0785 in.)
Black	1.993 – 1.997 mm (0.0785 – 0.0786 in.)
Colorless (no paint)	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Yellow	1.999 – 2.003 mm (0.0787 – 0.0789 in.)
Blue	2.002 – 2.006 mm (0.0788 – 0.0790 in.)

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Fig. 228: Identifying Standard Size Main Bearing Thickness
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 229: Identifying Standard Bearing Difference In Thickness
Courtesy of SUZUKI OF AMERICA CORP.

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4. From number stamped on crank web No.2 and alphabets stamped on lower crankcase, determine new standard bearing to be installed to journal, by referring to table shown.

   For example, if number stamped on crank web No.2 is "1" and alphabet stamped on lower crankcase is "B", install a new standard bearing painted in "Black" to its journal.

		Number stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on lower crankcase (Cap bore diameter)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue

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Fig. 230: Identifying New Standard Size Bearing Specifications
Courtesy of SUZUKI OF AMERICA CORP.

5. Using gauging plastic (1) and scale (2), check bearing clearance with newly selected standard bearing. If clearance still exceeds its limit, use next thicker bearing and recheck clearance.

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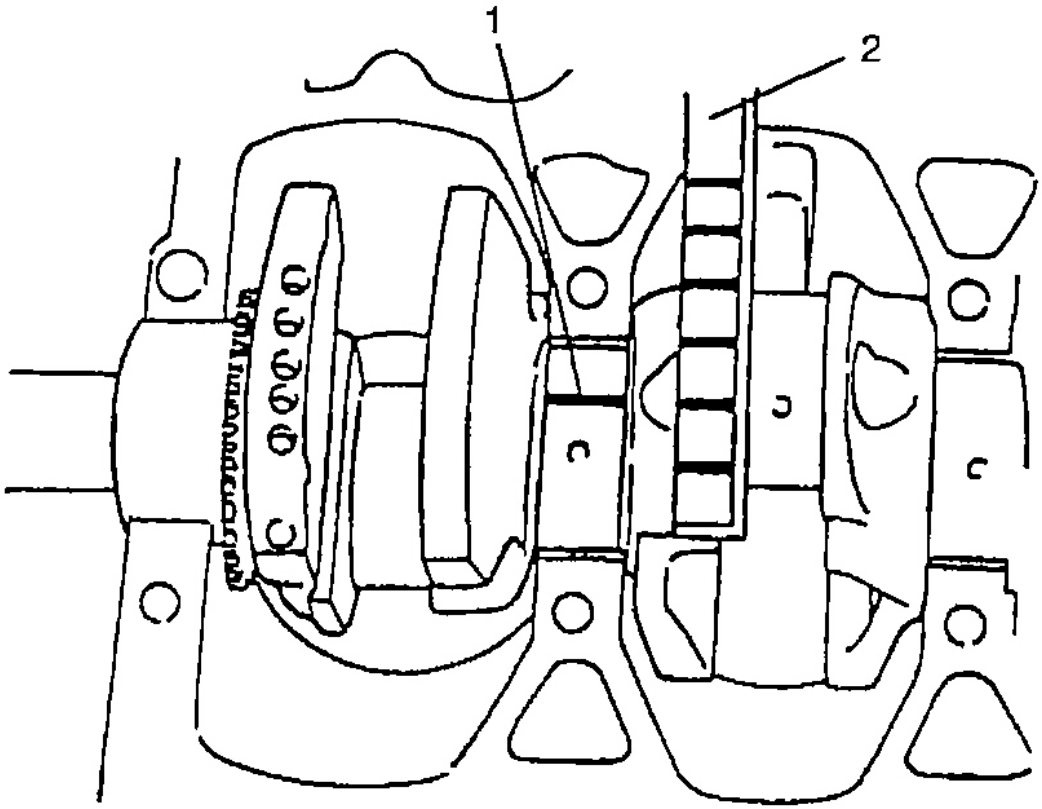


Fig. 231: Checking Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

6. When replacing crankshaft or cylinder block and lower crank case due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new lower crankcase.

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 (1) in the following colors at such position as indicated in figure.

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

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Color painted	Bearing thickness
Green & Red	2.115 – 2.119 mm (0.0833 – 0.0834 in.)
Black & Red	2.118 – 2.122 mm (0.0834 – 0.0835 in.)
Red only	2.121 – 2.125 mm (0.0835 – 0.0837 in.)
Yellow & Red	2.124 – 2.128 mm (0.0836 – 0.0838 in.)
Blue & Red	2.127 – 2.131 mm (0.0837 – 0.0839 in.)

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Fig. 232: Identifying Undersize Main Bearing Thickness
Courtesy of SUZUKI OF AMERICA CORP.

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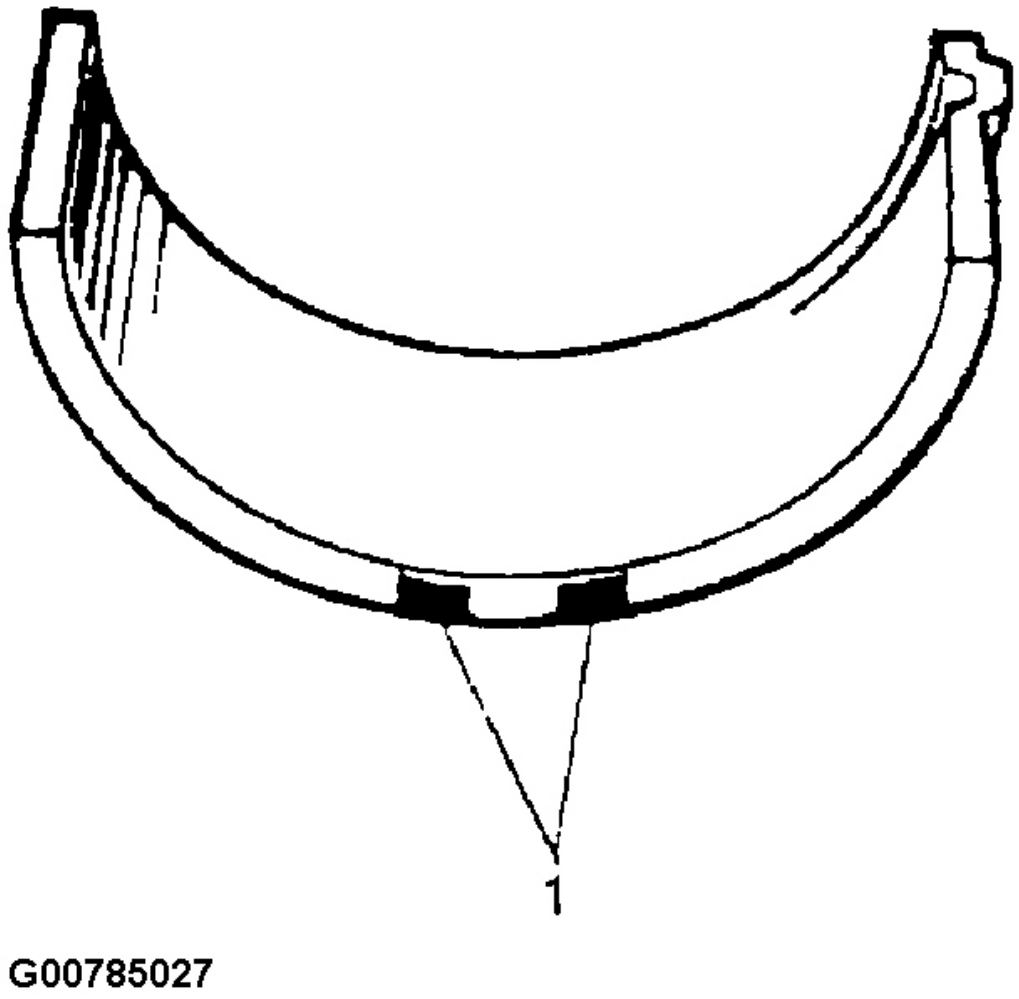


Fig. 233: Identifying Difference Between Bearings
Courtesy of SUZUKI OF AMERICA CORP.

- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.

a. Regrind journal to the following finished diameter.

Finished journal diameter

57.732 - 57.750 mm (2.2729 - 2.2736 in.)

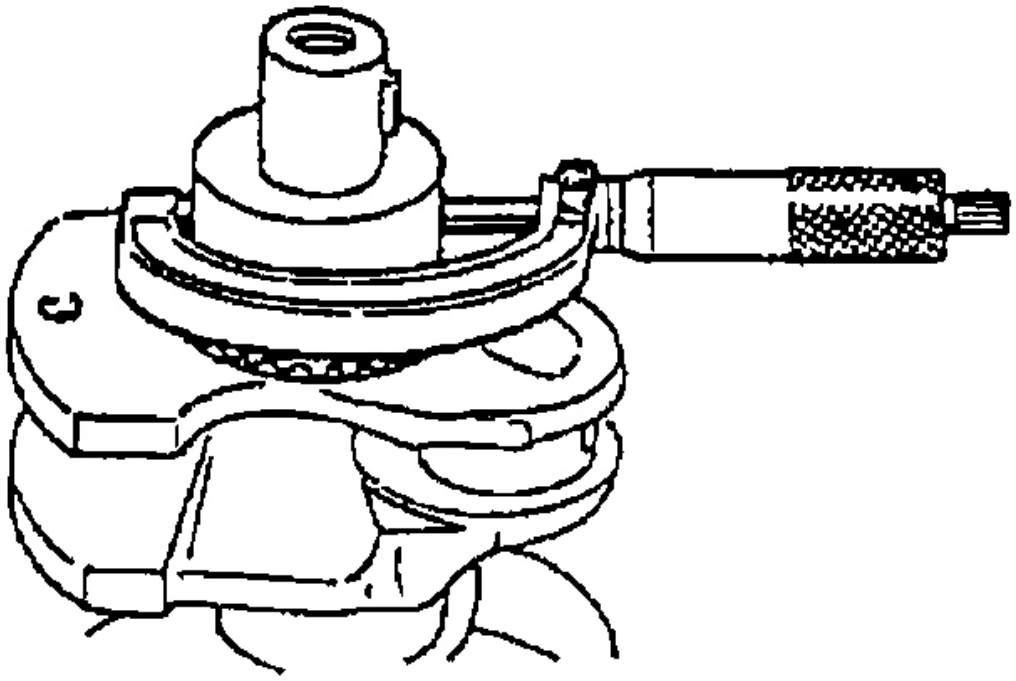
b. Using micrometer, measure reground journal diameter.

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

c. Using journal diameter measured and alphabets stamped on lower crankcase, select an undersize bearing by referring to the following table.

Check bearing clearance with newly selected undersize bearing.



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Fig. 234: Checking Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

Undersize bearing specification

		Measured journal diameter		
		57.744 – 57.750 mm (2.2734 – 2.2736 in.)	57.738 – 57.744 mm (2.2731 – 2.2733 in.)	57.732 – 57.738 mm (2.2729 – 2.2731 in.)
Alphabets stamped on lower crankcase	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red

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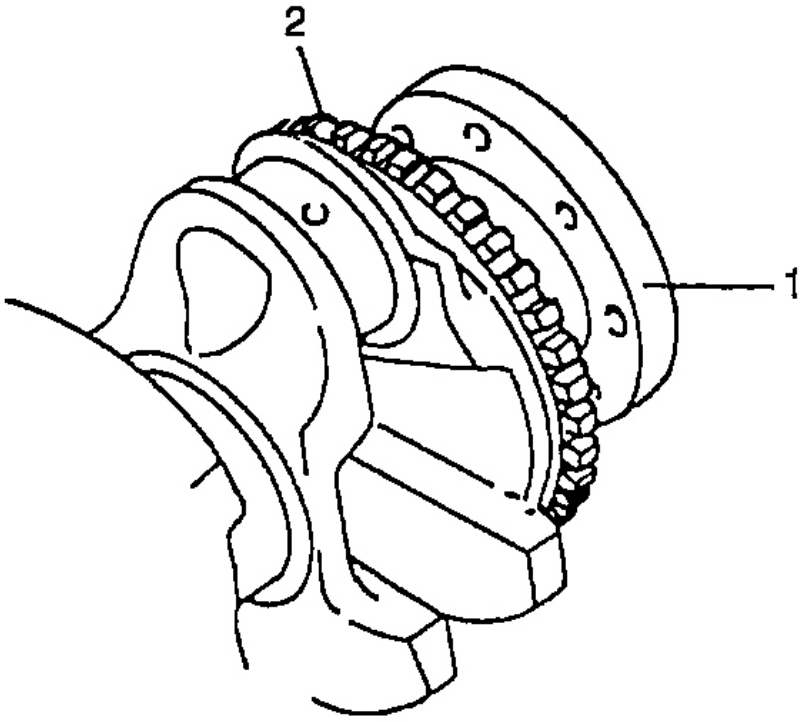
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Fig. 235: Identifying Undersize Bearing Specifications
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Position Sensor Plate

Check teeth of plate for damage.

If any damage is found, replace crankshaft (1).



2. Crankshaft position sensor plate

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Fig. 236: Checking Crankshaft Position Sensor Plate Teeth
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pump Sprocket

Check teeth of sprocket for wear or damage.

If any damage or wear is found, replace crankshaft (1).

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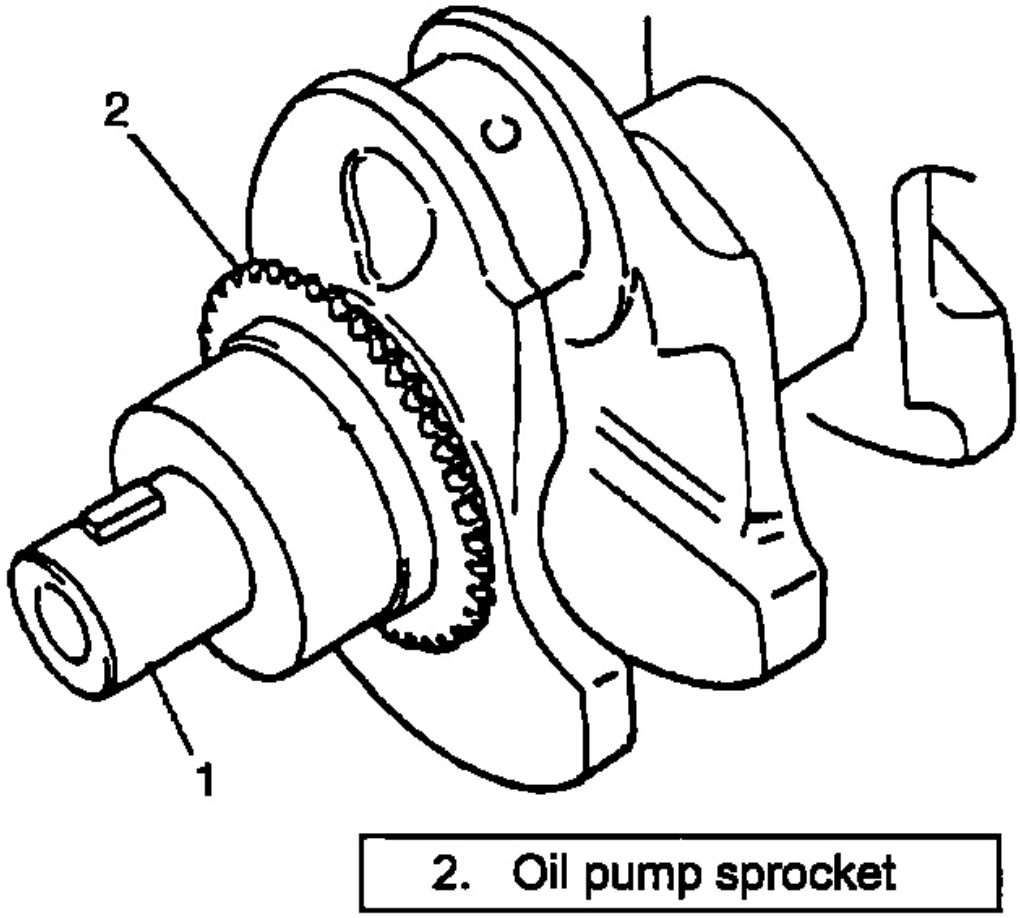
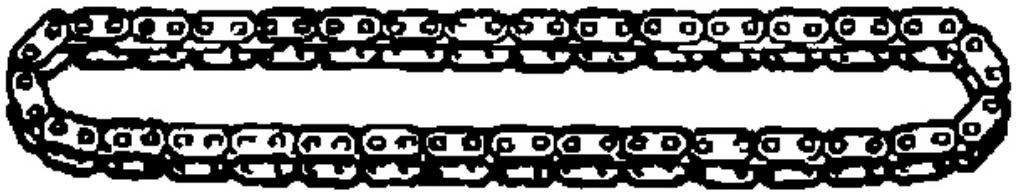


Fig. 237: Checking Oil Pump Sprocket Teeth
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pump Chain

Check oil pump chain for wear or damage.

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Fig. 238: Checking Oil Pump Chain
Courtesy of SUZUKI OF AMERICA CORP.

Flywheel

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

  If runout exceeds its limit, replace flywheel.

  Limit on runout

  0.2 mm (0.0078 in.)

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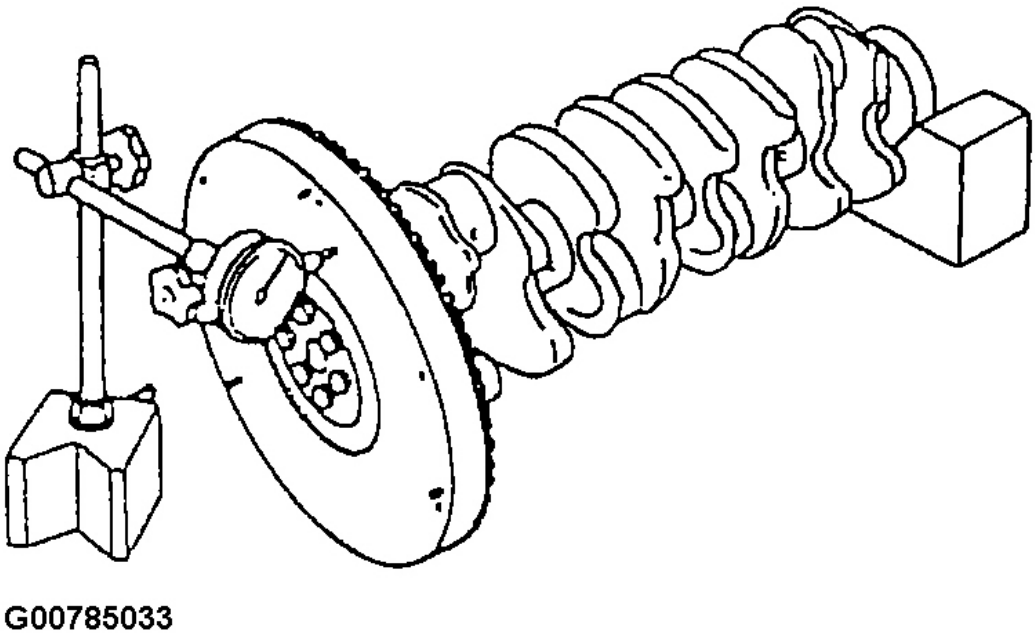


Fig. 239: Checking Flywheel For Face Runout
Courtesy of SUZUKI OF AMERICA CORP.

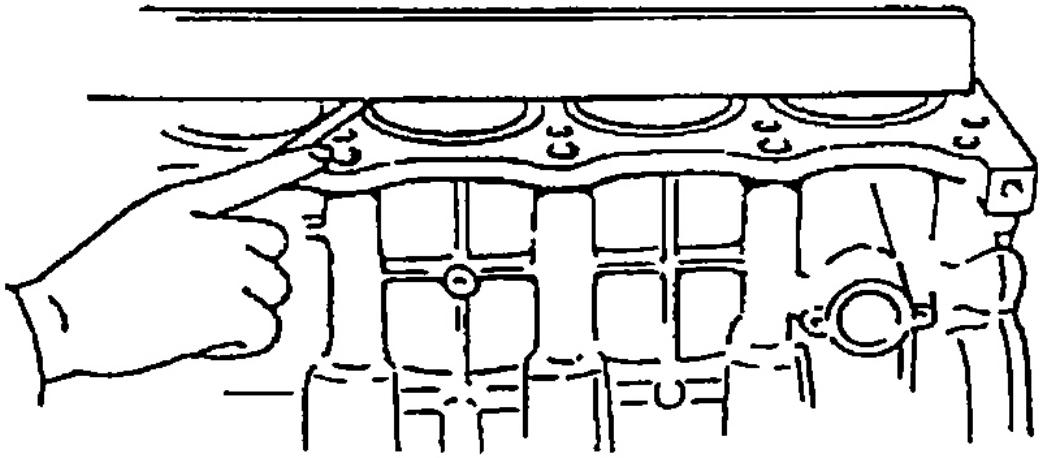
Cylinder Block

- Distortion of gasketed surface
- Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct It.

Flatness Limit

0.06 mm (0.0024 in.)

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Fig. 240: Checking Cylinder Block Gasketed Surface For Distortion
Courtesy of SUZUKI OF AMERICA CORP.

Honing or reboring cylinders

1. When any cylinder needs reboring, all other cylinders must also be rebored at the same time.

   Oversize piston specification

Size	Piston diameter
STD	89.970 – 89.990 mm (3.5422 – 3.5429 in.)
O/S 0.50	90.470 – 90.490 mm (3.5619 – 3.5626 in.)

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Fig. 241: Identifying Oversize Piston Specifications
Courtesy of SUZUKI OF AMERICA CORP.

2. Using micrometer, measure piston diameter.
3. Calculate cylinder bore diameter to be rebored as follows.

   D = A + B - C

   D: Cylinder bore diameter to be rebored.

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A: Piston diameter as measured.

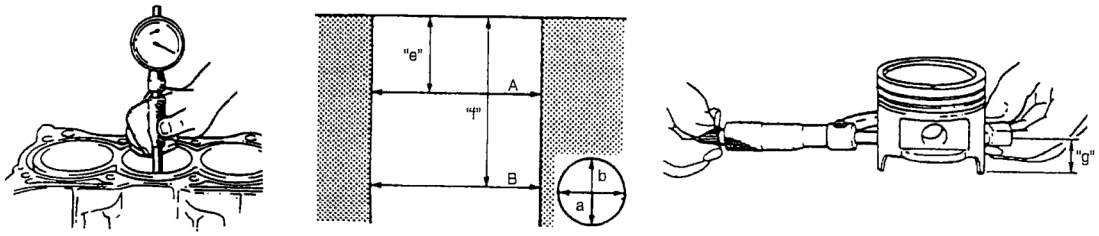
B: Piston clearance = 0.02 - 0.04 mm (0.0008 - 0.0015 in.)

C: Allowance for honing = 0.02 mm (0.0008 in.)

4. Rebore and hone cylinder to calculated dimension.

NOTE: Before reboring, install lower crankcase and tighten to specification to avoid distortion of bearing bores.

5. Measure piston clearance after honing.



"e": 50 mm (1.96 in.)	"g": 27.5 mm (1.08 in.)
"f": 95 mm (3.74 in.)	

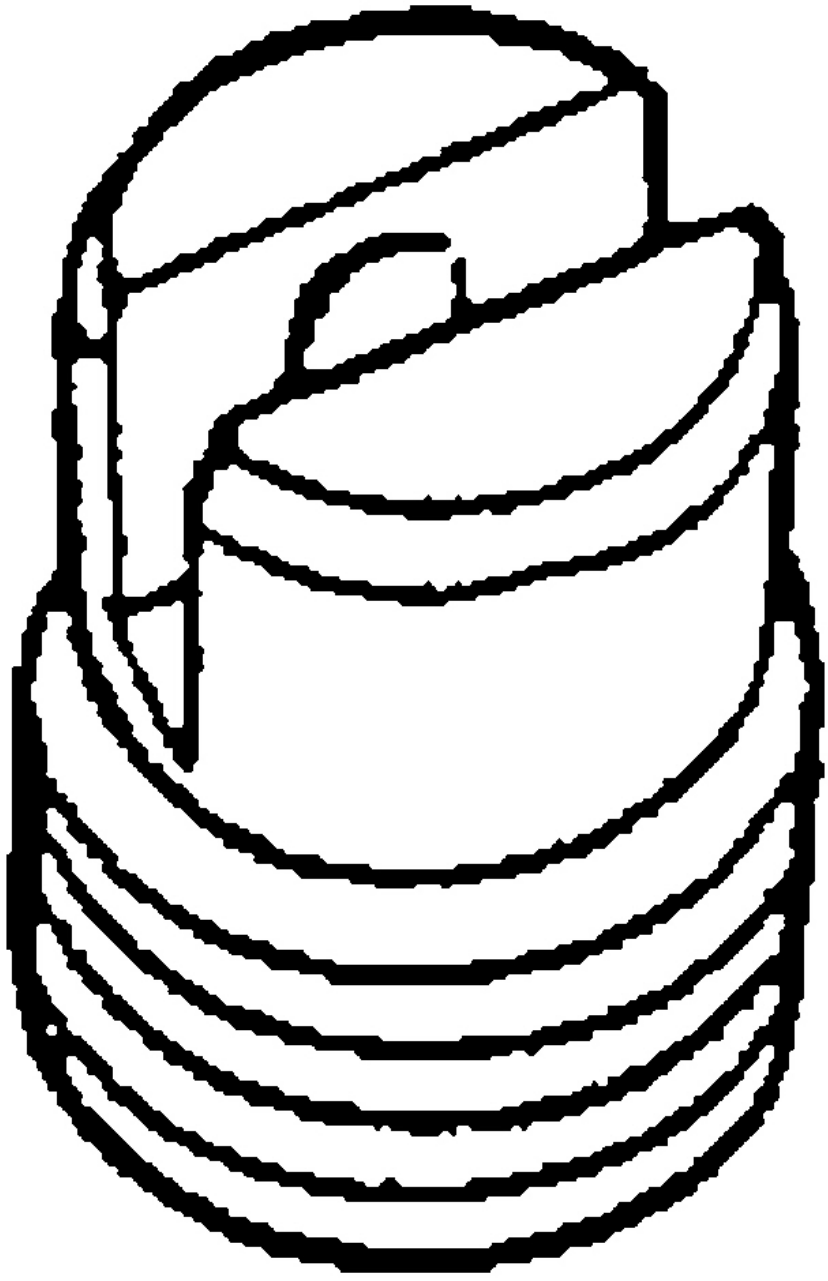
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Fig. 242: Measuring Piston Clearance Of Cylinders
Courtesy of SUZUKI OF AMERICA CORP.

Check Valve

Check check valve for clogging and ball for being stuck.

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Fig. 243: Checking Check Valve
Courtesy of SUZUKI OF AMERICA CORP.

SPECIAL TOOLS AND EQUIPMENT

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Special Tool

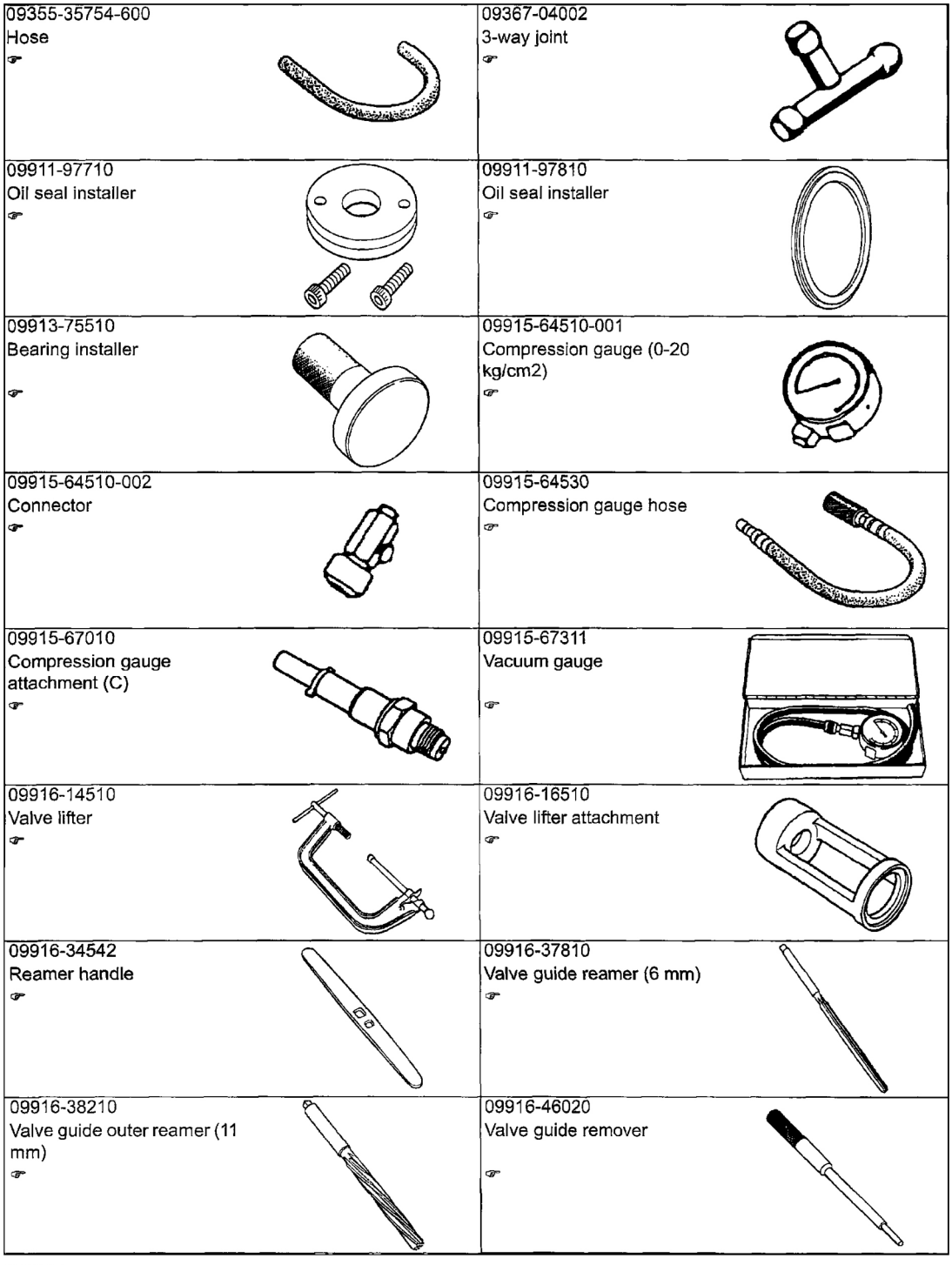


Fig. 244: Identifying Special Tools (1 of 2)
Courtesy of SUZUKI OF AMERICA CORP.

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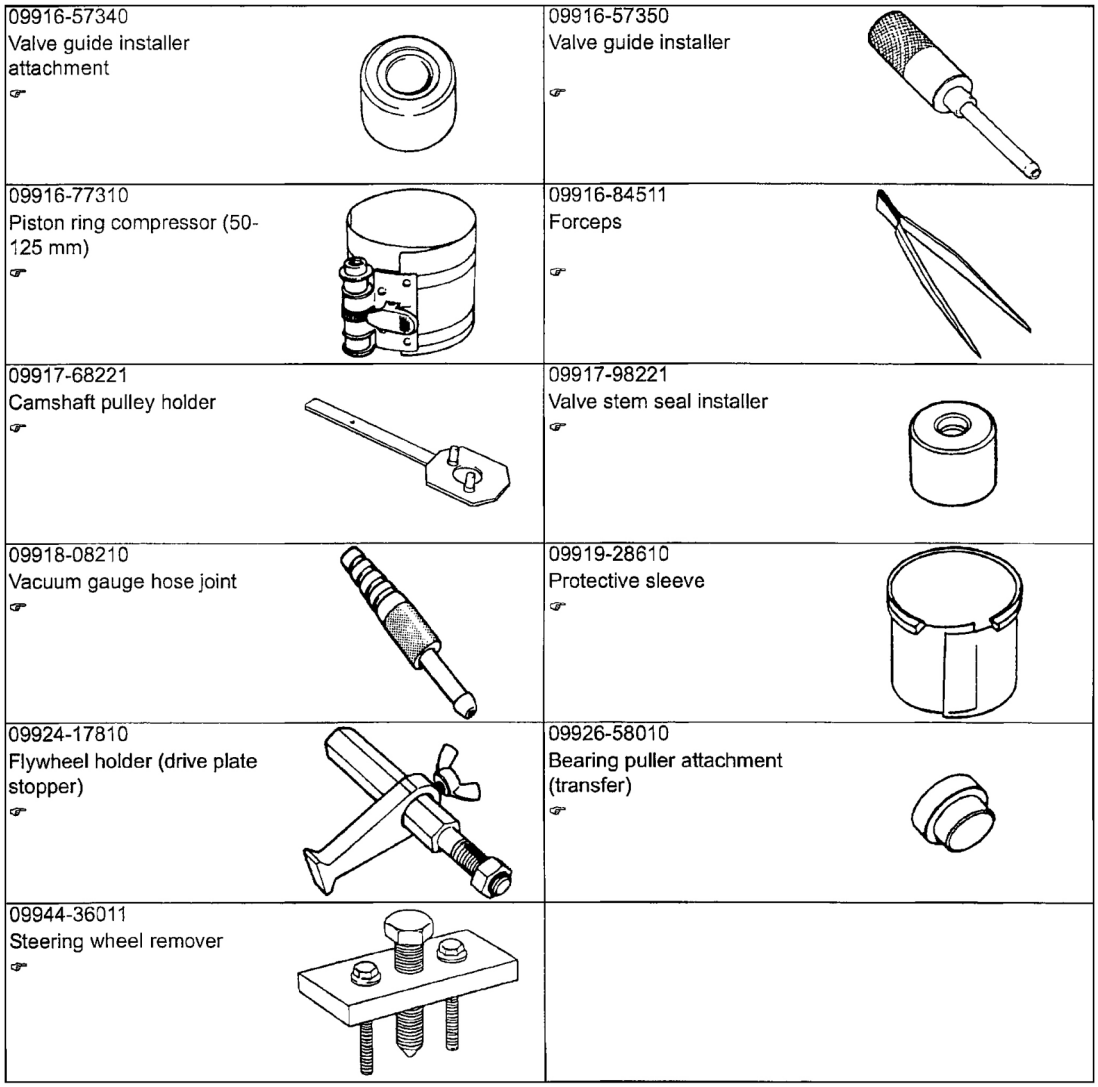


Fig. 245: Identifying Special Tools (2 of 2)
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE LUBRICATION SYSTEM

GENERAL DESCRIPTION

Engine Lubrication Description

The oil pump is trochoid type, and mounted under the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter.

The filtered oil flows into two paths in cylinder block.

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In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft.

In the other path oil goes up to the cylinder head and lubricates valves and camshafts, etc., after passing through the internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 510 kPa (5.1 kg/cm^2 , 74.0 psi).

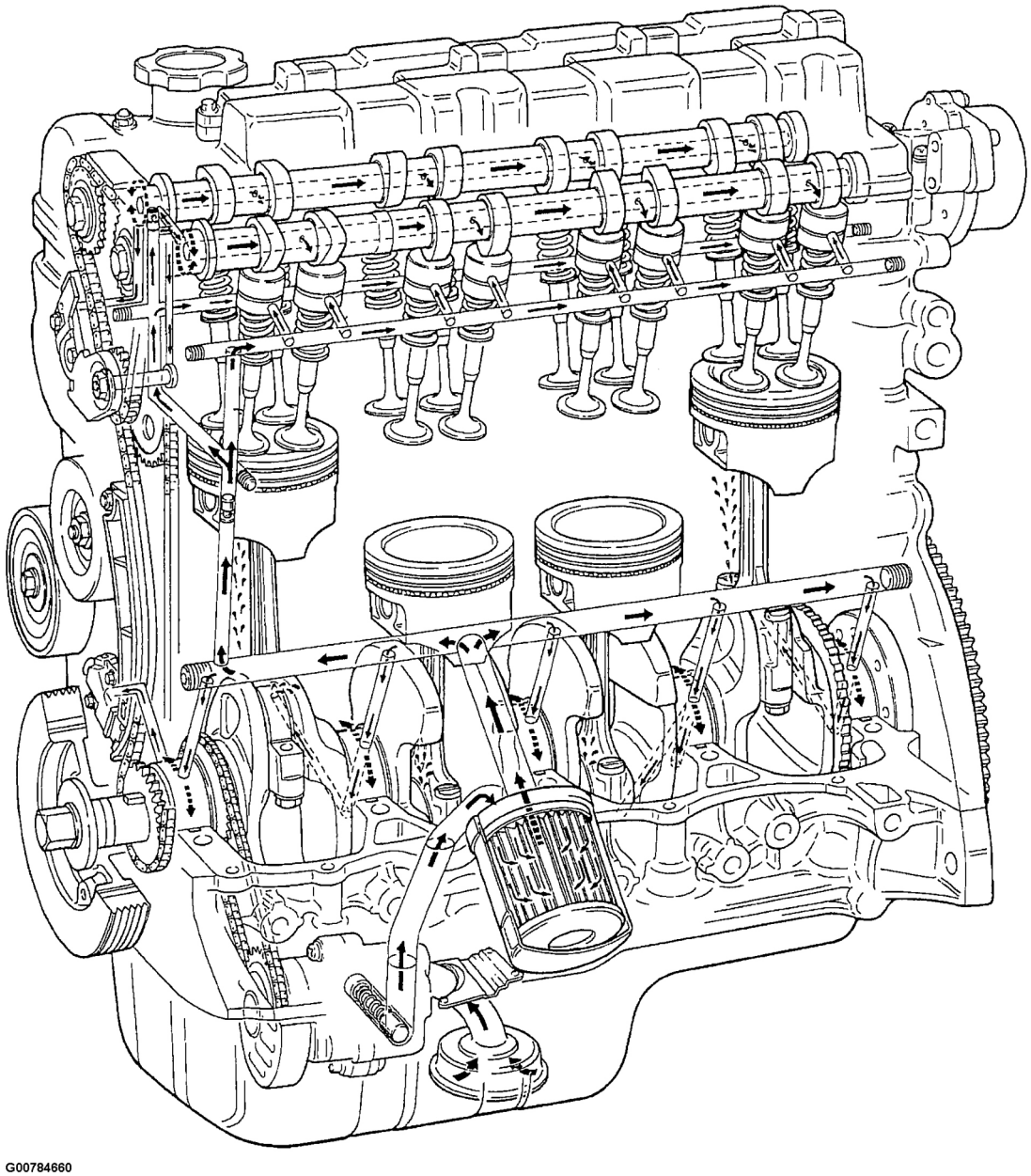


Fig. 246: Exploded View Of Engine

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Courtesy of SUZUKI OF AMERICA CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

Oil Pressure Check

WARNING: To avoid danger of being burned, do not touch exhaust manifold when exhaust system is hot. When servicing, be sure to perform it after exhaust system has cooled down.

NOTE:

Prior to checking oil pressure, check the following.

- **Oil level in oil pan**

  If oil level is low, add oil up to Full level hole on oil level gauge.

- **Oil quality**

  If oil is discolored, or deteriorated, change it.

- **Oil leaks**

  If leak is found, repair it.

1. Disconnect oil pressure switch connector.
2. Remove oil pressure switch (1) from cylinder block.

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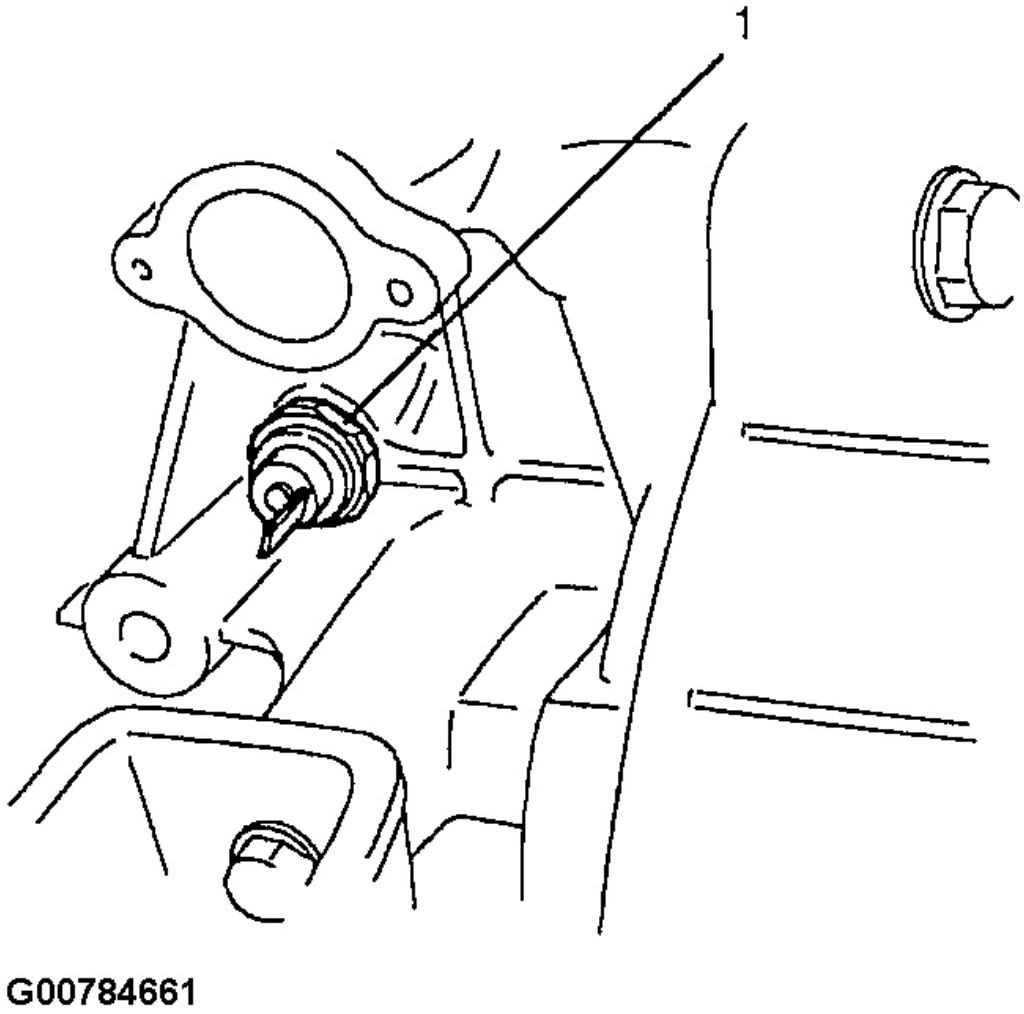


Fig. 247: Removing Oil Pressure Switch
Courtesy of SUZUKI OF AMERICA CORP.

3. Install special tool (Oil pressure gauge) to vacated threaded hole.

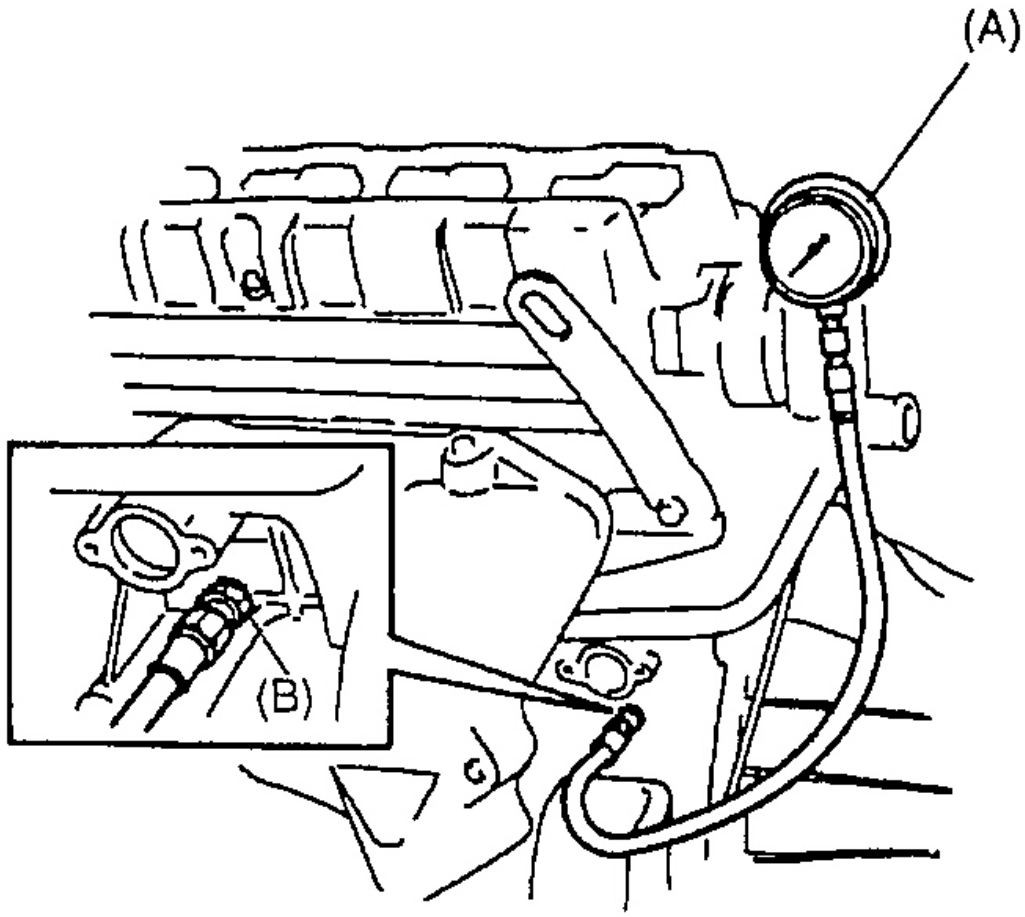
   Special tool

   (A): 09915-77310

   (B): 09915-78211

CAUTION: Be careful not to make special tool touch Exhaust manifold when installing because Exhaust manifold becomes very hot.

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Fig. 248: Installing Oil Pressure Gauge
Courtesy of SUZUKI OF AMERICA CORP.

4. Start engine and warm it up to normal operating temperature.

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

5. After warming up, raise engine speed to 4,000 RPM and measure oil pressure.

Oil pressure specification

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More than 390 kPa (3.9 kg/cm^2 , 55.5 psi)

6. After checking oil pressure, stop engine and remove oil pressure gauge.
7. Before reinstalling oil pressure switch (2), be sure to wrap its screw threads with sealing tape (1) and tighten switch to specified torque.

Tightening torque

Oil pressure switch (a): 15 N.m (1.5 kg-m, 11.0 lb-ft)

NOTE: If sealing tape edge is bulged out from screw threads of switch, cut it off.

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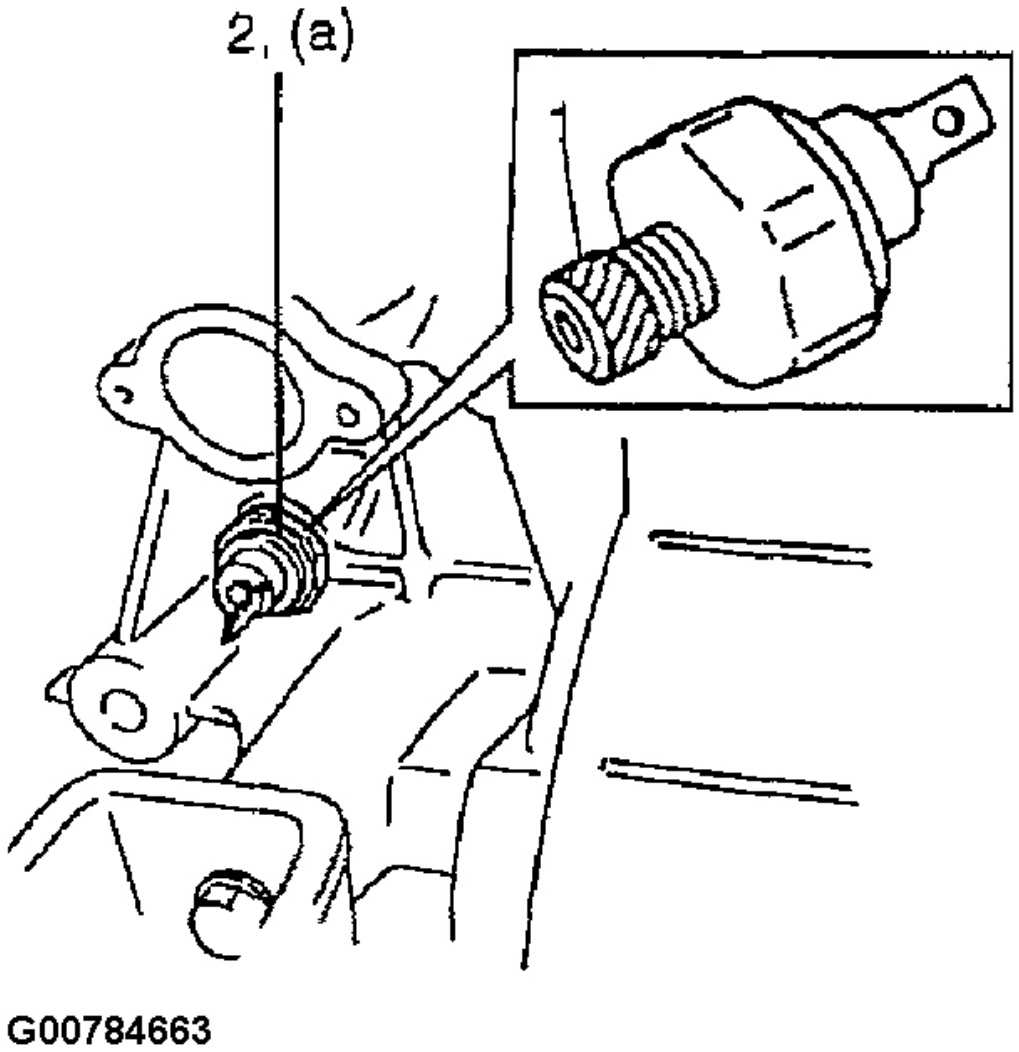


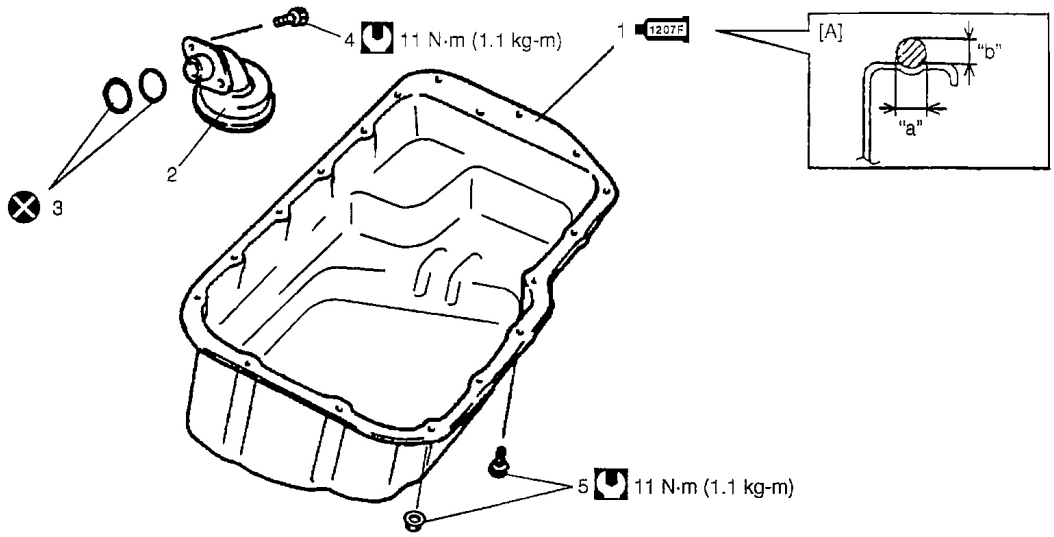
Fig. 249: Installing Oil Pressure Switch
Courtesy of SUZUKI OF AMERICA CORP.

8. Start engine and check oil pressure switch for oil leakage.

REPAIR INSTRUCTIONS

Oil Pan and Oil Pump Strainer Components

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[A]: Sealant application amount	3. O-ring
"a": 3 mm (0.12 in.)	4. Oil pump strainer bolt
"b": 2 mm (0.08 in.)	5. Oil pan bolt and nut
1207F 1. Oil pan: Apply sealant 99000-31150 to mating surface.	: Tightening torque
2. Oil pump strainer	: Do not reuse.

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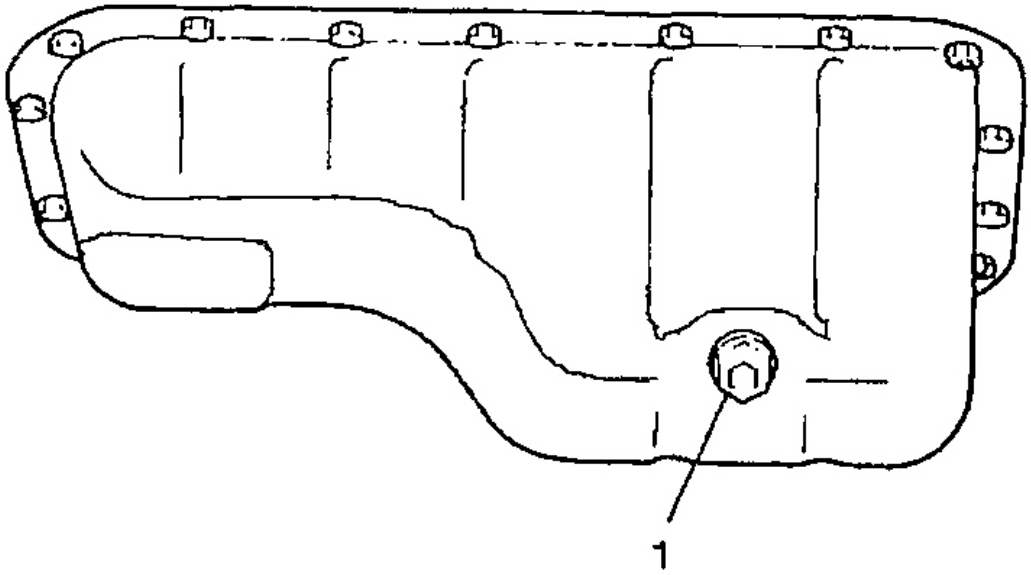
Fig. 250: Identifying Oil Pan & Oil Pump Strainer Components
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pan and Oil Pump Strainer Removal and Installation

Removal

1. Remove oil level gauge.
2. Raise vehicle.
3. Drain engine oil by removing drain plug (1).

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Fig. 251: Removing Drain Plug & Gasket
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove engine under cover(s) (1).
5. Remove exhaust No.1 pipe (2).
6. Support engine and transmission with engine support jack for 2WD vehicle.
7. Remove mounting member (3).

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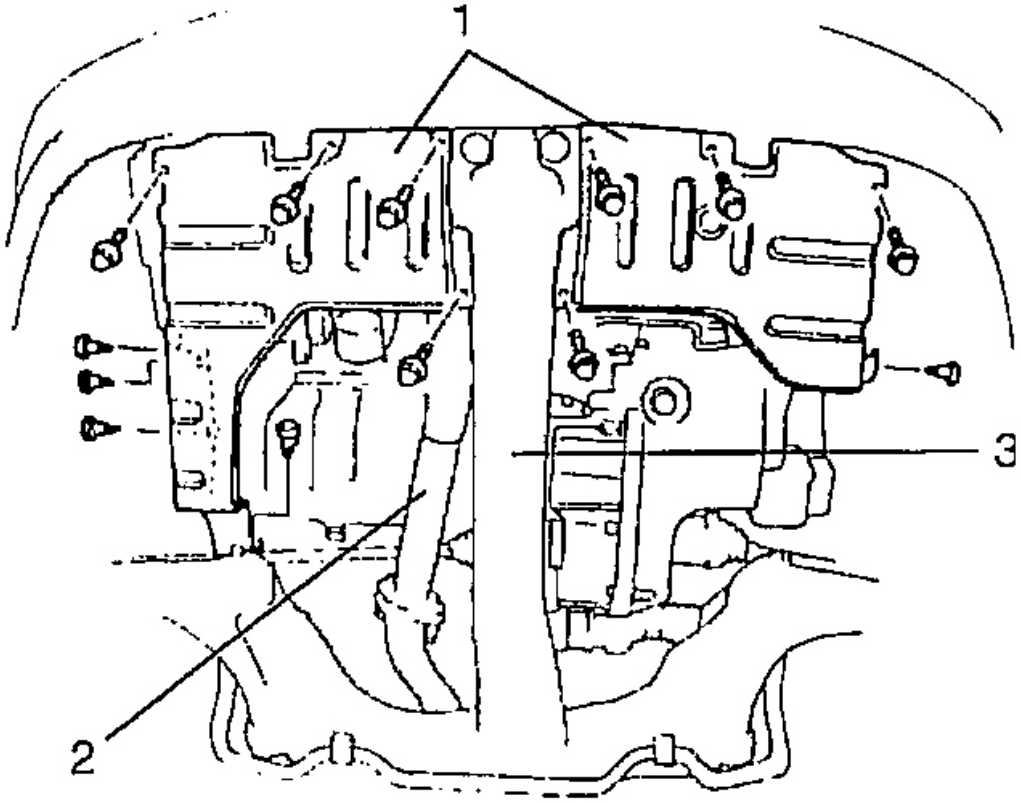


Fig. 252: Removing Engine Under Cover, Exhaust No.1 Pipe & Mounting Member
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove transaxle lower stiffener. Refer to **Manual Transaxle Unit Dismounting and Remounting** or **Automatic Transaxle Unit Dismounting and Remounting** .
9. Remove oil pan bolts and nuts.
10. Cut sealant at hatched part shown in figure using special tool and hammer (1).

    Special tool

    (A): 09921-96510

    NOTE: Be careful not to damage stud bolt (5) and oil pump mating surfaces (4) between oil pan and crank case when cutting sealant.

11. Remove oil pan (2) from lower crankcase (3).

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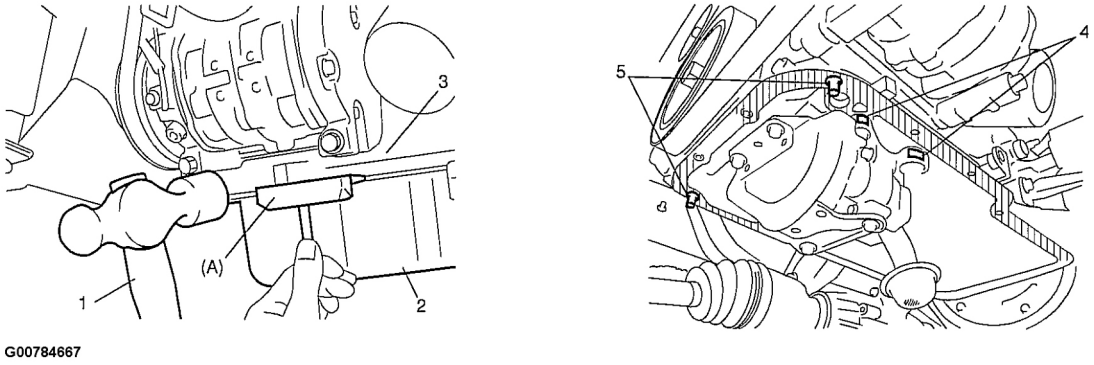


Fig. 253: Removing Oil Pan From Lower Crankcase
Courtesy of SUZUKI OF AMERICA CORP.

12. Oil pump strainer (6), and O-ring (7).

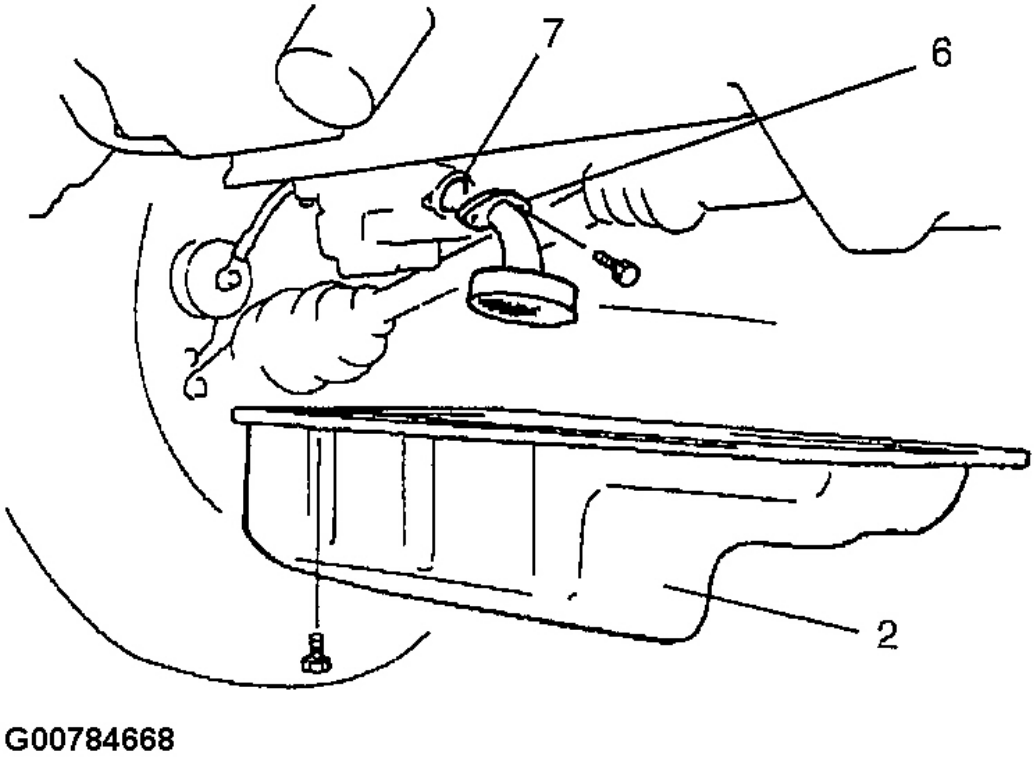


Fig. 254: Removing Oil Pump Strainer & O-Ring
Courtesy of SUZUKI OF AMERICA CORP.

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Installation

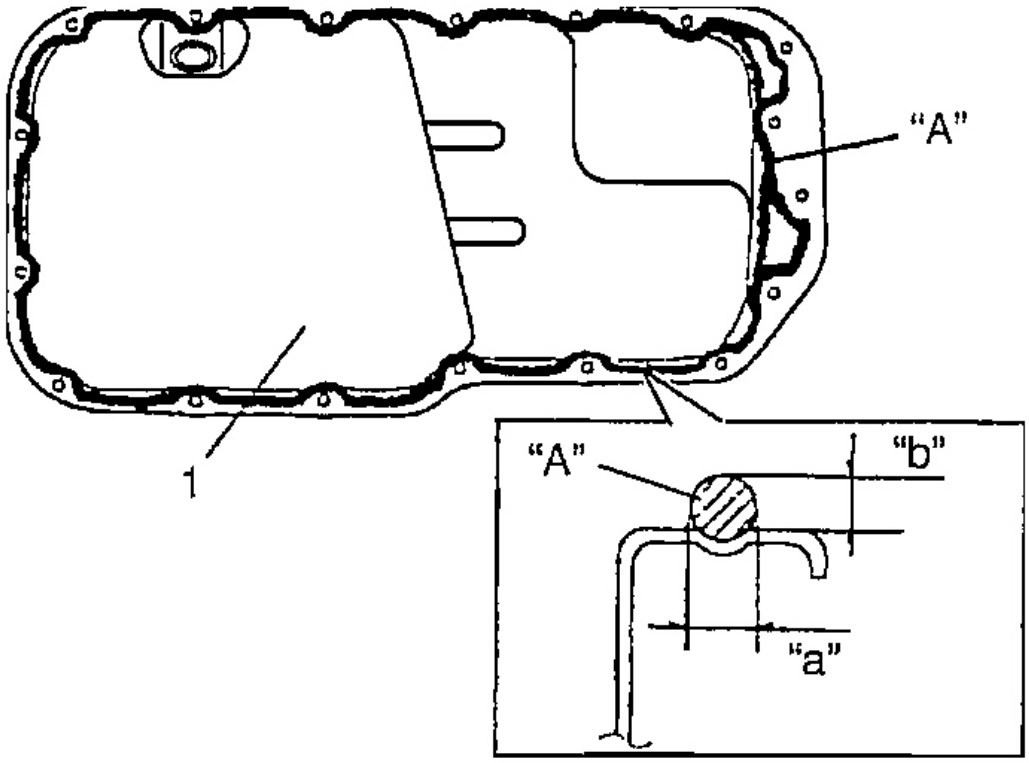
1. Apply sealant to oil pan (1) mating surface continuously as shown in figure.

   "A": Sealant 99000-31250

   Sealant amount for oil pan

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

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



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Fig. 255: Applying Sealant To Oil Pan Mating Surface
Courtesy of SUZUKI OF AMERICA CORP.

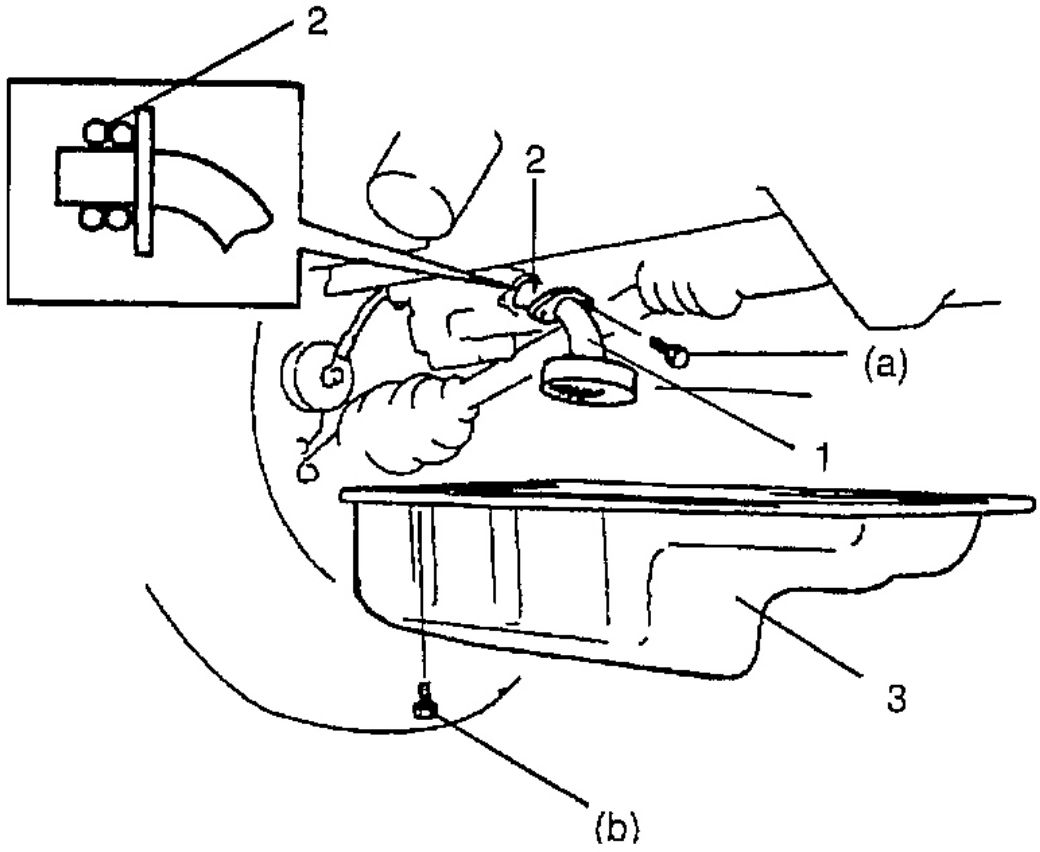
2. Install O-rings (2) to oil pump strainer (1) securely as shown in figure.

   Tighten strainer bolts to specified torque.

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Tightening torque

Oil pump strainer bolt (a): 11 N.m (1.1 kg-m, 8.0 lb-ft)



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Fig. 256: Installing O-rings To Oil Pump Strainer
Courtesy of SUZUKI OF AMERICA CORP.

3. After fitting oil pan (3) to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.

   Tighten bolts and nuts to specified torque.

   Tightening torque

   Oil pan bolt and nut (b): 11 N.m (1.1 kg-m, 8.0 lb-ft)

4. Install gasket and drain plug (1) to oil pan after applying engine oil.

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Tighten drain plug to specified torque.

Tightening torque

Oil drain plug (a): 50 N.m (5.5 kg-m, 36.5 lb-ft)

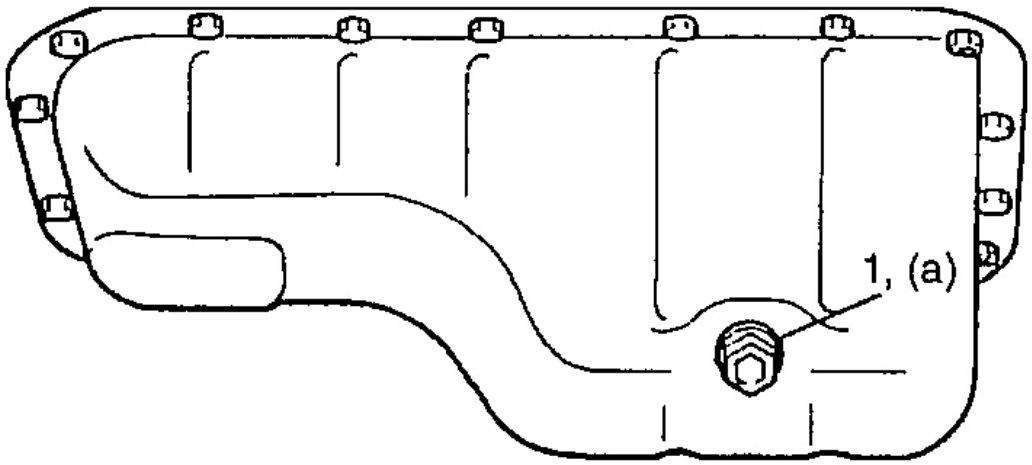


Fig. 257: Installing Gasket & Drain Plug
Courtesy of SUZUKI OF AMERICA CORP.

5. Install transmission lower stiffener. Refer to Manual Transaxle Unit Dismounting and Remounting or Automatic Transaxle Unit Dismounting and Remounting .
6. Install mounting member for 2WD vehicle.

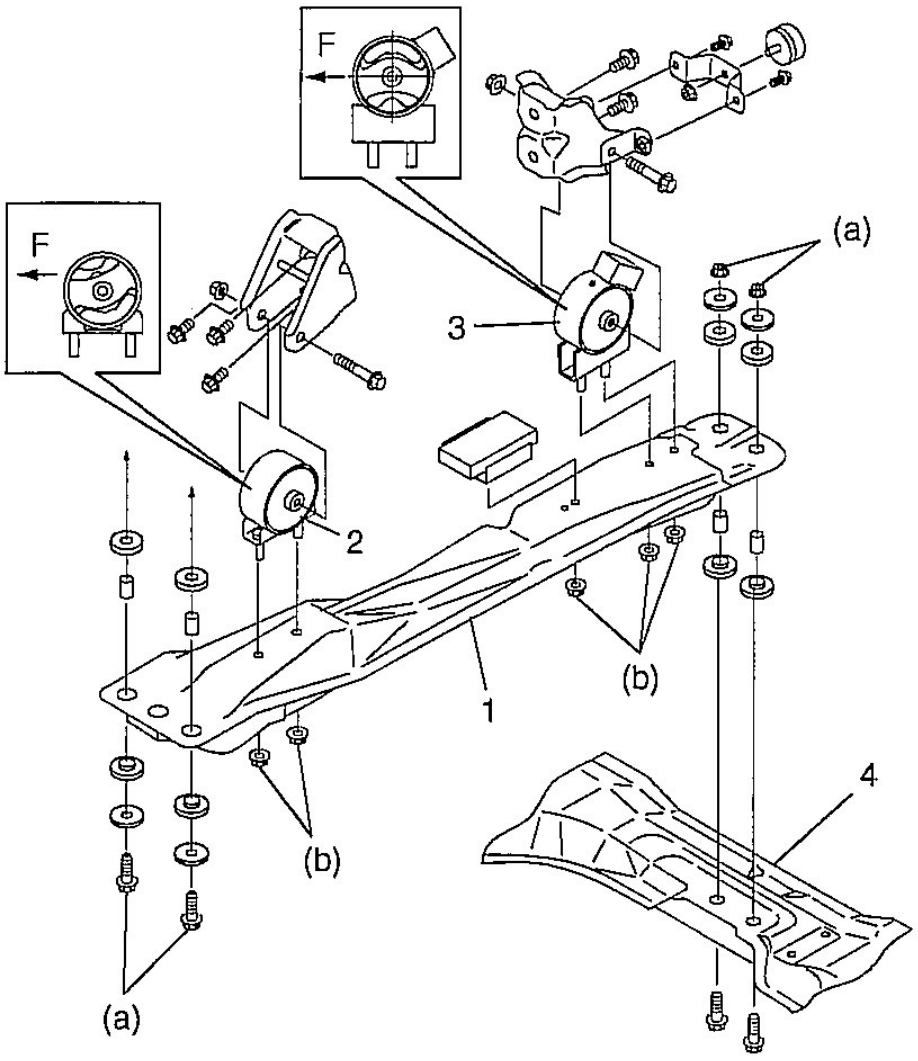
   Tighten bolts and nuts to specified torque.

   Tightening torque

   Engine mounting bolt and nut (a): 55 N.m (5.5 kg-m, 40.0 lb-ft)

   Engine front and rear mounting nut (b): 45 N.m (4.5 kg-m, 32.5 lb-ft)

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1. Mounting member	4. Suspension frame
2. Engine front torque bush	F: Forward
3. Engine rear mounting	

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Fig. 258: Installing Mounting Member
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove engine support jack for 2WD vehicle.
8. Install exhaust No. 1 pipe (1).

Tighten bolts and nuts to specified torque.

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9. Install exhaust No.1 pipe. .
10. Install engine under cover(s).
11. Install oil level gauge.
12. Refill engine with engine oil.

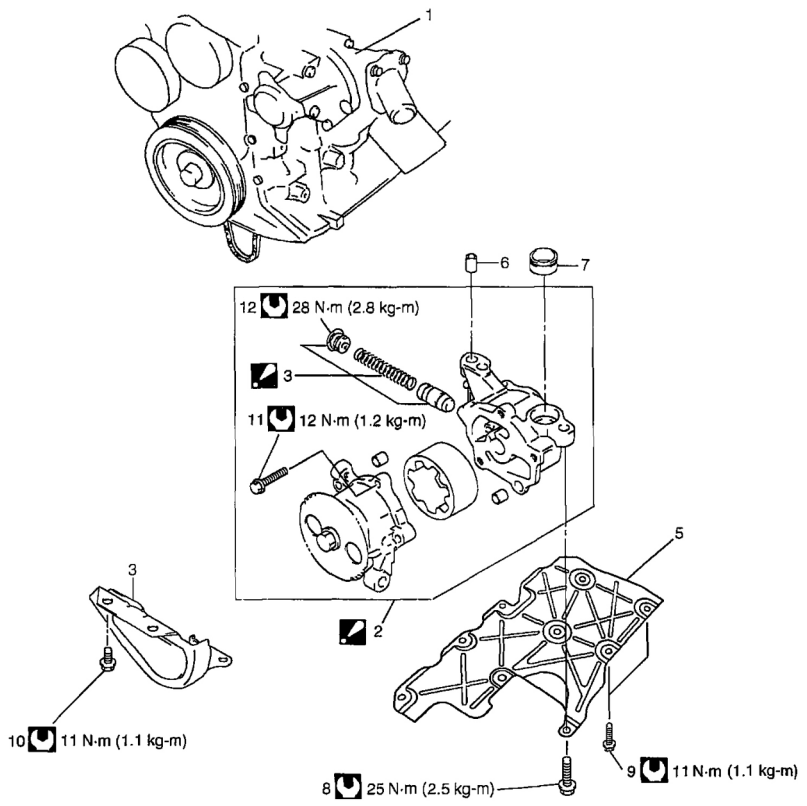
Oil Pan and Oil Pump Strainer Cleaning

- Clean mating surface of oil pan and cylinder block.

  Remove oil, old sealant and dust from mating surfaces and oil pan inside.

- Clean oil pump strainer screen.

Oil Pump Components



1. Cylinder block	5. Baffle plate	9. Baffle plate bolt (M6 bolt)	: Tightening torque
2. Oil pump assy : See [A]	6. Pin No.1	10. Oil pump sprocket cover bolt	[A]: Replace as a set
3. Oil pump relief valve set : See [A]	7. Pin No.2	11. Oil pump case bolt	
4. Oil pump sprocket cover	8. Oil pump mounting bolt (M8 bolt)	12. Oil pump relief valve retainer	

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Fig. 259: Identifying Oil Pump Components
Courtesy of SUZUKI OF AMERICA CORP.

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Oil Pump Removal and Installation

CAUTION: Don't remove sprocket and inner rotor from oil pump, otherwise damage of oil pump center shaft and abnormal operation of oil pump could result.

Removal

1. Disconnect negative cable at battery.
2. Drain engine oil.
3. Remove oil pan and oil pump strainer. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
4. Remove oil pump sprocket cover (1).

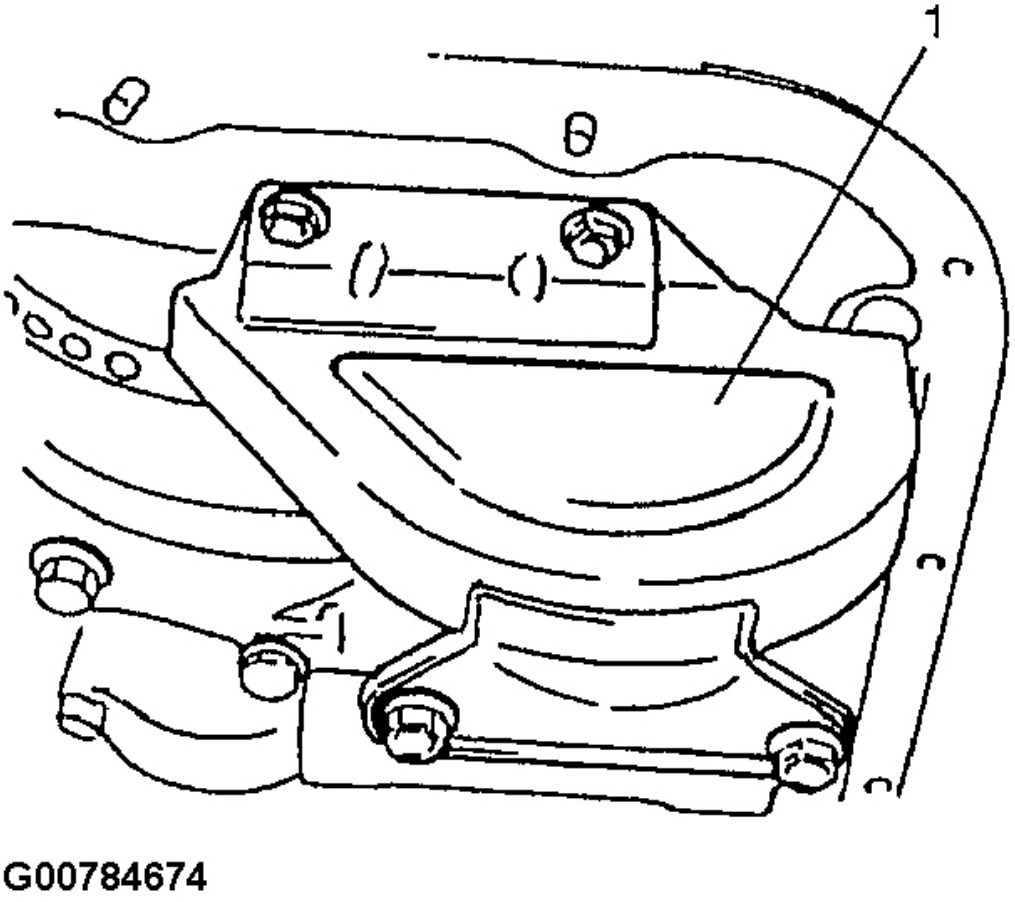
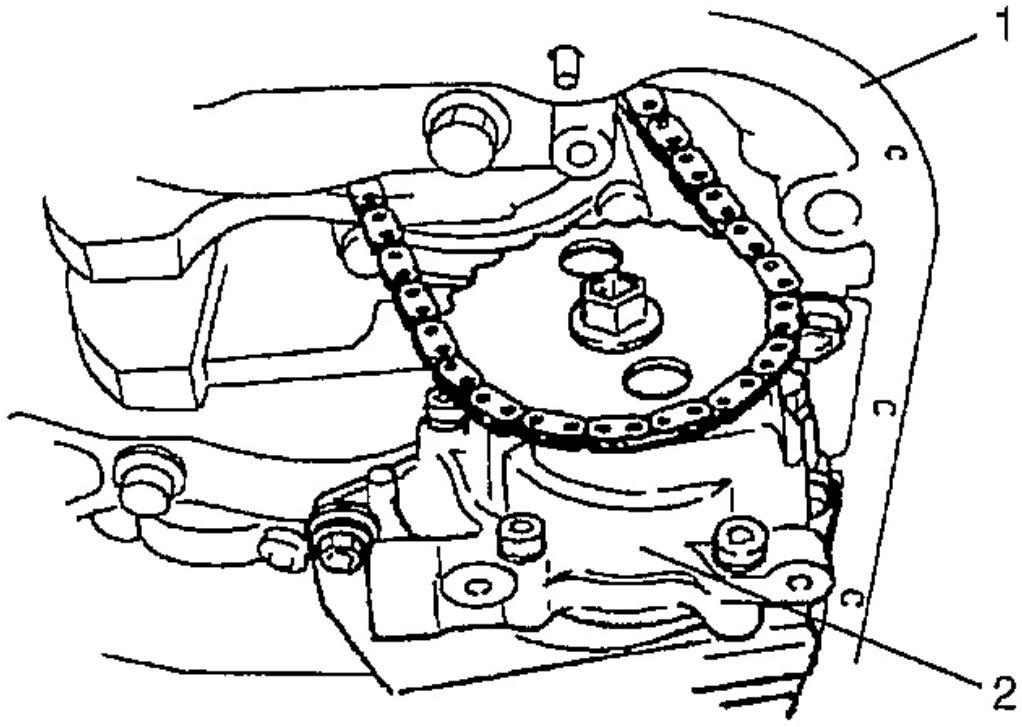


Fig. 260: Removing Oil Pump Sprocket Cover

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Courtesy of SUZUKI OF AMERICA CORP.

5. Remove baffle plate (5) from lower crank case (1).
6. Remove oil pump (2) with sprocket from lower crankcase (1).



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Fig. 261: Removing Oil Pump With Sprocket From Lower Crankcase
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install oil pump (2) and baffle plate to lower crank case (1) and tighten bolts to specified torque.

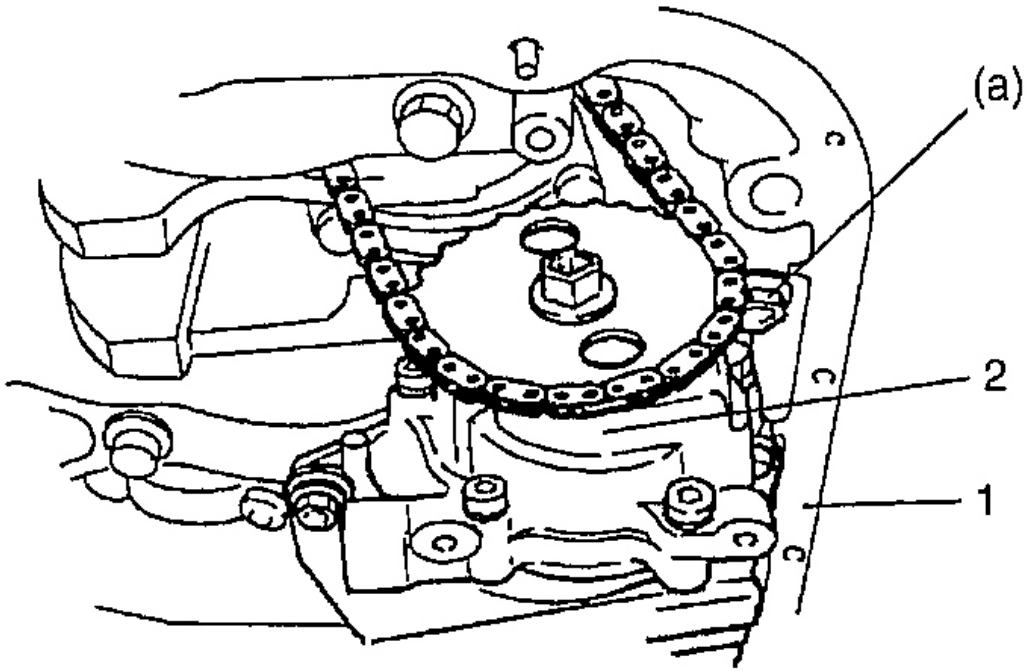
NOTE: When installing oil pump, be careful not to allow pins to fall off.

Tightening torque

Oil pump mounting bolt (M8 bolt) (a): 25 N.m (2.5 kg-m, 18.0 lb-ft)

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Baffle plate bolt (M6 bolt): 11 N.m (1.1 kg-m, 8.0 lb-ft)



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Fig. 262: Installing Oil Pump & Baffle Plate
Courtesy of SUZUKI OF AMERICA CORP.

2. Install oil pump sprocket cover (1) and tighten bolts to specified torque.

Tightening torque

Oil pump sprocket cover bolt (a): 11 N.m (1.1 kg-m, 8.0 lb-ft)

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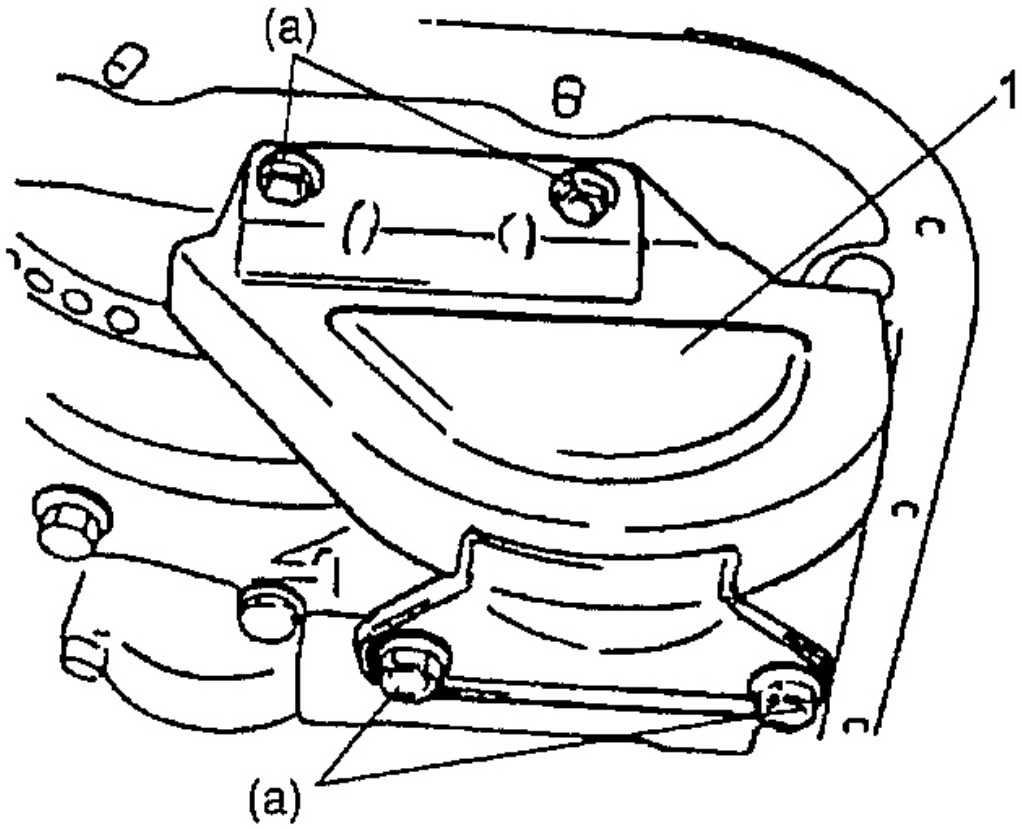


Fig. 263: Installing Oil Pump Sprocket Cover
Courtesy of SUZUKI OF AMERICA CORP.

3. Install oil pan and oil pump strainer. Refer to **Oil Pan and Oil Pump Strainer Removal and Installation**.
4. Refill engine with engine oil.
5. Connect negative cable at battery.
6. After completing installation, check oil pressure by running engine. Refer to **Oil Pressure Check**.

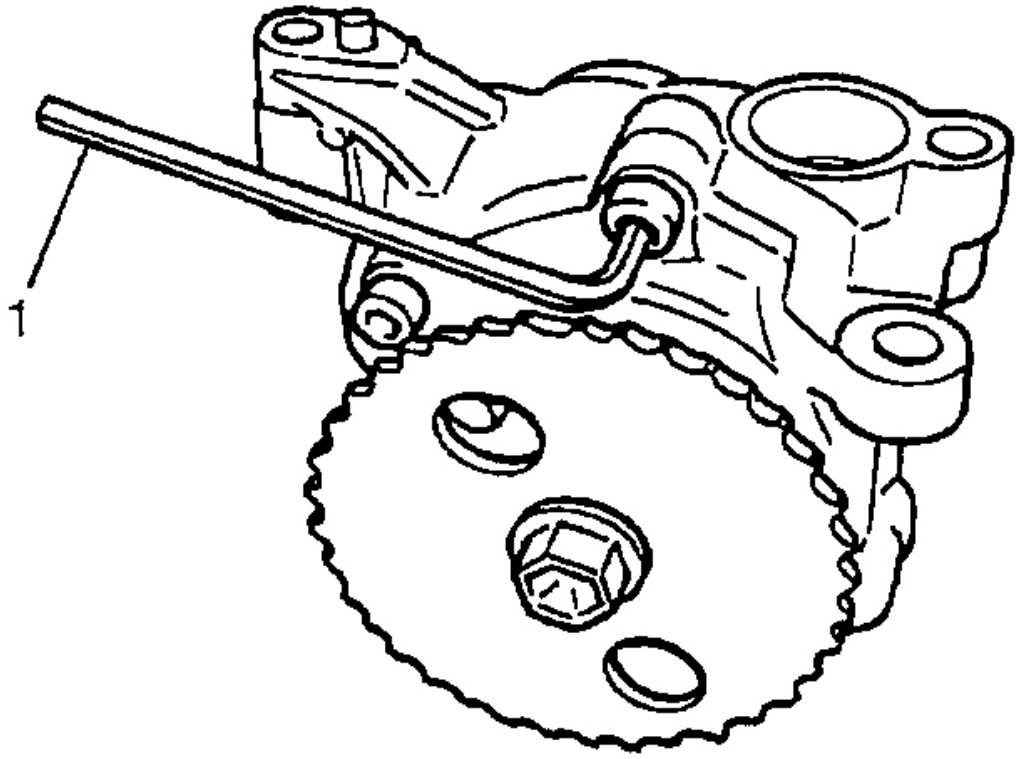
Oil Pump Disassembly and Assembly

CAUTION: Don't remove sprocket and inner rotor from oil pump, otherwise damage of oil pump center shaft and abnormal operation of oil pump could result.

Disassembly

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- Disassemble oil pump.



1. Hexagon wrench

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Fig. 264: Identifying Oil Pump Disassemble
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

1. Wash, clean and then dry all disassembled parts.
2. Apply thin coat of engine oil to inner and outer rotors, and inside surfaces of oil pump case.
3. Install outer rotor to pump case No. 1.
4. Install relief valve (3), relief spring (2) and retainer (1) to oil pump case No.2 (4).

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Tighten retainer to specified torque.

Tightening torque

Oil pump relief valve retainer (a): 28 N.m (2.8 kg-m, 20.5 lb-ft)

5. Install oil pump case pins (5) to oil pump case No.2.

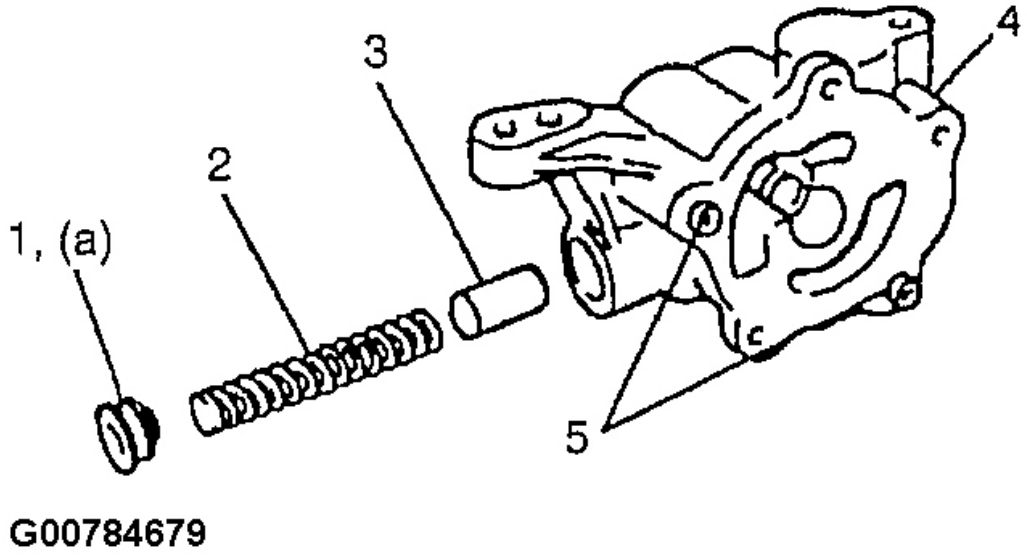


Fig. 265: Installing Relief Valve, Relief Spring, Retainer & Oil Pump Case Pins
Courtesy of SUZUKI OF AMERICA CORP.

6. Assemble oil pump. After assembling oil pump, check to be sure that rotor turns smoothly by hand.

Tightening torque

Oil pump case bolt (a): 12 N.m (1.2 kg-m, 9.0 lb-ft)

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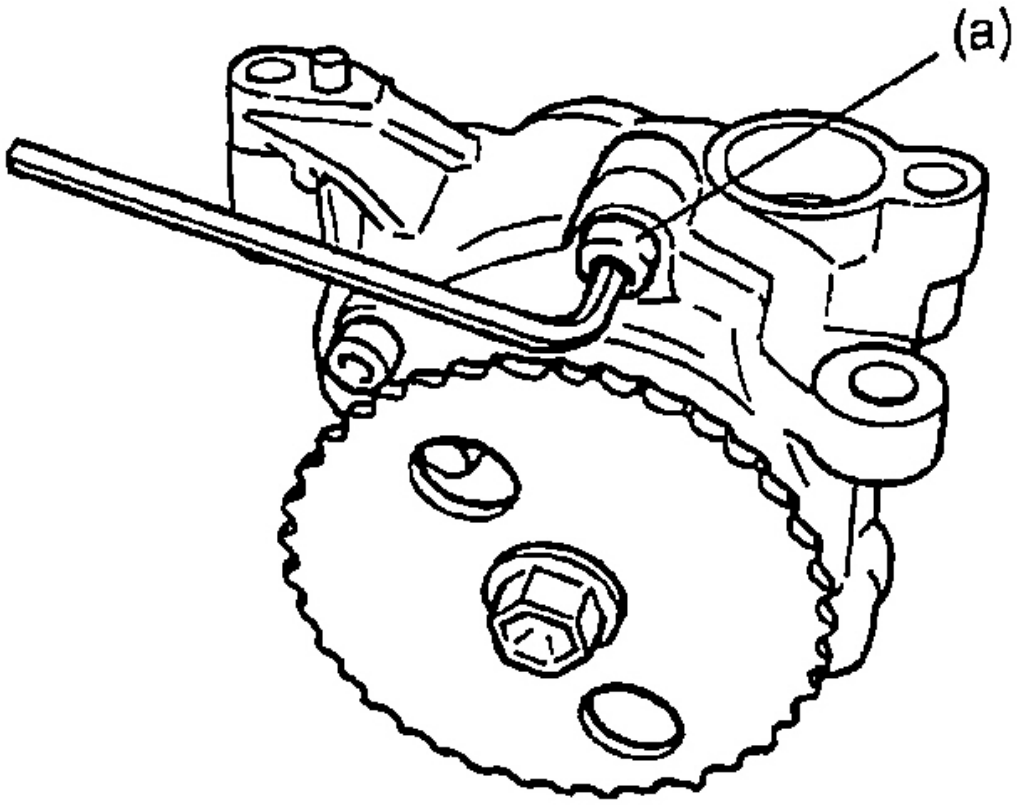


Fig. 266: Identifying Oil Pump Assemble
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pump Inspection

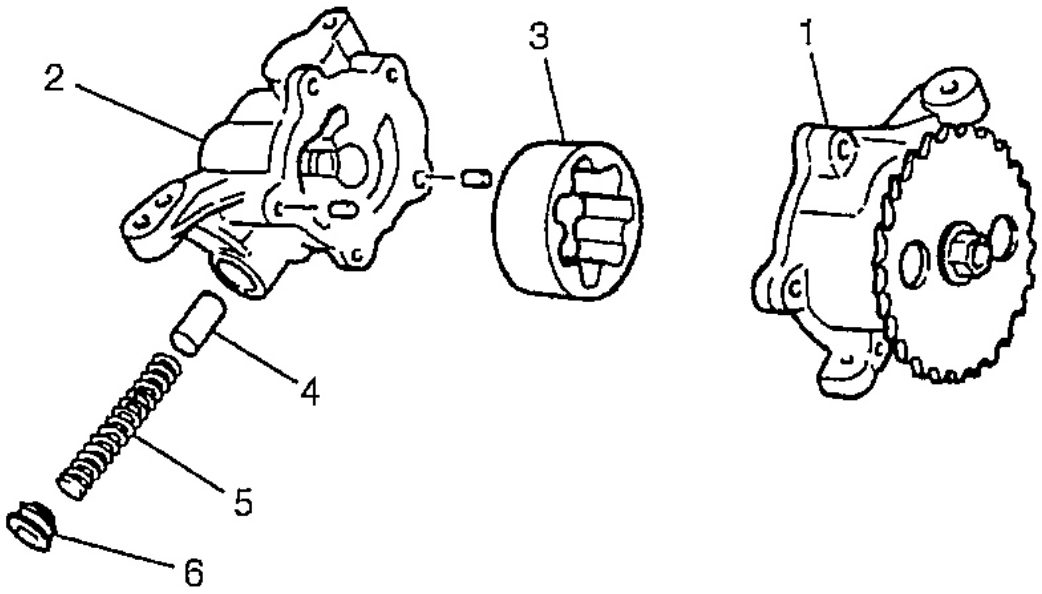
- Check outer rotor (3), inner rotor and oil pump cases (1), (2) for excessive wear or damage.

  If abnormal condition is found in above checks, replace oil pump assembly.

- Check relief valve (4) for excessive wear or damage.

  If abnormal condition is found in above checks, replace oil pump relief valve set.

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5.	Relief spring
6.	Retainer

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Fig. 267: Inspecting Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

- Measure free length and tension of oil relief spring.

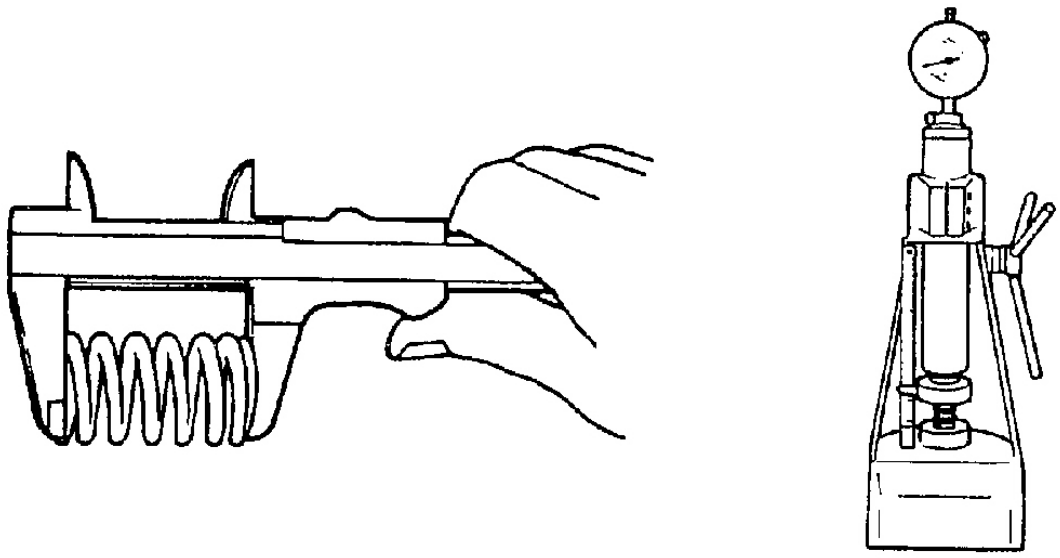
  If the measured values of length or tension is less than the specification, replace oil pump relief valve set.

Item	Standard
Spring free length	63.5 mm (2.5 in.)
Spring preload	85.0 N for 52.0 mm (8.5 kg for 52.0 mm, 19.0 lb/2.05 in.)

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Fig. 268: Identifying Oil Relief Spring Specification
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Fig. 269: Measuring Oil Relief Spring
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- Measure clearance of oil pump rotor and oil pump case.

Radial Clearance

Check radial clearance between outer rotor (2) and case No. 1 (1), using thickness gauge (4). If clearance exceeds its limit, replace oil pump assembly.

Limit on radial clearance between outer rotor and case

0.20 mm (0.0079 in.)

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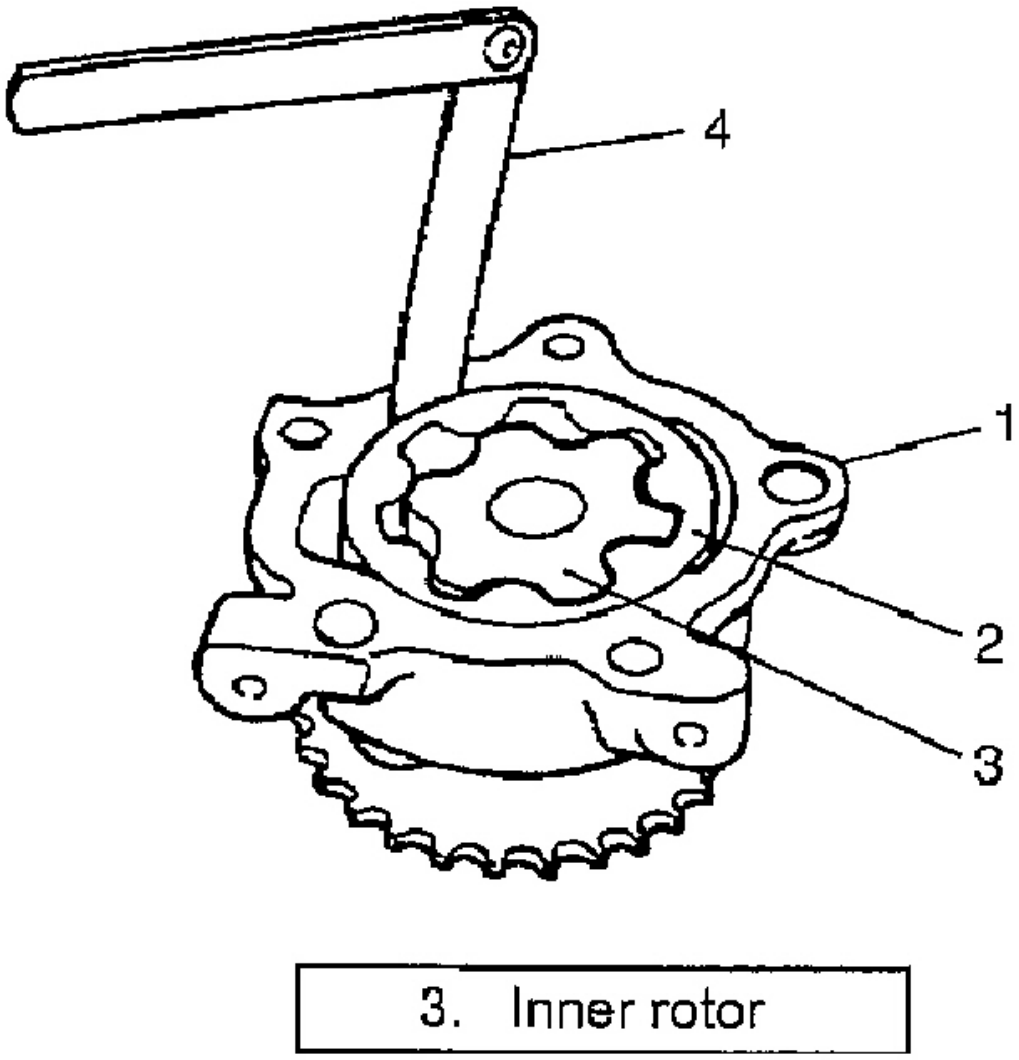


Fig. 270: Measuring Radial Clearance Between Outer Rotor & Case No.1
Courtesy of SUZUKI OF AMERICA CORP.

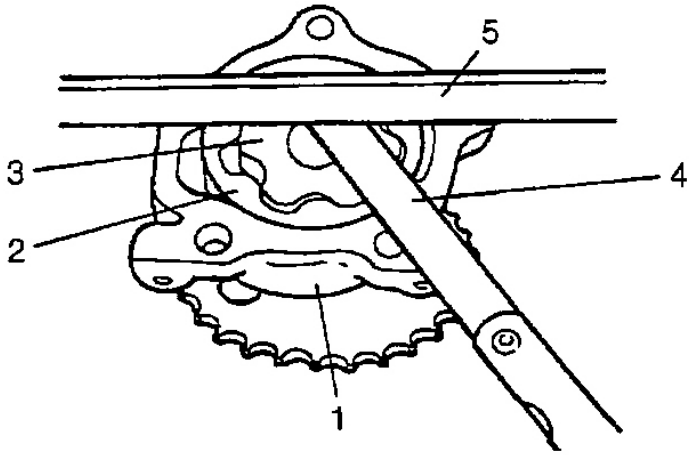
Side Clearance

Using straightedge (5) and thickness gauge (4), measure side clearance. If side clearance exceeds its limit, replace oil pump assembly.

Limit on side clearance

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0.11 mm (0.0043 in.)



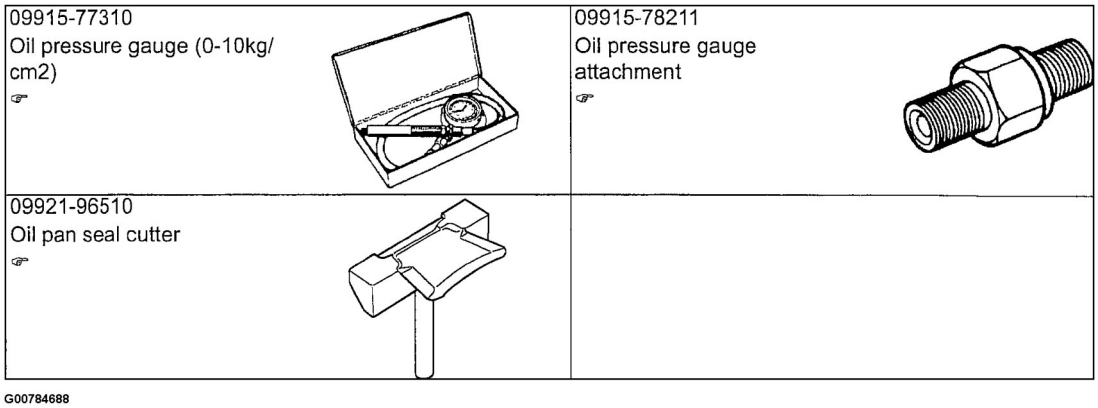
1. Oil pump case No.1	3. Inner rotor
2. Outer rotor	

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Fig. 271: Measuring Side Clearance
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SPECIAL TOOLS AND EQUIPMENT

Special Tool



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Fig. 272: Identifying Special Tools
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TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Bracket Bolt	40 (55)
Ball Stud Bolt	44 (60)
Ball Stud Lock Nut (4WD Only)	44 (60)
Camshaft Timing Sprocket Bolt	58 (80)
Camshaft Position Sensor	11 (15)
Center Coupling Bolt (4WD Only)	17 (23)
Center Support Nut (4WD Only)	37 (50)
Center Shaft Support Bolt	40 (55)
Clutch Cover Bolt	17 (23)
Connecting Rod Bolt/Nut	
2002 & 2003	33 (45)
2004	(18) Tighten bolts to 15 N.m (1.5 kg-m, 11.0 lb-ft), then tighten 45°.
Crankcase Bolts (1)	
Step 1 (10 mm Bolt)	(2)
Step 2 (10 mm Bolt)	(3)
Step 3 (10 mm Bolt)	(4)
Step 4 (10 mm Bolt)	(5)
Step 5 (8 mm Bolt)	(6)
Crankshaft Pulley Bolt	109 (150)
Cylinder Head-To-Cylinder Block (7)	
Step 1	(8)
Step 2	(9)
Step 3	(10)
Step 4	(11)
Step 5	(12)
Step 6	(13)
Drive Shaft Nut	127 (175)
Engine Mounting (16)	
Engine Front Bush Nut/Bolt	40 (55)
Engine Front Mounting Nut	40 (55)
Engine Left Mounting Bracket Nut	40 (55)
Engine Left Mounting Bracket Bolt/Nut	18 (25)
Engine Left Mounting Stiffener Bolt	18 (25)

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Engine Right Mounting Bolt	40 (55)
Engine Right Mounting Bracket Bolt /Nut	40 (55)
Engine Rear Mounting Bracket Bolt	40 (55)
Engine Rear Mounting Bracket Bolt	69 (93)
Engine Rear Mounting Bracket Nut	40 (55)
Engine Rear Mounting Nut	33 (45)
Mounting Member To Suspension Frame Nut	40 (55)
Dynamic Damper Nut	33 (45)
Engine RH Mounting Bracket Bolt	40 (55)
Exhaust Manifold-To-No. 1 Pipe Nut	(14) 40 (55)
Exhaust No. 1 Pipe-To-Exhaust Manifold Bolt (4WD Only)	37 (50)
Exhaust No. 1 Pipe-To-No. 2 Pipe Bolt	32 (43)
Exhaust Pipe No. 1 Stiffener Bolt	40 (55)
Exhaust No. 2 Pipe-To-No. 1 Pipe Bolt (4WD Only)	32 (43)
Exhaust Pipe No. 1 Stiffener Mounting Bolt	53 (73)
Flywheel Or Drive Plate Bolt	51 (70)
Generator Belt Idler Pulley Nut	31 (42)
Generator Belt Tensioner Bolt	18 (25)
Intake Manifold Bolt/Nut	18 (25)
Intake Manifold Front Stiffener Bolt	18 (25)
Intake Manifold Rear Stiffener Bolt	40 (55)
Knock Sensor	17 (23)
Oil Drain Plug	37 (50)
Oil Pressure Switch	11 (15)
Oil Pump Mounting Bolt	18 (25)
Oil Pump Relief Valve Retainer Nut	13 (28)
Propeller Shaft No. 1 Bolt (4WD Only)	(17) 17 (23)
Propeller Shaft No. 2 Bolt (4WD Only)	17 (23)
Suspension Frame Bolt (4WD Only)	65 (90)
Throttle Body Bolt/Nut	18 (25)
Timing Chain Tensioner Adjuster No. 2 Nut	33 (45)
Timing Chain Tensioner Nut	18 (25)
Torque Converter Housing Lower Stiffener	37 (50)
Transfer Mounting Bolt (4WD Only)	37 (50)
Transfer-To-Engine Stiffener Bolt (4WD Only)	37 (50)
Transfer-To-Transaxle Stiffener Bolt (4WD Only)	37 (50)
Transaxle Fluid Drain Plug (A/T)	29 (40)
Transaxle Oil Filler/Level & Drain Plug (M/T)	16 (21)
Water Pump Mounting Bolt	18 (25)
Wheel Nut	62 (85)

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	INCH Lbs. (N.m)
Baffle Plate	97 (11)
Camshaft Housing Bolt	(15) 97 (11)
Crankshaft Position Sensor Bolt	53 (6)
Cylinder Block Heater Bolt	97 (11)
Cylinder Head Cover Nut	97 (11)
Engine Cover Bolt	71 (8)
Oil Pan Bolt/Nut	97 (11)
Oil Pump Case Bolt	106 (12)
Oil Pump Sprocket Cover Bolt	97 (11)
Oil Pump Strainer Bolt	97 (11)
Timing Chain Cover Bolt/Nut	97 (11)
Timing Chain Guide No. 1 Bolt	90 (9)
Timing Chain Tensioner Adjuster No. 1 Bolt	97 (11)
Timing Chain Tensioner Adjuster No. 2 Bolt	97 (11)

(1) Tighten bolts in sequence. See **Fig. 273**.

(2) Tighten bolts 1-10 to 30 Ft Lbs. (40 N.m).

(3) Loosen bolts 1-10 until tightening torque is reduced to 0 (Zero) in reverse order of tightening.

(4) Same as step 1; tighten bolts 1-10 to 30 Ft. Lbs. (40 N.m).

(5) Same as step 1; tighten bolts 1-10 to 30 Ft Lbs. (40 N.m).

(6) Tighten bolts 11-22 to 18 Ft. Lbs. (25 N.m). Tighten bolts 11-22 to 43 Ft. Lbs (58 N.m).

(7) Tighten bolts in sequence. See **Fig. 274**.

(8) Tighten all bolts to 39 Ft. Lbs. (53 N.m).

(9) Retighten bolts to 61 Ft. Lbs. (84 N.m).

(10) Loosen all bolts until tightening torque is reduced to 0 according to tightening sequence.

(11) Tighten all bolts to 39 Ft. Lbs. (53 N.m).

(12) Retighten bolts to 77 Ft. Lbs. (105 N.m).

(13) Hex hole bolt (# 3 in tightening sequence graphic). Tighten bolt to 97 INCH Lbs. (11 N.m).

(14) Tighten bolt/nut marked (a) first. See **Fig. 276**.

(15) Tighten bolts in sequence. Tighten in increments evenly among bolts. Repeat tightening sequence 2 or 3 times before they are tightened to specified torque. See **Fig. 275**.

(16) For engine mounting components, see **Fig. 277** and **Fig. 278** .

(17) For propeller shaft tightening specifications, see **Fig. 279**.

(18) Retighten them by turning additional 45°.

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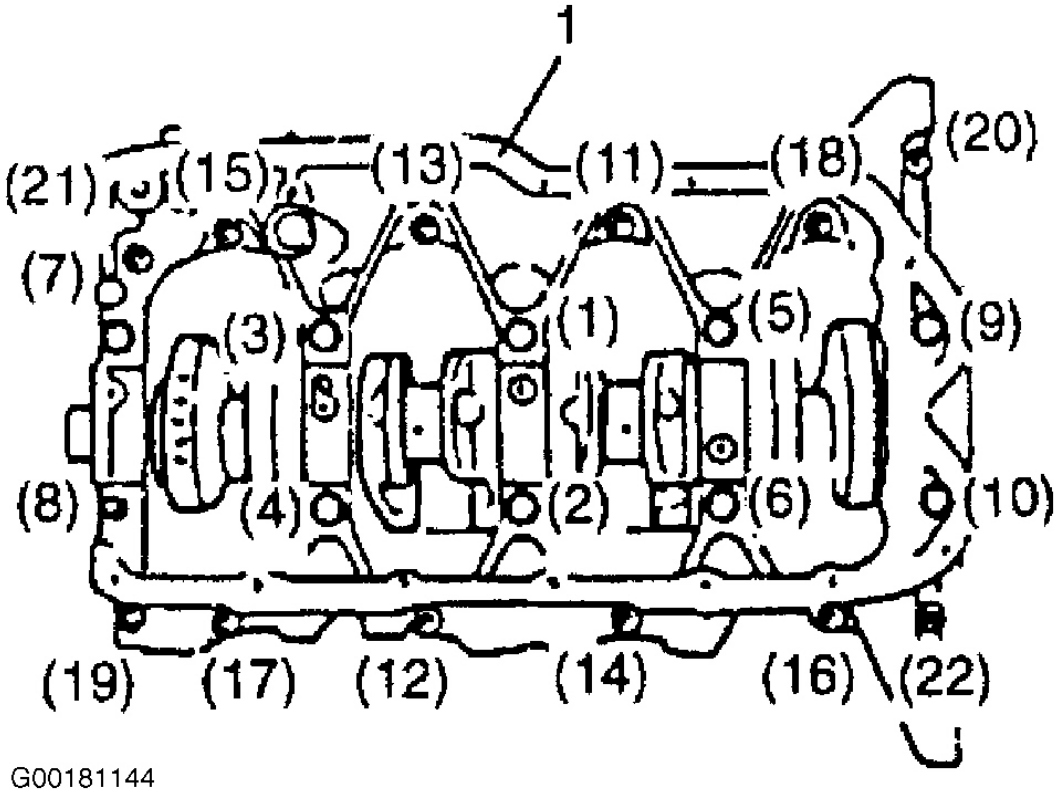


Fig. 273: Crankcase Tightening Sequence
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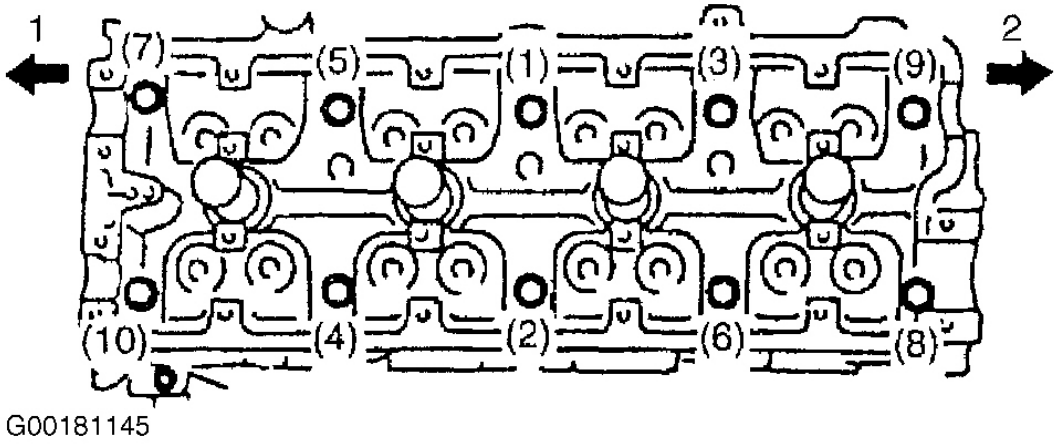


Fig. 274: Cylinder Head Tightening Sequence

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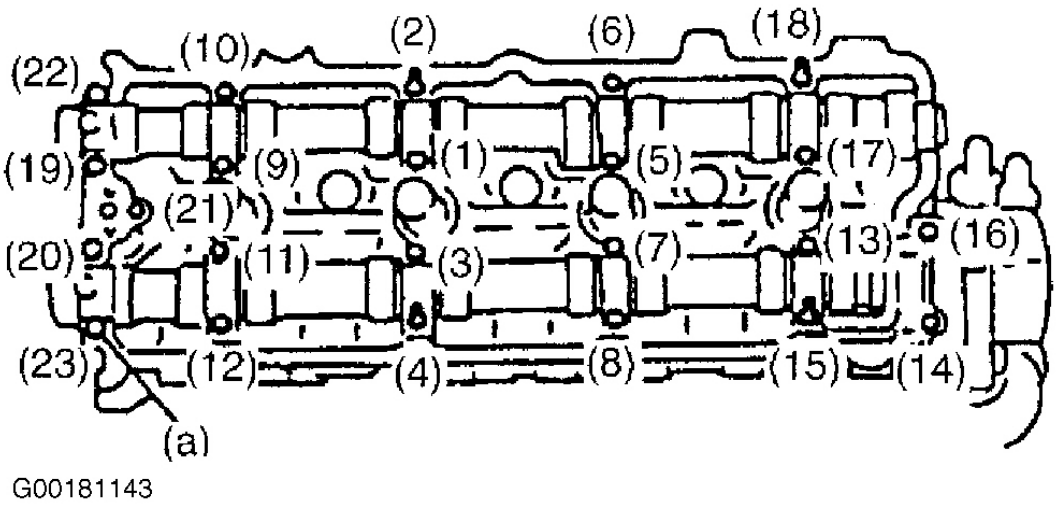


Fig. 275: Camshaft Tightening Sequence
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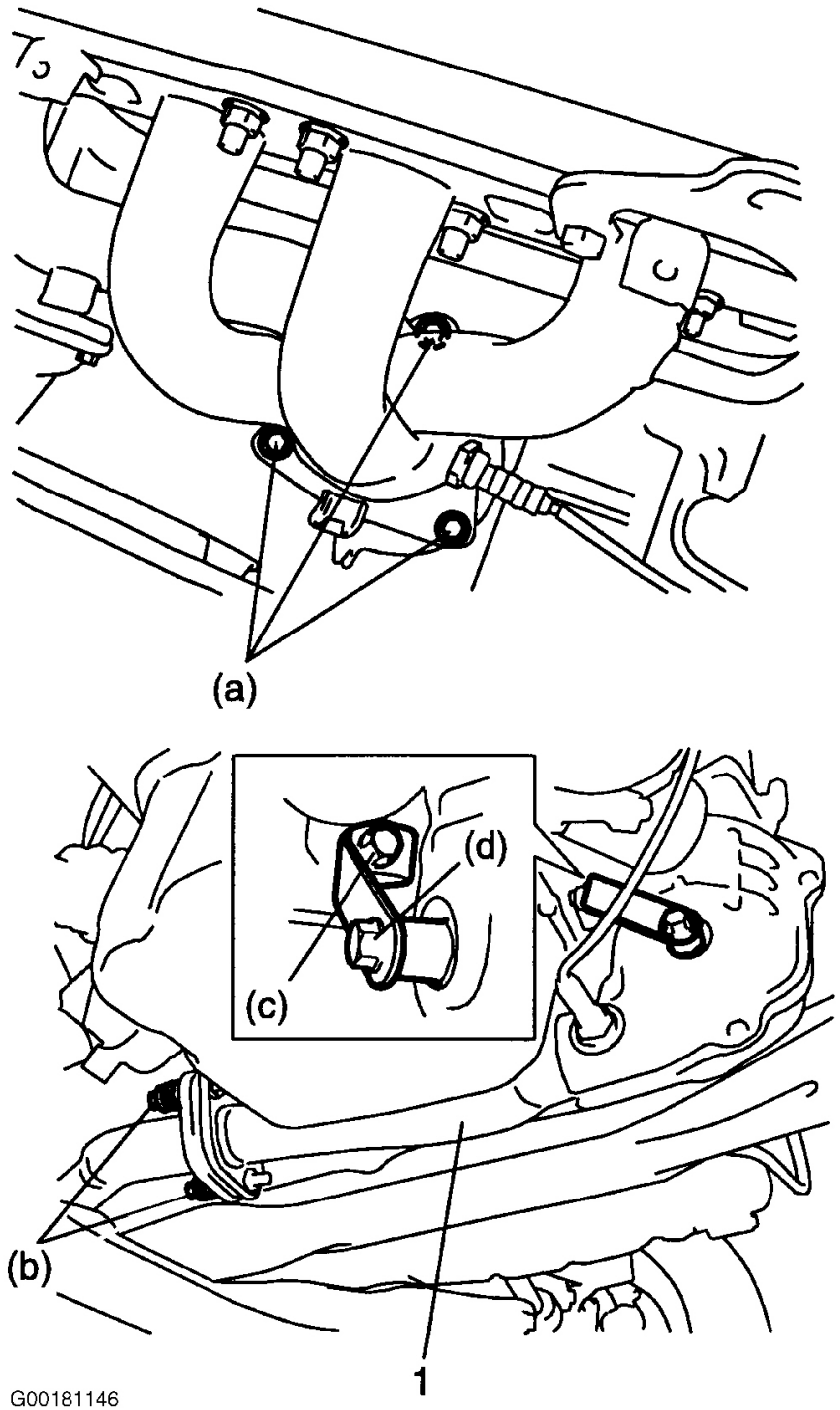
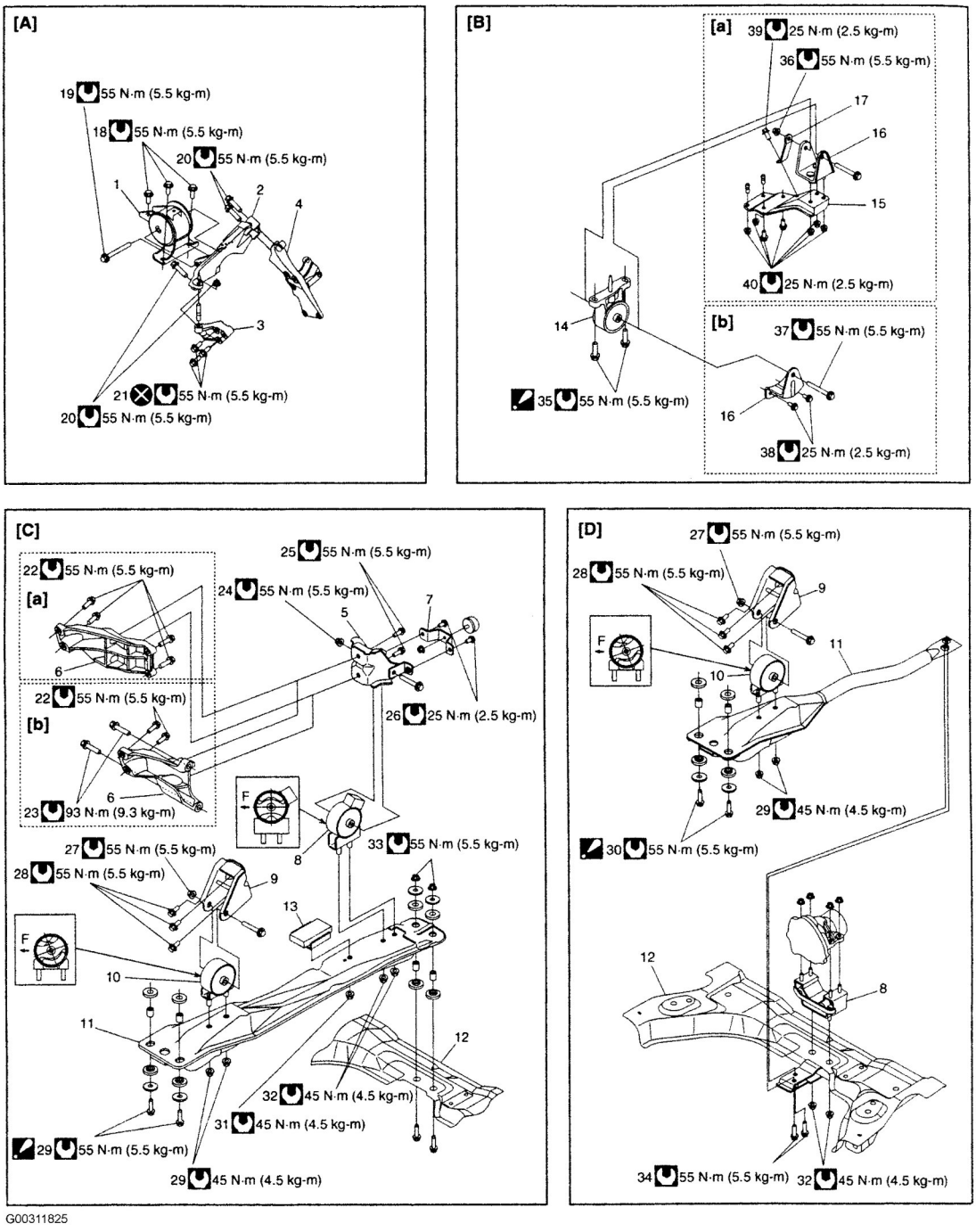


Fig. 276: Exhaust Manifold Torque Sequence
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Fig. 277: Identifying Engine Mounting Components (1 of 2)
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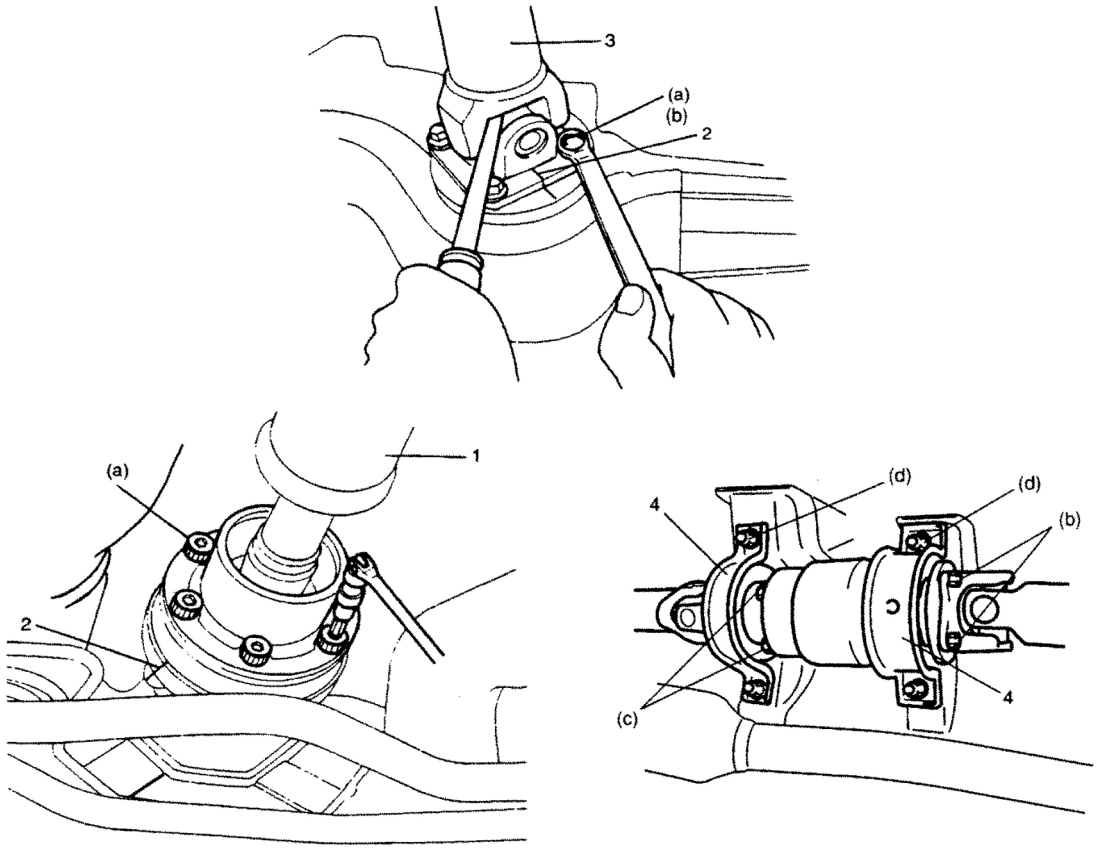
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[A]: Engine right mounting assembly	12. Suspension frame	29. Engine front mounting nut
[B]: Engine left mounting assembly	13. Dynamic damper	30. Mounting member to body bolt : See NOTE "A" below
[C]: Engine front and rear mounting assemblies for 2WD model	14. Engine left mounting	31. Dynamic damper nut
[D]: Engine front and rear mounting assemblies for 4WD model	15. Engine left mounting No.1 bracket	32. Engine rear mounting nut
[a]: For M/T model	16. Engine left mounting No.2 bracket	33. Mounting member to suspension frame nut
[b]: For A/T model	17. Engine left mounting stiffener	34. Mounting member to suspension frame bolt
1. Engine right mounting	18. Engine right mounting bolt	35. Engine left mounting bolt : See NOTE "B" below
2. Engine right mounting No.1 bracket	19. Engine right mounting bolt	36. Engine left mounting No.2 bracket nut
3. Engine right mounting bracket	20. Engine right mounting No.1 bracket bolt and nut	37. Engine left mounting No.2 bracket bolt (long)
4. Generator and P/S pump bracket	21. Engine right mounting bracket bolt	38. Engine left mounting No.2 bracket bolt (short)
5. Engine rear mounting No.1 bracket	22. Engine rear mounting No.2 bracket bolt (short)	39. Engine left mounting stiffener bolt
6. Engine rear mounting No.2 bracket	23. Engine rear mounting No.2 bracket bolt (long)	40. Engine left mounting No.1 bracket bolt and nut
7. Engine rear mounting No.3 bracket	24. Engine rear mounting No.1 bracket nut	F: Forward
8. Engine rear mounting	25. Engine rear mounting No.1 bracket bolt	: Tightening torque
9. Engine front bush bracket	26. Engine rear mounting No.3 bracket bolt	: Do not reuse
10. Engine front mounting	27. Engine front bush bracket nut	
11. Mounting member	28. Engine front bush bracket bolt	

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Fig. 278: Identifying Engine Mounting Components (2 of 2)
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1. Propeller shaft No. 1	4. Propeller shaft center support bracket
3. Propeller shaft No. 2	

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Fig. 279: Identifying Propeller Shaft Tightening Specifications
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