2006 ENGINE

Engine Mechanical - XL-7

GENERAL DESCRIPTION

ENGINE GENERAL INFORMATION

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

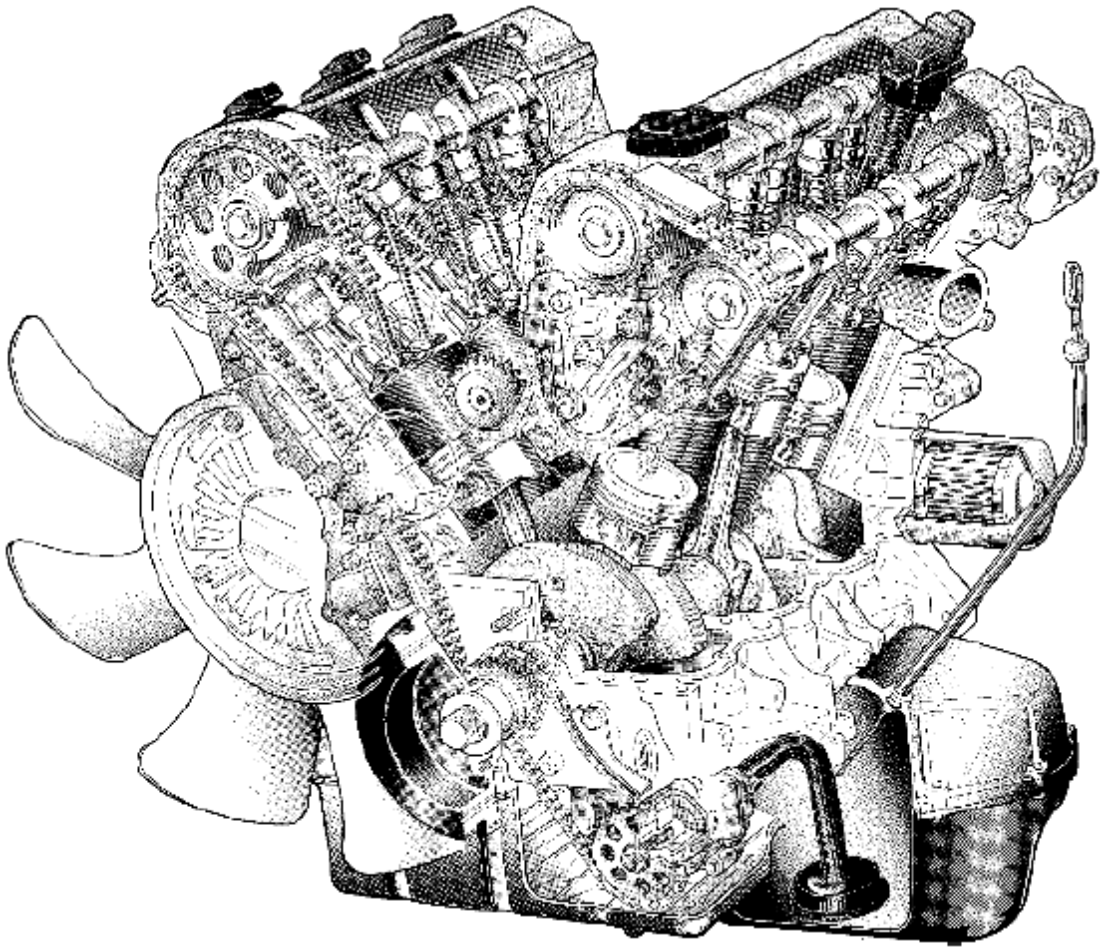


Fig. 1: Identifying Engine
Courtesy of SUZUKI OF AMERICA CORP.

AIR CLEANER ELEMENT INTRODUCTION

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

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DIAGNOSTIC INFORMATION AND PROCEDURES

COMPRESSION CHECK

Check compression pressure on all 6 cylinders as follows:

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

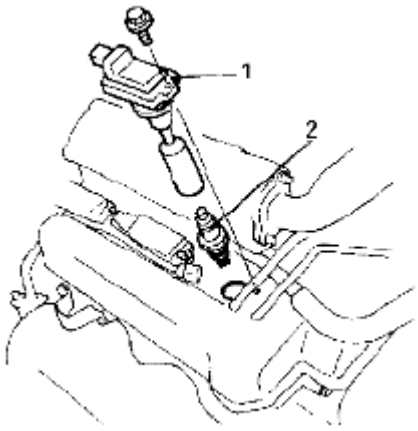


Fig. 2: Identifying Ignition Coil And Spark Plug
Courtesy of SUZUKI OF AMERICA CORP.

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

Special Tool

(A): 09915-64510

(B): 09915-64530

(C): 09915-67010

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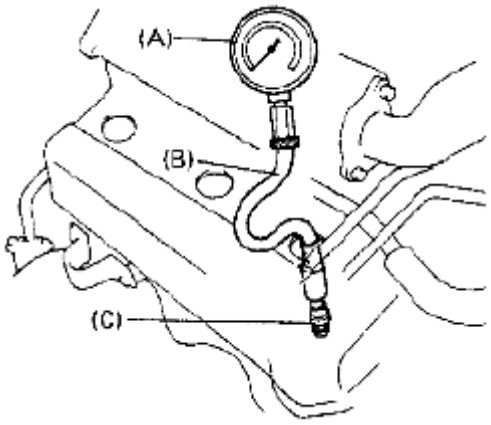


Fig. 3: Identifying Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

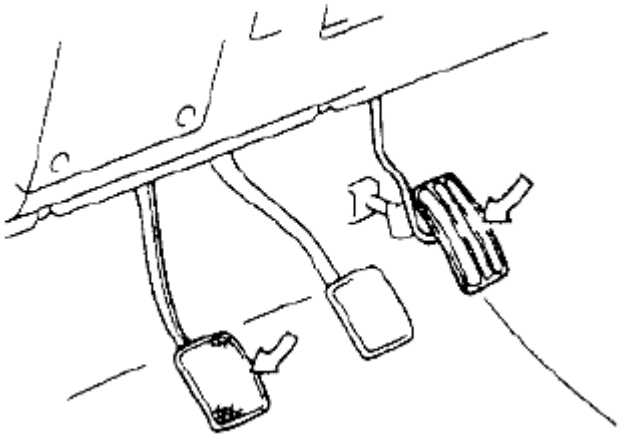


Fig. 4: Depressing Accelerator Pedal
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Compression pressure

Standard: 1400 - 1600 kPa (14.0 - 16.0 kg/cm^2 , 199.0 - 227.5 psi)

Limit: 1300 kPa (13.0 kg/cm^2 , 185.0 psi)

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

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

ENGINE VACUUM CHECK

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

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

   Special Tool

   (A): 09915-67311

   (B): 09918-08210

   (C): 09355-35754-600 Hose, SUZUKI genuine parts

   (D): 09367-04002 3-way joint, SUZUKI genuine parts

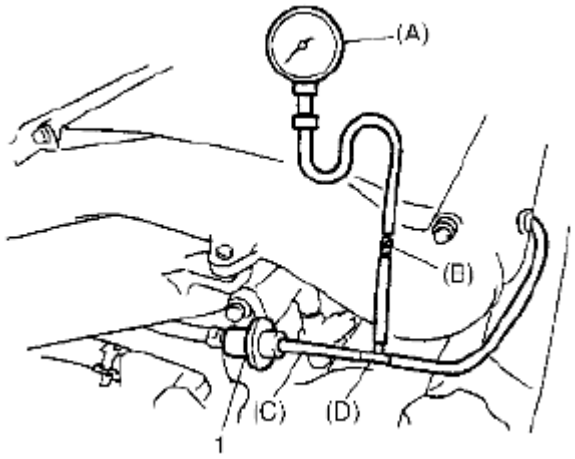


Fig. 5: Identifying Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

   Vacuum specifications (sea level)

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

5. After checking, remove, all special tools.

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6. Connect vacuum hoses to fuel pressure regulator valve.

REPAIR INSTRUCTIONS

AIR CLEANER ELEMENT REMOVAL AND INSTALLATION

Removal

1. Remove air cleaner upper case (1).

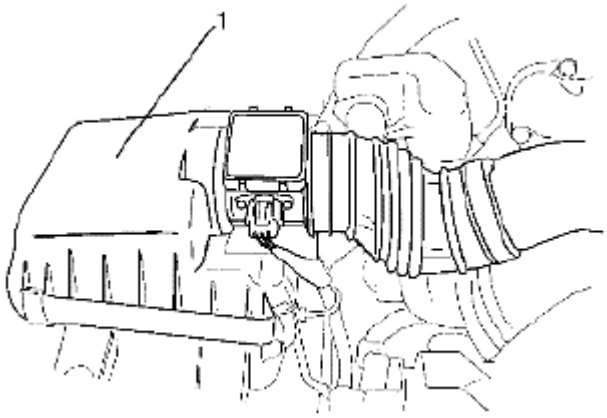


Fig. 6: Identifying Air Cleaner Upper Case
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove air cleaner element.

Installation

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

1. Install element to air cleaner box.
2. Install air cleaner upper case.

AIR CLEANER ELEMENT INSPECTION AND CLEANING

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

Inspection

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

Cleaning

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

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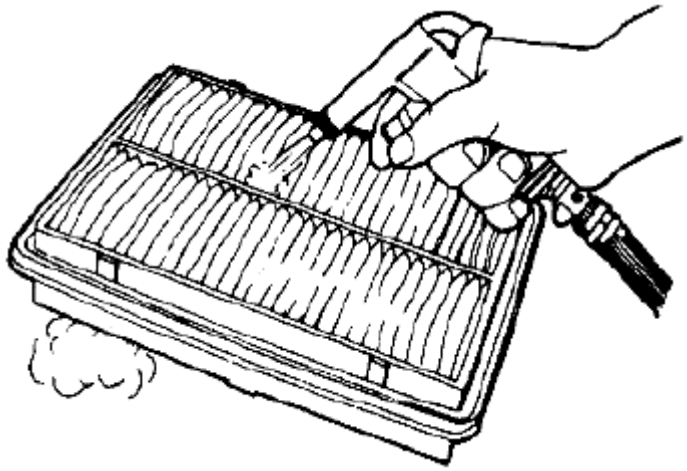


Fig. 7: Blowing Compressed Air On Air Cleaner Element
Courtesy of SUZUKI OF AMERICA CORP.

ACCELERATOR CABLE ADJUSTMENT

1. Warm up engine to normal operating temperature.
2. With throttle valve closed, check accelerator pedal play "a" which should be within the following specification.

   If measured value is out of specification, adjust accelerator cable (1) so as pedal play to be within specification with cable adjusting nut (2). Then tighten lock nut (3).

   Accelerator pedal play

   "a": 2 - 5 mm (0.08 - 0.20 in.)

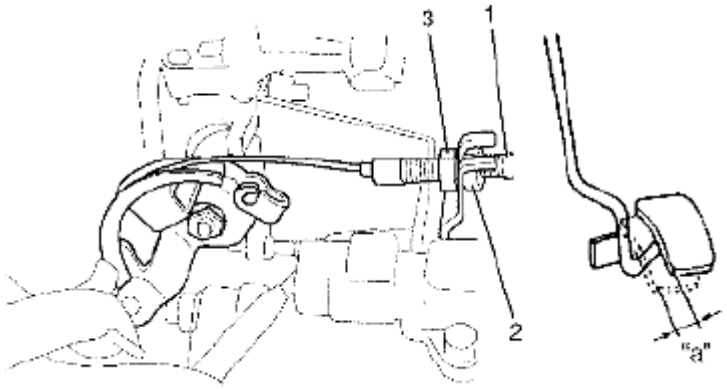


Fig. 8: Identifying Accelerator Cable, Cable Adjusting Nut And Lock Nut
Courtesy of SUZUKI OF AMERICA CORP.

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

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If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt (3).

Clearance between throttle lever and lever stopper (throttle body) (with accelerator pedal depressed fully)

"b": 0.5 - 2.0 mm (0.02 - 0.08 in.)

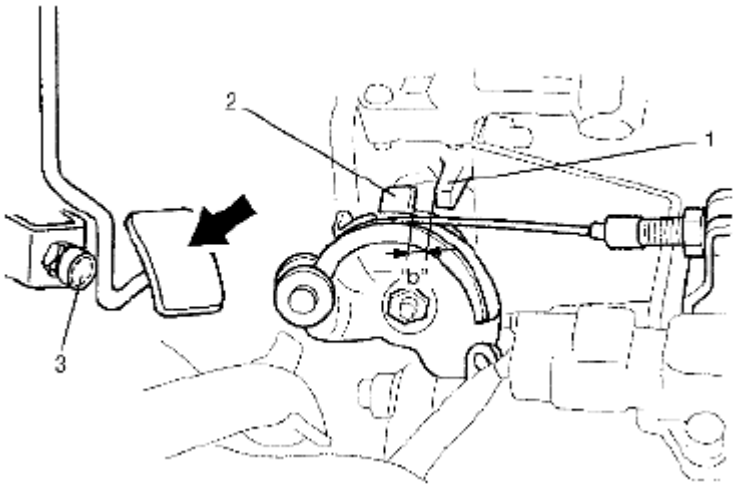
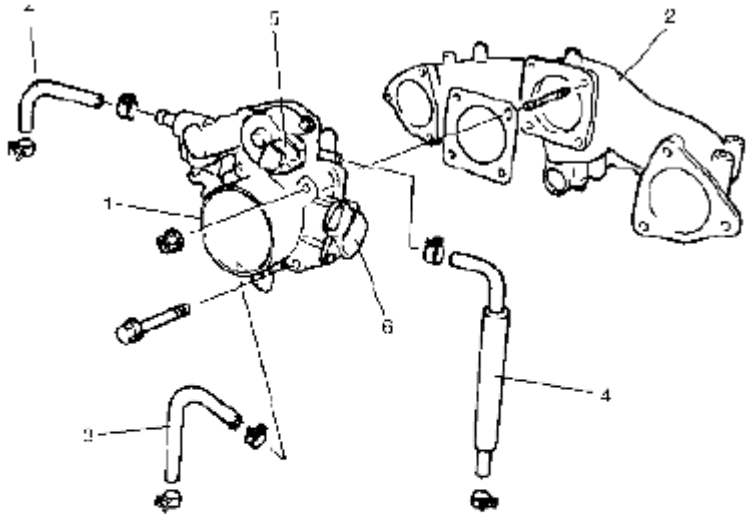


Fig. 9: Identifying Throttle Lever, Lever Stopper And Pedal Stopper Bolt
Courtesy of SUZUKI OF AMERICA CORP.

THROTTLE BODY COMPONENTS

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1. Throttle body	3. Breather hose	5. MAF sensor
2. Intake collector	4. Water hose	6. TP sensor

Fig. 10: Identifying Throttle Body Components
Courtesy of SUZUKI OF AMERICA CORP.

THROTTLE BODY ON-VEHICLE INSPECTION

Check that throttle valve lever moves smoothly.

THROTTLE BODY REMOVAL AND INSTALLATION

Reference: **THROTTLE BODY COMPONENTS**

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

Removal

1. Disconnect negative (-) cable at battery.
2. Drain engine coolant referring to **COOLANT DRAINING** .
3. Detach fuse/relay box.
4. Remove strut tower bar.
5. Disconnect accelerator cable (1) from throttle body.

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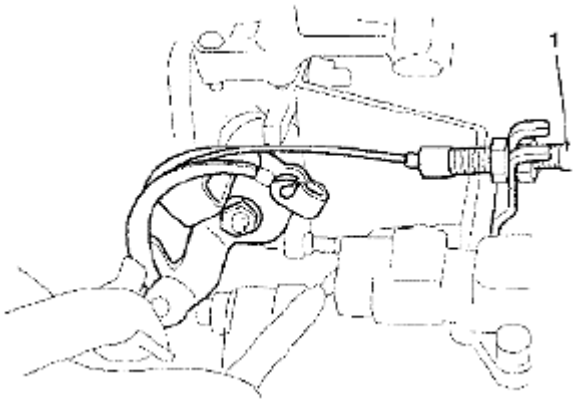


Fig. 11: Identifying Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect water hoses (2) from throttle body.

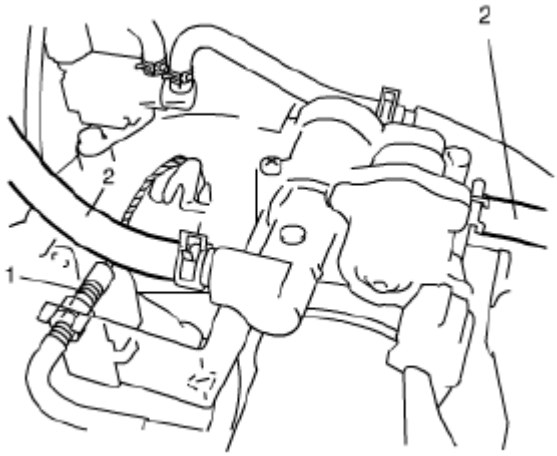


Fig. 12: Identifying Water Hoses
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove surge tank cover.
8. Remove intake air pipe (1), surge tank pipe (2) and intake control valve (3).

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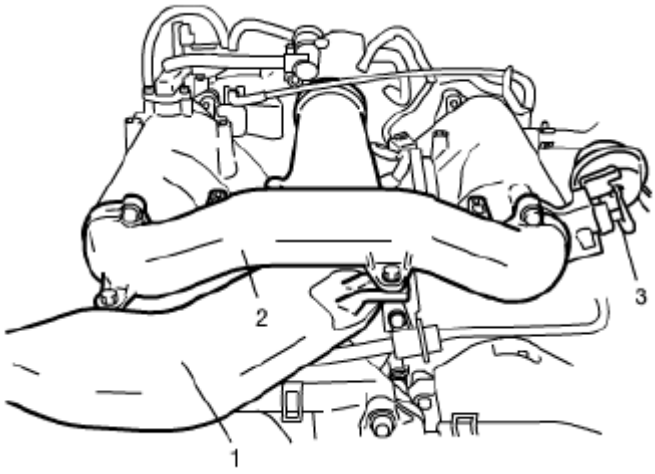


Fig. 13: Identifying Intake Air Pipe, Surge Tank Pipe And Intake Control Valve
Courtesy of SUZUKI OF AMERICA CORP.

9. Disconnect connectors of TP sensor (2) and IAC valve (3).
10. Disconnect ground terminal (5) from intake manifold (4).
11. Remove clamp bracket (1) and harness clamps from intake collector.

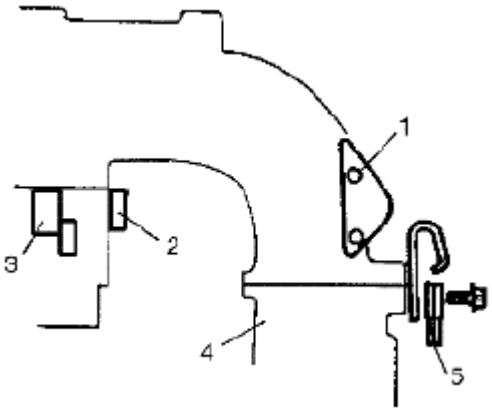


Fig. 14: Identifying TP Sensor, IAC Valve, Intake Manifold, Terminal And Clamp Bracket
Courtesy of SUZUKI OF AMERICA CORP.

12. Disconnect connectors of EVAP canister purge valve (1) and EGR valve (5).
13. Disconnect PCV valve hose (6), ground terminal connector (7) and breather hose (3) from cylinder head and EVAP canister purge valve hose (2).
14. Detach EGR pipe (4) from exhaust manifold.

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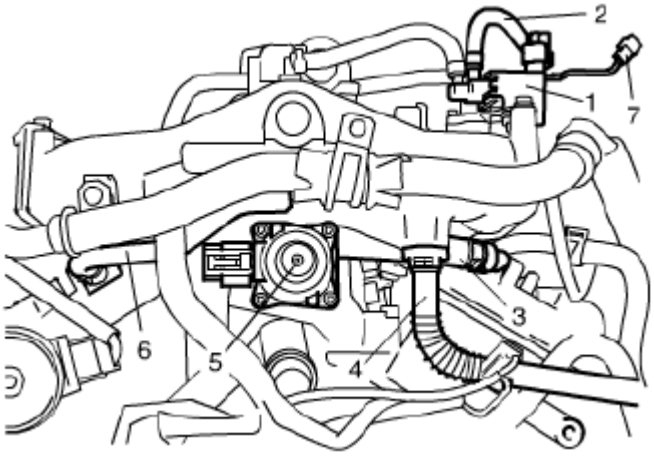


Fig. 15: Identifying EVAP Canister Purge Valve, EGR Valve, PCV Valve Hose, Terminal Connector, EVAP Canister Purge Valve Hose, EGR Pipe And Breather Hose
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove throttle body (3) and intake collector (2) from intake manifold (1).
16. Disconnect hoses of PCV from throttle body.
17. Remove throttle body from intake collector.

CAUTION:
- **TP sensor (4), or other components containing rubber must not be placed in a solvent or cleaner bath. 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.**

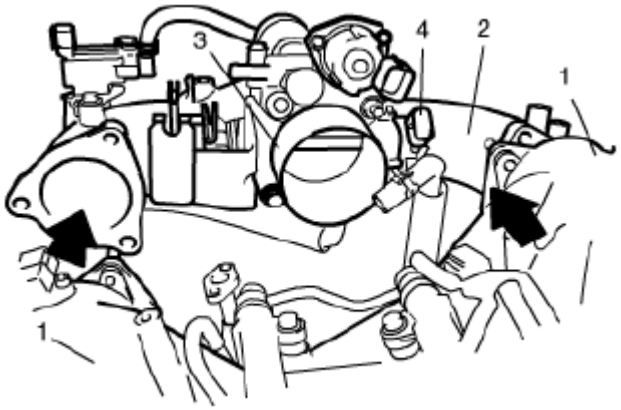


Fig. 16: Identifying Throttle Body, Intake Collector, Intake Manifold And TP Sensor
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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Reference: **THROTTLE BODY CLEANING**

1. Clean mating surfaces and install new throttle body gasket (2) to intake collector (1).

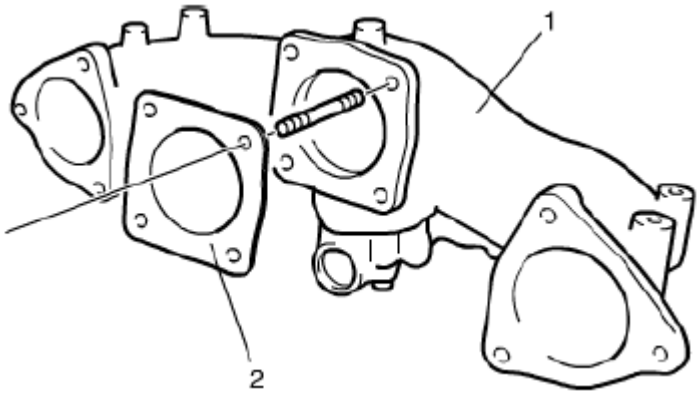


Fig. 17: Identifying Throttle Body Gasket And Intake Collector
Courtesy of SUZUKI OF AMERICA CORP.

2. Install throttle body to intake collector and tighten bolts and nuts.
3. Connect PCV hose to throttle body.
4. Install throttle body and intake collector to intake manifold with new intake collector gaskets.
5. Install EGR pipe with new gaskets.
6. Connect breather hose, EVAP canister purge valve hose and PCV valve hose.
7. Connect connectors of EVAP canister purge valve and EGR valve.

   Fix wire harness with clamps.

8. Install clamp bracket to intake collector.
9. Connect ground wire connector.
10. Connect connectors of TP sensor and IAC valve.
11. Install surge tank pipe and intake control valve to intake manifold with new gaskets and intake air pipe to throttle body. Install surge tank cover.
12. Connect water hoses to throttle body.
13. Connect accelerator cable.
14. Install strut tower bar (1) and tighten strut tower bar mounting bolts (2) to specification.

    Tightening torque

    Strut tower bar mounting bolts a: 50 N.m (5.0 kg-m, 36.5 lb-ft)

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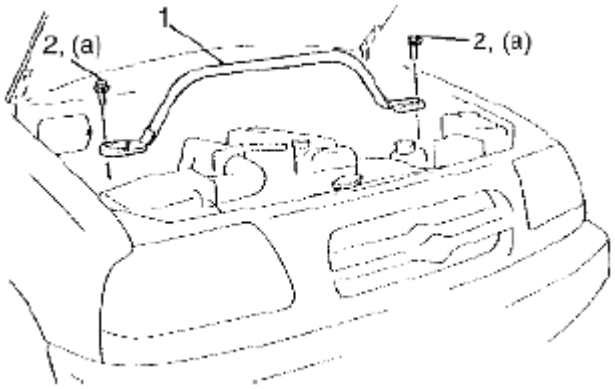


Fig. 18: Identifying Strut Tower Bar And Strut Tower Bar Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

15. Install fuse/relay box.
16. Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
17. Connect negative (-) cable at battery.
18. Adjust accelerator cable referring to **ACCELERATOR CABLE ADJUSTMENT**.

THROTTLE BODY CLEANING

Reference: **THROTTLE BODY REMOVAL AND INSTALLATION**

CAUTION:
- **Do not blow compressed air through bypass air passage with IAC valve installed to throttle body. This will cause IAC valve to malfunction.**
- **TP sensor, idle air control valve or other components containing rubber must not be places in a solvent or cleaner bath.**

  A chemical reaction will cause these parts to swell, harden or get distorted.

Clean throttle body bore and bypass air passages (1) by blowing compressed air.

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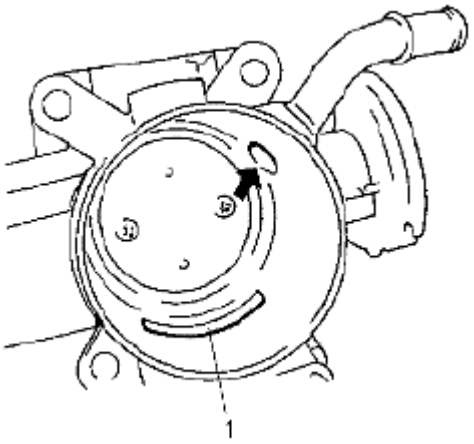


Fig. 19: Identifying Bypass Air Passage
Courtesy of SUZUKI OF AMERICA CORP.

INTAKE CONTROL VALVE REMOVAL AND INSTALLATION

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

INTAKE CONTROL VALVE INSPECTION

1. Connect special tool (A) to intake control valve (1).

   Special Tool

   (A): 09917-47011

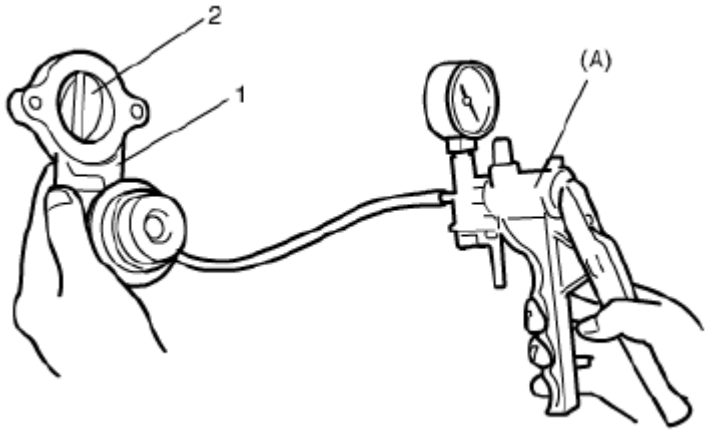


Fig. 20: Identifying Special Tool & Intake Control Valve
Courtesy of SUZUKI OF AMERICA CORP.

2. Apply vacuum to intake control valve (1) and verify that throttle (2) fully closes within the specified range.

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If intake control valve (1) fails the check, replace it.

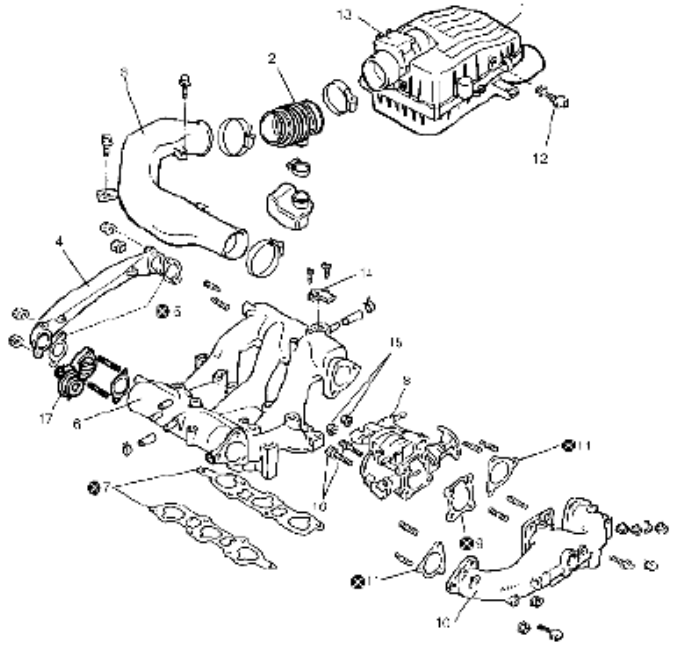
CAUTION: Do not apply above 88 kPa of negative pressure. Damage may occur to intake control valve (1).

Valve operation pressure

1.3 - 34 kPa (9.8 - 255 mmHg)

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

THROTTLE BODY AND INTAKE MANIFOLD COMPONENTS



1. Air cleaner box	5. Gasket	9. Throttle body gasket	13. MAF sensor	17. Intake control valve
2. Intake air hose	6. Intake manifold	10. Intake collector	14. MAP sensor	: Do not reuse.
3. Intake air pipe	7. Intake manifold gasket	11. Gasket	15. Throttle body nut	
4. Surge tank pipe	8. Throttle body assembly	12. IAT sensor	16. Throttle body bolt	

Fig. 21: Identifying Throttle Body And Intake Manifold Components
Courtesy of SUZUKI OF AMERICA CORP.

THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION

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

Removal

1. Release fuel pressure in fuel feed line by referring to **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative (-) cable at battery.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Detach fuse/relay box and remove strut tower bar (2).
5. Disconnect coupler from IAT sensor and MAF sensor.
6. Remove surge tank cover (1).

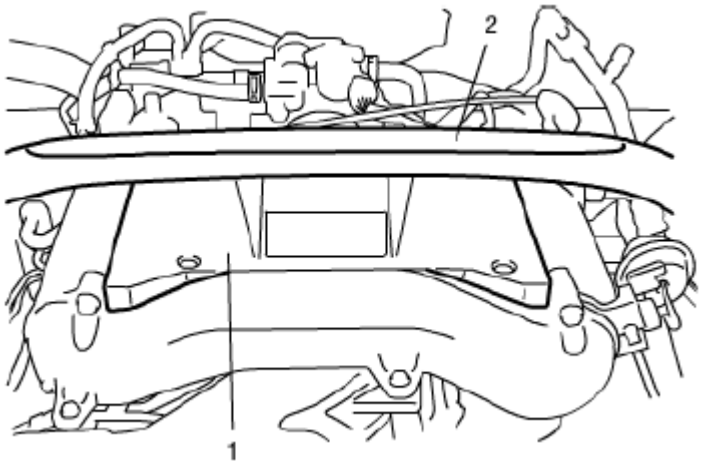
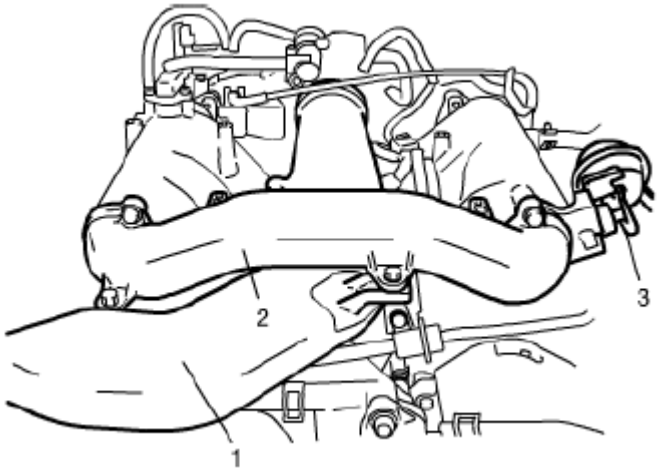


Fig. 22: Identifying Surge Tank Cover And Strut Tower Bar
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove air cleaner upper case, MAF sensor, intake air hose, intake air pipe (1) and surge tank pipe (2) as one component. Do not disassemble them, when removing and reinstalling.
8. Remove intake control valve (3).



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Fig. 23: Identifying Intake Air Pipe, Surge Tank Pipe And Intake Control Valve
Courtesy of SUZUKI OF AMERICA CORP.

9. Disconnect accelerator cable (1) from throttle body.
10. Disconnect water hoses (2) from throttle body.

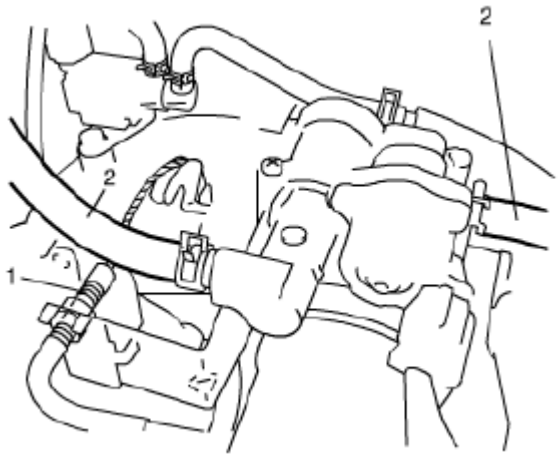


Fig. 24: Identifying Accelerator Cable And Water Hoses
Courtesy of SUZUKI OF AMERICA CORP.

11. Disconnect injector wire (1) coupler.
12. Disconnect brake booster hose (2), fuel pressure regulator vacuum hose (4) and intake control valve hose (3) from intake manifold.

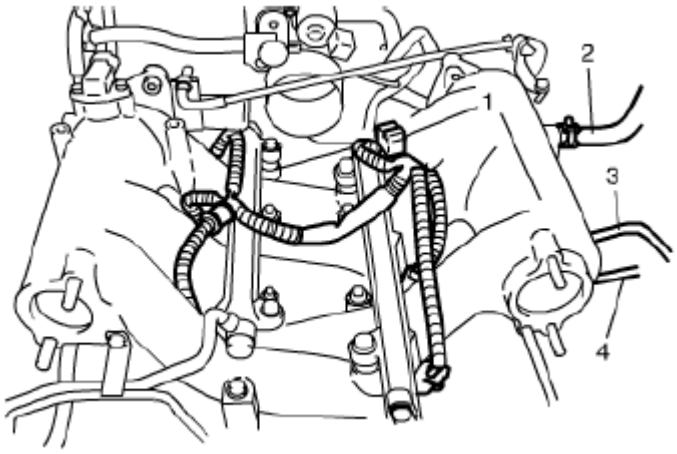


Fig. 25: Identifying Injector Wire, Brake Booster Hose, Fuel Pressure Regulator Vacuum Hose And Intake Control Valve Hose
Courtesy of SUZUKI OF AMERICA CORP.

13. Disconnect couplers of TP sensor (1) and IAC valve (2).
14. Disconnect earth terminal (3) from intake collector.

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15. Remove clamp bracket (4) from intake collector.

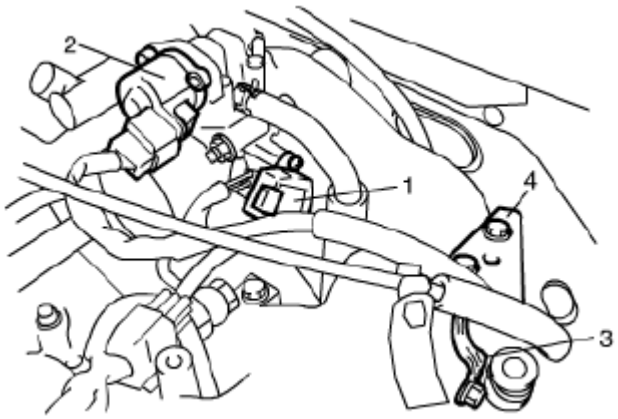


Fig. 26: Identifying TP Sensor, IAC Valve, Terminal And Clamp Bracket
Courtesy of SUZUKI OF AMERICA CORP.

16. Disconnect couplers from MAP sensor, EVAP canister purge valve (1), earth terminal (9) and EGR valve (2).
17. Disconnect PCV hose (6) from cylinder head cover.
18. Disconnect breather hoses (8) from throttle body or cylinder head cover.
19. Disconnect EVAP canister purge valve hose (4), heater hose (5) and water hose (7).
20. Remove EGR pipe (3) and wire harness clamps.

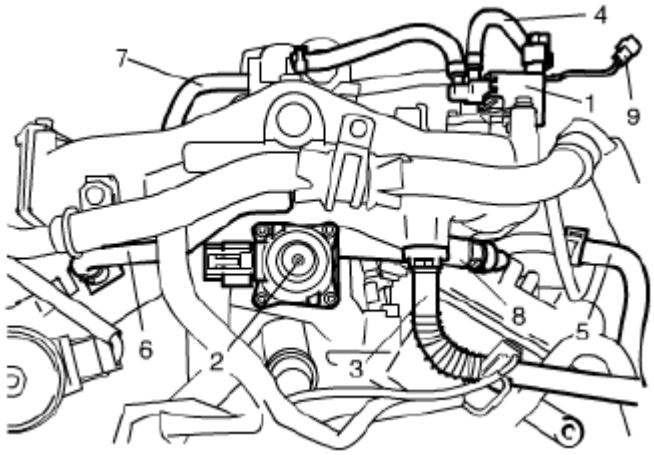


Fig. 27: Identifying EVAP Canister Purge Valve, Terminal, EGR Valve, PCV Hose, EGR Pipe, Breather Hoses, Water Hose And Heater Hose
Courtesy of SUZUKI OF AMERICA CORP.

21. Disconnect hoses of heater (1), EVAP canister purge (4), fuel feed (2) and fuel return (3).

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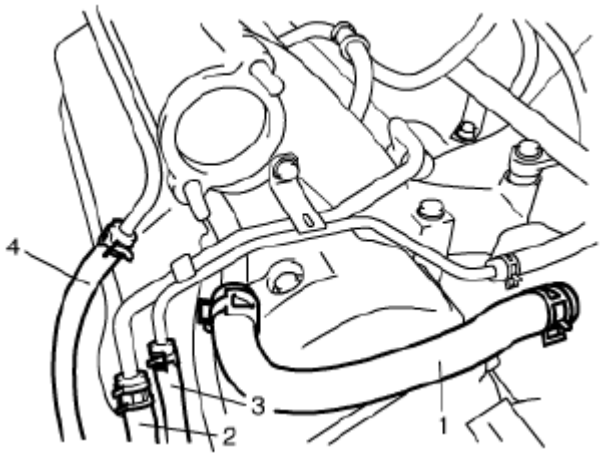


Fig. 28: Identifying Heater Hose, EVAP Canister Purge, Fuel Feed And Fuel Return
Courtesy of SUZUKI OF AMERICA CORP.

22. Remove throttle body (1) and intake collector (2) from intake manifold (3).

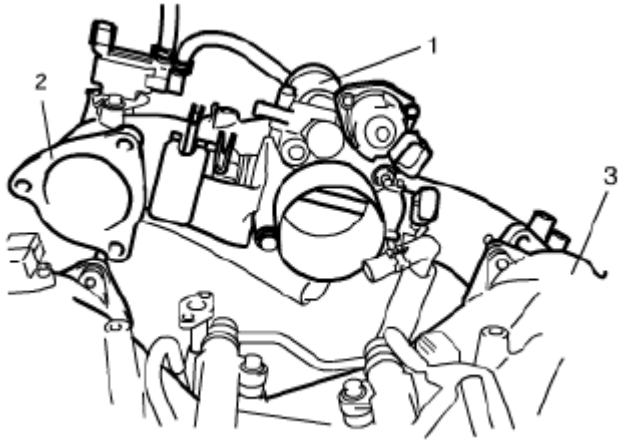


Fig. 29: Identifying Throttle Body, Intake Collector And Intake Manifold
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23. Disconnect hoses of PCV valve and EVAP canister purge valve from intake collector.
24. Remove throttle body (1) from intake collector.

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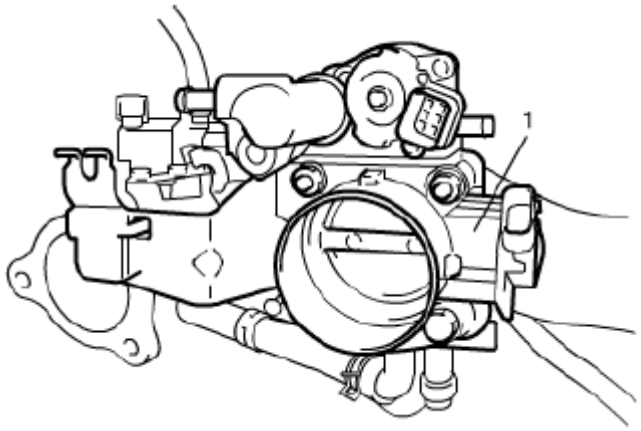


Fig. 30: Identifying Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

25. Remove IAC valve from throttle body.
26. Remove EGR valve and EVAP canister purge valve from intake collector.
27. Remove intake manifold bolts (8 pcs.) and nuts (4 pcs.).

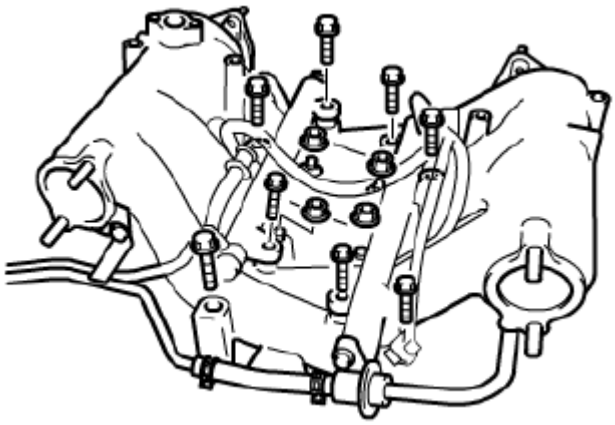


Fig. 31: Identifying Intake Manifold Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

28. Remove intake manifold.

Installation

1. Install new intake manifold gaskets (1) to cylinder heads.

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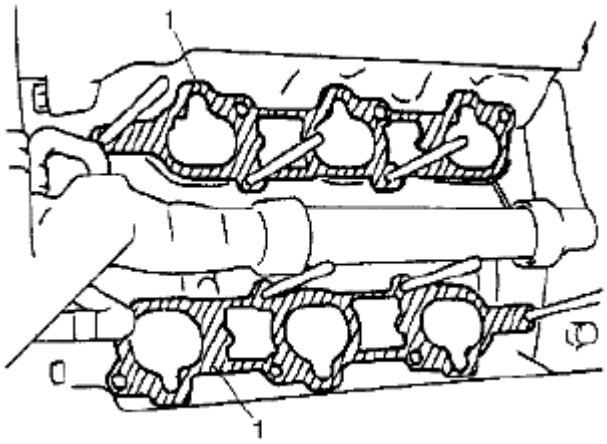


Fig. 32: Identifying Intake Manifold Gaskets
Courtesy of SUZUKI OF AMERICA CORP.

2. Install intake manifold (1), and tighten bolts (2) and nuts (3).

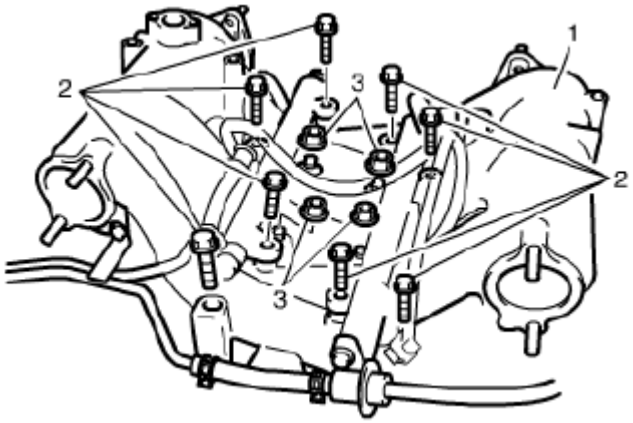


Fig. 33: Identifying Intake Manifold, Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

3. Install throttle body (2) to intake collector (1) with new throttle body gasket.

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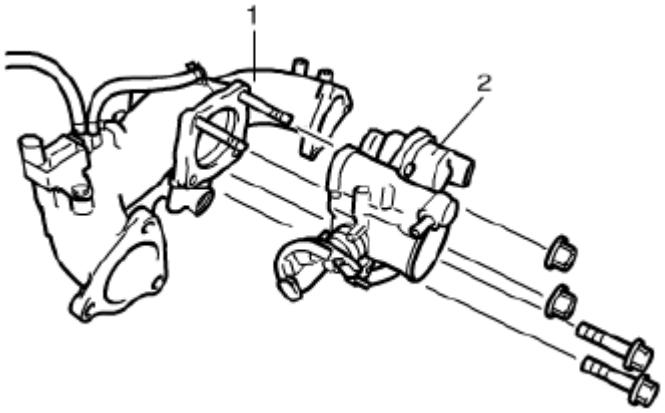
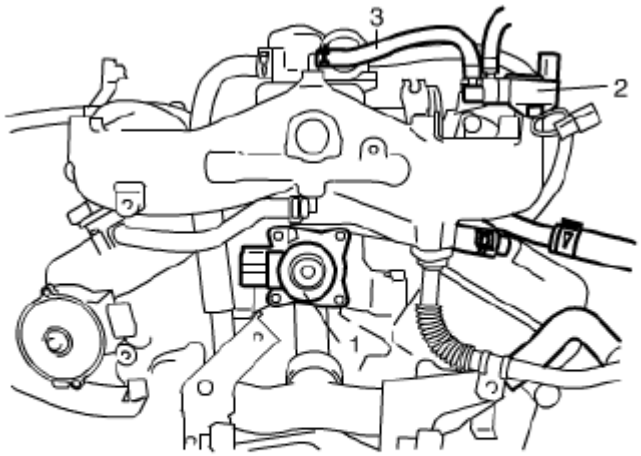


Fig. 34: Identifying Throttle Body And Intake Collector
Courtesy of SUZUKI OF AMERICA CORP.

4. Install IAC valve, EGR valve (1), EVAP canister purge valve (2), MAP sensor and each hoses to intake collector and throttle body if removed.

NOTE: Use new gasket when installing IAC valve and EGR valve.



3. EVAP canister purge valve hose

Fig. 35: Identifying EGR Valve, EVAP Canister Purge Valve & EVAP Canister Purge Valve Hose
Courtesy of SUZUKI OF AMERICA CORP.

5. Install throttle body and intake collector assembly to intake manifold with new intake collector gaskets.
6. Connect hoses of heater (1), EVAP canister (4), fuel feed (2) and fuel return (3).

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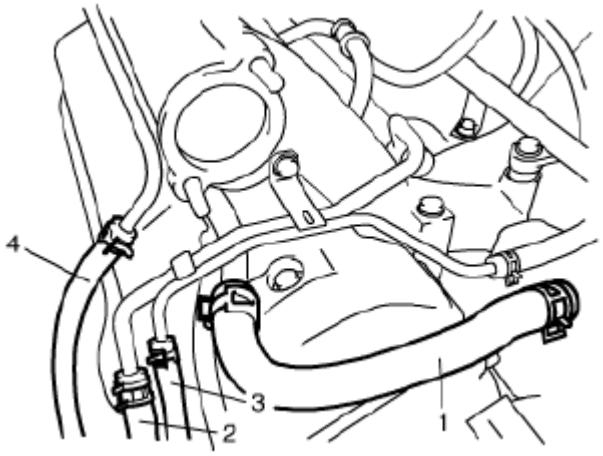


Fig. 36: Identifying Heater Hose, EVAP Canister Hose, Fuel Feed Hose And Fuel Return Hose
Courtesy of SUZUKI OF AMERICA CORP.

7. Install EGR pipe (3) with new gaskets.
8. Connect hoses of EVAP canister purge valve (4) and heater (5).
9. Connect hoses of PCV (6), breather (8) and water (7).
10. Connect couplers of manifold absolute pressure (MAP) sensor, EVAP canister purge valve (1), EGR valve (2) and earth terminal (9).

    Fix wire harness with clamps.

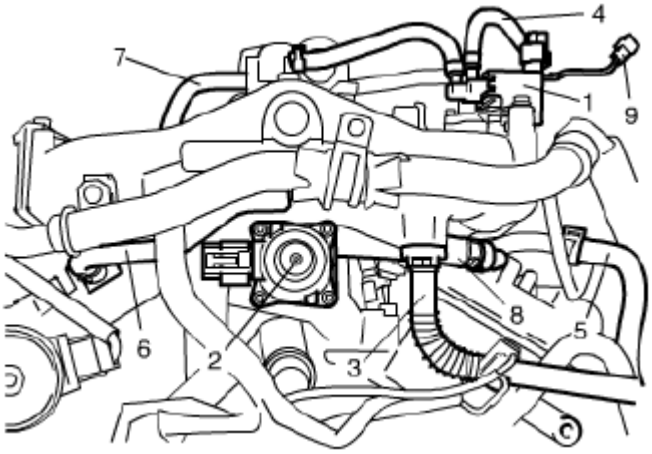


Fig. 37: Identifying EGR Pipe, EVAP Canister Purge Valve Hose, Heater Hose, PCV Hose, Breather Hose, Water Hose, EVAP Canister Purge Valve, EGR Valve And Earth Terminal
Courtesy of SUZUKI OF AMERICA CORP.

11. Install clamp bracket (4) to intake collector.
12. Connect earth terminal (3) to intake collector.
13. Connect couplers of TP sensor (1) and IAC valve (2).

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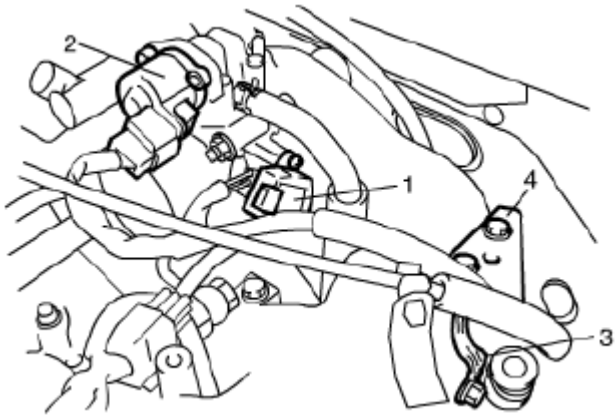


Fig. 38: Identifying Clamp Bracket, Earth Terminal, TP Sensor Coupler And IAC Valve Coupler
Courtesy of SUZUKI OF AMERICA CORP.

14. Connect brake booster hose (2), fuel pressure regulator vacuum hose (4) and intake control valve hose (3) to intake manifold.
15. Connect injector wire (1) coupler.

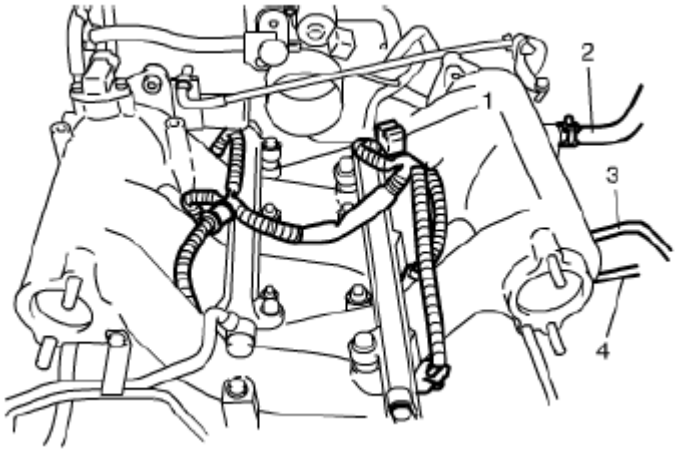


Fig. 39: Identifying Brake Booster Hose, Fuel Pressure Regulator Vacuum Hose, Intake Control Valve Hose & Injector Wire
Courtesy of SUZUKI OF AMERICA CORP.

16. Connect water hoses (2) to throttle body.
17. Connect accelerator cable (1) to throttle body.

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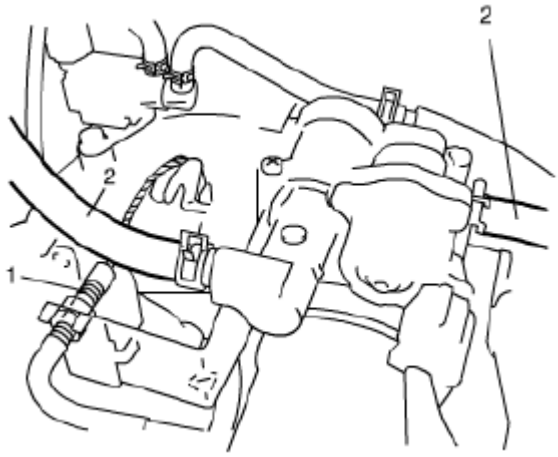


Fig. 40: Identifying Water Hoses And Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

18. Install surge tank pipe (2) and intake control valve (3) to intake manifold with new gaskets and intake air pipe (1) to throttle body.

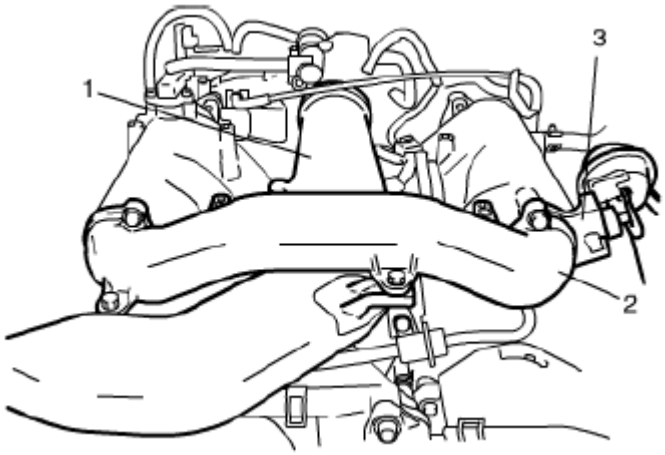


Fig. 41: Identifying Surge Tank Pipe, Intake Control Valve And Intake Air Pipe
Courtesy of SUZUKI OF AMERICA CORP.

19. Install surge tank cover (1).

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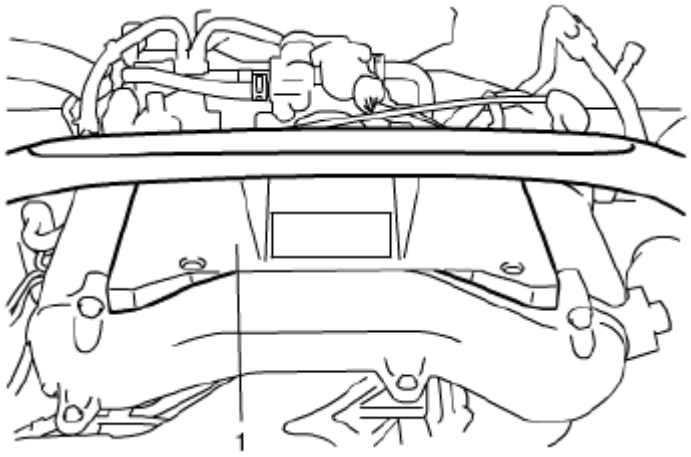


Fig. 42: Identifying Surge Tank Cover
Courtesy of SUZUKI OF AMERICA CORP.

20. Install air cleaner upper case.
21. Connect coupler to intake air temp. sensor and MAF sensor.
22. Install strut tower bar (1) and tighten strut tower bar mounting bolts (2) to specification.

Tightening torque

Strut tower bar mounting bolts a: 50 N.m (5.0 kg-m, 36.5 lb-ft)

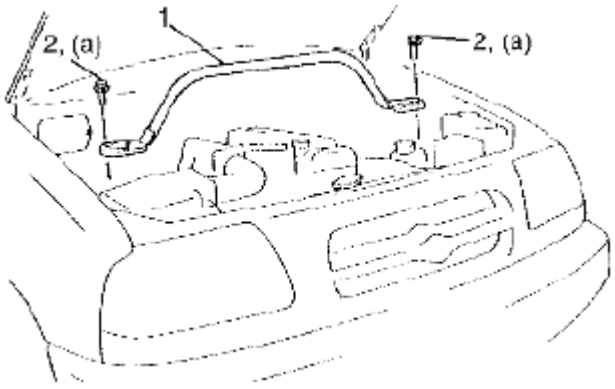


Fig. 43: Identifying Strut Tower Bar And Strut Tower Bar Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

23. Install fuse/relay box.
24. Check to ensure that all removed parts are back in place.

    Reinstall any necessary parts which have not been reinstalled.

25. Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
26. Connect negative cable (-) at battery.

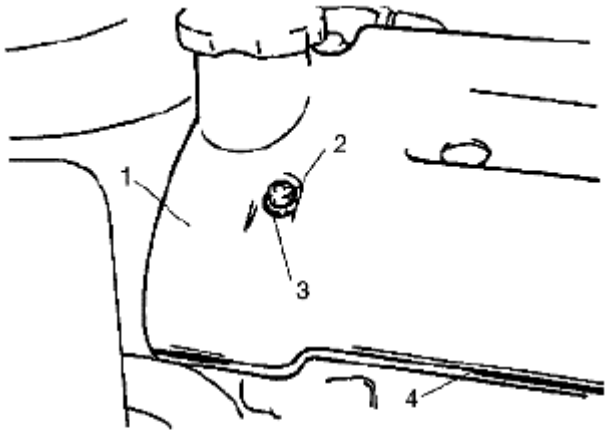
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27. Upon completion of installation, verify that there is no fuel leakage at each connection according to **FUEL LEAKAGE CHECK PROCEDURE** .

CYLINDER HEAD COVERS REMOVAL AND INSTALLATION

Removal

1. Remove throttle body and intake manifold referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**
2. Remove ignition coil covers.
3. Disconnect ignition coil couplers and remove ignition coils referring to **IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL) REMOVAL AND INSTALLATION** .
4. Remove cylinder head covers (1).



2.	Nut
3.	Seal washer
4.	Cylinder head cover gasket

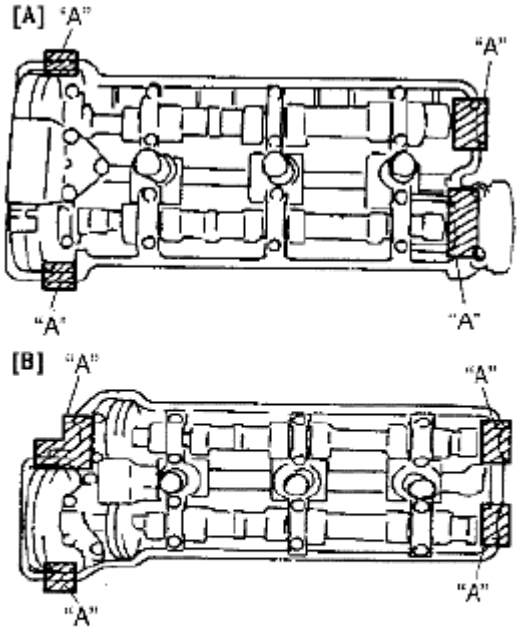
Fig. 44: Identifying Cylinder Head Cover, Nut, Seal Washer And Cylinder Head Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

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

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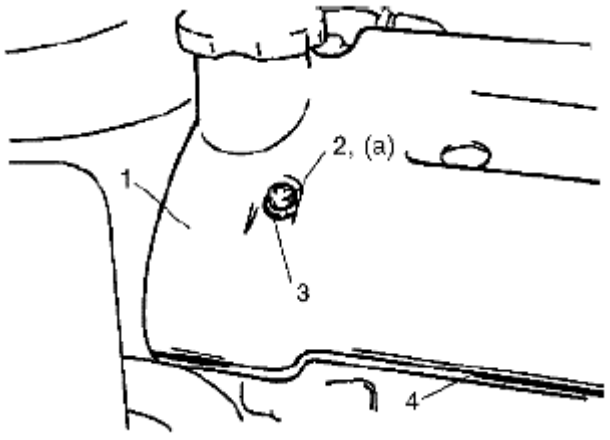
[A]: Left (No.1) cylinder	[B]: Right (No.2) cylinder

Fig. 45: Identifying Cylinder Heads Sealant Application Area
Courtesy of SUZUKI OF AMERICA CORP.

3. Install new cylinder head cover gaskets (4) to head covers (1).
4. Install cylinder head covers (1) to cylinder heads.
5. Using new seal washers (3), tighten nuts (2) to specified torque.

Tightening torque

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

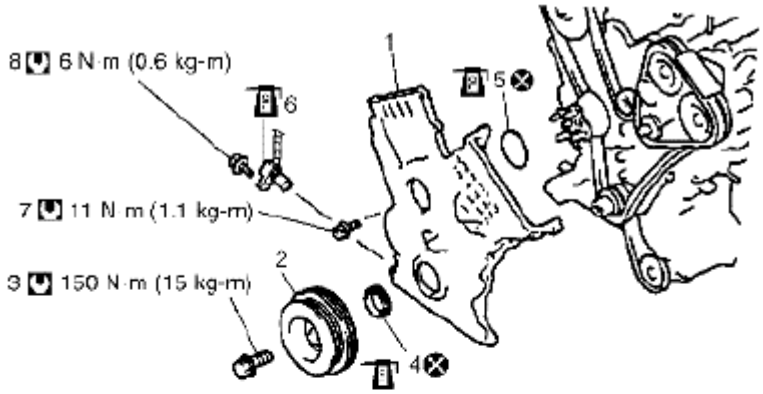


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Fig. 46: Identifying Cylinder Head Cover, Seal Washer, Nut And Cylinder Head Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

6. Install ignition coils and connect ignition coil couplers referring to **IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL) REMOVAL AND INSTALLATION** .
7. Install ignition coil covers.
8. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.

TIMING CHAIN COVER COMPONENTS



1.	Timing chain cover	7.	Timing chain cover bolt
2.	Crankshaft pulley	8.	CKP sensor bolt
3.	Crankshaft pulley bolt	:	Tightening torque
4.	Oil seal	:	Do not reuse
5.	O-ring	:	Apply engine oil
6.	CKP sensor		

Fig. 47: Identifying Timing Chain Cover Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN COVER REMOVAL AND INSTALLATION

Reference: **TIMING CHAIN COVER COMPONENTS**

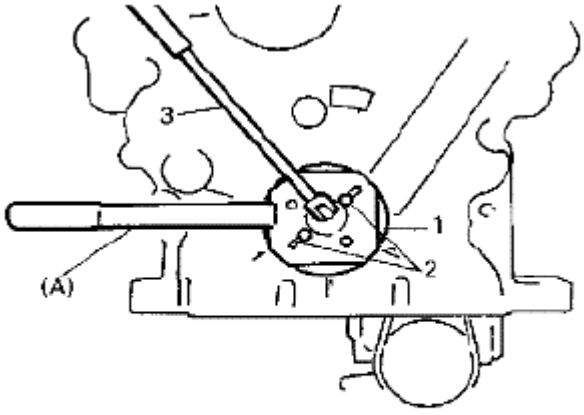
Removal

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1. Disconnect negative (-) cable at battery.
2. Drain engine oil.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Remove throttle body and intake manifold referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
5. Remove cylinder head covers. Refer to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
6. Remove P/S pump (A/C compressor) drive belt. Refer to **P/S PUMP DRIVE BELT INSPECTION AND ADJUSTMENT.**
7. Remove cooling fan, fan clutch and water pump pulley. Refer to **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.**
8. Remove radiator. Refer to **RADIATOR REMOVAL AND INSTALLATION.**
9. Remove thermostat cap. Refer to **THERMOSTAT REMOVAL AND INSTALLATION.**
10. Remove P/S pump and P/S pump bracket. Refer to **P/S PUMP REMOVAL AND INSTALLATION.**
11. Raise vehicle.
12. Remove oil pan. Refer to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
13. Remove crankshaft pulley bolt (1). To lock crankshaft pulley, use special tool (camshaft pulley holder) as shown in figure.

Special Tool

(A): 09917-68221



2. Bolt	3. Wrench

Fig. 48: Identifying Crankshaft Pulley Bolt, Wrench And Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Be sure to use the following bolt for fixing special tool to crankshaft

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pulley.
Bolt size: M8, P1.25 L=45 mm
Strength: 7T

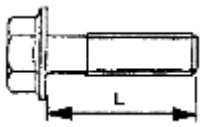


Fig. 49: Identifying Bolt Length
Courtesy of SUZUKI OF AMERICA CORP.

14. Remove crankshaft pulley (1).

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

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

    Special Tool

    (B): 09944-36011

    (C): 09926-58010

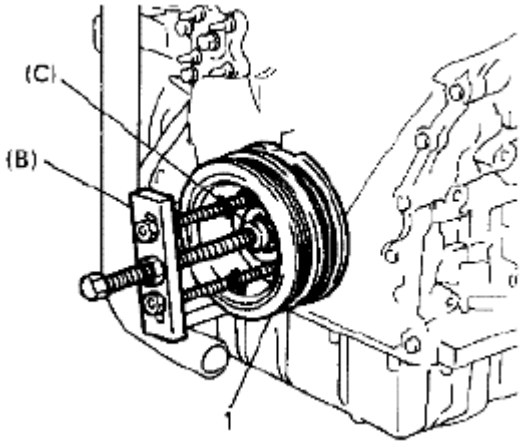


Fig. 50: Identifying Crankshaft Pulley And Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

15. Disconnect CKP sensor connector and remove CKP sensor if necessary.
16. Remove timing chain cover.

Installation

Reference: **TIMING CHAIN COVER INSPECTION**

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

- Clean sealing surface on timing chain cover, crankcase, cylinder block and cylinder heads. Remove oil, old sealant, and dust from sealing surface.

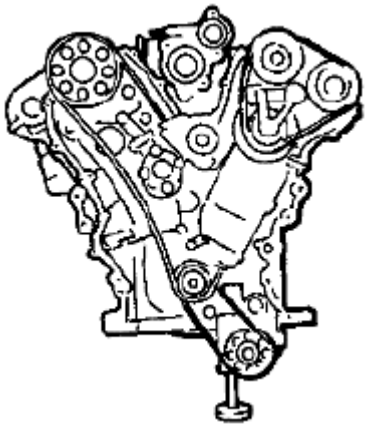
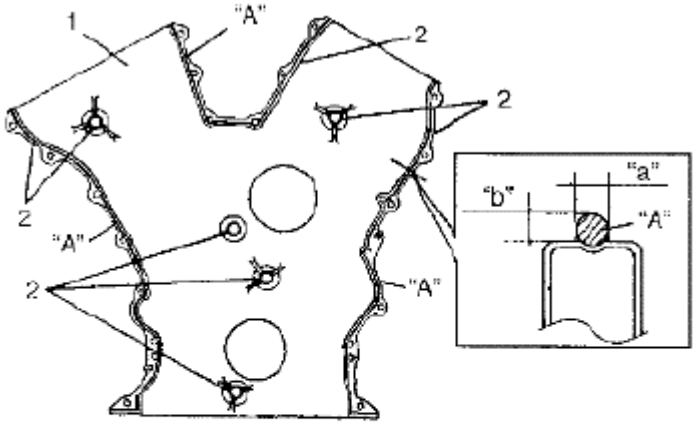


Fig. 51: Identifying Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

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



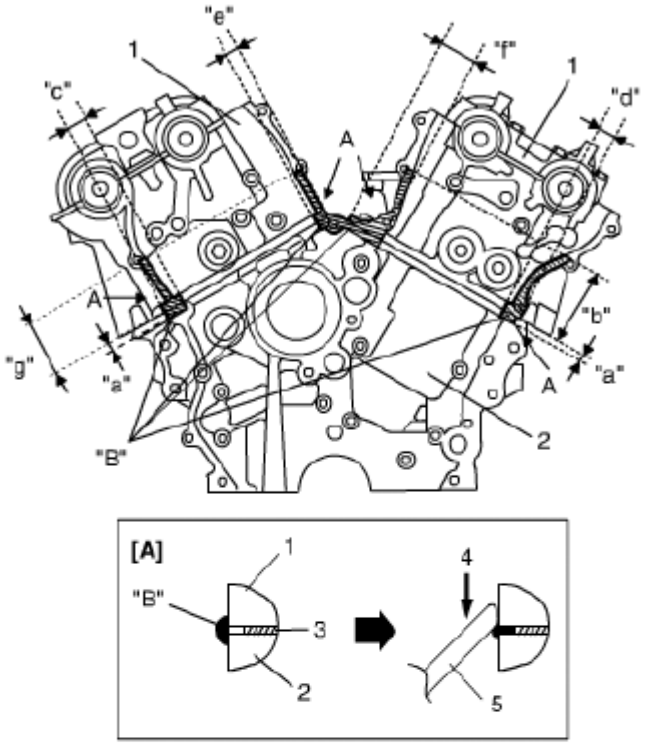
"a":	3 mm (0.12 in)	1.	Timing chain cover
"b":	2 mm (0.08 in)	2.	Sealant "A"

Fig. 52: Identifying Timing Chain Cover Sealant Application Area
Courtesy of SUZUKI OF AMERICA CORP.

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

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



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

Fig. 53: Identifying Cylinder Head And Cylinder Block Sealant Application Area
Courtesy of SUZUKI OF AMERICA CORP.

- Apply engine oil to new oil seal lip and water pump O-ring. Using special tool (bearing installer), install

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new oil seal (2) with its surface is flash with edge of timing chain cover (1).

Special Tool

(D): 09913-75510

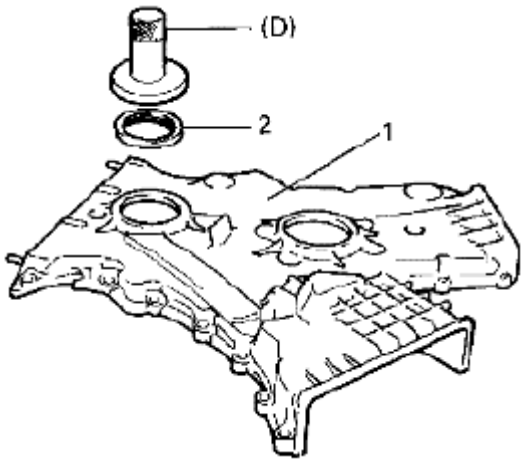


Fig. 54: Identifying Oil Seal, Timing Chain Cover & Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

- Install timing chain cover.

  Tightening torque

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

- Apply engine oil to O-ring of CKP sensor and install CKP sensor (4) to timing chain cover.

  Tightening torque

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

- Install crankshaft pulley (1).

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

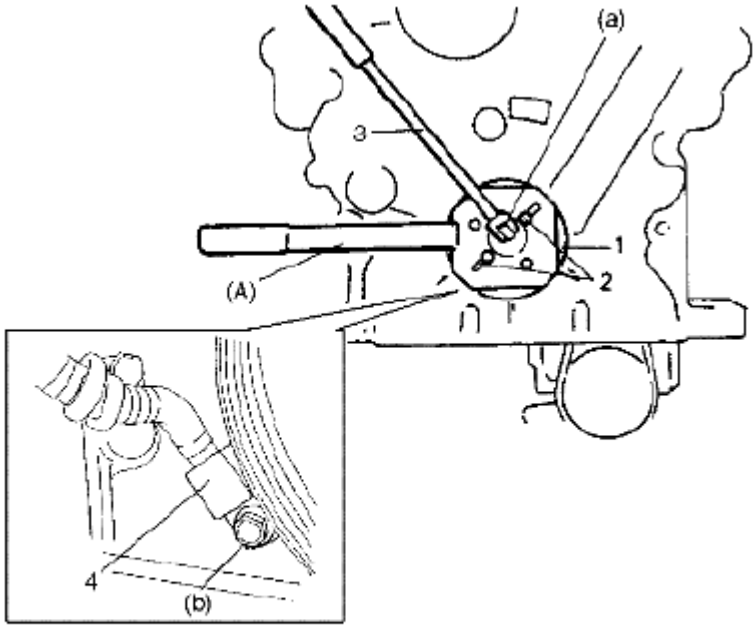
  Special Tool

  (A): 09917-68221

  Tightening torque

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

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2. Bolt	3. Wrench

Fig. 55: Identifying CKP Sensor, Bolt, Wrench, Crankshaft Pulley And Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

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

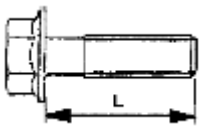


Fig. 56: Identifying Bolt Length
Courtesy of SUZUKI OF AMERICA CORP.

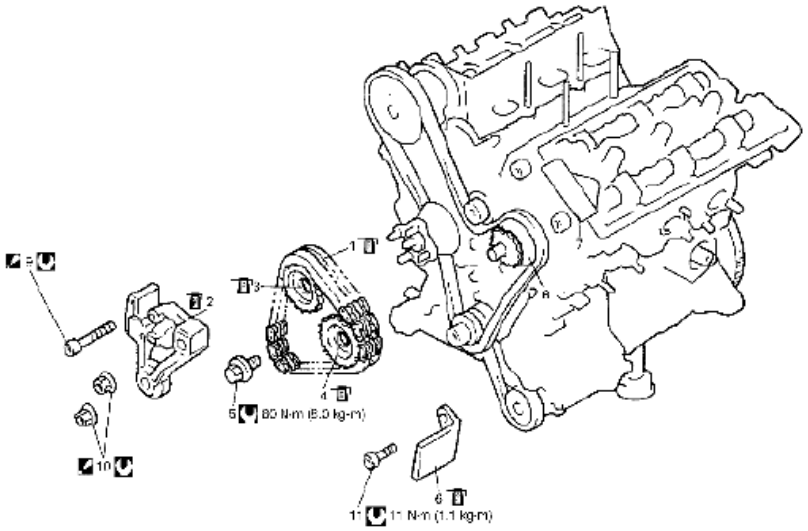
TIMING CHAIN COVER INSPECTION

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

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

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

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

Fig. 57: Identifying LH (No.1) Bank 2nd Timing Chain And Chain Tensioner Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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

Reference: **TIMING CHAIN COVER COMPONENTS**

1. Disconnect negative (-) cable at battery.
2. Drain engine oil.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
5. Turn crankshaft to meet the following condition.
   - Key (1) on crankshaft positions as shown.
   - Arrow mark on idler sprocket No.2 (2) points the center of crankshaft.
   - The marks on sprockets (3) match with marks on cylinder head.

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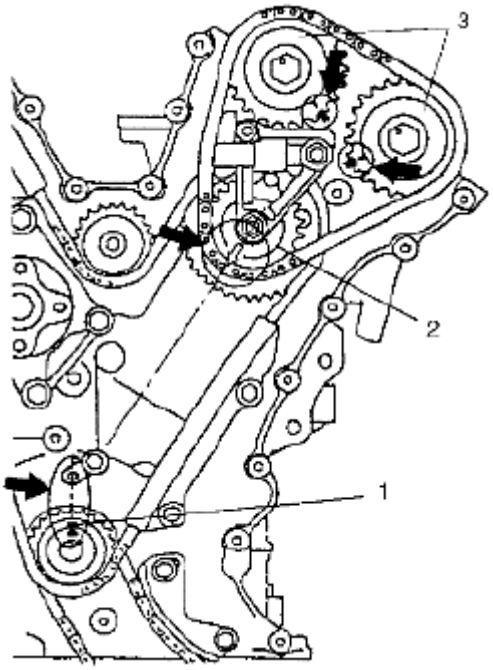


Fig. 58: Identifying Key, Sprockets And Idler Sprocket No. 2
Courtesy of SUZUKI OF AMERICA CORP.

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

   To remove it, slacken LH bank 2nd timing chain by turning intake camshaft (2) counterclockwise a little while pushing back pad.

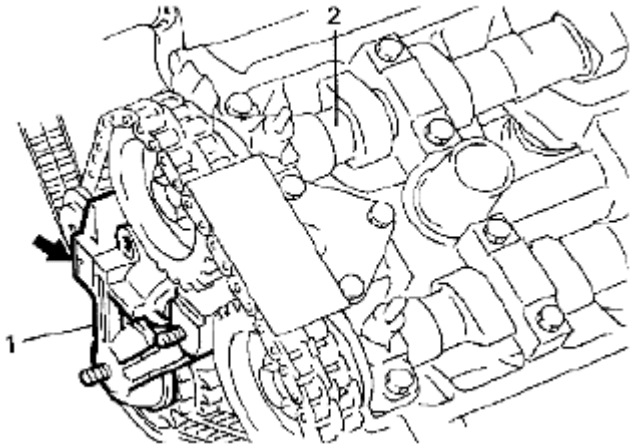
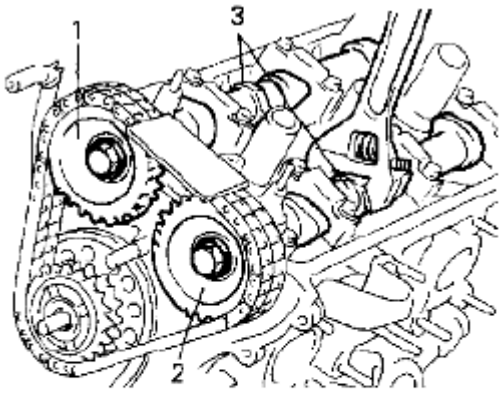


Fig. 59: Identifying Timing Chain Tensioner Adjuster No. 3 And Intake Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove LH bank intake and exhaust camshaft sprocket bolts.

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

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1.	LH bank intake camshaft sprocket
2.	LH bank exhaust camshaft sprocket

Fig. 60: Identifying LH Bank Intake And Exhaust Camshaft Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove LH bank exhaust camshaft sprocket (1).

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

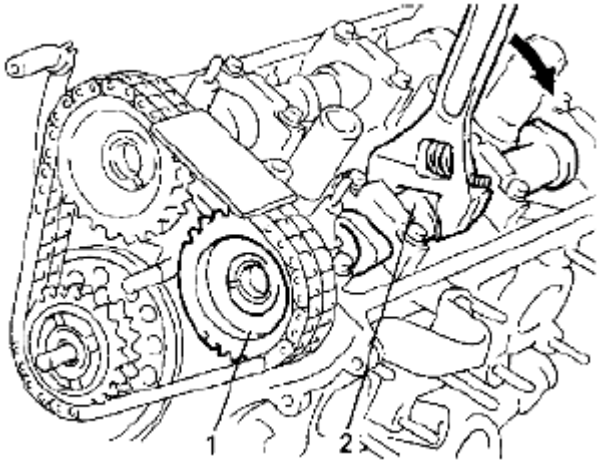


Fig. 61: Identifying LH Bank Exhaust Camshaft & Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove LH bank intake camshaft sprocket.
10. Remove LH bank 2nd timing chain.

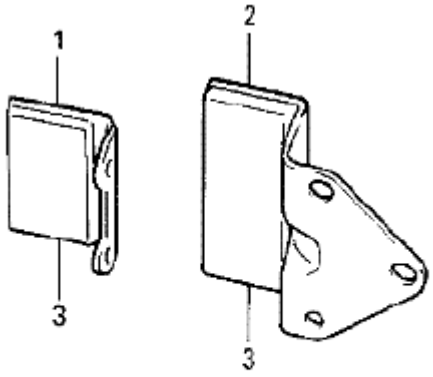
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LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSPECTION

Reference: **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Removal**

Timing Chain Guide No.4 and No.5

Check shoe (3) for wear or damage.



1. Timing chain guide No.4	2. Timing chain guide No.5

Fig. 62: Identifying Shoe, Timing Chain Guide No. 4 And No. 5
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Sprocket

Check teeth of sprocket for wear or damage.

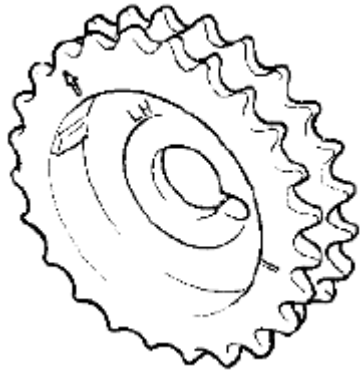


Fig. 63: Identifying Camshaft Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain

Check timing chain for wear or damage.

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

Tensioner Adjuster No. 3

- Check shoe (1) for wear or damage.

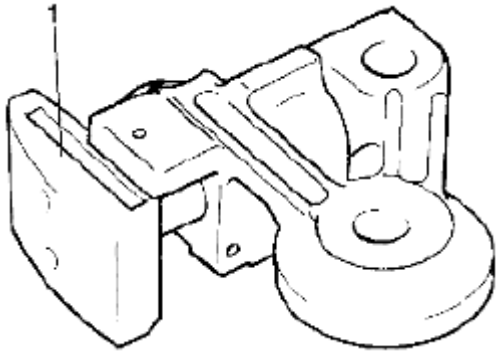


Fig. 65: Identifying Shoe
Courtesy of SUZUKI OF AMERICA CORP.

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

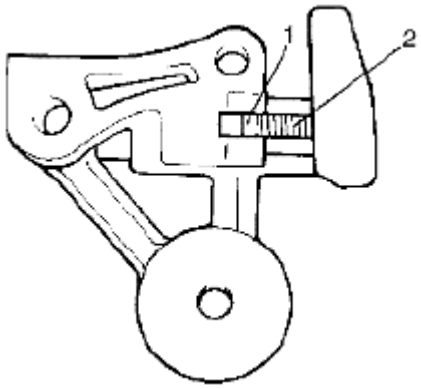


Fig. 66: Identifying Latch And Tooth Surface
Courtesy of SUZUKI OF AMERICA CORP.

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

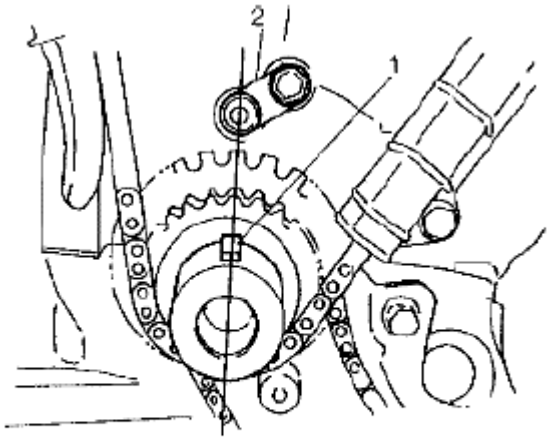
Reference: **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Components**

Reference: **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Removal**

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Reference: **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Inspection**

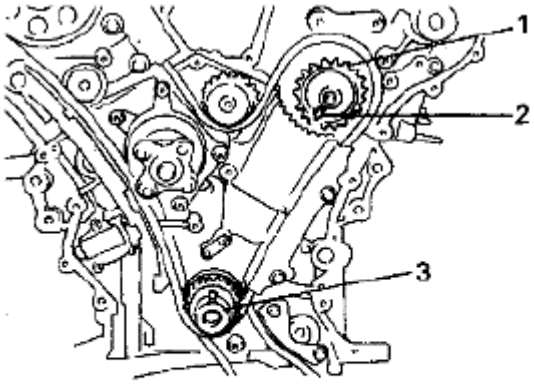
1. Check timing mark on crankshaft as shown in figure.



1. Crank timing pulley key	2. Oil jet

Fig. 67: Identifying Crank Timing Pulley Key And Oil Jet
Courtesy of SUZUKI OF AMERICA CORP.

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



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

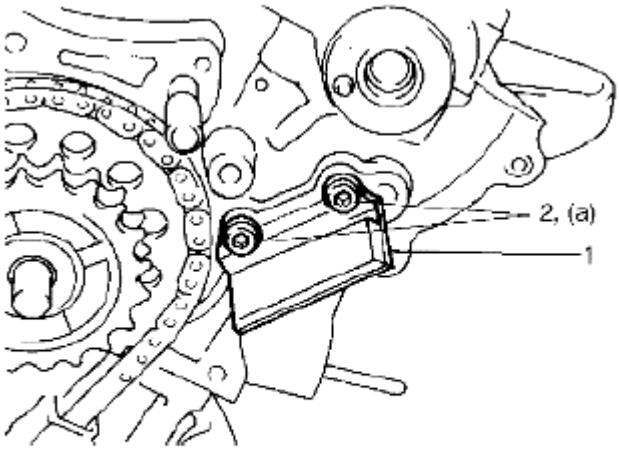
Fig. 68: Identifying Timing Mark On Idler Sprocket No. 2, Match Mark Of Idler Sprocket No. 2 & Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

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

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Tightening torque

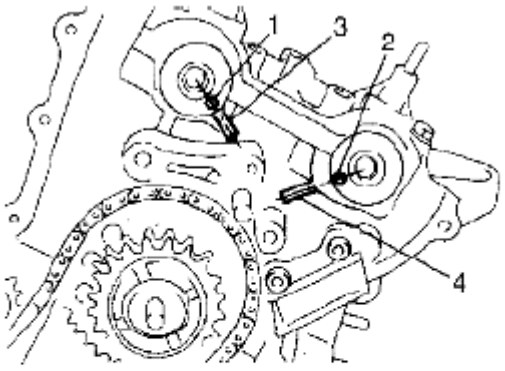
Timing chain guide No.4 bolt a: 11 N.m (1.1 kg-m, 8.0 lb-ft)



2.	Bolts

Fig. 69: Identifying Timing Chain Guide No. 4 & Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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



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

Fig. 70: Identifying Knock-Pins Of LH Bank Intake And Exhaust Camshafts & Match Marks
Courtesy of SUZUKI OF AMERICA CORP.

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

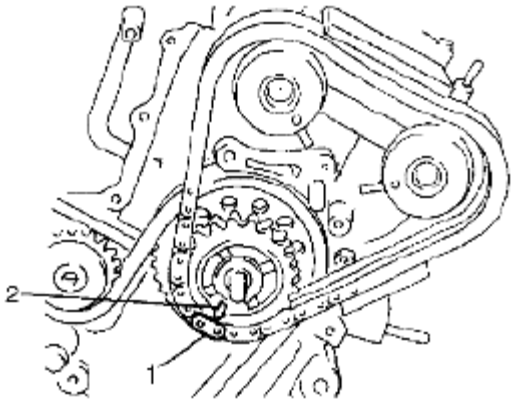


Fig. 71: Identifying Match Marks & Yellow Plate
Courtesy of SUZUKI OF AMERICA CORP.

6. Install sprockets to intake and exhaust camshafts by aligning silver plate (1) of LH bank 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

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

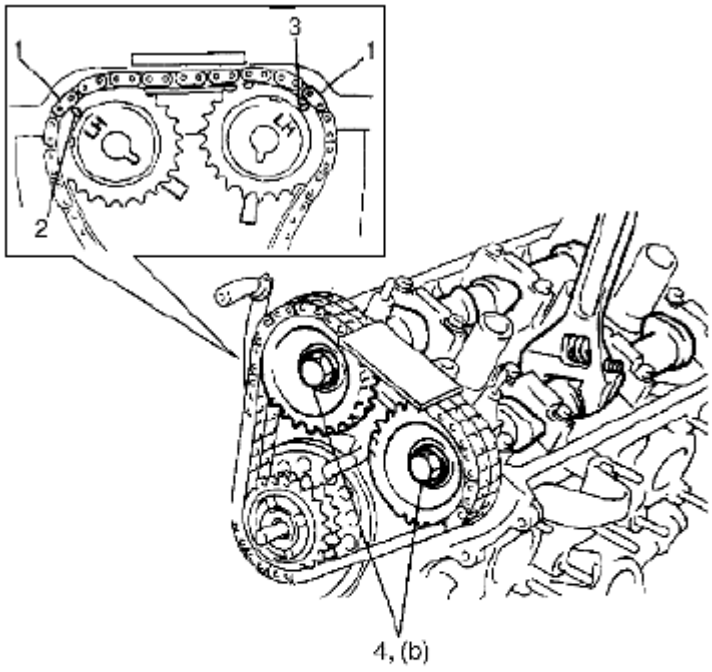
7. Install LH bank intake and exhaust camshaft timing sprockets.

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

   Tightening torque

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

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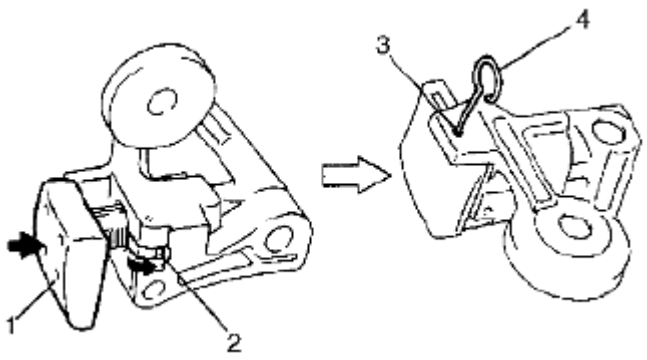


2.	Arrow mark on intake camshaft timing sprocket
3.	Arrow mark on exhaust camshaft timing sprocket
4.	Sprocket bolt

Fig. 72: Identifying Silver Plate, Arrow Mark On Intake And Exhaust Camshaft Timing Sprockets & Sprocket Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

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



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Fig. 73: Identifying Tensioner Adjuster No. 3 Latch, Plunger, Set Hole And Stopper Pin
Courtesy of SUZUKI OF AMERICA CORP.

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

   Tightening torque

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

   Timing chain tensioner adjuster No.3 nut d: Tighten 55 N.m (5.5 kgf-m, 40.0 lb-ft) by the specified procedure

   Tightening order for tensioner bolt and nuts

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

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

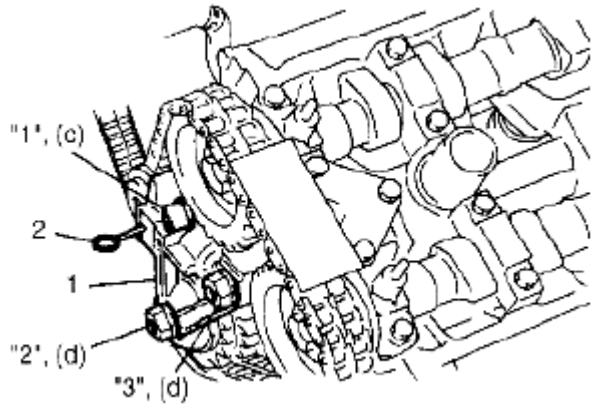
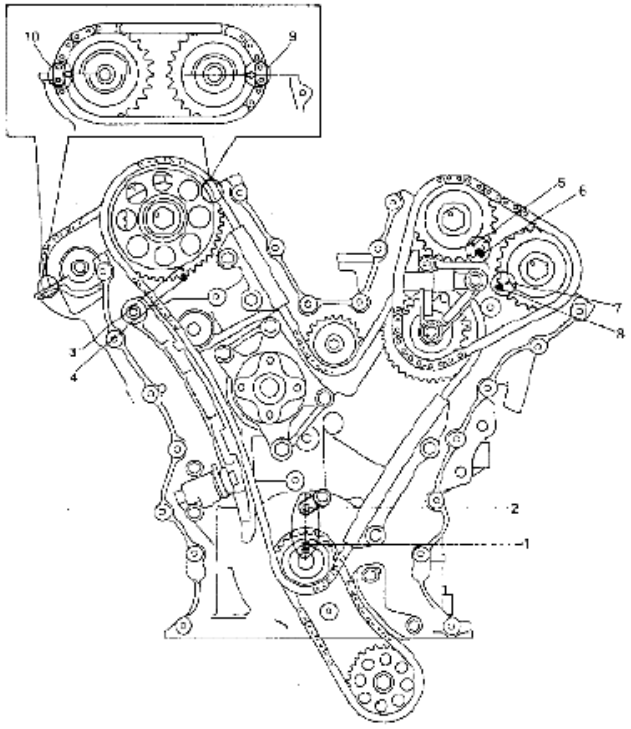


Fig. 74: Identifying Timing Chain Tensioner Adjuster No. 3, Stopper Pin & Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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1. Crank timing pulley key	5. Timing mark or LH bank 2nd timing chain intake sprocket	9. Timing mark of RH bank 2nd timing chain intake sprocket
2. Oil jet	6. Timing mark of LH bank 2nd timing chain	10. Timing mark of RH bank 2nd timing chain exhaust sprocket
3. Timing mark of RH bank 1st timing chain sprocket	7. Timing mark of LH bank 2nd timing chain exhaust sprocket	
4. Timing mark of RH bank 1st timing chain	8. Timing mark of LH bank 2nd timing chain	

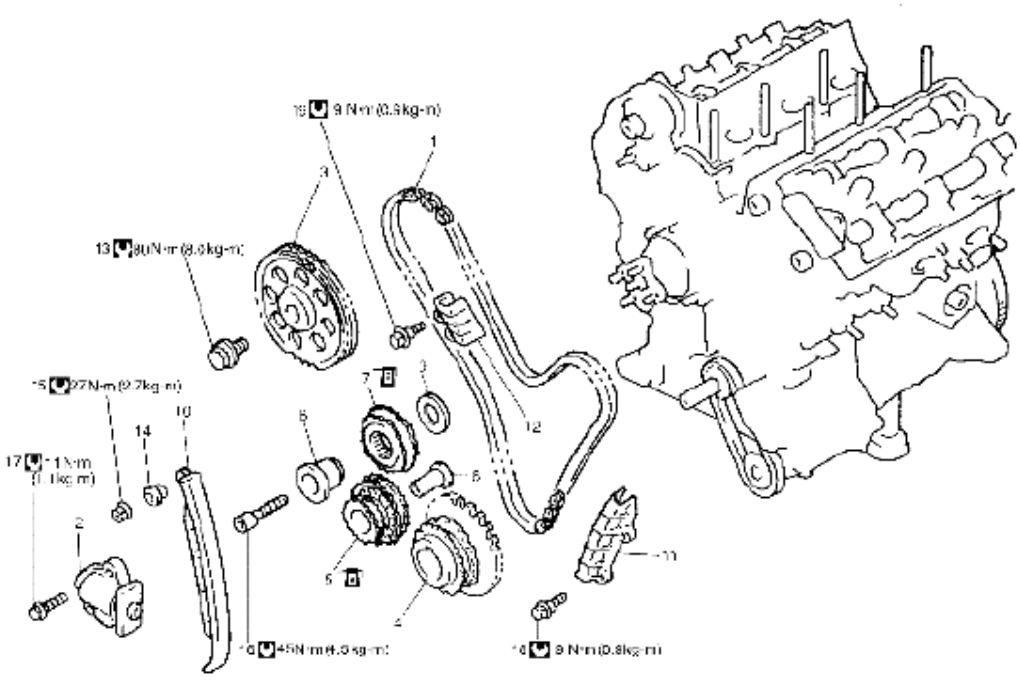
Fig. 75: Identifying Timing Marks On Crankshaft And Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

12. Apply oil to timing chains, tensioner adjusters sprockets and guides.
13. Install timing chain cover referring to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
14. Install oil pan referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
15. Install front differential referring to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front.
16. Install P/S system referring to **P/S PUMP REMOVAL AND INSTALLATION.**
17. Install cooling system referring to **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.** and **RADIATOR REMOVAL AND INSTALLATION.** .
18. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
19. Refill coolant referring to **COOLING SYSTEM FLUSH AND REFILL** .

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20. Refill engine oil referring to **ENGINE OIL AND FILTER CHANGE.**
21. Refill P/S fluid and bleed air in P/S system referring to **P/S SYSTEM AIR BLEEDING PROCEDURE** .
22. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .
23. Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

1ST TIMING CHAIN AND CHAIN TENSIONER COMPONENTS



1. 1st timing chain	8. Shaft	15. Timing chain tensioner nut
2. Timing chain tensioner adjuster No.1	9. Washer	16. Idler sprocket No.1 bolt
3. RH bank 1st timing chain intake camshaft sprocket	10. Timing chain tensioner	17. Timing tensioner adjuster No.1 bolt
4. 1st timing chain crankshaft sprocket	11. Timing chain guide No.1	18. Timing chain guide No.1 bolt
5. Idler sprocket No.2	12. Timing chain guide No.2	19. Timing chain guide No.2 bolt
6. Shaft	13. Camshaft sprocket bolt	: Tightening torque
7. Idler sprocket No.1	14. Spacer	: Apply engine oil to sliding parts.

Fig. 76: Identifying 1st Timing Chain And Chain Tensioner Components With Torque Specifications

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Courtesy of SUZUKI OF AMERICA CORP.

1ST TIMING CHAIN AND CHAIN TENSIONER REMOVAL

Reference: **1st Timing Chain and Chain Tensioner Components**

1. Disconnect negative cable at battery.
2. Drain engine oil.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
5. For reinstallation of timing chain, align 8 timing marks as shown in figure by turning crankshaft.

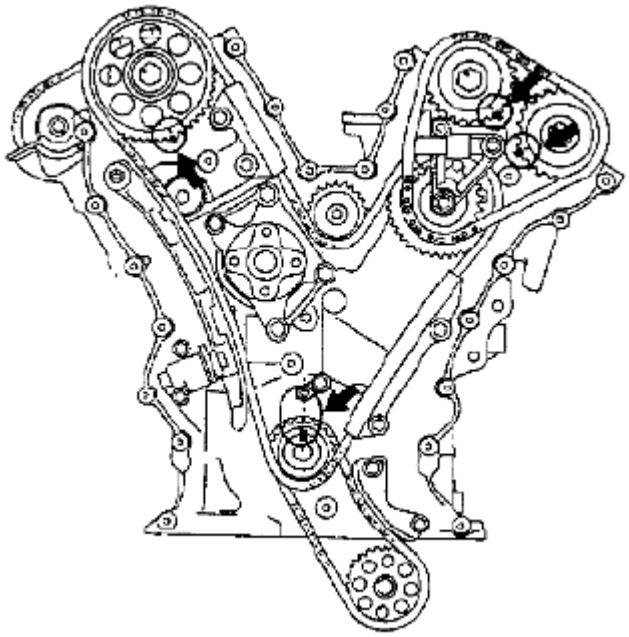


Fig. 77: Identifying Crankshaft Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

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

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9. Remove RH bank 1st timing chain intake camshaft sprocket (1).

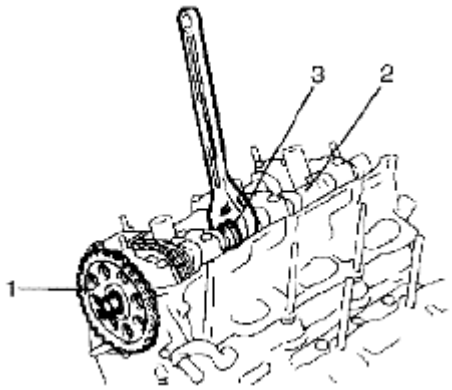


Fig. 78: Identifying Camshaft Sprocket, Center & Hexagonal Part
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove 1st timing chain crankshaft sprocket.

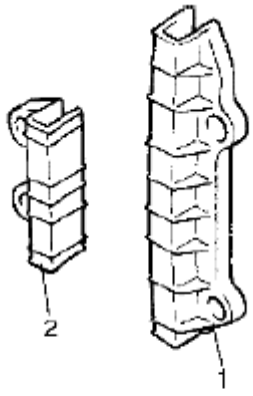
1ST TIMING CHAIN AND CHAIN TENSIONER INSPECTION

Reference: **1st Timing Chain and Chain Tensioner Removal**

Timing Chain Guides No.1 and No.2

Check shoe for excessive wear or damage.

If any malfunction is found, replace it.



1. Timing chain guide No.1	2. Timing chain guide No.2

Fig. 79: Identifying Timing Chain Guide No. 1 And No. 2
Courtesy of SUZUKI OF AMERICA CORP.

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Timing Chain Tensioner

Check shoe (1) for wear or damage.

If any malfunction is found, replace it.



Fig. 80: Identifying Shoe
Courtesy of SUZUKI OF AMERICA CORP.

1st Timing Chain Crankshaft Sprocket

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.

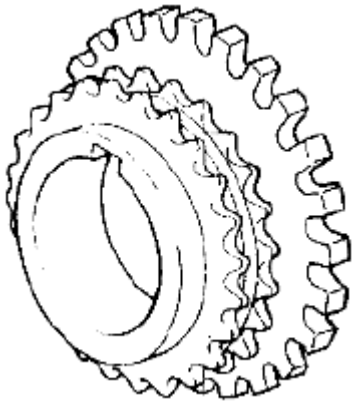


Fig. 81: Identifying 1st Timing Chain Crankshaft Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

RH Bank 1st Timing Chain Intake Camshaft Sprocket

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.

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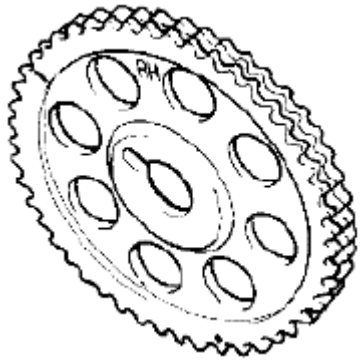
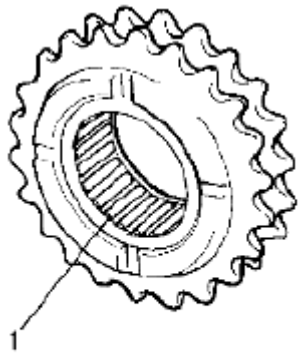


Fig. 82: Identifying RH Bank 1st Timing Chain Intake Camshaft Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

Idler Sprocket No.1

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.



1. Bearing

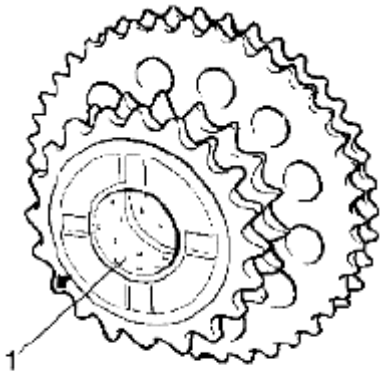
Fig. 83: Identifying Idler Sprocket No. 1 And Bearing
Courtesy of SUZUKI OF AMERICA CORP.

Idler Sprocket No.2

Check teeth of sprocket for wear or damage.

If any malfunction is found, replace it.

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1. Bush

Fig. 84: Identifying Idler Sprocket No. 2 And Bush
Courtesy of SUZUKI OF AMERICA CORP.

1st Timing Chain

Check timing chain for wear or damage.

If any malfunction is found, replace it.

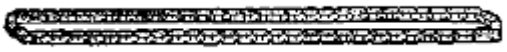


Fig. 85: Identifying 1st Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner Adjuster No.1

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

If any malfunction is found, replace it.

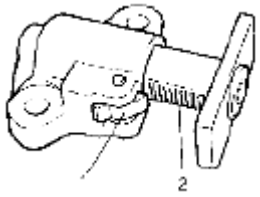


Fig. 86: Identifying Timing Chain Tensioner Adjuster No. 1 Latch And Tooth Surface
Courtesy of SUZUKI OF AMERICA CORP.

1ST TIMING CHAIN AND CHAIN TENSIONER INSTALLATION

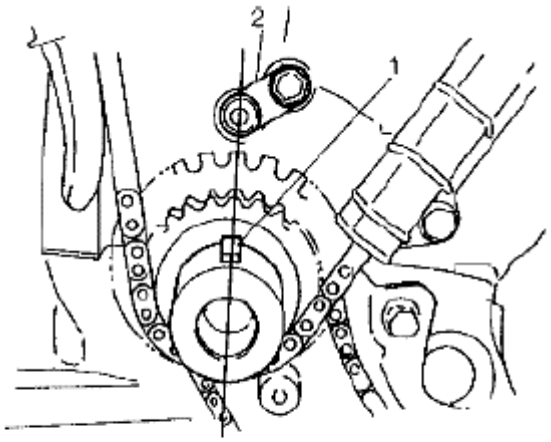
Reference: **1st Timing Chain and Chain Tensioner Components**

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Reference: **1st Timing Chain and Chain Tensioner Removal**

Reference: **1st Timing Chain and Chain Tensioner Inspection**

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



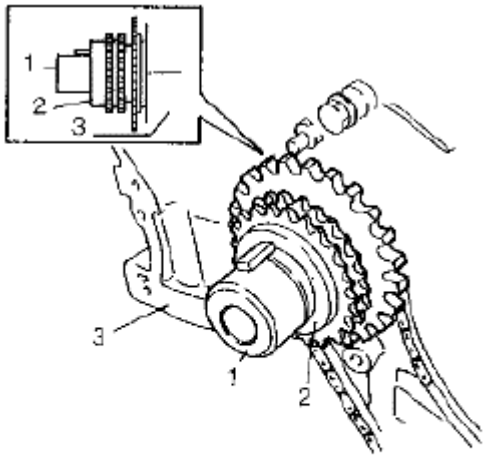
1. Crank timing pulley key	2. Oil jet

Fig. 87: Identifying Crank Timing Pulley Key And Oil Jet
Courtesy of SUZUKI OF AMERICA CORP.

2. Install 1st timing chain crankshaft sprocket (2) to crankshaft (1) as shown in figure.

   Confirm that tooth for CKP sensor are free from metal particles and damage.

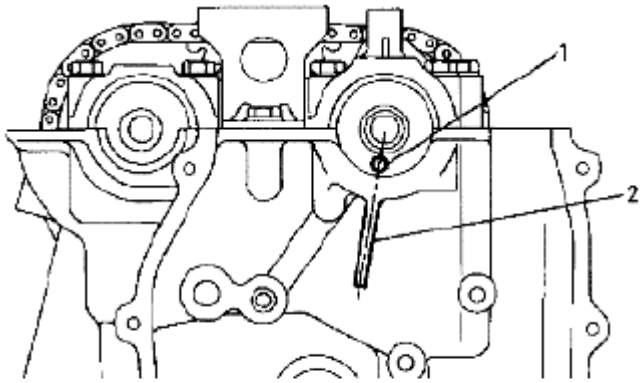
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3. Lower crankcase	

Fig. 88: Identifying 1st Timing Chain Crankshaft Sprocket, Lower Crankcase And Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

3. Check timing mark on RH bank intake camshaft as shown in figure.



1. Knock pin of intake camshaft	2. Match mark

Fig. 89: Identifying Knock Pin Of Intake Camshaft & Match Mark
Courtesy of SUZUKI OF AMERICA CORP.

4. Install RH bank 1st timing chain intake camshaft sprocket (1) noting the following points.
   - The sprocket should be set in such way that its RH mark (4) can be seen.
   - Camshaft (2) should be held stationary by using a spanner at its hexagonal parts (3) as shown in figure.

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Tightening torque

RH bank 1st timing chain intake camshaft sprocket bolt a: 80 N.m (8.0 kg-m, 58.0 lb-ft)

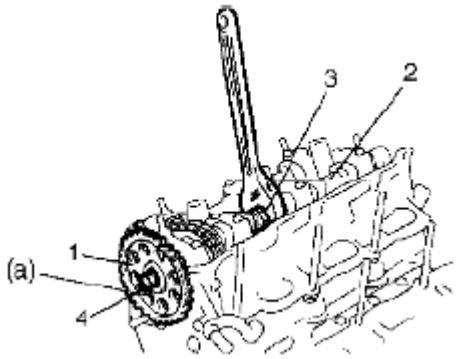
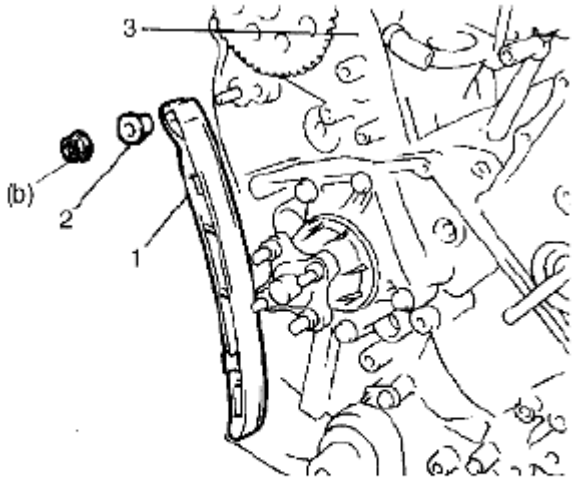


Fig. 90: Identifying RH Bank 1st Timing Chain Intake Camshaft Sprocket, Camshaft, Hexagonal Part & RH Mark
Courtesy of SUZUKI OF AMERICA CORP.

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

Tightening torque

Timing chain tensioner nut b: 27 N.m (2.7 kg-m, 19.5 lb-ft)



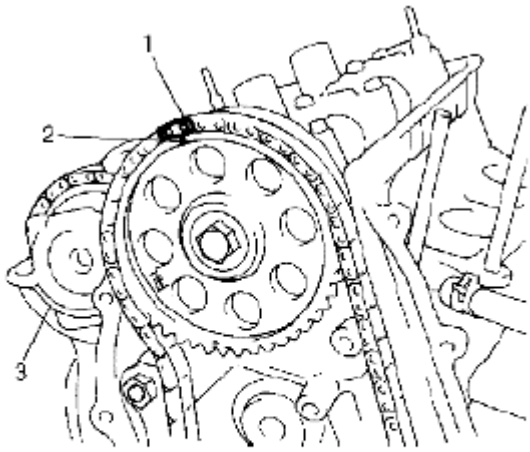
2. Spacer	3. RH bank cylinder head

Fig. 91: Identifying Timing Chain Tensioner, Spacer & RH Bank Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

6. Install 1st timing chain by aligning match marks (2) on RH silver plate (1) of 1st timing chain and RH

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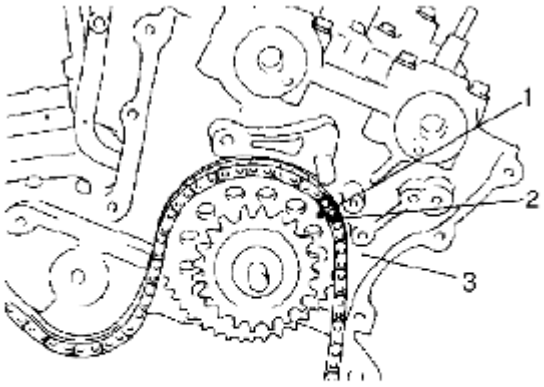
bank 1st timing chain intake camshaft sprocket.



3. RH bank cylinder head

Fig. 92: Identifying Match Marks, RH Silver Plate & RH Bank Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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



3. RH bank cylinder head

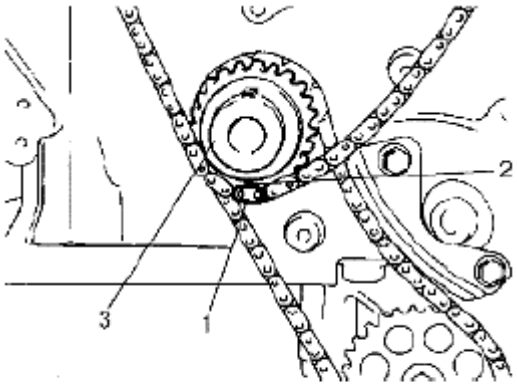
Fig. 93: Identifying Match Marks, LH Silver Plate & RH Bank Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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

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To install it, fit a spanner to hexagonal part at the center of RH bank intake camshaft to turn a little.

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



3. Crankshaft

Fig. 94: Identifying Match Marks, Yellow Plate & Crankshaft
Courtesy of SUZUKI OF AMERICA CORP.

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

Tightening torque

Idler sprocket No.1 bolt c: 45 N.m (4.5 kg-m, 32.5 lb-ft)

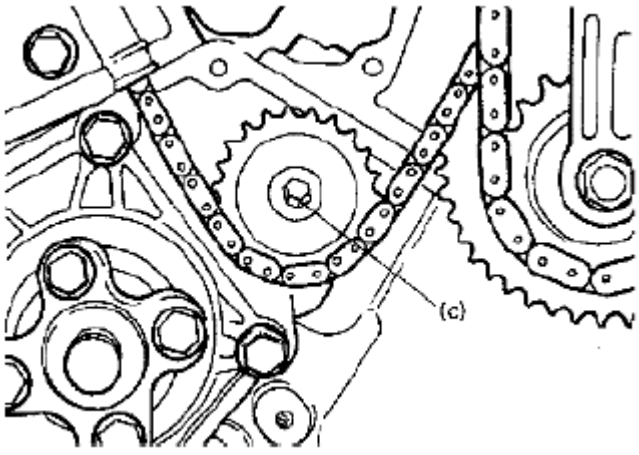


Fig. 95: Identifying Idler Sprocket No. 1 Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

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

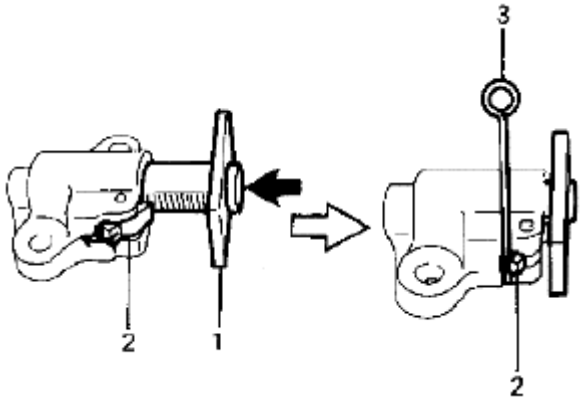


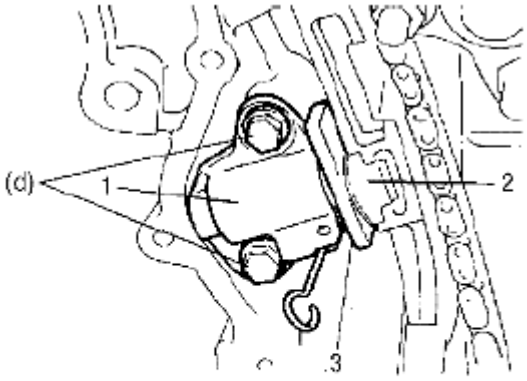
Fig. 96: Identifying Stopper, Plunger And Latch
Courtesy of SUZUKI OF AMERICA CORP.

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

    Tightening torque

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

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



2.	Timing chain tensioner

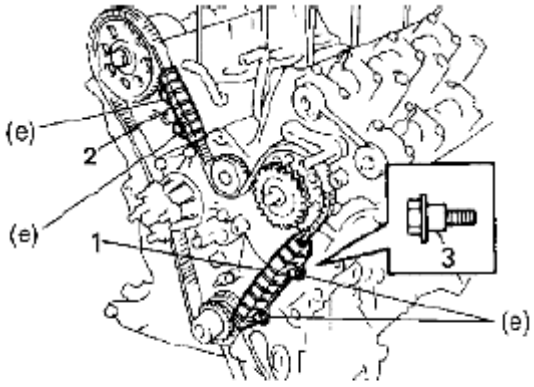
Fig. 97: Identifying Timing Chain Tensioner Adjuster No. 1, Stopper & Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

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

Tightening torque

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

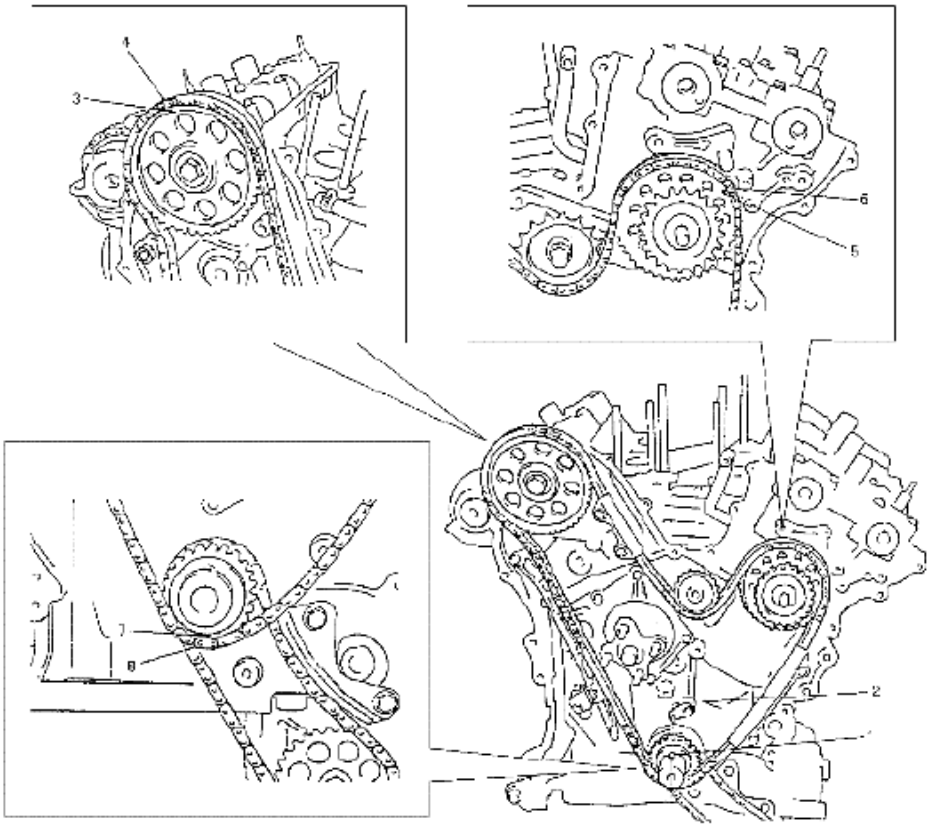


3. Guide bolts

Fig. 98: Identifying Timing Chain Guide No. 1 & No. 2 & Guide Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Fig. 99: Identifying Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

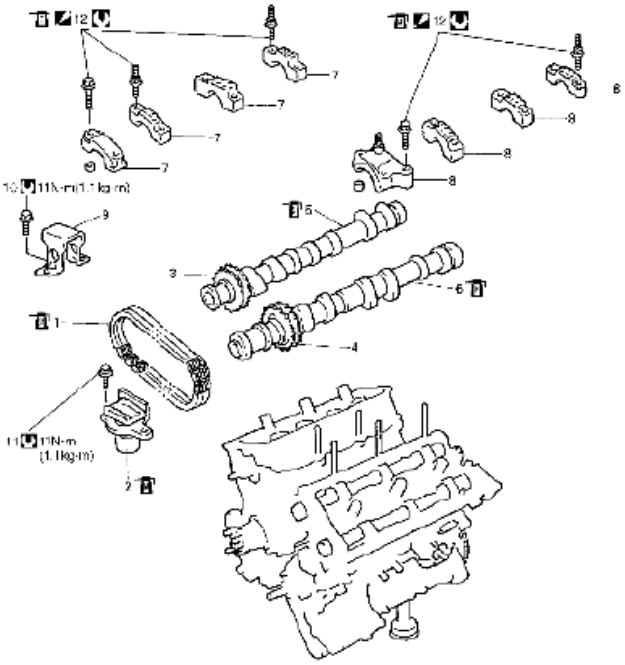
18. Install LH bank 2nd timing chain. Refer to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Installation**.
19. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
20. Install oil pan referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
21. Install front differential housing referring to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front.
22. Install P/S system referring to **P/S PUMP REMOVAL AND INSTALLATION.**
23. Install cooling system referring to **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.** and **RADIATOR REMOVAL AND INSTALLATION.** .
24. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE**

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MANIFOLD REMOVAL AND INSTALLATION..

25. Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
26. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .
27. Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

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



1. RH bank 2nd timing chain	6. RH bank intake camshaft	11. Timing chain tensioner adjuster No.2 bolt
2. Timing chain tensioner adjuster No.2	7. RH bank exhaust camshaft housing	12. Camshaft housing bolt : Tighten 12 N·m (1.2 kgf-m, 9.0 lb-ft) by the specified procedure
3. RH bank exhaust camshaft sprocket	8. RH bank intake camshaft housing	: Apply engine oil to sliding surface of each part.
4. RH bank 2nd timing chain intake camshaft sprocket	9. Timing chain guide No.3	: Tightening torque
5. RH bank exhaust camshaft	10. Timing chain guide No.3 bolt	

Fig. 100: Identifying RH (No. 2) Bank 2nd Timing Chain And Chain Tensioner Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

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

Reference: **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Components**

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1. For reinstallation of timing chain, align 12 timing marks as shown in figure by turning crankshaft.

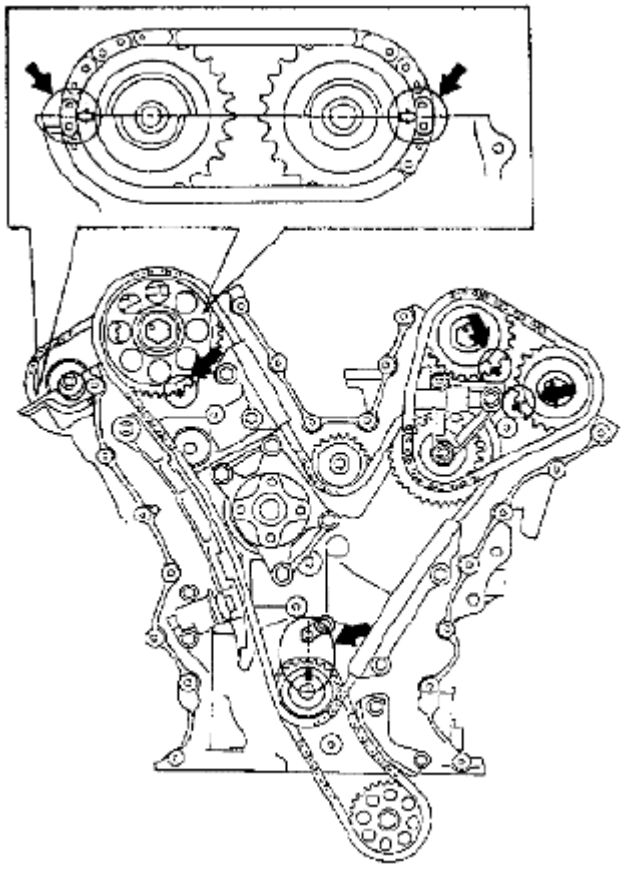


Fig. 101: Identifying Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

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

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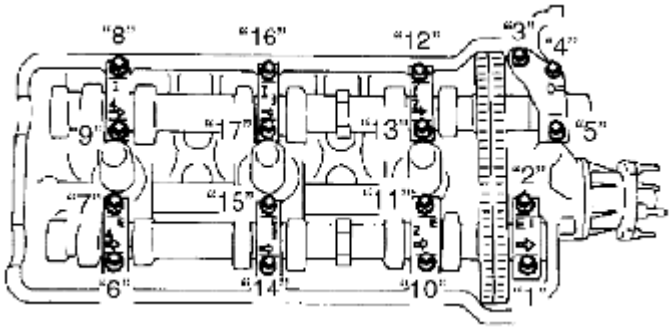


Fig. 102: Identifying Camshaft Housing Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Reference: **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Removal**

Timing Chain Guide No.3

Check shoe (1) for excessive wear or damage.

If any malfunction is found, replace it.

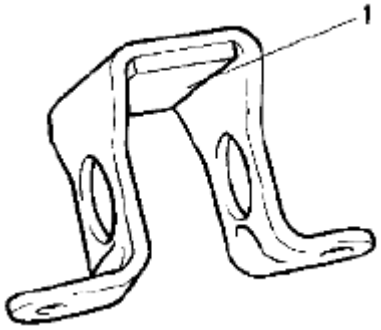


Fig. 103: Identifying Timing Chain Guide No. 3 Shoe
Courtesy of SUZUKI OF AMERICA CORP.

RH Bank 2nd Timing Chain Sprockets

Check teeth of sprocket for wear or damage.

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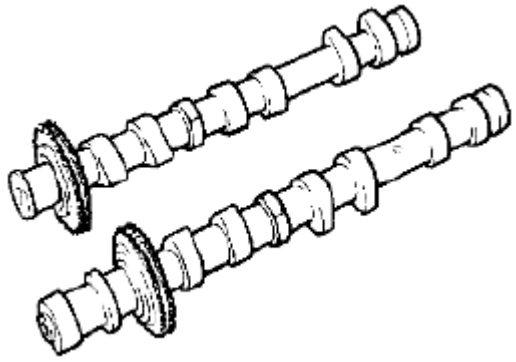


Fig. 104: Identifying RH Bank 2nd Timing Chain Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

RH Bank 2nd Timing Chain

Check timing chain for wear or damage.

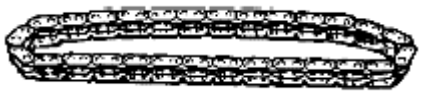


Fig. 105: Identifying RH Bank 2nd Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Tensioner Adjuster No.2

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

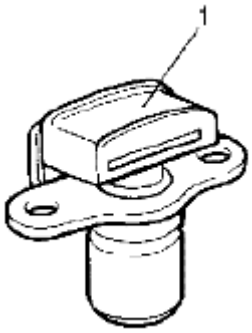


Fig. 106: Identifying Timing Chain Tensioner Adjuster No. 2 Shoe
Courtesy of SUZUKI OF AMERICA CORP.

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

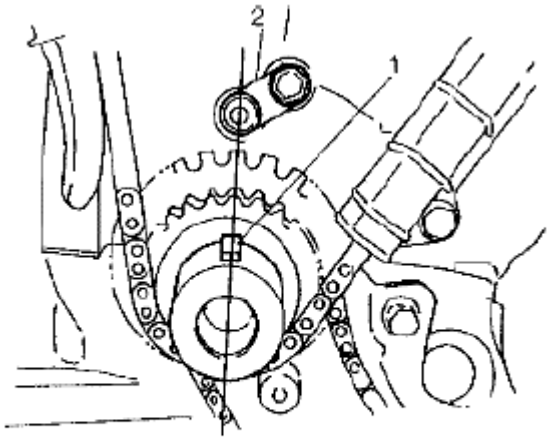
Reference: **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Components**

Reference: **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Removal**

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Reference: **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Inspection**

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



1. Crank timing pulley key	2. Oil jet

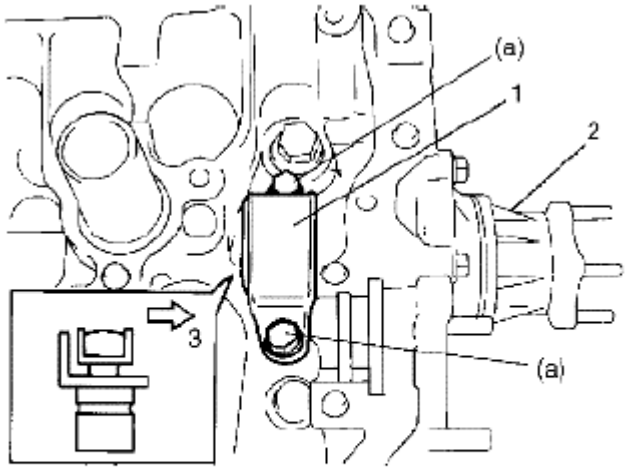
Fig. 107: Identifying Crank Timing Pulley Key And Oil Jet
Courtesy of SUZUKI OF AMERICA CORP.

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

Tightening torque

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

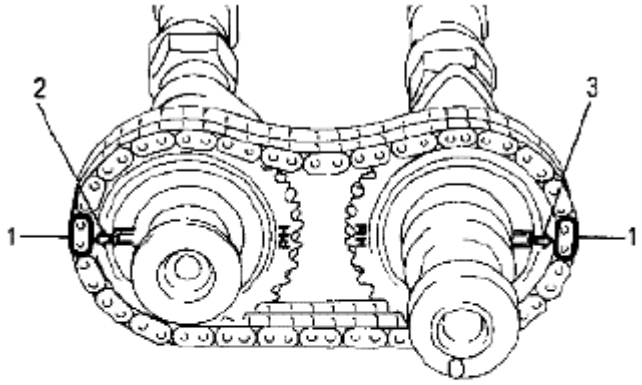
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2. Water pump	3. Engine front side

Fig. 108: Identifying Timing Chain Tensioner Adjuster No. 2, Water Pump & Engine Front Side
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply oil to sliding surface of each camshafts and camshaft journals.
5. Install RH bank 2nd timing chain by aligning match marks on yellow or silver plates (1) of RH bank 2nd timing chain, RH bank 2nd timing chain intake camshaft sprocket and RH bank 2nd timing chain exhaust camshaft sprocket as shown in figure.

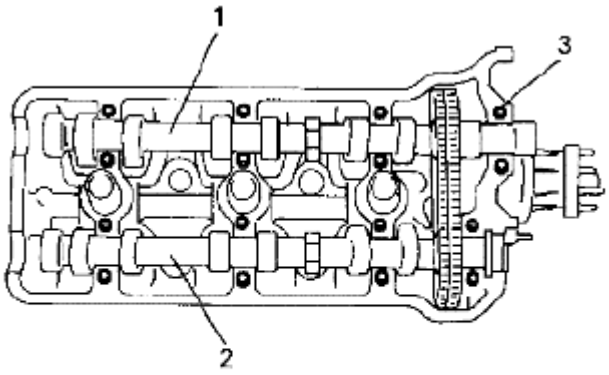


2.	Match mark of RH bank 2nd timing chain exhaust camshaft sprocket
3.	Match mark of RH bank 2nd timing chain intake camshaft sprocket

Fig. 109: Identifying Silver Plates & Match Marks Of RH Bank 2nd Timing Chain Intake & Exhaust Camshaft Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

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

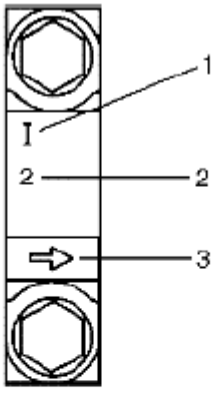


1. RH bank intake camshaft	2. RH bank exhaust camshaft

Fig. 110: Identifying Camshaft Housing Pins, RH Bank Intake Camshaft & RH Bank Exhaust Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

7. Check position of camshaft housings.

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



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

Fig. 111: Identifying Marks On Camshaft Housing

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

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

   Tightening torque

   Camshaft housing bolt: Tighten 12 N.m (1.2 kgf-m, 9.0 lb-ft) by the specified procedure

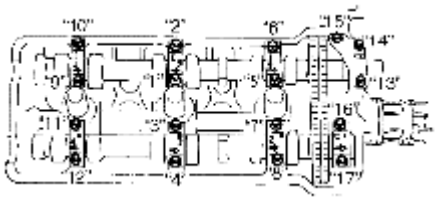


Fig. 112: Identifying Housing Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

   Tightening torque

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

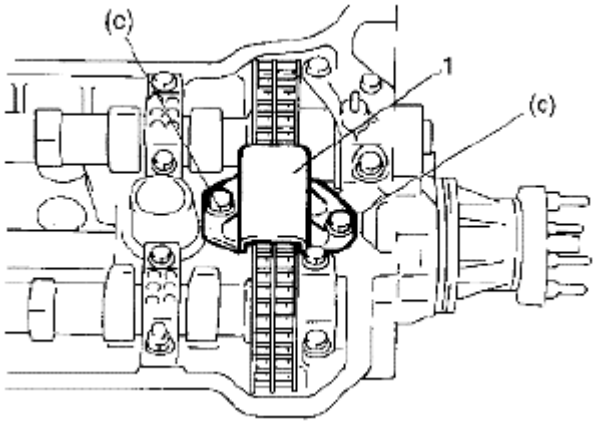


Fig. 113: Identifying Timing Chain Guide No. 3 & Bolt
Courtesy of SUZUKI OF AMERICA CORP.

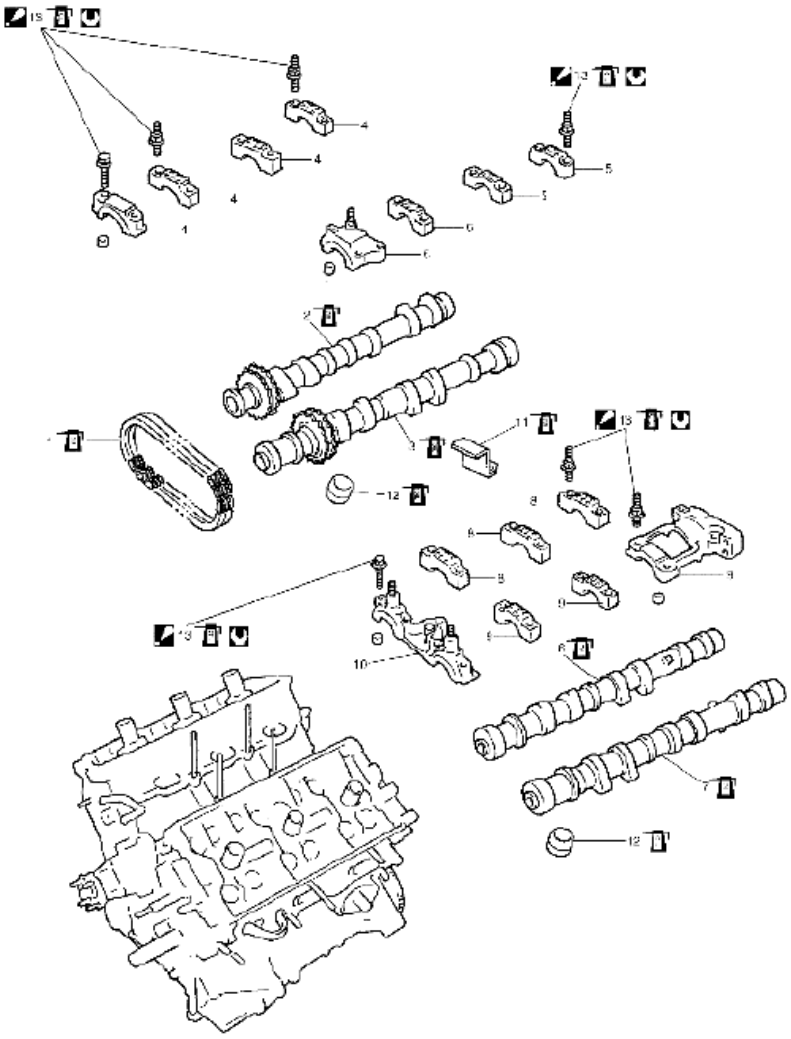
10. Install 1st timing chain. Refer to **1st Timing Chain and Chain Tensioner Installation**.
11. Install LH bank 2nd timing chain. Refer to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Installation**.
12. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.

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13. Install oil pan referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
14. Install front differential housing referring to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front.
15. Install P/S system referring to **P/S PUMP REMOVAL AND INSTALLATION.**
16. Install cooling system referring to **RADIATOR REMOVAL AND INSTALLATION.** .
17. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
18. Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
19. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .
20. Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

CAMSHAFTS AND VALVE LASH ADJUSTERS COMPONENTS

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1.	RH bank 2nd timing chain	6.	LH bank intake camshaft	11.	Timing chain guide No.5
2.	RH bank exhaust camshaft	7.	LH bank exhaust camshaft	12.	Valve lash adjuster
3.	RH bank intake camshaft	8.	LH bank intake camshaft housing	13.	Camshaft housing bolt : Tighten 12 N·m (1.2 kgf-m, 9.0 lb-ft) by the specified procedure
4.	RH bank exhaust camshaft housing	9.	LH bank exhaust camshaft housing	:	Tightening torque
5.	RH bank intake camshaft housing	10.	LH bank camshaft housing	:	Apply engine oil to sliding surface of each part.

Fig. 114: Identifying Camshafts And Valve Lash Adjusters Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION

Reference: **CAMSHAFTS AND VALVE LASH ADJUSTERS COMPONENTS**

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Removal

1. Disconnect negative (-) cable at battery.
2. Drain engine oil.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
5. Remove LH bank 2nd timing chain. Refer to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Removal**.
6. Remove 1st timing chain. Refer to **1st Timing Chain and Chain Tensioner Installation**.
7. Remove RH bank camshafts. Refer to **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Removal**.
8. Remove CMP sensor referring to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .
9. Loosen LH bank camshaft housing bolts in such order ("1"-"19") as indicated in figure and remove them.

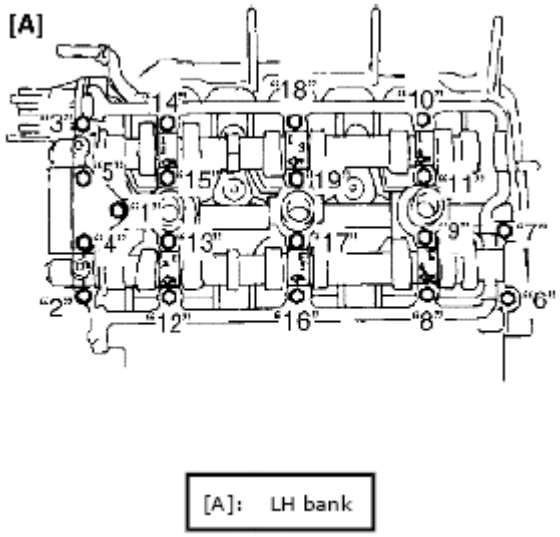


Fig. 115: Identifying LH Bank Camshaft Housing Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove LH bank camshaft housings.
11. Remove LH bank camshafts.
12. Remove valve lash adjuster.

CAUTION:
- **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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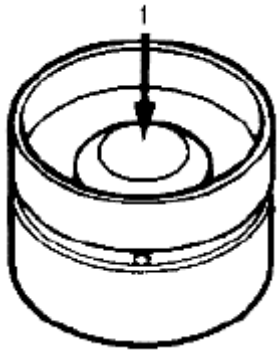


Fig. 116: Identifying Adjuster Body
Courtesy of SUZUKI OF AMERICA CORP.

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

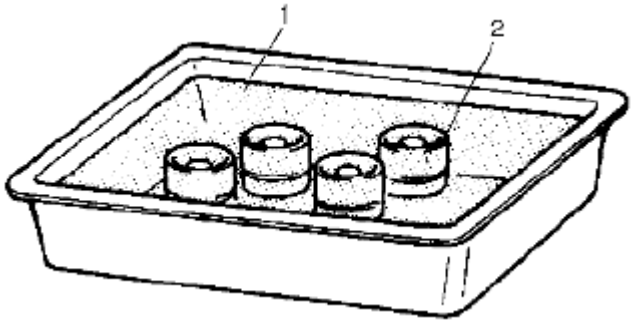


Fig. 117: Identifying Adjuster Immersed In Clean Engine Oil
Courtesy of SUZUKI OF AMERICA CORP.

Installation

Reference: **CAMSHAFTS AND CAMSHAFT HOUSINGS INSPECTION**

Reference: **VALVE LASH ADJUSTERS INSPECTION**

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 2000 to 3000 rpm,**

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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 24 of them, check as follows.

- **Stop engine and remove cylinder head cover.**
- **Push adjuster downward by hand (with less than 200 N (20 kg, 44 lbs) of force) when can 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.**

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

   Pour engine oil through oil holes (2) and check that oil comes out from oil holes (2) in sliding part of valve lash adjuster.

   Perform this check on both intake and exhaust sides.

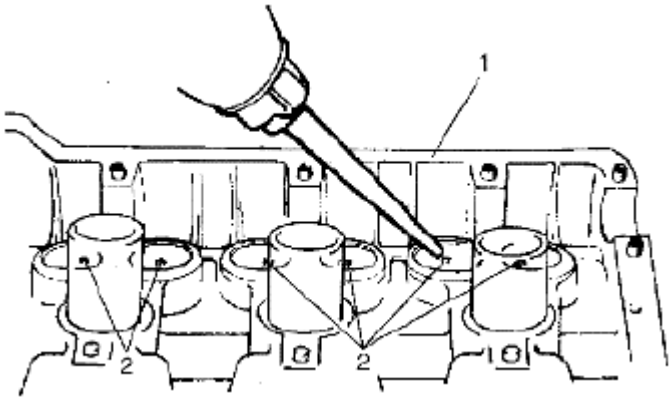


Fig. 118: Identifying Oil Holes & Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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

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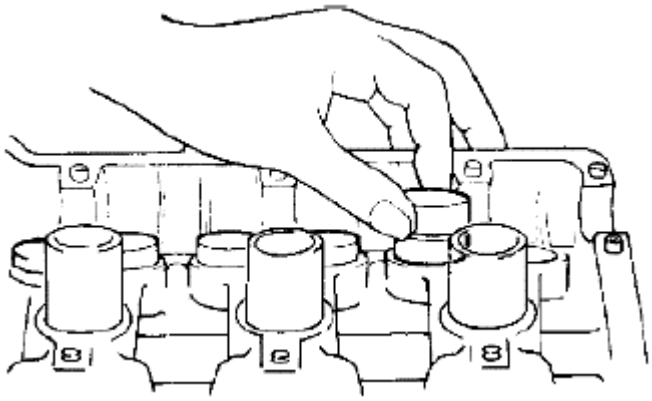
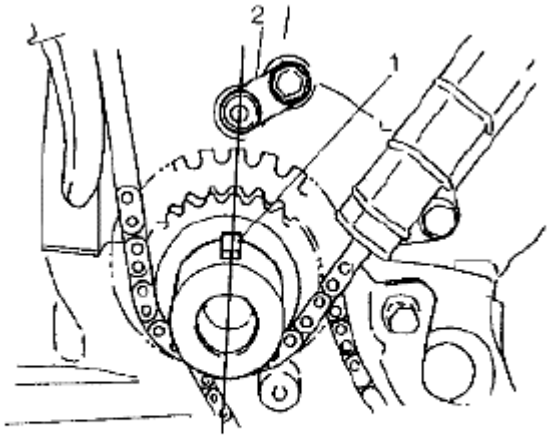


Fig. 119: Installing Valve Lash Adjuster To Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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



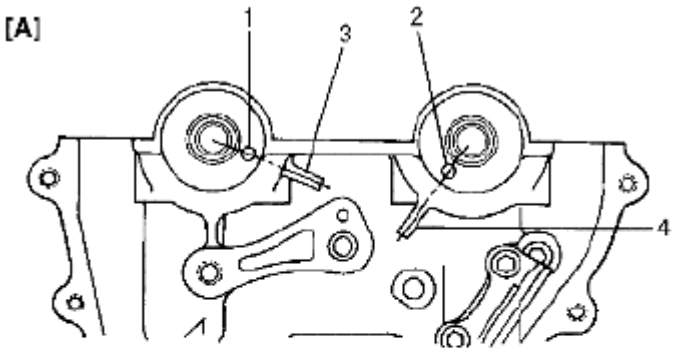
1. Crank timing pulley key	2. Oil jet

Fig. 120: Identifying Crank Timing Pulley Key & Oil Jet
Courtesy of SUZUKI OF AMERICA CORP.

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

   Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks (4) on cylinder head (3) and LH bank camshafts as shown in figure.

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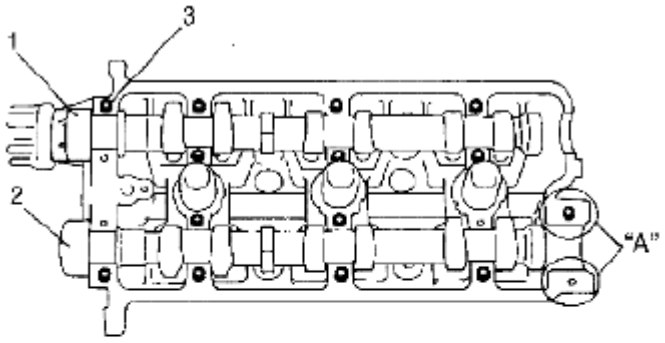


[A]:	LH bank
1.	LH bank intake camshaft
2.	LH bank exhaust camshaft

Fig. 121: Identifying Match Marks, Cylinder Head And LH Bank Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

6. Install LH bank camshaft housing pins as shown in figure.
7. Apply sealant "A" to LH bank exhaust camshaft housing No.5 sealing surface area as shown in figure.

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



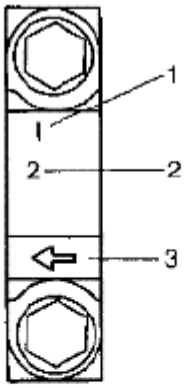
1.	LH bank intake camshaft
2.	LH bank exhaust camshaft
3.	Pin installation position

Fig. 122: Identifying LH Bank Intake & Exhaust Camshafts & Pin Installation Position
Courtesy of SUZUKI OF AMERICA CORP.

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8. Check position of LH bank camshaft housings.

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



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

Fig. 123: Identifying Intake Side, Exhaust Side, Position From Timing Chain Side & Timing Chain Side
Courtesy of SUZUKI OF AMERICA CORP.

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

   Then tighten them by following sequence ("1"-"19") as indicated in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence 2 or 3 times before they are tightened to specified torque below.

   Tightening torque

   Camshaft housing bolt: Tighten 12 N.m (1.2 kgf-m, 9.0 lb-ft) by the specified procedure

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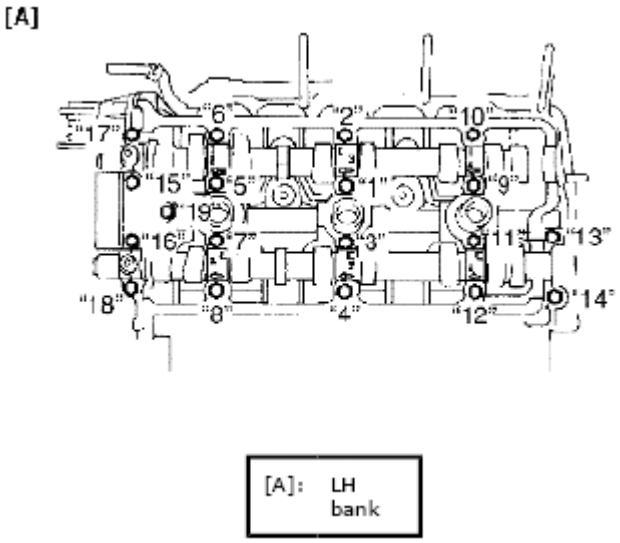


Fig. 124: Identifying Housing Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Install 1st timing chain. Refer to **1st Timing Chain and Chain Tensioner Inspection**.
11. Install LH bank 2nd timing chain. Refer to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Installation**.
12. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
13. Install oil pan referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
14. Install front differential housing referring to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front.
15. Install P/S system referring to **P/S PUMP REMOVAL AND INSTALLATION.**
16. Install cooling system referring to **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION** and **RADIATOR REMOVAL AND INSTALLATION.** .
17. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
18. Install CMP sensor referring to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .
19. Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
20. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .
21. Verify that there is no fuel leakage, water leakage and oil leakage at each connection.
22. Check ignition timing, referring to **IGNITION TIMING CHECK AND ADJUSTMENT** .

CAMSHAFTS AND CAMSHAFT HOUSINGS INSPECTION

Reference: **CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION**

Cam Wear

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

Cam height specifications

CAM HEIGHT SPECIFICATIONS

	Intake cam	Exhaust cam
Standard	40.402 - 40.562 mm (1.5906 - 1.5969 in.)	39.428 - 39.588 mm (1.5523 - 1.586 in.)
Limit	40.300 mm (1.3581 in.)	39.400 mm (1.5512 in.)

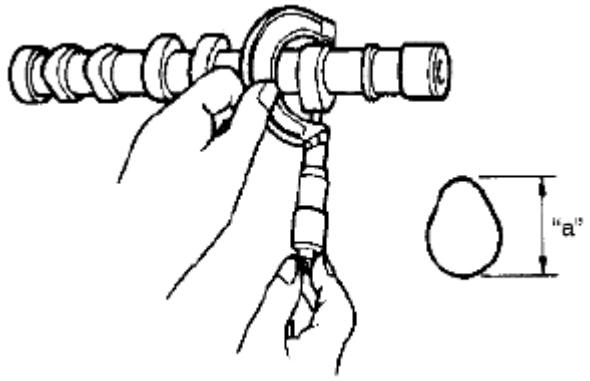


Fig. 125: Measuring Cam Height
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Runout

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

If measured runout exceeds specified limit, replace camshaft.

Camshaft runout limit

: 0.04 mm (0.002 in.)

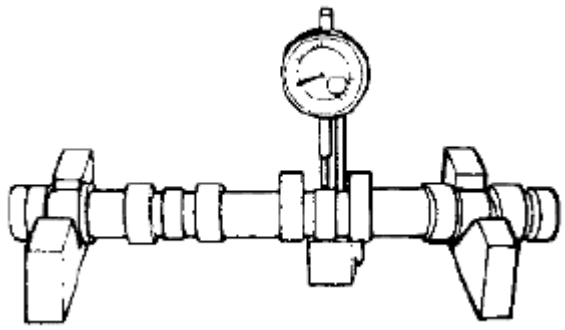


Fig. 126: Measuring Camshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

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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.

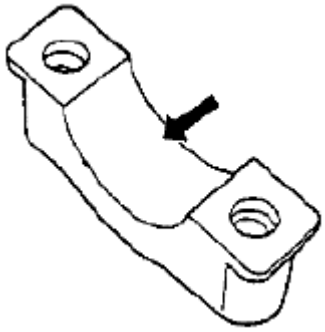


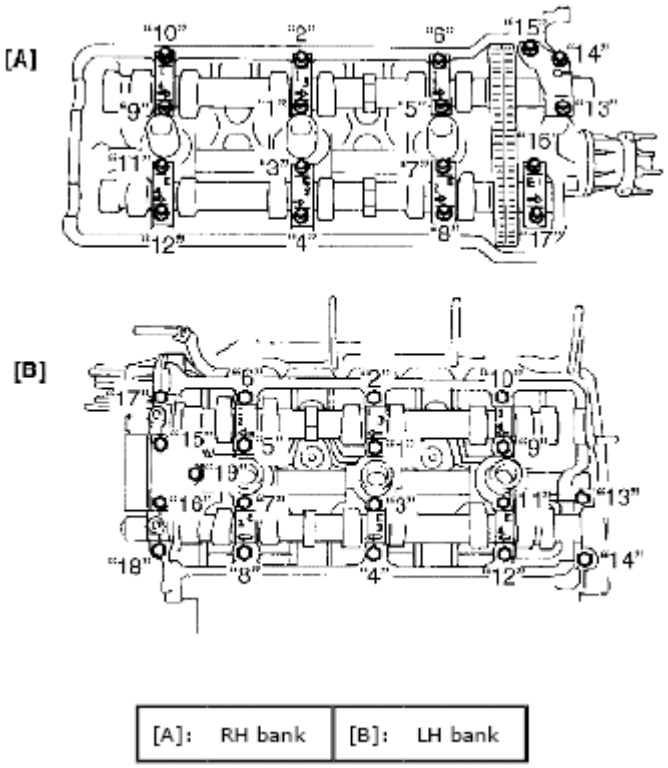
Fig. 127: Identifying Camshaft Journal
Courtesy of SUZUKI OF AMERICA CORP.

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

1. Clean housings and camshaft journals.
2. Make sure that all valve lash adjusters are removed and install camshaft to cylinder head.
3. Place a piece of gauging plastic the full width of journal of camshaft (parallel to camshaft).
4. Install camshaft housing.
5. Tighten camshaft housing bolts in such order ([A]: "1"-->"17", [B]: "1"-->"19") as shown in figure a little at a time till they are tightened to specified torque.

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

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[A]: RH bank	[B]: LH bank

Fig. 128: Identifying Camshaft Housing Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

Camshaft journal clearance

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

Limit: 0.12 mm (0.0047 in.)

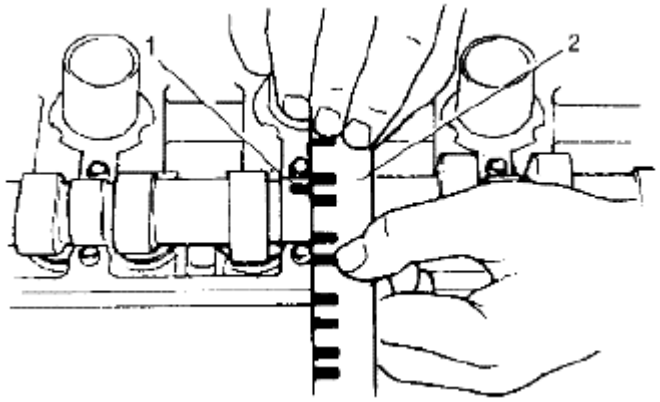


Fig. 129: Identifying Scale & Gauging Plastic

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Courtesy of SUZUKI OF AMERICA CORP.

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

Camshaft journal bore via. (IN and EX)

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

Camshaft journal O.D. (IN and EX)

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

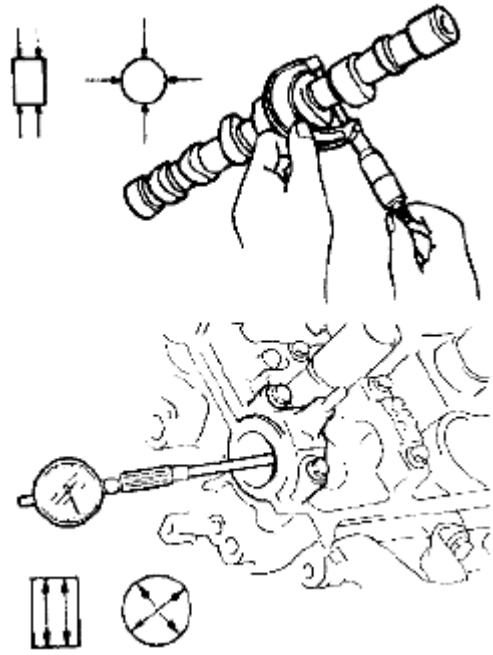


Fig. 130: Measuring Journal (Housing) Bore And Outside Diameter Of Camshaft Journal
Courtesy of SUZUKI OF AMERICA CORP.

VALVE LASH ADJUSTERS INSPECTION

Reference: **CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION**

Check adjuster for pitting, scratches, or damage.

If any malcondition is found, replace.

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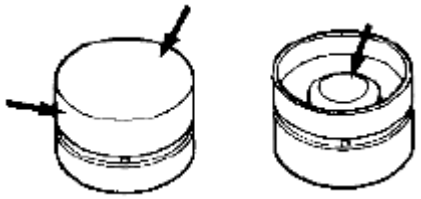


Fig. 131: Inspecting Valve Lash Adjusters
Courtesy of SUZUKI OF AMERICA CORP.

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

Hydraulic valve lash adjuster O.D .

Standard: 30.959 - 30.975 mm (1.2188 - 1.2194 in.)

Cylinder head bore

Standard: 31.000 - 31.025 mm (1.2205 - 1.2214 in.)

Cylinder head to adjuster clearance

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

Limit: 0.15 mm (0.0059 in.)

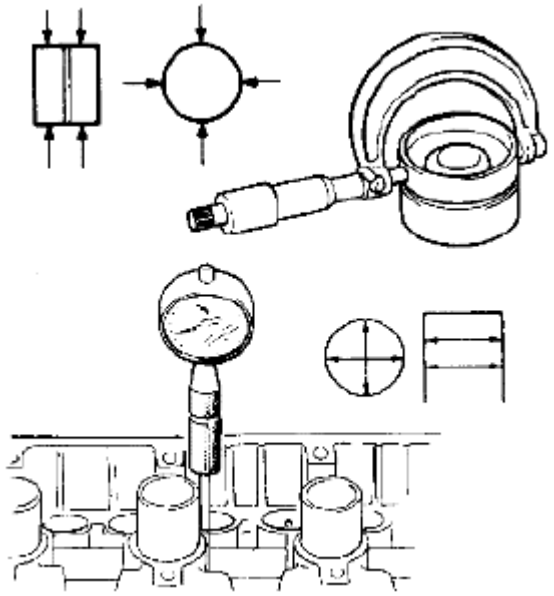


Fig. 132: Measuring Cylinder Head Bore And Adjuster Outside Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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VALVE LASH ADJUSTERS NOISE INSPECTION

In case of the followings, 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.

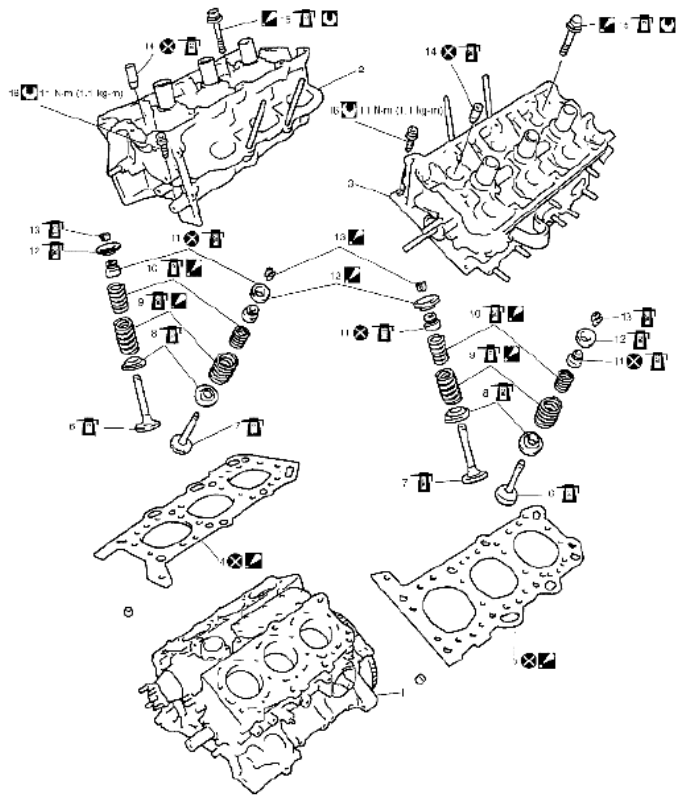
1. Check engine oil for the followings.
    - Oil level in oil pan - If oil level is low, add oil up to full level hole on oil level gauge.
    - Oil quality - If oil is discolored, or deteriorated, change it. For particular oil to be used, refer to **ENGINE OIL AND FILTER CHANGE.**
    - Oil leaks - 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 2000 to 3000 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.
    b. Push adjuster downward by hard (with less than 200 N (20 kg, 44 lbs) of force) when cam crest is not on adjuster to be check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

VALVES AND CYLINDER HEADS COMPONENTS

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1. Cylinder block	8. Valve spring seat	15. Cylinder head bolt : Tighten 53 N·m (5.3 kgf-m, 38.5 lb-ft), 84 N·m (8.4 kgf-m, 61.0 lb-ft), 0 N·m (0 kgf-m, 0 lb-ft), 53 N·m (5.3 kgf-m, 38.5 lb-ft) and 105 N·m (10.5 kgf-m, 76.0 lb-ft) by the specified procedure.
2. RH bank cylinder head	9. Outer valve spring: Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).	16. Cylinder head bolt (hex hole bolt)
3. LH bank cylinder head	Inner valve spring: 10. Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).	Tightening torque :
4. RH bank cylinder head gasket: Carved lot number on cylinder head gasket should face up (toward cylinder head side).	11. Valve stem oil seal	: Do not reuse.
5. LH bank cylinder head gasket: Carved lot number on cylinder head gasket should face up (toward cylinder head side).	12. Valve spring retainer	: Apply engine oil.
6. Exhaust valve	13. Valve cotter	
7. Intake valve	14. Valve guide	

Fig. 133: Identifying Valves And Cylinder Heads Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION

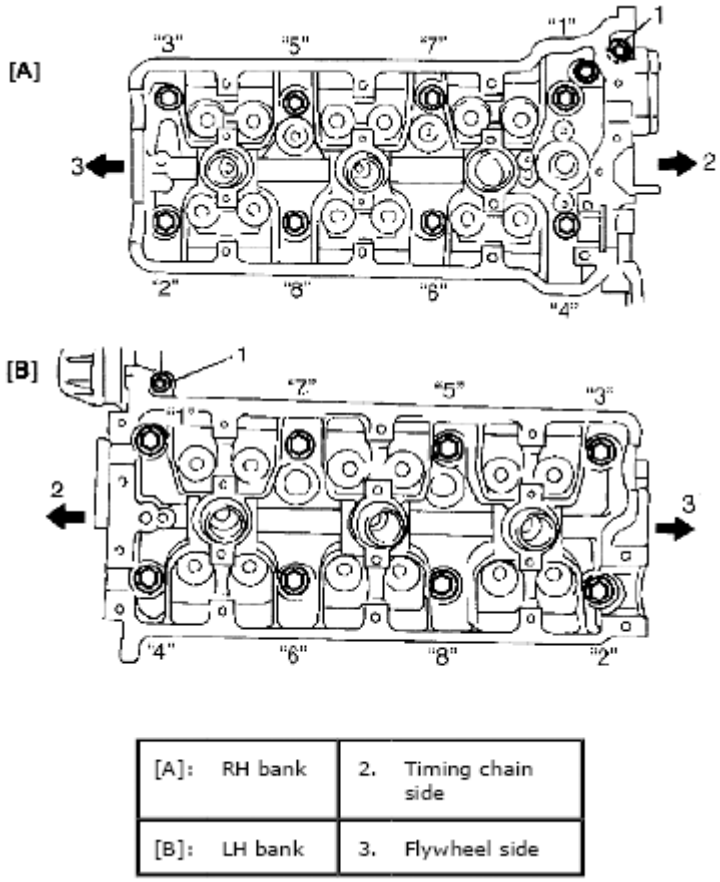
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Reference: **VALVES AND CYLINDER HEADS COMPONENTS**

Removal

1. Relieve fuel pressure according to **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative (-) cable at battery.
3. Drain engine oil.
4. Drain coolant referring to **COOLANT DRAINING** .
5. Remove CMP sensor, camshaft and valve lash adjuster referring to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** for CMP sensor removal and **CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION** for camshaft and valve lash adjuster removal.
6. Remove exhaust manifold referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
7. Remove water outlet cap.
8. Loosen cylinder head bolts in such order ("1"-->"8") as shown in figure and remove them.

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



[A]:	RH bank	2.	Timing chain side
[B]:	LH bank	3.	Flywheel side

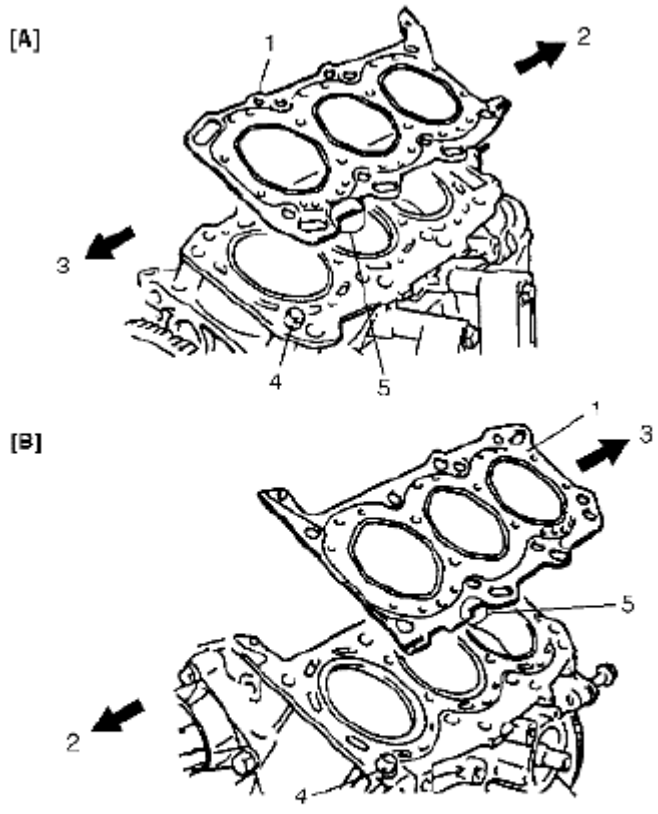
Fig. 134: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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9. Remove cylinder heads.

Installation

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



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

Fig. 135: Identifying Cylinder Head Gasket, Crankshaft Pulley Side, Flywheel Side, Knock Pin & Lot Number
Courtesy of SUZUKI OF AMERICA CORP.

4. Install cylinder head to block.

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

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

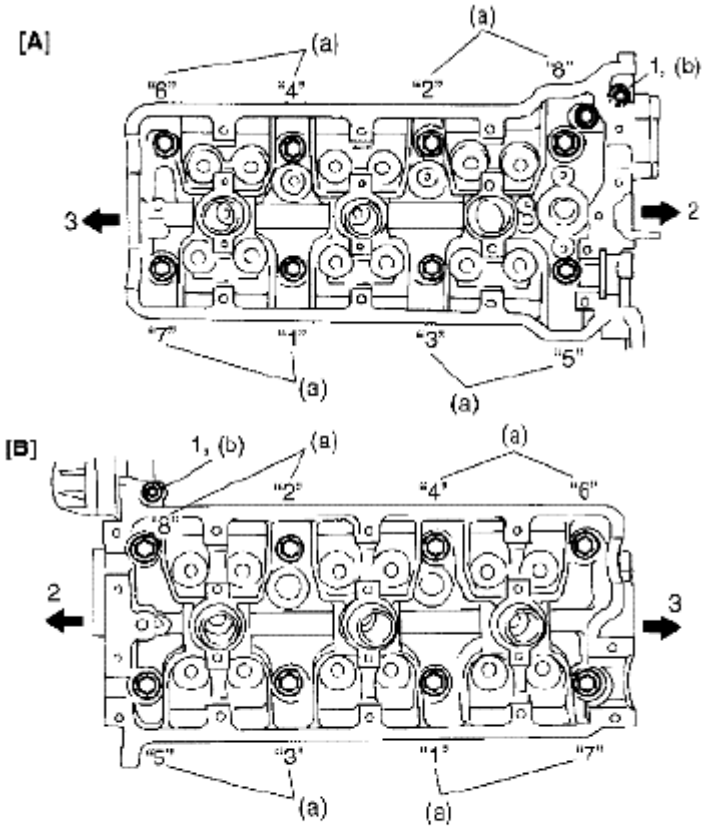
Tightening torque

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

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

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

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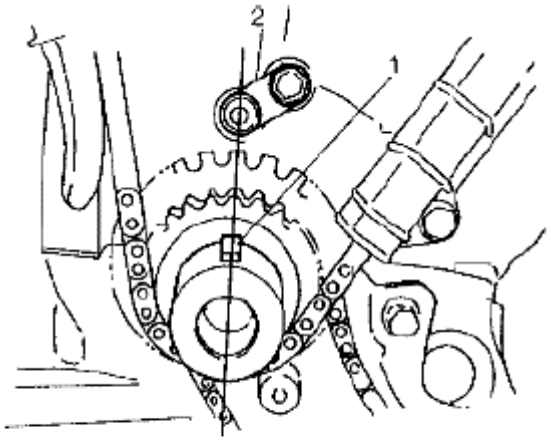


2. Crankshaft pulley side	3. Flywheel side

Fig. 136: Identifying Crankshaft Pulley Side, Flywheel Side & Hex Hole Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

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1. Crank timing pulley key	2. Oil jet

Fig. 137: Identifying Crank Timing Pulley Key & Oil Jet
Courtesy of SUZUKI OF AMERICA CORP.

7. Install valve lash adjuster, camshaft, CMP sensor and RH bank 2nd timing chain.

   Refer to **CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION** and **RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSTALLATION**. For CMP sensor, refer to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL AND INSTALLATION** .

8. Install 1st timing chain referring to **1st Timing Chain and Chain Tensioner Installation**.
9. Install LH bank 2nd timing chain referring to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Installation**.
10. Install timing chain cover referring to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
11. Install oil pan and oil pump strainer referring to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
12. Install cylinder head cover referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
13. Install exhaust manifold referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
14. Install radiator outlet pipe, radiator, cooling fan and water hose.

    Refer to **COOLING WATER PIPES OR HOSES REMOVAL AND INSTALLATION** , **RADIATOR REMOVAL AND INSTALLATION** and **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.** .

15. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
16. Adjust water pump drive belt tension.

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Refer to **COOLING FAN / GENERATOR BELT TENSION CHECK AND ADJUSTMENT** .

17. Adjust power steering pump drive belt tension referring to **P/S PUMP DRIVE BELT INSPECTION AND ADJUSTMENT.** .
18. Adjust accelerator cable play referring to **ACCELERATOR CABLE ADJUSTMENT**
19. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
20. Refill engine with engine oil referring to **ENGINE OIL AND FILTER CHANGE.**
21. Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
22. Refill front differential housing with gear oil if drained referring to **FRONT DIFFERENTIAL GEAR OIL INSPECTION AND CHANGE** : Front.
23. Connect negative (-) cable at battery.
24. Check ignition timing and adjust as necessary referring to **IGNITION TIMING CHECK AND ADJUSTMENT** .
25. Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each connection.
26. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .

VALVES AND CYLINDER HEADS DISASSEMBLY AND ASSEMBLY

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

Disassembly

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

Special Tool

(A): 09916-14510

(B): 09916-14910

(C): 09919-28610

(D): 09916-84511

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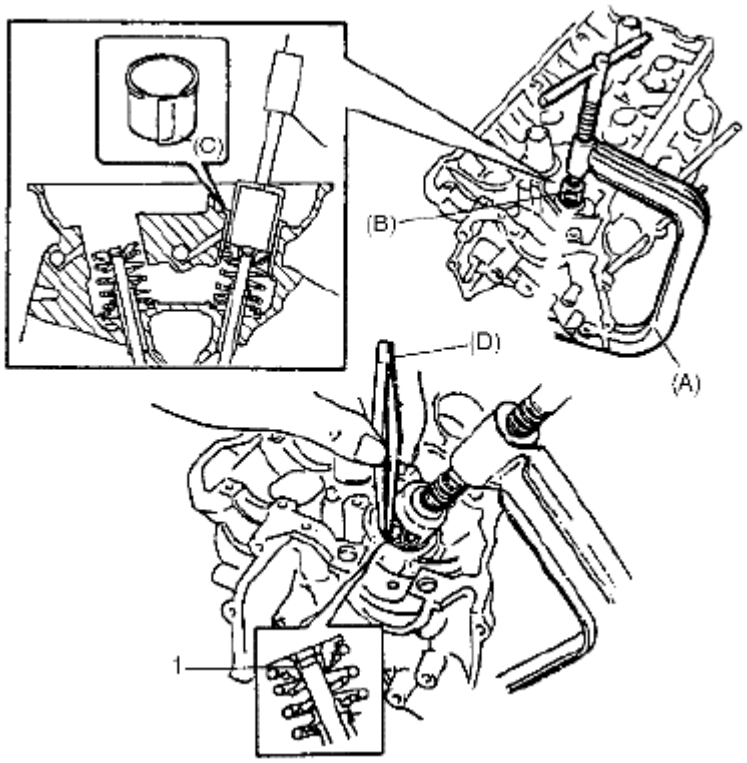


Fig. 138: Identifying Valve Cotters & Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

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

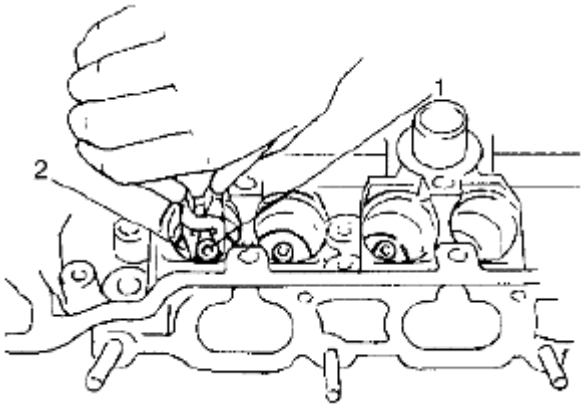


Fig. 139: Identifying Valve Stem Seal And Valve Spring Seat
Courtesy of SUZUKI OF AMERICA CORP.

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

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valve spring side.

Special Tool

(E): 09916-44910

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

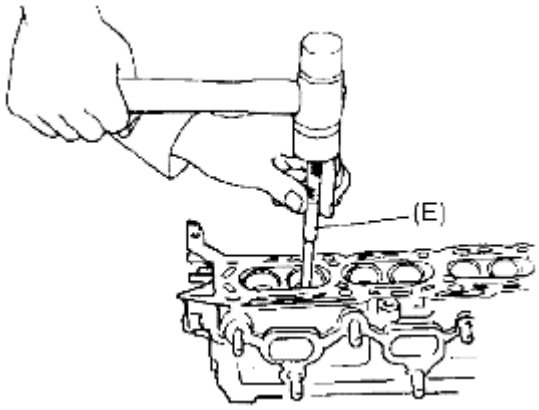


Fig. 140: Driving Out Valve Guide Using Valve Guide Remover
Courtesy of SUZUKI OF AMERICA CORP.

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

Assembly

Reference: **VALVES AND VALVE GUIDES INSPECTION**

Reference: **CYLINDER HEAD INSPECTION**

Reference: **VALVE SPRINGS INSPECTION**

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

   Special Tool

   (E): 09916-34542

   (F): 09916-38210

2. Install valve guide to cylinder head.

   Heat cylinder head uniformly at a temperature of 80 to 100°C (176 to 212°F) so that head will not be

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distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.

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

Special Tool

(G): 09916-58210

(H): 09917-87810

NOTE:

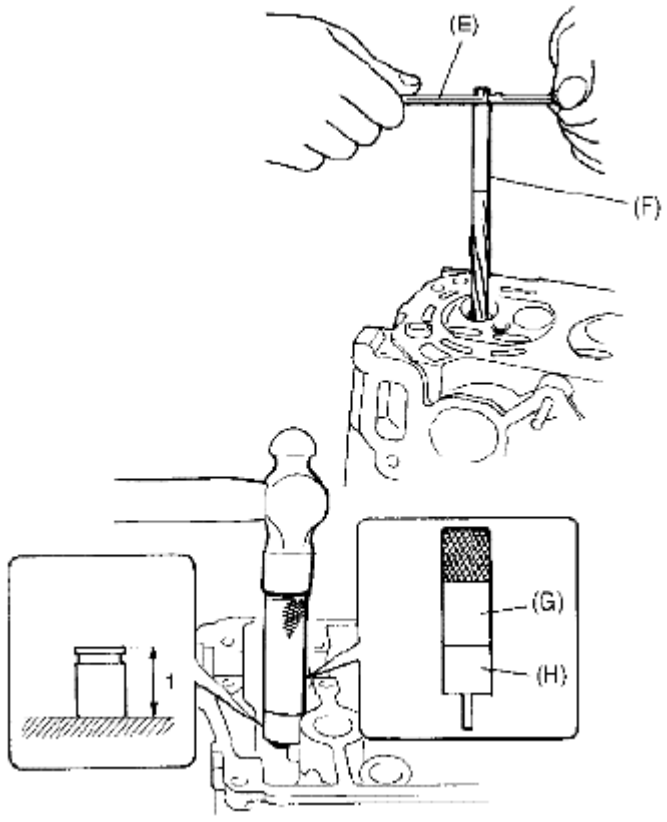
- **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

Width of oversized valve guide

11.088 - 11.103 mm (0.4365 - 0.4371 in.)

Valve guide protrusion (In and Ex)

13.5 mm (0.53 in.)



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Fig. 141: Identifying Valve Guide Protrusion & Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

   Special Tool

   (E): 09916-34542

   (I): 09916-37810

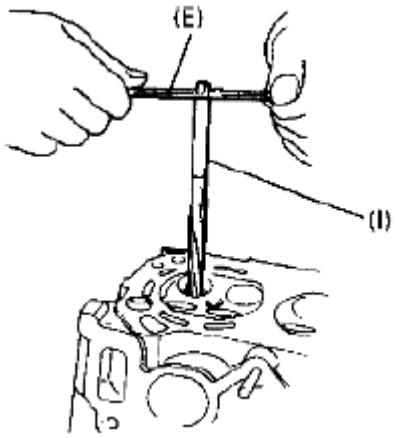


Fig. 142: Reaming Valve Guide Bore With Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

   Special Tool

   (J): 09917-98221

   (K): 09916-58210

NOTE:

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

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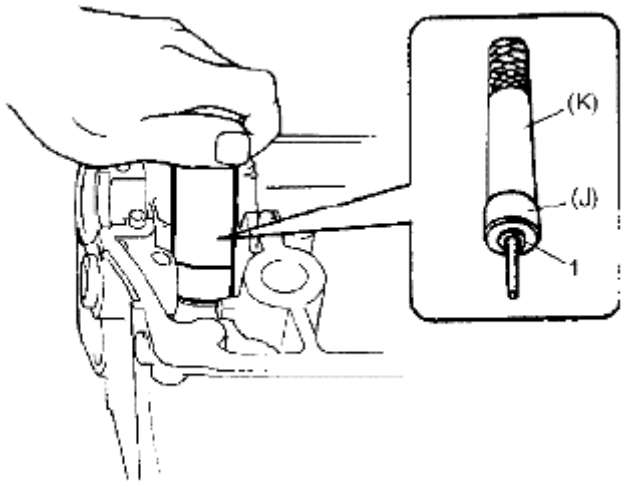


Fig. 143: Identifying Valve Stem Seal & Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

6. Install valve (1) to valve guide.

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

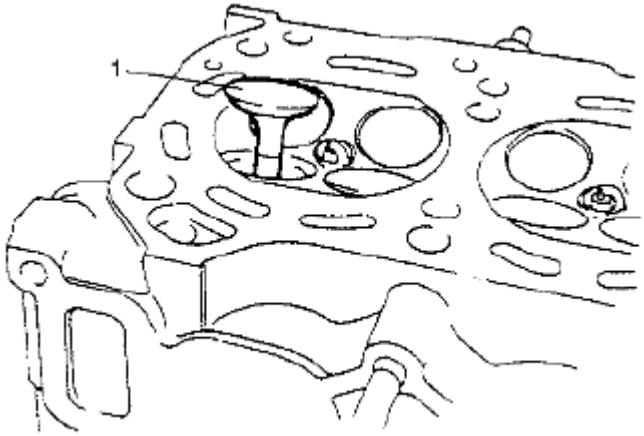


Fig. 144: Identifying Valve
Courtesy of SUZUKI OF AMERICA CORP.

7. Install valve springs (inner and outer) and spring retainer.

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

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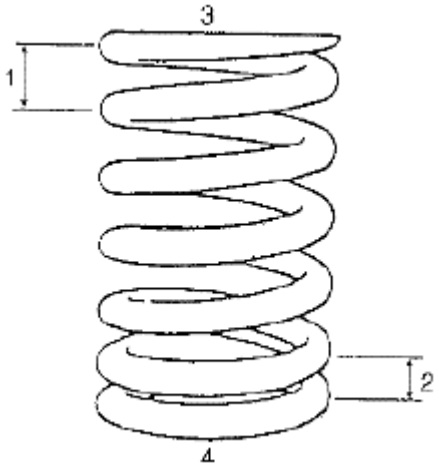


Fig. 145: Identifying Top End And Bottom End Of Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

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

Special Tool

(A): 09916-14510

(B): 09916-14910

(C): 09916-84511

(D): 09919-28610

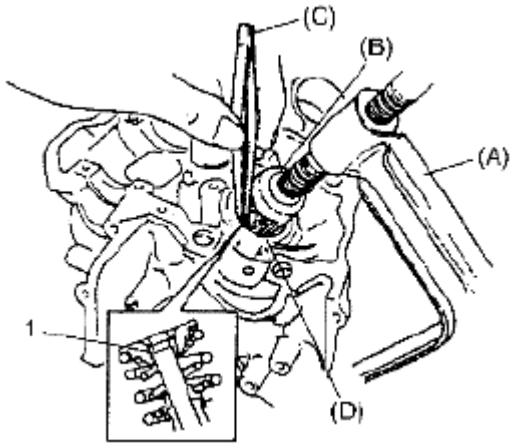


Fig. 146: Identifying Valve Cotters & Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

VALVES AND VALVE GUIDES INSPECTION

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

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

Valve Guides

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

If clearance exceeds limit, replace valve and valve guide.

Valve stem-to-guide clearance

VALVE STEM-TO-GUIDE CLEARANCE SPECIFICATION

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

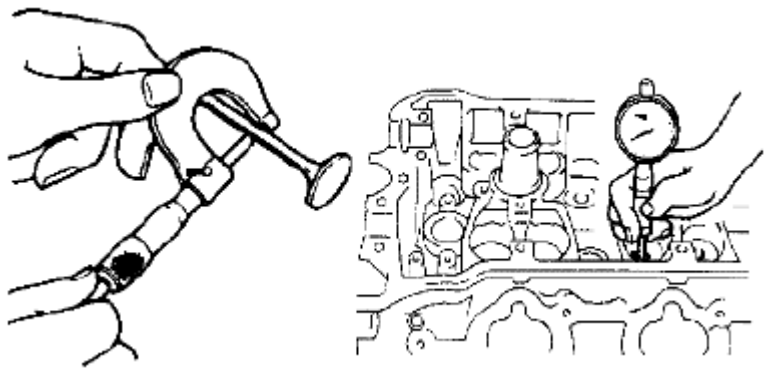


Fig. 147: Measuring Valve Stem & Guide Diameter
Courtesy of SUZUKI OF AMERICA CORP.

Valves

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

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Valve specifications

VALVE SPECIFICATIONS

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

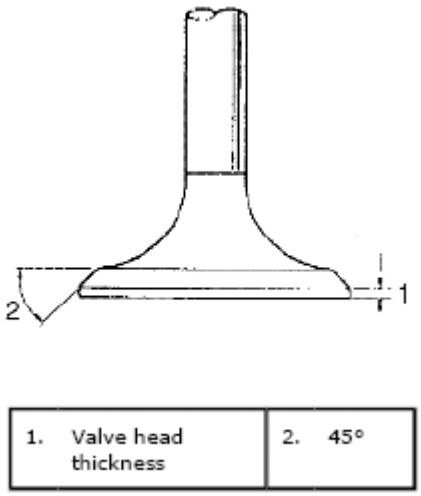


Fig. 148: Identifying Valve Head Thickness
Courtesy of SUZUKI OF AMERICA CORP.

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



Fig. 149: Identifying 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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Valve head radial runout

Limit: 0.08 mm (0.003 in.)

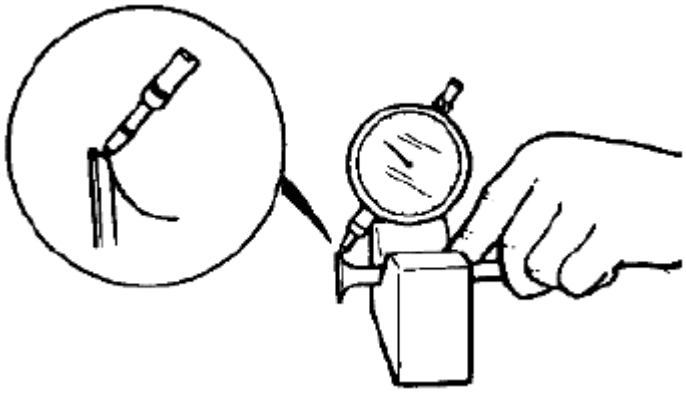


Fig. 150: Checking Valve Head Radial Runout
Courtesy of SUZUKI OF AMERICA CORP.

- Seating contact width

  Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.

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

  Standard seating width revealed by contact pattern on valve face

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

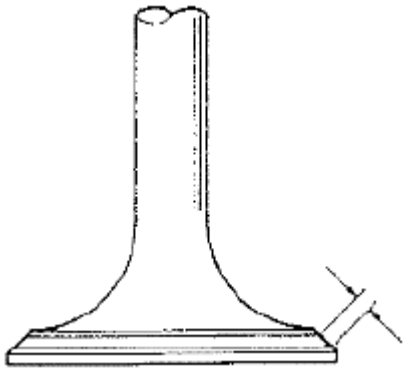


Fig. 151: Identifying Valve Seating Width
Courtesy of SUZUKI OF AMERICA CORP.

- Valve seat repair

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

a. **Exhaust valve seat**

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

Seat width for exhaust valve seat

1.1 - 1.3 mm (0.0433 - 0.0512 in.)

b. **Intake valve seat**

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

Seat width for intake valve seat

1.1 - 1.3 mm (0.0433 - 0.0512 in.)

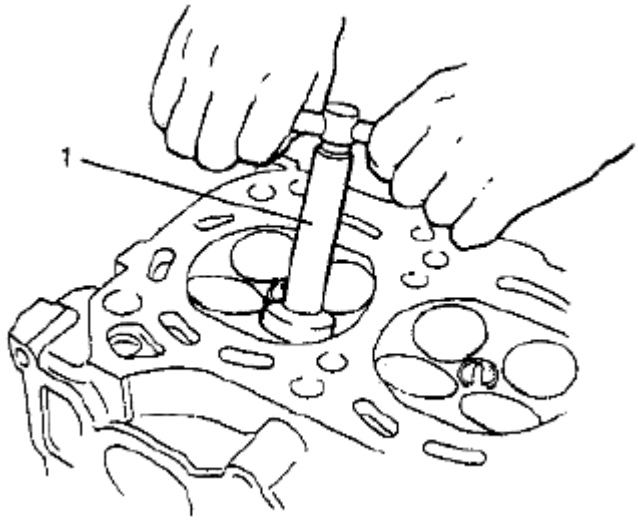
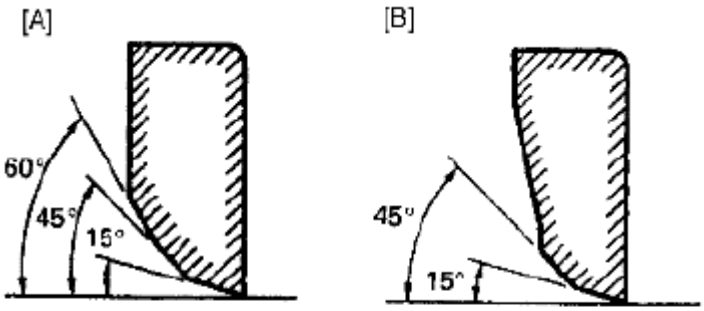


Fig. 152: Identifying Valve Seat Cutter
Courtesy of SUZUKI OF AMERICA CORP.

c. **Valve lapping**

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

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[A]: Intake valve	[B]: Exhaust valve

Fig. 153: Identifying Intake & Exhaust Valve Lapping
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD INSPECTION

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

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

- 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 decarboning. The same applies to valves and valve seats, too.**

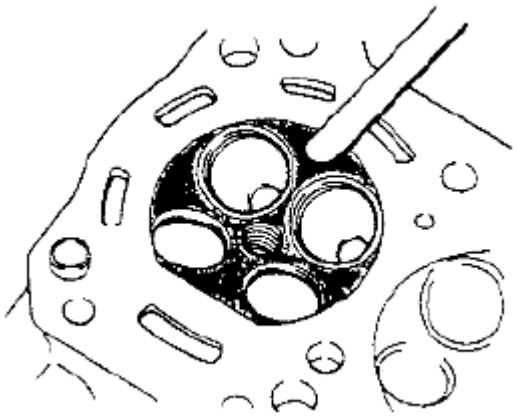


Fig. 154: Removing Carbon From Combustion Chambers
Courtesy of SUZUKI OF AMERICA CORP.

- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface. Using straightedge (1) and thickness gauge (2), check flatness of gasketed surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive

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paper of about #400 (Waterproof silicon carbide abrasive paper): Place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.

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

Cylinder head gasketed surface distortion

Limit: 0.05 mm (0.002 in.)

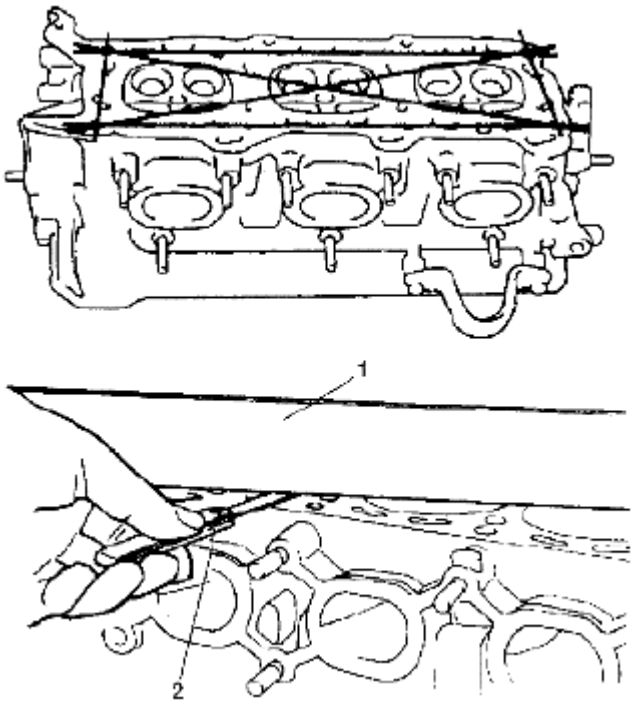


Fig. 155: Checking Flatness Of Gasketed Surface Using Straightedge & Thickness Gauge
Courtesy of SUZUKI OF AMERICA CORP.

- Distortion of manifold seating faces

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

  Manifold seating surface distortion

  Limit: 0.10 mm (0.004 in.)

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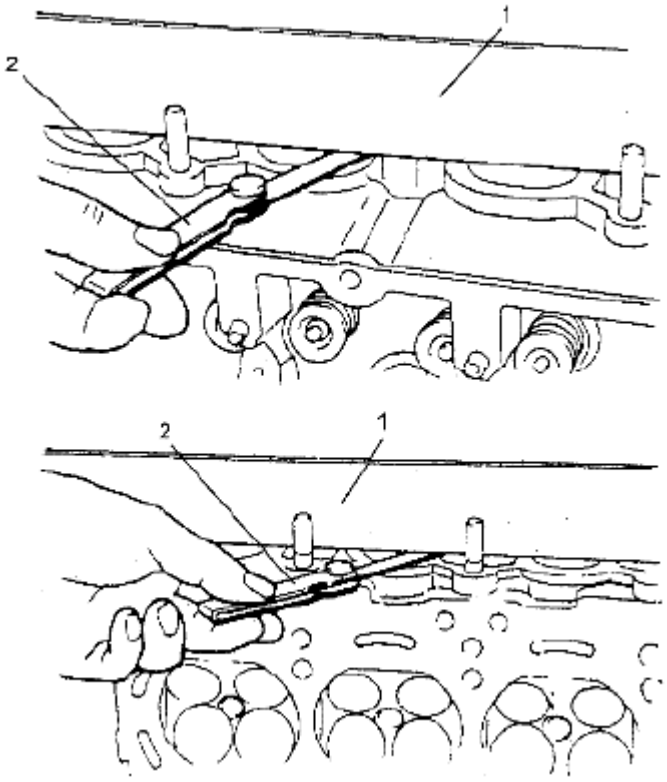


Fig. 156: Checking Seating Faces Of Cylinder Head Using Straightedge & Thickness Gauge
Courtesy of SUZUKI OF AMERICA CORP.

VALVE SPRINGS INSPECTION

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

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

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

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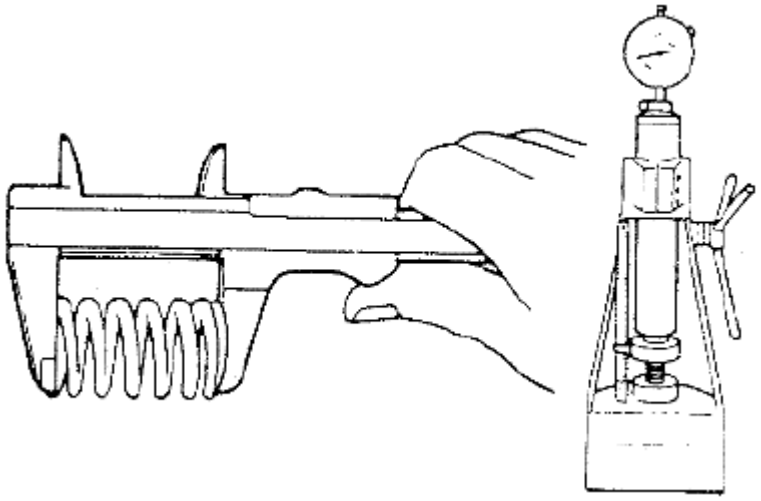


Fig. 157: Inspecting Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

Valve spring free length

VALVE SPRING FREE LENGTH SPECIFICATION

Item	Standard	Limit
Inner	36.08 mm (1.4205 in.)	35.00 mm (1.3780 in.)
Outer	40.44 mm (1.5921 in.)	39.22 mm (1.5441 in.)

Valve spring preload

VALVE SPRING PRELOAD

Item	Standard	Limit
Inner	6.9 - 7.9 kg for 27.5 mm (15.2 - 17.4 lb/1.08 in.)	5.9 kg for 27.5 mm (13.0 lb/1.08 in.)
Outer	15.4 - 17.8 kg for 31.7 mm (34.0 - 39.2 lb/1.25 in.)	13.3 kg for 31.7 mm (29.3 lb/1.25 in.)

- Spring squareness

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

  Valve spring squareness limit

  Inner spring: 1.6 mm (0.063 in.)

  Outer spring: 1.8 mm (0.071 in.)

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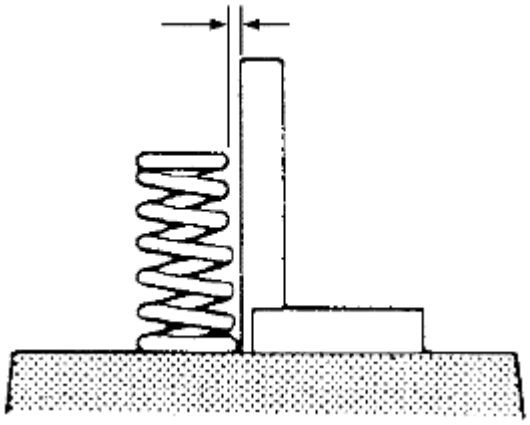
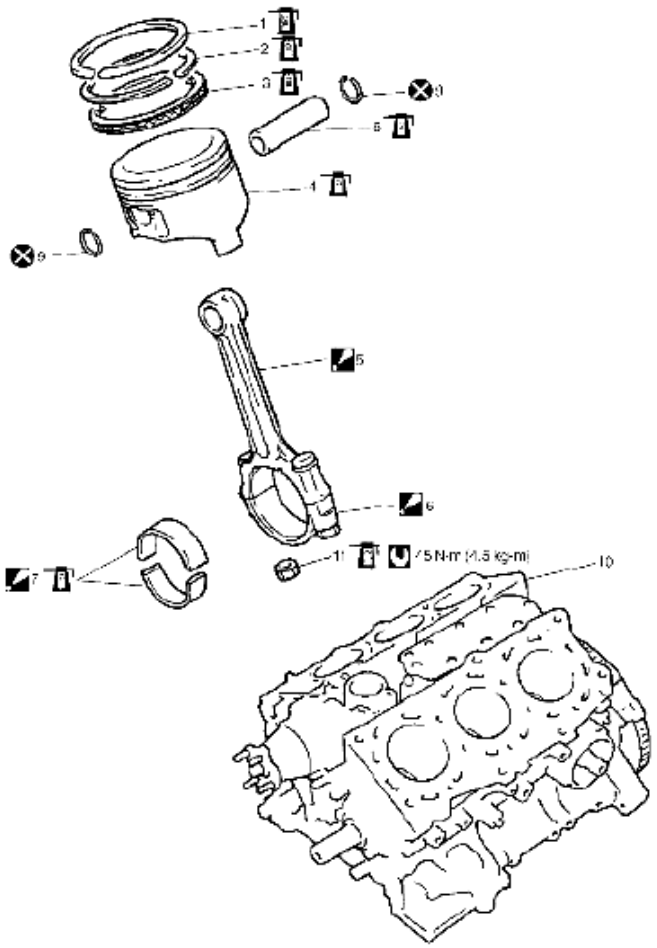


Fig. 158: Checking Valve Spring For Squareness
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS COMPONENTS

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1. Top ring	6. Connecting rod bearing cap: Clean bearing installing surface when install.	11. Bearing cap nut
2. 2nd ring	7. Connecting rod bearing: Apply engine oil to inner surface. Clean outer surface when install.	: Tightening torque
3. Oil ring	8. Piston pin	: Do not reuse.
4. Piston	9. Piston pin circlip	: Apply engine oil.
5. Connecting rod: Clean bearing installing surface when install.	10. Cylinder block	

Fig. 159: Identifying Pistons, Piston Rings, Connecting Rods And Cylinders Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND

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INSTALLATION

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

Removal

1. Disconnect negative (-) cable at battery.
2. Drain engine oil.
3. Drain coolant referring to **COOLANT DRAINING** .
4. Remove cylinder heads. Refer to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
5. Remove oil pump. Refer to **OIL PUMP REMOVAL AND INSTALLATION.**
6. Mark cylinder number on all pistons, connecting rods and connecting rod caps.
7. Remove rod bearing caps.
8. Install guide hose (1) over threads of rod bolts. This prevents damage to bearing journal and rod bolt threads when removing connecting rod.

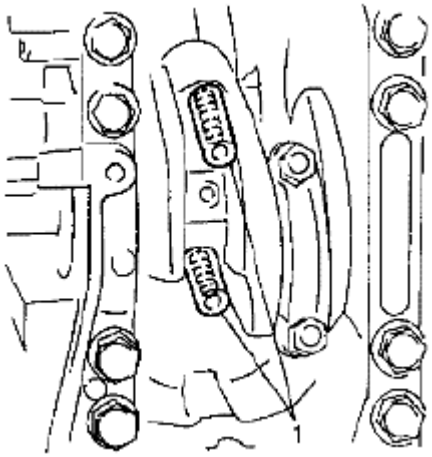


Fig. 160: Identifying Guide Hose
Courtesy of SUZUKI OF AMERICA CORP.

9. Clean carbon from top of cylinder bore before removing piston from cylinder.
10. Push piston and connecting rod assembly out through the top of cylinder bore.

Installation

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

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

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

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

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

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

2. Install guide hoses (1) over connecting rod bolts.

   These guide hoses (1) protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.

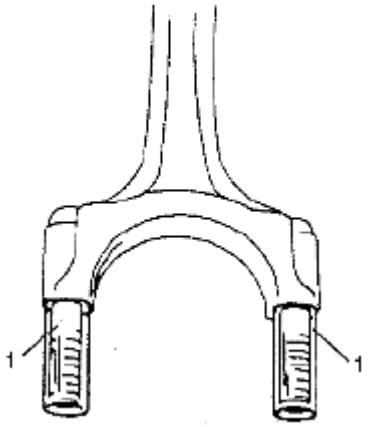


Fig. 161: Identifying Guide Hoses
Courtesy of SUZUKI OF AMERICA CORP.

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

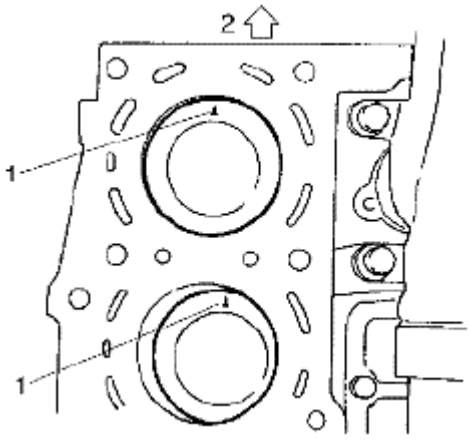


Fig. 162: Identifying Mark On Piston Head & Crankshaft Pulley Side
Courtesy of SUZUKI OF AMERICA CORP.

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

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

   Special Tool

   (A): 09916-77310

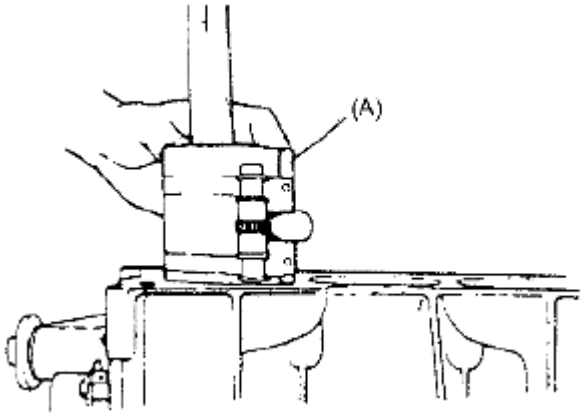


Fig. 163: Compressing Rings Using Piston Ring Compressor
Courtesy of SUZUKI OF AMERICA CORP.

5. Install bearing cap

   Point mark (1) on cap to crankshaft pulley side (2). Tighten cap nuts to specification.

   Tightening torque

   Connecting rod bearing cap nut a: 45 N.m (4.5 kg-m, 32.5 lb-ft)

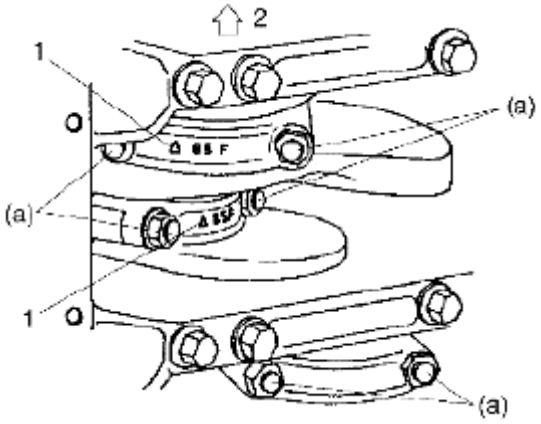


Fig. 164: Identifying Mark On Connecting Rod Bearing Cap, Connecting Rod Bearing Cap Nuts &

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Crankshaft Pulley Side
Courtesy of SUZUKI OF AMERICA CORP.

6. Install cylinder heads to cylinder block referring to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
7. Install oil pump to cylinder block referring to **OIL PUMP REMOVAL AND INSTALLATION.**
8. Install valve lash adjusters and camshafts referring to **CAMSHAFTS AND VALVE LASH ADJUSTERS REMOVAL AND INSTALLATION**.
9. Install RH bank 2nd timing chain referring to **RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER INSTALLATION**.
10. Install 1st timing chain. Refer to **1st Timing Chain and Chain Tensioner Installation**.
11. Install LH bank 2nd timing chain. Refer to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Installation**.
12. Install timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
13. Install oil pan and pump strainer. Refer to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
14. Install cylinder head cover. Refer to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.
15. Install exhaust manifold. Refer to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
16. Install radiator outlet pipe, radiator, cooling fan and water hose.

    Refer to **COOLING WATER PIPES OR HOSES REMOVAL AND INSTALLATION** , **RADIATOR REMOVAL AND INSTALLATION.** and **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.**

17. Install intake manifold with throttle body referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.**.
18. Adjust water pump drive belt tension. Refer to **COOLING FAN / GENERATOR BELT TENSION CHECK AND ADJUSTMENT**
19. Adjust power steering pump drive belt tension. Refer to **DRIVE BELT INSPECTION AND ADJUSTMENT.**
20. Adjust accelerator cable play referring to **ACCELERATOR CABLE ADJUSTMENT**
21. Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
22. Refill engine with engine oil referring to **ENGINE OIL AND FILTER CHANGE.**
23. Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
24. Refill front differential housing with gear oil if drained, referring to **FRONT DIFFERENTIAL GEAR OIL INSPECTION AND CHANGE** : Front.
25. Connect negative cable at battery.
26. Check ignition timing and adjust as necessary, referring to **IGNITION TIMING CHECK AND ADJUSTMENT** .
27. Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each

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connection.

28. Check wheel alignment referring to **FRONT ALIGNMENT INSPECTION AND ADJUSTMENT** .

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS DISASSEMBLY AND ASSEMBLY

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

Disassembly

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

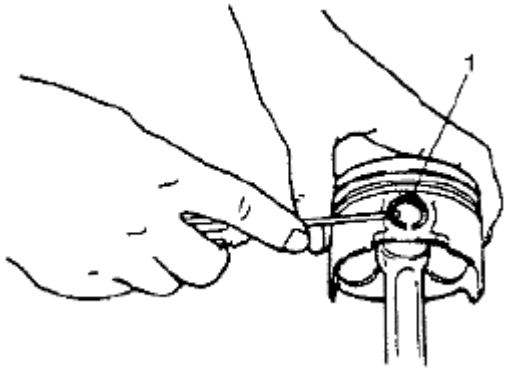


Fig. 165: Identifying Piston Pin Circlips
Courtesy of SUZUKI OF AMERICA CORP.

   b. Force piston pin out.

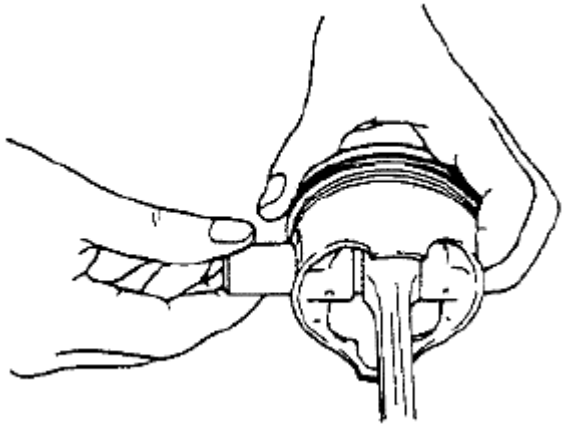


Fig. 166: Removing Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

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Assembly

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

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

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

1. 2 sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.
   a. Each piston has stamped number (1 or 2) on its piston head. It represents outer diameter of piston.
   b. There are also stamped numbers of 1 and 2 on the cylinder block as shown in figure.
   c. Stamped number on piston and cylinder block must correspond. That is, install number "2" stamped piston to cylinder which is stamped also number "2" and a number "1" piston to cylinder with number "1".

   Piston outer diameter

   PISTON OUTER DIAMETER SPECIFICATION

Number at the top (mark)	Outer diameter
1	87.98 - 87.99 mm (3.4638 - 3.4642 in.)
2	87.97 - 87.98 mm (3.4634 - 3.4638 in.)

   Cylinder outer diameter

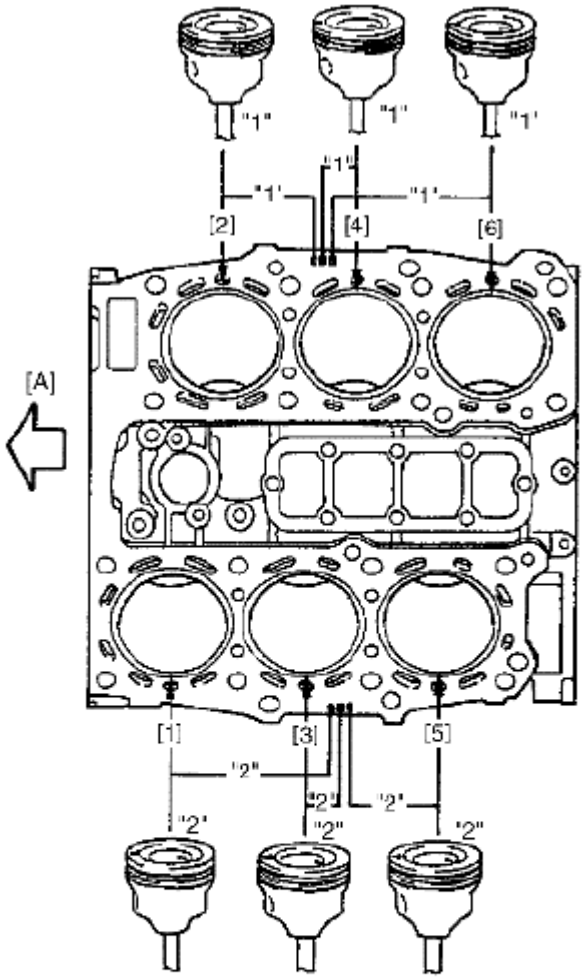
   CYLINDER OUTER DIAMETER SPECIFICATION

Number on cylinder block (mark)	Outer diameter
1	88.01 - 88.02 mm (3.4650 - 3.4653 in.)
2	88.00 - 88.01 mm (3.4646 - 3.4650 in.)

   Piston-to-cylinder clearance

   0.02 - 0.04 mm (0.0008 - 0.0016 in.)

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[1]: No.1 cylinder	[4]: No.4 cylinder	[A]: Crankshaft pulley side
[2]: No.2 cylinder	[5]: No.5 cylinder	
[3]: No.3 cylinder	[6]: No.6 cylinder	

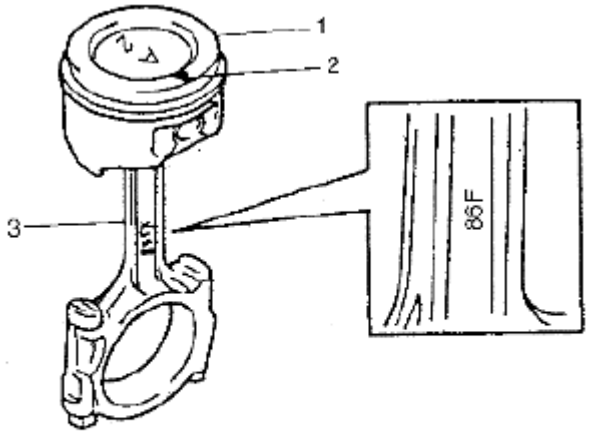
Fig. 167: Identifying Piston Stamped Numbers & Cylinders
Courtesy of SUZUKI OF AMERICA CORP.

2. Install piston pin to piston and connecting rod:

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

   NOTE: "86F" mark on connecting rod must face toward crankshaft pulley side.

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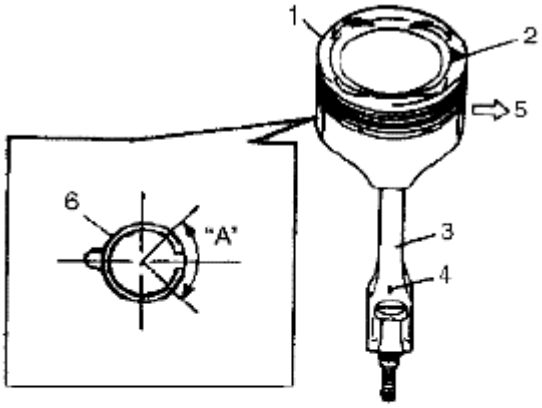


2.	Arrow mark

Fig. 168: Identifying Piston, Arrow Mark & Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

NOTE:

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



1.	Piston	4.	Oil hole
2.	Arrow mark	5.	Crankshaft pulley side
3.	Connecting rod	6.	Circlip

Fig. 169: Identifying Circlip End Gap Range, Piston, Arrow Mark, Connecting Rod, Oil Hole, Crankshaft Pulley Side & Circlip
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

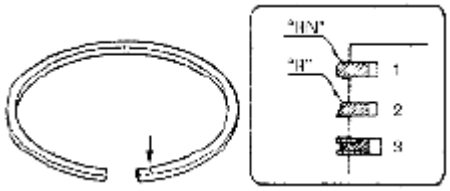
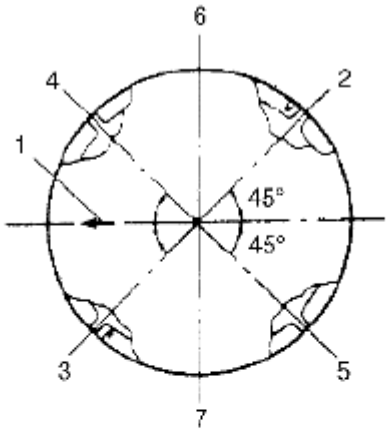


Fig. 170: Identifying Piston Rings & Oil Ring
Courtesy of SUZUKI OF AMERICA CORP.

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



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

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

CYLINDERS, PISTONS AND PISTON RINGS INSPECTION

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

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

NOTE: Before the following inspection, clean carbon from piston head and ring grooves, using a suitable tool.

Cylinders

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

Cylinder bore dia. limit

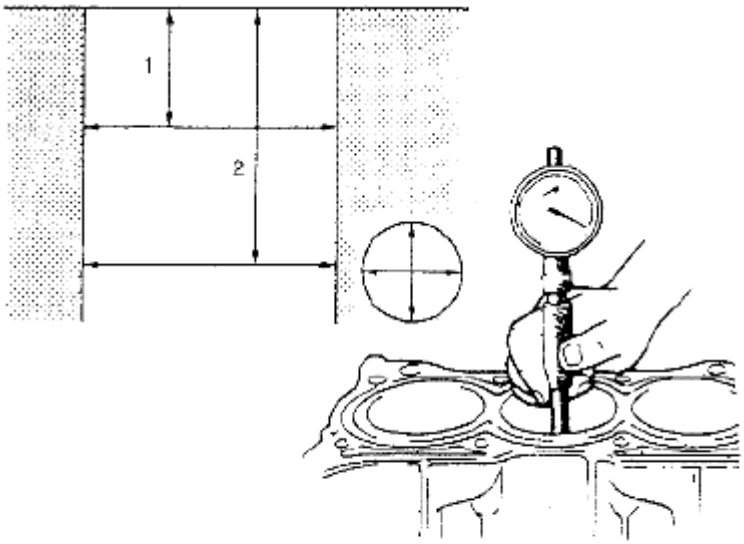
: 88.050 mm (3.4665 in.)

Taper and out-of-round

Limit: 0.10 mm (0.004 in.)

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

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

Fig. 172: Measuring Cylinder Bore Diameter, Taper & Out-Of-Round
Courtesy of SUZUKI OF AMERICA CORP.

Pistons

- Inspect piston for faults, cracks or other damages.

  Damaged or faulty piston should be replaced.

- Piston diameter:

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

  Piston diameter

  Standard: 83.970 - 83.990 mm (3.3059 - 3.3067 in.)

  Oversize 0.50 mm: 84.470 - 84.490 mm (3.3256 - 3.3264 in.)

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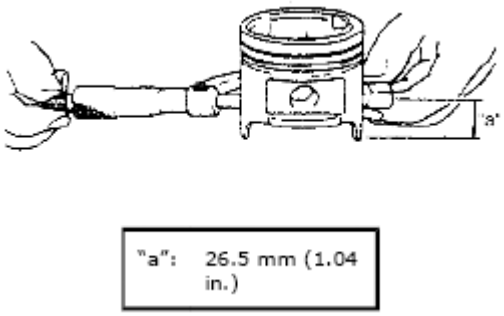


Fig. 173: Measuring Piston Diameter
Courtesy of SUZUKI OF AMERICA CORP.

- Piston clearance:

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

  Piston-to-cylinder clearance

  0.02 - 0.04 mm (0.0008 - 0.0015 in.)

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

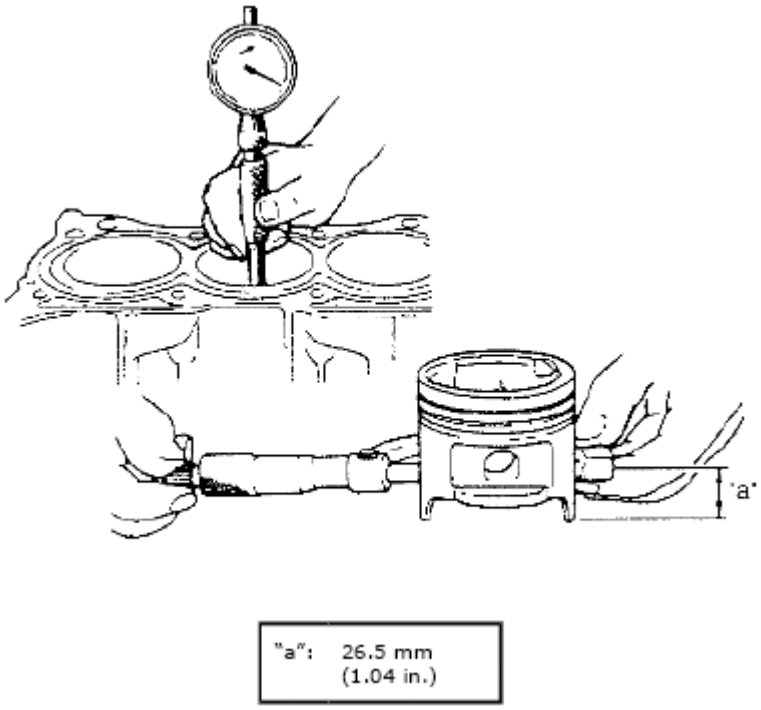


Fig. 174: Identifying Piston-To-Cylinder Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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- Ring groove clearance:

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

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

  Ring groove clearance

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

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

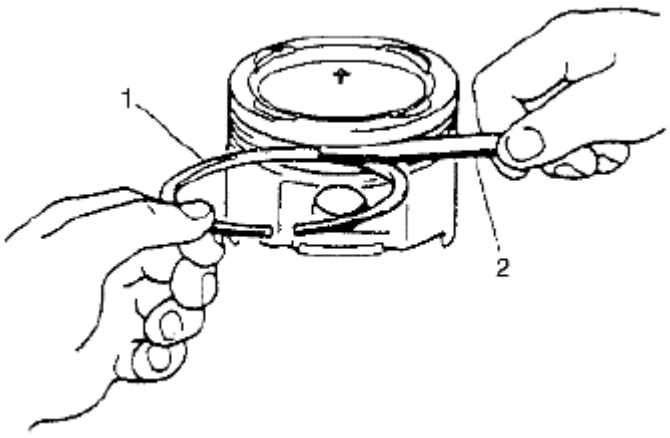


Fig. 175: Identifying Piston Ring & Thickness Gauge
Courtesy of SUZUKI OF AMERICA CORP.

Piston Rings

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

If measure gap is out of specification, replace ring.

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

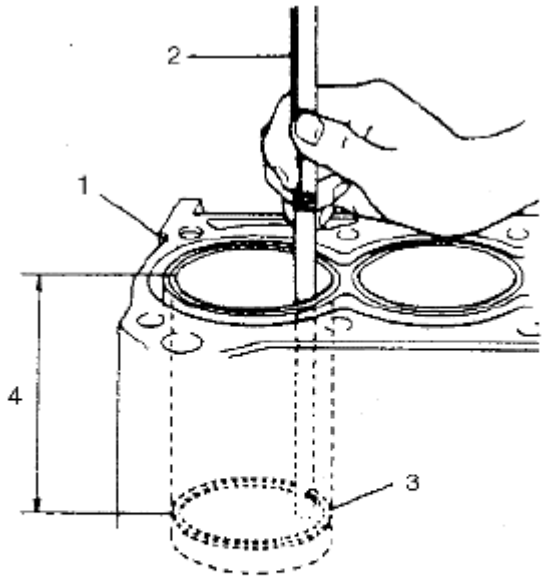
Piston ring end gap

PISTON RING END GAP SPECIFICATION

Item	Standard	Limit
Top ring	0.20 - 0.35 mm (0.0079 - 0.0138 in.)	0.7 mm (0.0276 in.)
2nd ring	0.35 - 0.47 mm (0.0138 - 0.0197 in.)	0.7 mm (0.0276 in.)

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Oil ring	0.20 - 0.70 mm (0.0079 - 0.0276 in.)	1.8 mm (0.0709 in.)



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

Fig. 176: Identifying Cylinder Block, Feeler Gauge, Piston Ring & 120 MM
Courtesy of SUZUKI OF AMERICA CORP.

PISTON PINS AND CONNECTING RODS INSPECTION

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

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

Piston Pins

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

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

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Piston pin clearance in small end

0.003 - 0.014 mm (0.0001 - 0.0006 in.)

Small-end bore

21.003 - 21.011 mm (0.8269 - 0.8272 in.)

Piston pin diameter

20.997 - 21.000 mm (0.8267 - 0.8268 in.)

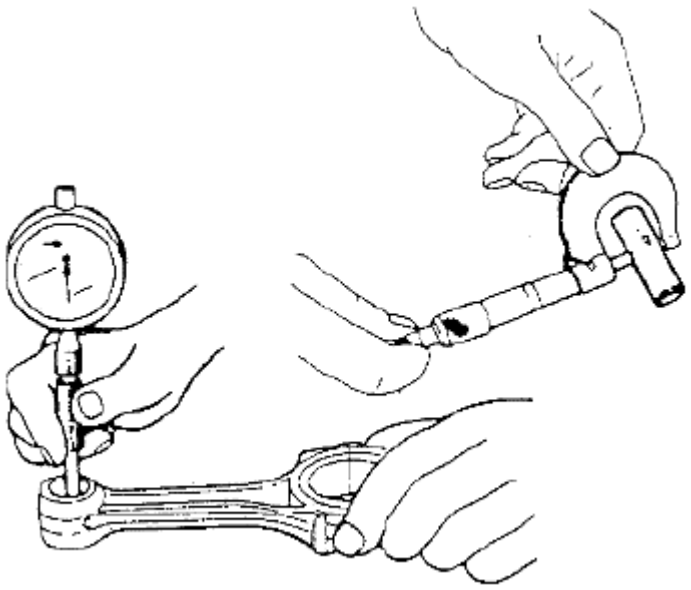


Fig. 177: Measuring Piston Pin Diameter, Small-End Bore & Piston Pin Clearance In Small End
Courtesy of SUZUKI OF AMERICA CORP.

Connecting Rods

- Big-end side clearance:

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

  Big-end side clearance

  Standard: 0.25 - 0.35 mm (0.0098 - 0.0138 in.)

  Limit: 0.45 mm (0.0177 in.)

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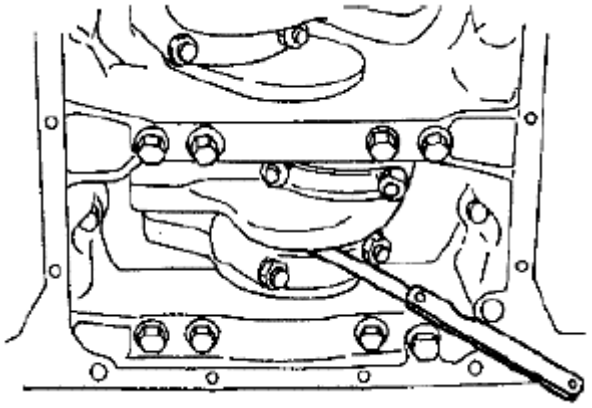


Fig. 178: Checking Big-End Of Connecting Rod For Side Clearance
Courtesy of SUZUKI OF AMERICA CORP.

- Connecting rod alignment:

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

  Connecting rod alignment

  Limit on bow: 0.05 mm (0.0020 in.)

  Limit on twist: 0.10 mm (0.0039 in.)

CRANK PINS AND CONNECTING ROD BEARINGS INSPECTION

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

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

- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin then inspect rod bearing clearance referring to "Rod bearing clearance".

  Crank pin diameter

  CRANK PIN DIAMETER SPECIFICATION

Connecting rod bearing size	Crank pin diameter
Standard	49.982 - 50.000 mm (1.9678 - 1.9685 in.)
0.25 mm (0.0098 in.) undersize	49.732 - 49.750 mm (1.9580 - 1.9587 in.)

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

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Limit: 0.01 mm (0.0004 in.)

Crank pin taper (c - d)

Limit: 0.01 mm (0.0004 in.)

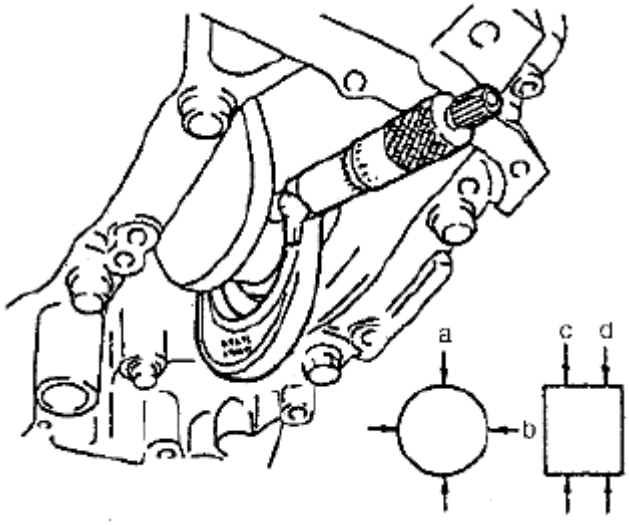


Fig. 179: Measuring Crank Pin For Out-Of-Round Or Taper With Micrometer
Courtesy of SUZUKI OF AMERICA CORP.

- **Connecting rod bearing general information:**

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

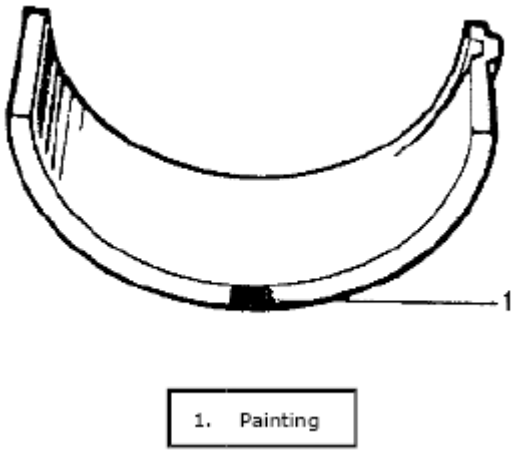


Fig. 180: Identifying Red Painting On Undersize Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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- **Connecting rod bearing visual inspection:**

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

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

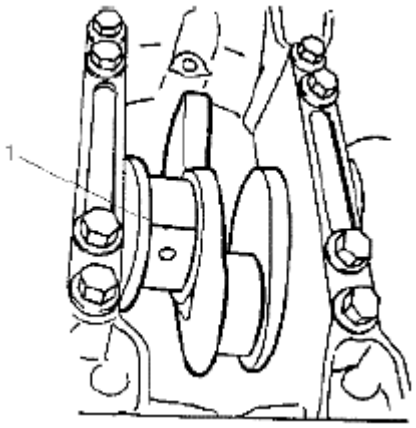


Fig. 181: Identifying Gaging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

  d. Install rod bearing cap to connecting rod.

  When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, as shown in figure.

  After applying engine oil to rod bolts, tighten cap nuts to specified torque.

  Tightening torque

  Connecting rod bearing cap nut a: 45 N.m (4.5 kg-m, 32.5 lb-ft)

  NOTE: DO NOT turn crankshaft with gaging plastic installed.

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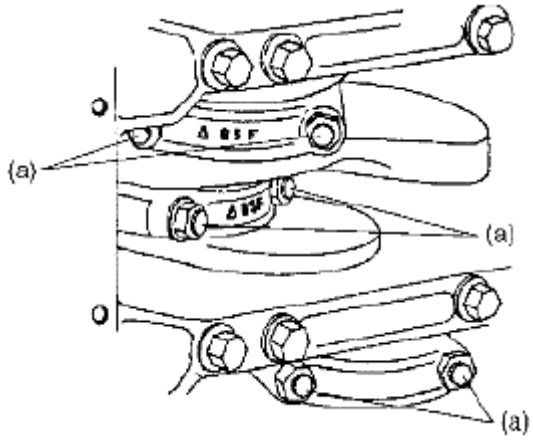


Fig. 182: Identifying Connecting Rod Bearing Cap Nuts
Courtesy of SUZUKI OF AMERICA CORP.

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

   If clearance exceed its limit, use a new standard size bearing referring to "Selection of Connecting Rod Bearings" in this section.

   After selecting new bearing, recheck clearance.

   Bearing clearance

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

   Limit: 0.08 mm (0.0031 in.)

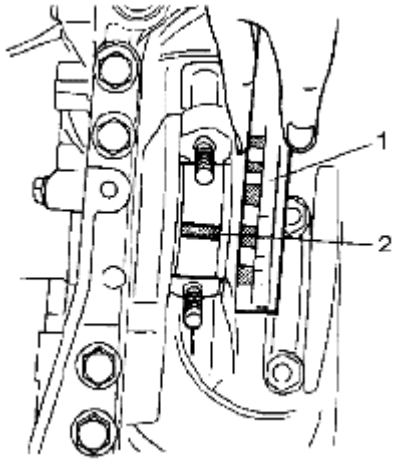


Fig. 183: Identifying Scale & Gaging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

f. If clearance can not be brought to within its limit even by using a new standard size bearing,

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regrind crankpin to undersize and use 0.25 mm undersize bearing as follows.

i. Install 0.25 mm undersize bearing to connecting rod big end.
ii. Measure bore diameter of connecting rod big end.
iii. Regrind crank pin to following finished diameter:

Finished crank pin dia. = Measured big end bore dia. (including under-size bearing) - 0.054 mm (0.0021 in.)

iv. Confirm that bearing clearance is within above standard value.

- **Selection of connecting rod bearings:**

NOTE:

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

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

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

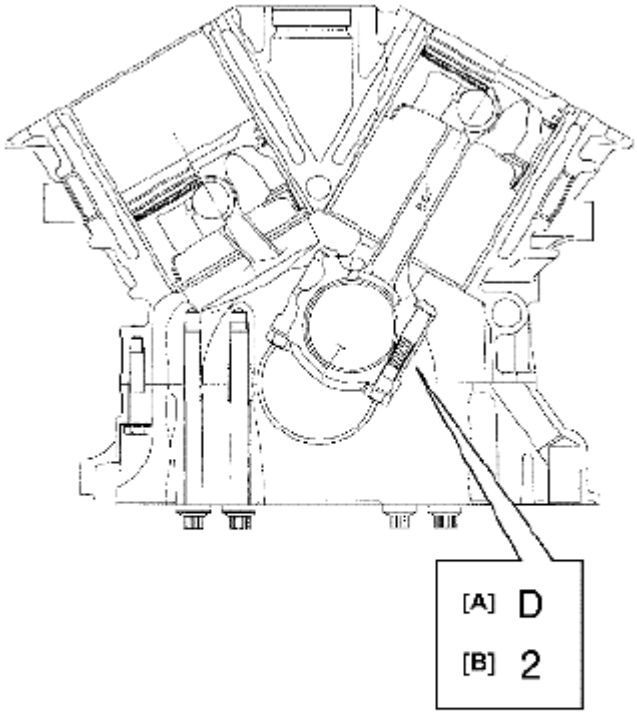
For example, stamped number "1" indicates that corresponding connecting rod big end inside diameter is 53.0000 - 53.0060 mm (2.0867 - 2.0868 in.).

Connecting rod big end inside diameter

CONNECTING ROD BIG END INSIDE DIAMETER SPECIFICATION

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

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[A]:	Weight indication mark
[B]:	Connecting rod big end inside diameter number

Fig. 184: Identifying Weight Indication Mark And Connecting Rod Big End Inside Diameter Number
Courtesy of SUZUKI OF AMERICA CORP.

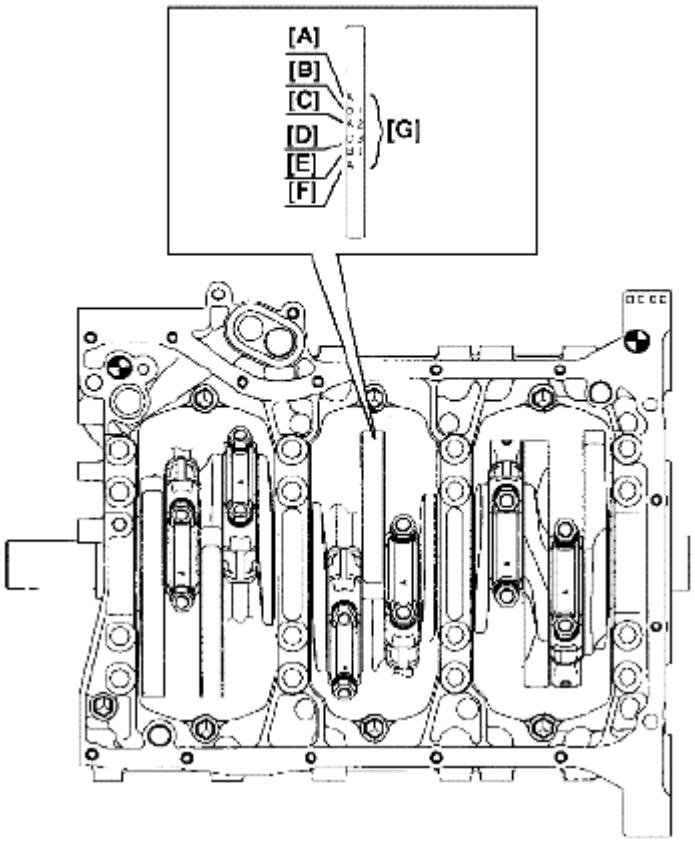
b. Next, check crankshaft pin diameter. On crank web No.3, six alphabets are stamped as shown in figure. Three kinds of alphabet ("A", "B" and "C") represent the following crankshaft pin diameter respectively. For example, stamped "A" indicates that corresponding crankshaft pin diameter is 49.9940 -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

Crankshaft pin diameter

CRANKSHAFT PIN DIAMETER SPECIFICATION

Stamped alphabet	Crankshaft pin diameter
A	49.9940 - 50.0000 mm (1.9683 - 1.9685 in.)
B	49.9880 - 49.9939 mm (1.9681 - 1.9682 in.)
C	49.9820 - 49.9879 mm (1.9677 - 1.9680 in.)

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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
[E]:	Crankshaft pin diameter for No.5 cylinder
[F]:	Crankshaft pin diameter for No.6 cylinder
[G]:	Crank main shaft outside diameter tolerance mark

Fig. 185: Identifying Crankshaft Pin Diameter For Cylinders
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Standard size of connecting rod bearing thickness

STANDARD SIZE OF CONNECTING ROD BEARING THICKNESS

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

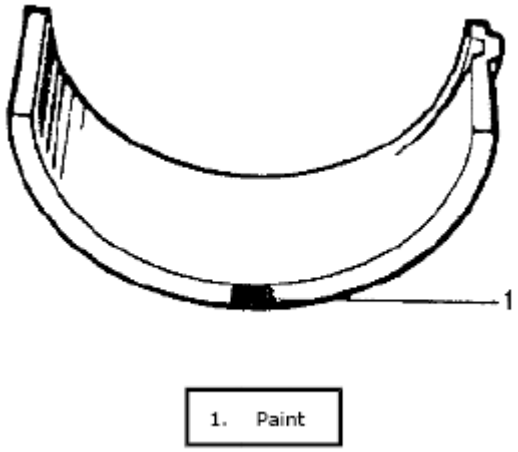


Fig. 186: Identifying Paint Mark On Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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

Specification of new standard connecting rod bearing size

SPECIFICATION OF NEW STANDARD CONNECTING ROD BEARING SIZE

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

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e. Check bearing clearance with newly selected standard bearing referring to "Selection of Connecting Rod Bearing" under "Connecting Rod Bearings" in this section.

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

ENGINE ASSEMBLY REMOVAL AND INSTALLATION

Removal

1. Release fuel pressure in fuel feed line referring to **FUEL PRESSURE RELIEF PROCEDURE** .
2. Disconnect negative (-) cable at battery.
3. Remove engine hood.
4. Drain engine oil.
5. Drain coolant referring to **COOLANT DRAINING** .
6. Remove radiator, radiator fan shroud, cooling fan and radiator reservoir. Refer to **COOLING FAN AND FAN CLUTCH REMOVAL AND INSTALLATION.**
7. Disconnect accelerator cable (1) from throttle body.

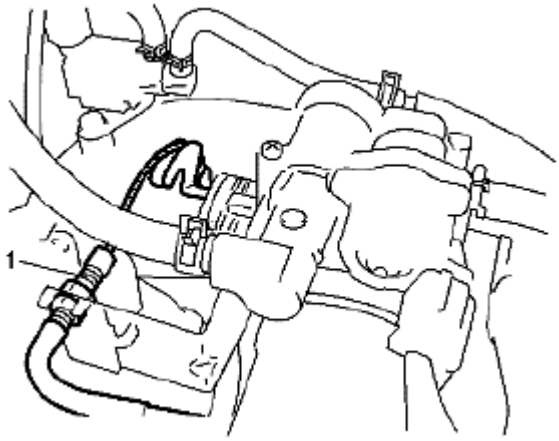


Fig. 187: Identifying Accelerator Cable
Courtesy of SUZUKI OF AMERICA CORP.

8. Detach fuse/relay box, then remove strut tower bar and surge tank cover.
9. Disconnect IAT sensor coupler and MAF sensor coupler then remove air cleaner upper case, intake air hose, intake air pipe and surge tank pipe as a component.
10. Remove intake control valve, referring to **THROTTLE BODY REMOVAL AND INSTALLATION**.
11. Remove engine oil level gauge guide and A/T fluid level gauge guide (for A/T vehicle).
12. Remove ignition coil covers.
13. Disconnect the following electric lead wires:
    - Injector wire coupler
    - CMP sensor coupler

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- Ignition coil couplers
- CKP sensor coupler
- MAP sensor coupler
- TP sensor (1) coupler
- IAC valve (2) coupler
- Earth wire (3) from surge tank
- EVAP canister purge valve (5) coupler
- EGR valve (6) coupler
- Oxygen sensor-1 and -2 couplers (Refer to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**)
- Coolant temperature sensor coupler
- Knock sensor coupler
- Generator wires
- Starter wires
- Oil pressure wire
- P/S pump wire
- Earth wire from generator bracket
- Engine block heater (if equipped)

14. Remove clamps and brackets (4).
15. Disconnect the following hoses:
    - Heater hose (7) from heater water pipe and water outlet cap
    - Tank pressure control solenoid valve hose from intake manifold
    - EVAP canister hose from canister purge pipe
    - Brake booster vacuum hose
16. Remove EVAP canister purge valve (5).

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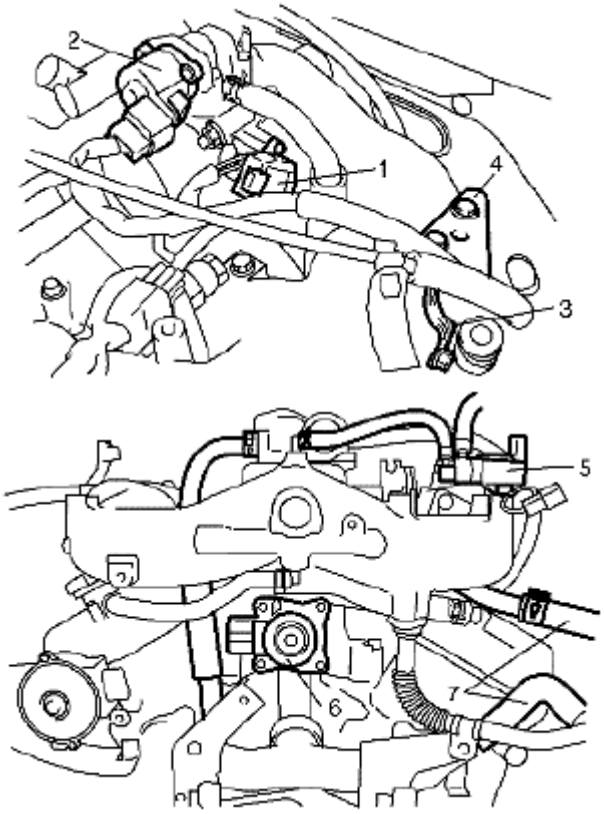


Fig. 188: Identifying TP Sensor, IAC Valve, Wire, EVAP Canister Purge Valve, EGR Valve, Brackets And Heater Hose
Courtesy of SUZUKI OF AMERICA CORP.

17. Disconnect the following hoses at the location shown in figure:
    - Fuel feed hose (1) from fuel feed pipe
    - Fuel return hose (2) from fuel return pipe

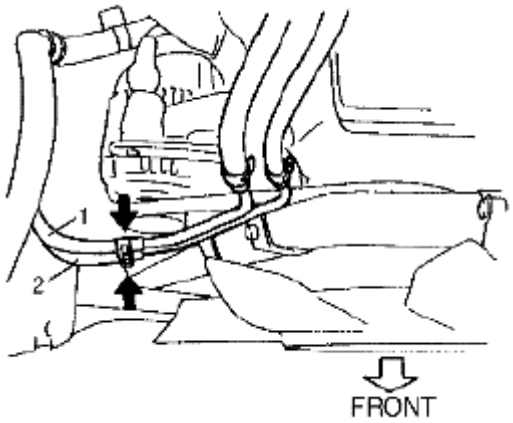


Fig. 189: Identifying Fuel Feed Hose And Return Hose
Courtesy of SUZUKI OF AMERICA CORP.

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18. Remove P/S pump assembly referring to **P/S PUMP REMOVAL AND INSTALLATION.**
19. Remove A/C compressor assembly referring to **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** : Manual Type, Compressor Assembly Removal and Installation: Automatic Type.
20. Remove steering shaft lower assembly referring to **STEERING LOWER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
21. Raise vehicle.
22. Remove front differential housing with differential from chassis if equipped. Refer to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front.
23. Remove exhaust No.1 pipe referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
24. Remove exhaust manifold stiffener from transmission.
25. Remove A/T fluid hose clamps (1) from engine mounting bracket (2). (for A/T vehicle)

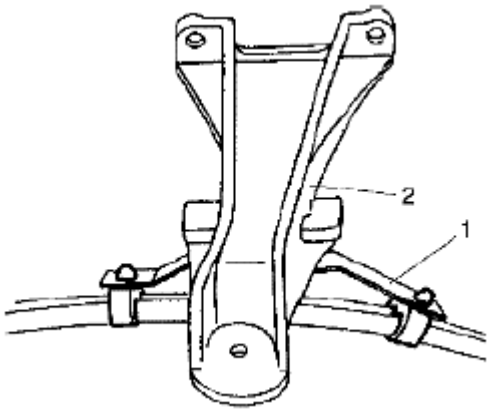


Fig. 190: Identifying A/T Fluid Hose Clamps And Engine Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

26. Remove clutch housing lower plate.
27. Remove torque converter bolts (for A/T vehicle).
28. Remove starter motor.
29. Lower vehicle.
30. Support transmission.

CAUTION: Do not support A/T by placing a jacking equipment under oil pan. If may damage to A/T.

31. Remove bolts and nuts fastening cylinder block and transmission.

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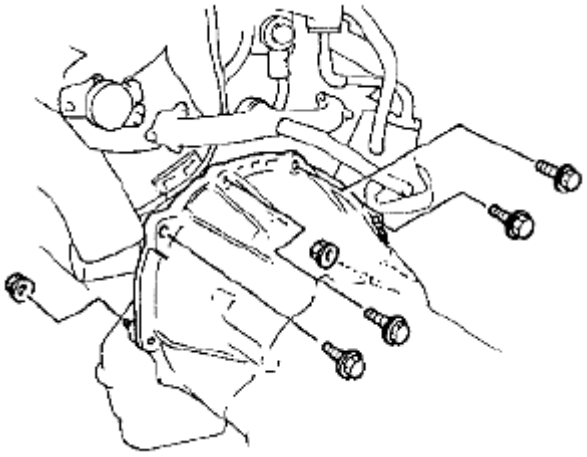


Fig. 191: Identifying Transmission Case Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

32. Install lifting device.
33. Disconnect engine side mounting brackets (1) from engine mountings (2) by removing nuts (3).

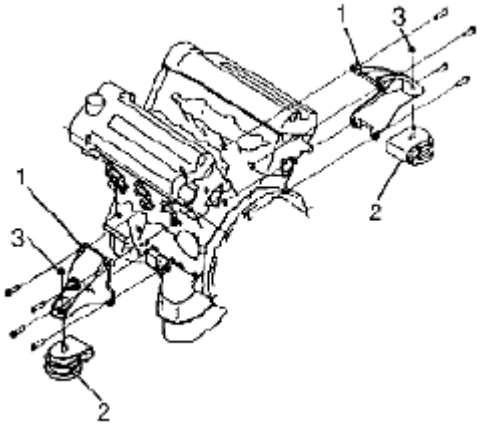


Fig. 192: Identifying Engine Side Mounting Brackets, Engine Mountings & Nuts
Courtesy of SUZUKI OF AMERICA CORP.

34. Before lifting engine, check to ensure all hoses, wires and cables are disconnected from engine.
35. Remove engine assembly from chassis and transmission by sliding toward front, and then, carefully hoist engine assembly.

Installation

Reverse removal procedure for installation noting the following points.

- Tighten engine side mounting bracket nuts to specified torque.

  Tightening torque

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

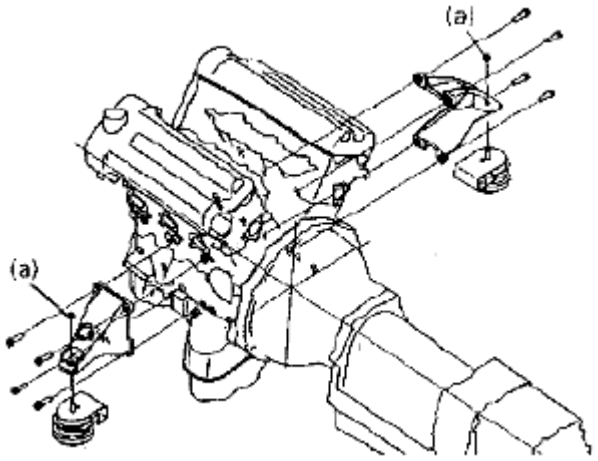


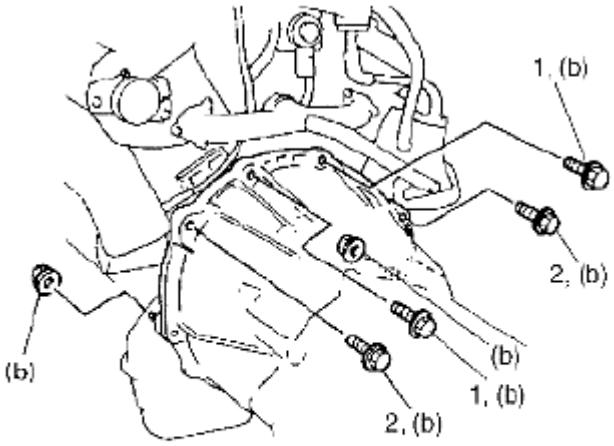
Fig. 193: Identifying Engine Side Mounting Bracket Nuts
Courtesy of SUZUKI OF AMERICA CORP.

- Tighten transmission case bolts and nuts to specified torque.

Tightening torque

Transmission case bolt and nut b: 85 N.m (8.5 kg-m, 61.5 lb-ft) (for M/T vehicle)

Transmission case bolt and nut b: 80 N.m (8.0 kg-m, 58.0 lb-ft) (for A/T vehicle)



1.	Bolt (short)	2.	Bolt (Long)

Fig. 194: Identifying Transmission Case Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

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- Tighten torque converter bolts to specified torque (for A/T vehicle).

  Tightening torque

  Torque converter bolt c: 65 N.m (6.5 kg-m, 47.0 lb-ft)

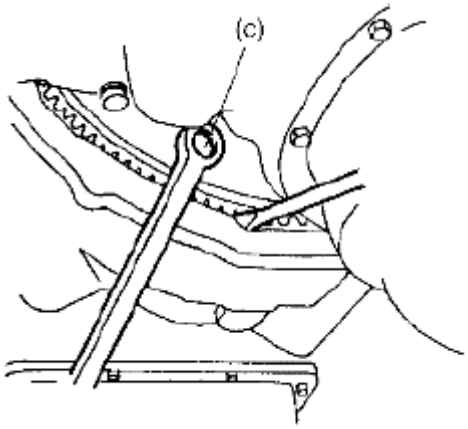


Fig. 195: Identifying Torque Converter Bolts
Courtesy of SUZUKI OF AMERICA CORP.

- Tighten bolts and nuts of exhaust No.1 pipe (1) to specified torque.

  Tightening torque

  Exhaust No.1 pipe bolt and nut d: 50 N.m (5.0 kg-m, 36.5 lb-ft)

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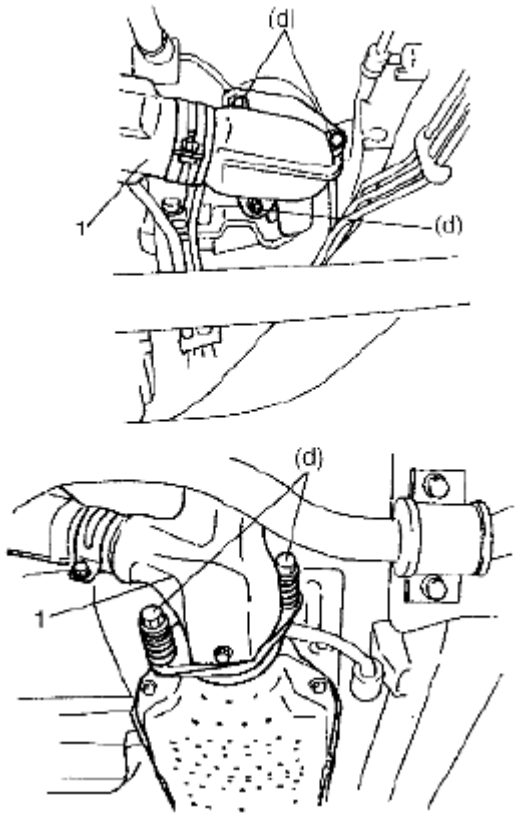
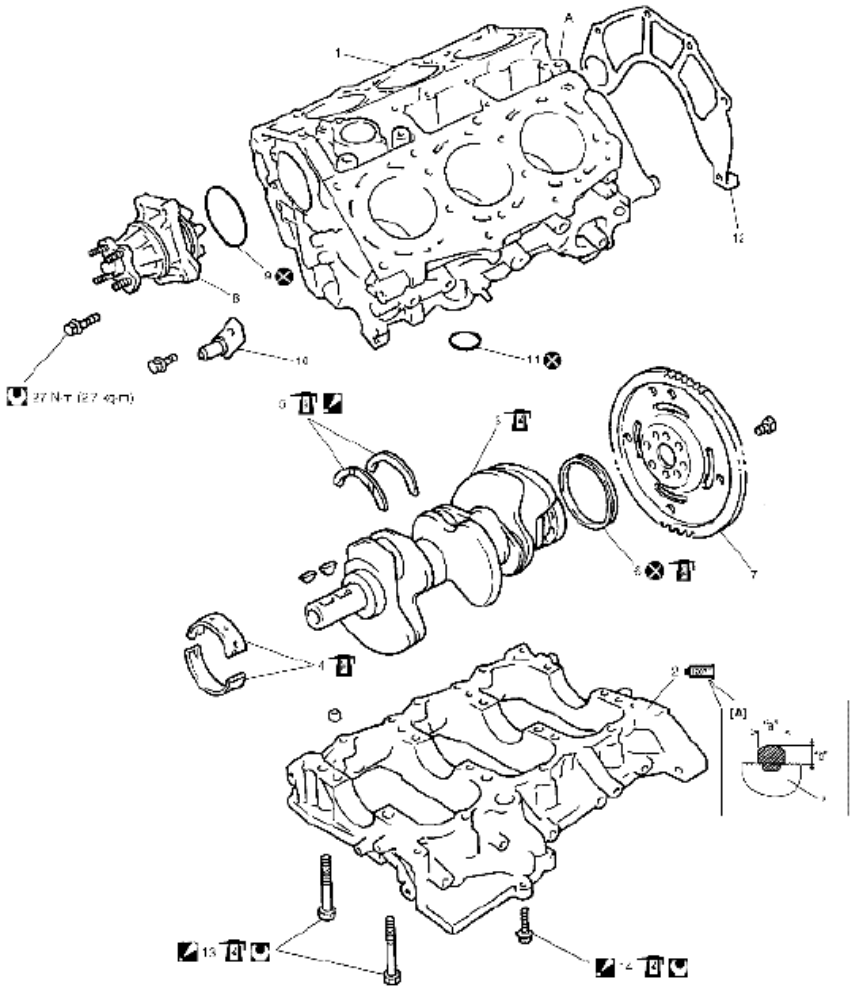


Fig. 196: Identifying Exhaust No. 1 Pipe, Bolts And Nuts
Courtesy of SUZUKI OF AMERICA CORP.

- Install front differential housing with differential to chassis referring to **FRONT DIFFERENTIAL DISMOUNTING AND REMOUNTING** : Front, if necessary.
- Install steering shaft lower assembly referring to **STEERING LOWER SHAFT ASSEMBLY REMOVAL AND INSTALLATION** .
- Install A/C compressor assembly, referring to **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** : Manual Type, **COMPRESSOR ASSEMBLY REMOVAL AND INSTALLATION** : Automatic Type.
- Install P/S pump assembly referring to **P/S PUMP REMOVAL AND INSTALLATION.**
- Adjust accelerator cable play referring to **ACCELERATOR CABLE ADJUSTMENT**
- Refill engine with engine oil referring to **ENGINE OIL AND FILTER CHANGE.**
- Refill cooling system referring to **COOLING SYSTEM FLUSH AND REFILL** .
- Check to ensure that all fasteners and clamps are tightened.
- Upon completion of installation, verify that there is no fuel leakage, coolant leakage, P/S fluid leakage or exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

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1. Cylinder block	8. Water pump	[A]: Sealant application amount
1207B 2. Lower crankcase: Apply sealant 99000-31250 to lower crankcase mating surface.	9. O-ring	"a": Width 3 mm (0.12 in.)
3. Crankshaft: Apply engine oil to crankshaft journals.	10. Timing chain oil jet	"b": Height 2 mm (0.08 in.)
4. Main bearing: Apply engine oil to bearing inside surfaces.	11. O-ring	: Tightening torque
5. Thrust bearing: Set bearing facing grooved side to crank weds. Apply engine oil.	12. Clutch housing plate	: Do not reuse.
6. Rear oil seal: Apply engine oil to contact part of crankshaft with oil seal lip.	13. Crankcase bolt (10 mm (0.39 in.) thread diameter) : Tighten 42 N·m (4.2 kgf-m, 30.5 lb-ft), 0 N·m (0 kgf-m, 0 lb-ft), 42 N·m (4.2 kgf-m, 30.5 lb-ft) and 60 N·m (6.0 kgf-m, 43.5 lb-ft) by the specified procedure.	: Apply engine oil.
7. Flywheel (M/T), Drive plate (A/T)	14. Crankcase bolt (8 mm (0.31 in.) thread diameter)	

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Fig. 197: Identifying Main Bearings, Crankshaft And Cylinder Block Components With Torque Specifications
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK REMOVAL AND INSTALLATION

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

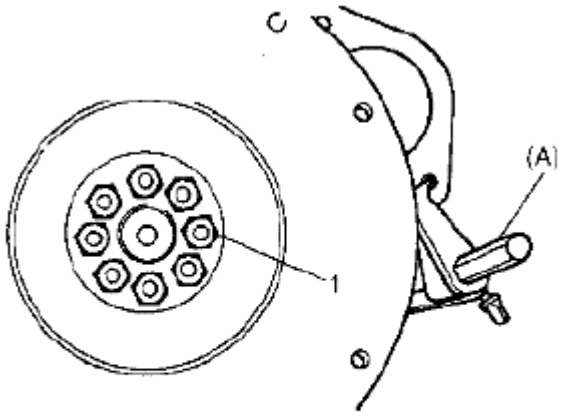
Removal

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

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

   Special Tool

   (A): 09924-17811



1. Flywheel bolt

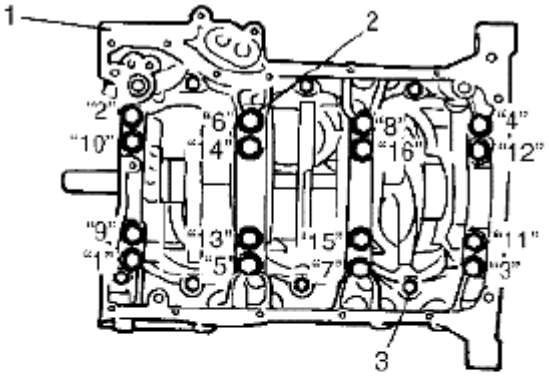
Fig. 198: Identifying Special Tool (Flywheel Holder) And Flywheel Bolt
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove throttle body with intake manifold and exhaust manifold referring to **THROTTLE BODY AND INTAKE MANIFOLD REMOVAL AND INSTALLATION.** and **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
4. Remove oil pans (lower and upper) and oil pump strainer. Refer to **OIL PAN AND OIL PUMP STRAINER REMOVAL AND INSTALLATION.**
5. Remove cylinder head cover referring to **CYLINDER HEAD COVERS REMOVAL AND INSTALLATION**.

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6. Remove timing chain cover. Refer to **TIMING CHAIN COVER REMOVAL AND INSTALLATION**.
7. Remove LH bank 2nd timing chain and tensioner referring to **LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Removal**.
8. Remove 1st timing chain and tensioner referring to **1st Timing Chain and Chain Tensioner Removal**.
9. Remove RH bank 2nd timing chain and tensioner referring to **RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Removal**.
10. Remove cylinder head assembly referring to **VALVES AND CYLINDER HEADS REMOVAL AND INSTALLATION**.
11. Remove pistons and connecting rods referring to **PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS REMOVAL AND INSTALLATION**.
12. Remove oil pump referring to **OIL PUMP REMOVAL AND INSTALLATION.**
13. Remove oil pump chain referring to **OIL PUMP CHAIN REMOVAL AND INSTALLATION** .
14. Loosen crankcase bolts, following sequence in figure and remove them.

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



1.	Lower crankcase
2.	Bolt (10 mm (0.39 in.) thread diameter)
3.	Bolt (8 mm (0.31 in.) thread diameter)

Fig. 199: Identifying Crankcase Bolts Loosening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove crankshaft from cylinder block.

Installation

Reference: **CRANKSHAFT INSPECTION**

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Reference: **MAIN BEARINGS INSPECTION**

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

Reference: **CYLINDER BLOCK INSPECTION**

NOTE:

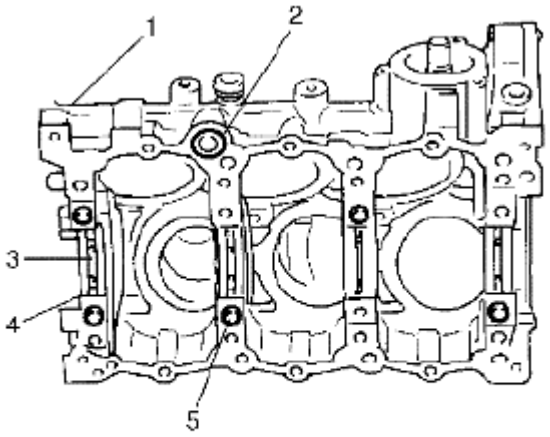
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crank pins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, crankcase (bearings caps), connecting rods, rod bearings, rod bearing 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 crankcase, remove oil, old sealant and dust from mating surface.**

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

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

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

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



5. Knock pin

Fig. 200: Identifying Main Bearing, Cylinder Block, O-Ring, Oil Groove And Knock Pin
Courtesy of SUZUKI OF AMERICA CORP.

3. Fit thrust bearings (1) to cylinder block between No.2 and No.3 cylinders.

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Face oil groove (2) sides to crank webs.

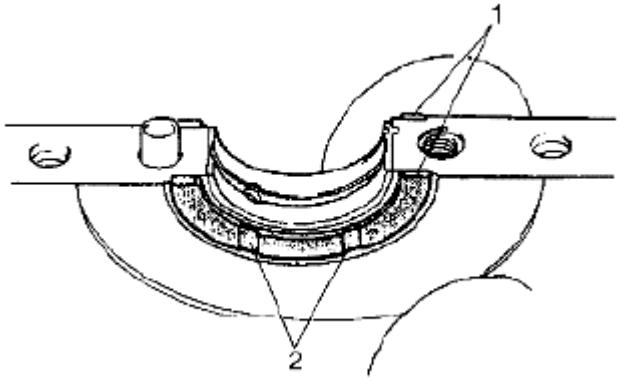
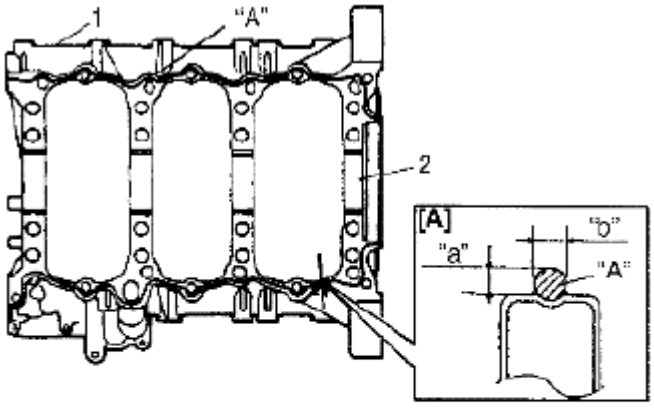


Fig. 201: Identifying Thrust Bearing And Oil Groove
Courtesy of SUZUKI OF AMERICA CORP.

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

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



[A]:	Sealant application amount	1.	Lower crankcase
"a":	2 mm (0.08 in.)	2.	Bearing
"b":	3 mm (0.12 in.)		

Fig. 202: Identifying Lower Crankcase, Bearing & Sealant Application Area
Courtesy of SUZUKI OF AMERICA CORP.

6. Install crankcase to cylinder block. Apply oil to crankcase bolts before installing them. Tighten crankcase bolts gradually as follows.
   a. Tighten crankcase bolts (10 mm (0.39 in.) thread diameter) to 42 N.m (4.2 kgf-m, 30.5 lb-ft) according to numerical order in figure.

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b. Loosen all bolts until tightening torque is reduced to 0 in reverse order of tightening.
c. In the same manner as Step a, tighten them to 42 N.m (4.2 kgf-m, 30.5 lb-ft).
d. In the same manner as Step a again, tighten them to specified torque.
e. Tighten crankcase bolts (8 mm (0.31 in.) thread diameter) to specified torque.

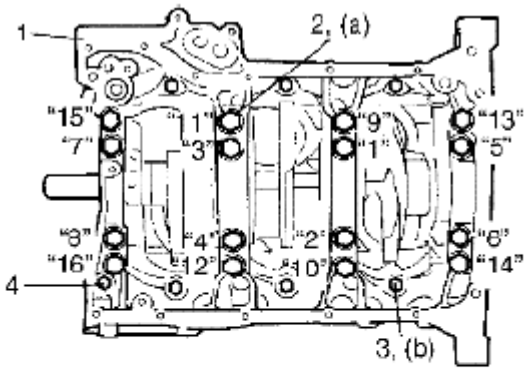
NOTE: Tighten 10 mm (0.39 in.) thread diameter bolts first (the following the order shown in figure), then tighten 8 mm (0.31 in.) thread diameter bolts.

Tightening torque

Crankcase bolt a: Tighten 42 N.m (4.2 kgf-m, 30.5 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 42 N.m (4.2 kgf-m, 30.5 lb-ft) and 60 N.m (6.0 kgf-m, 43.5 lb-ft) by the specified procedure (10 mm (0.39 in.) thread diameter)

Crankcase bolt b: Tighten 27 N.m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure (8 mm (0.31 in.) thread diameter)

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



1.	Lower crankcase	3.	Bolt (8 mm (0.31 in.) thread diameter)
2.	Bolt (10 mm (0.39 in.) thread diameter)	4.	Long bolt (8 mm (0.31 in.) thread diameter)

Fig. 203: Identifying Crankcase Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

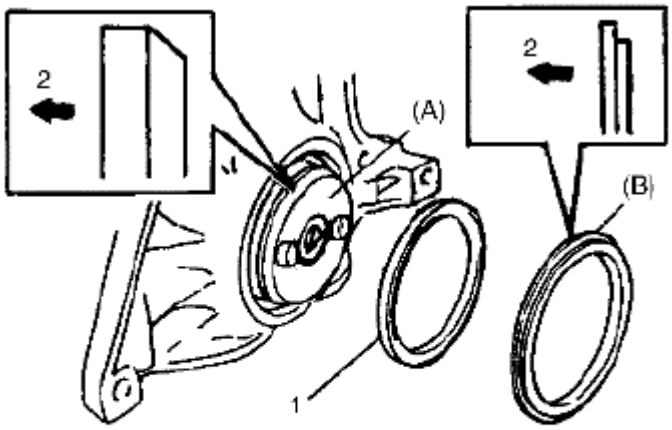
7. Using special tools (Oil seal installer and oil seal guide), install rear oil seal (1).

Special Tool

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(A): 09911-97710

(B): 09911-97811



2. Crankshaft side	3. Oil seal side

Fig. 204: Identifying Rear Oil Seal, Crankshaft Side, Oil Seal Side & Special Tools
Courtesy of SUZUKI OF AMERICA CORP.

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

"A": Sealant 99000-31110 SUZUKI Bond No.1215

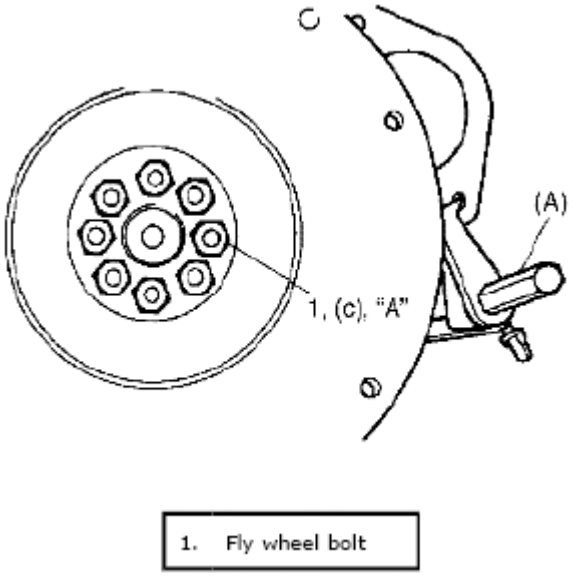
Special Tool

(A): 09924-17811

Tightening torque

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

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1. Fly wheel bolt

Fig. 205: Identifying Flywheel Bolt, Sealant Application Area & Special Tool
Courtesy of SUZUKI OF AMERICA CORP.

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

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CRANKSHAFT INSPECTION

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

Crankshaft Runout

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

Crankshaft runout

Limit: 0.06 mm (0.0023 in.)

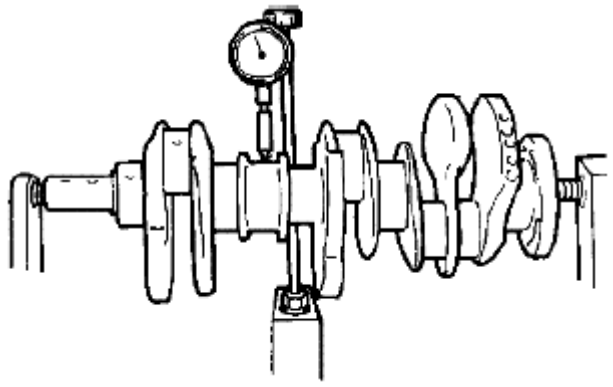


Fig. 206: Measuring Crankshaft Runout
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Thrust Play

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed. Tighten crankcase bolts gradually as follows.

1. Tighten crankcase bolts (10 mm (0.39 in.) thread diameter) to 42 N.m (4.2 kgf-m, 30.5 lb-ft) according to numerical order in figure.
2. Loosen all bolts until tightening torque is reduced to 0 in reverse order of tightening.
3. In the same manner as Step a), tighten them to 42 N.m (4.2 kgf-m, 30.5 lb-ft).
4. In the same manner as Step a) again tighten them to specified torque.
5. Tighten crankcase bolts (8 mm (0.31 in.) thread diameter) to specified torque.

NOTE: Tighten 10 mm (0.394 in.) thread diameter bolts first (following the order shown in figure), then tighten 8 mm (0.315 in.) thread diameter bolts.

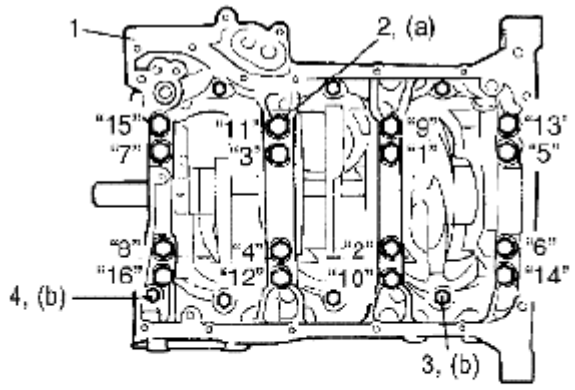
Tightening torque

Crankcase bolt a: Tighten 42 N.m (4.2 kgf-m, 30.5 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 42 N.m (4.2 kgf-

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m, 30.5 lb-ft) and 60 N.m (6.0 kgf-m, 43.5 lb-ft) by the specified procedure (10 mm (0.39 in.) thread diameter)

Crankcase bolt b: Tighten 27 N.m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure (8 mm (0.31 in.) thread diameter)



1.	Lower crankcase	3.	Bolt (8 mm (0.31 in.) thread diameter)
2.	Bolt (10 mm (0.39 in.) thread diameter)	4.	Long bolt (8 mm (0.31 in.) thread diameter)

Fig. 207: Identifying Crankcase Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Crankshaft thrust play

Standard: 0.1 - 0.35 mm (0.0039 - 0.0138 in.)

Limit: 0.38 mm (0.0150 in.)

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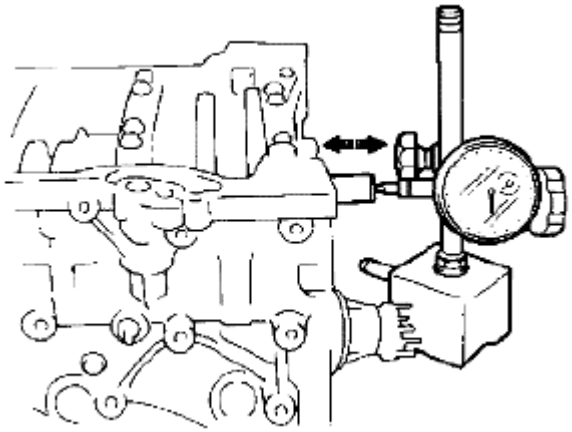
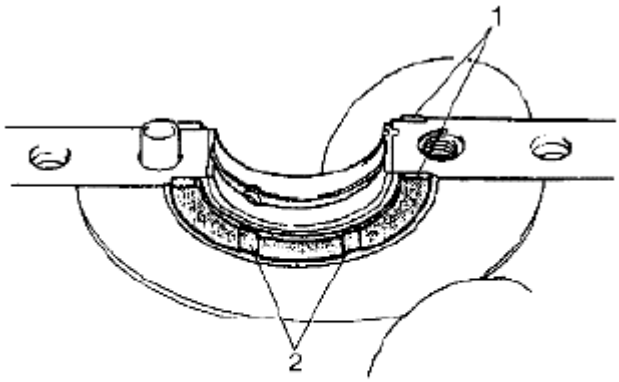


Fig. 208: Checking Crankshaft Thrust Play
Courtesy of SUZUKI OF AMERICA CORP.

Thickness of crankshaft thrust bearing

Standard: 2.500 mm (0.984 in.)

Oversize (0.125 mm (0.0049 in.)): 2.563 mm (0.1009 in.)



1. Thrust bearing	2. Oil groove

Fig. 209: Identifying Thrust Bearings And Oil Grooves
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

Limit: 0.01 mm (0.0004 in.)

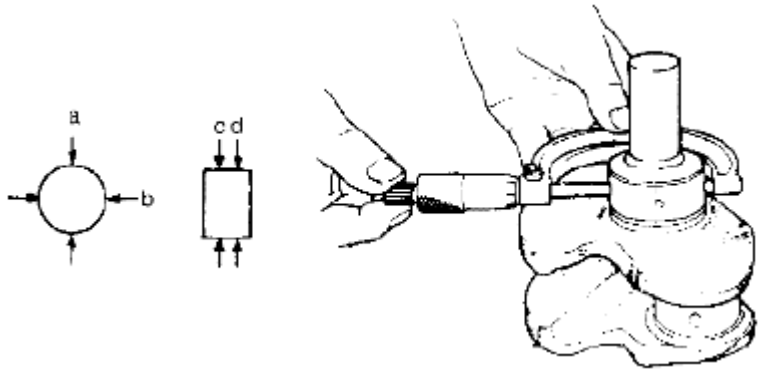


Fig. 210: Checking Crank Journal Out-Of-Round And Taper
Courtesy of SUZUKI OF AMERICA CORP.

MAIN BEARINGS INSPECTION

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

Main Bearing General Information

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

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

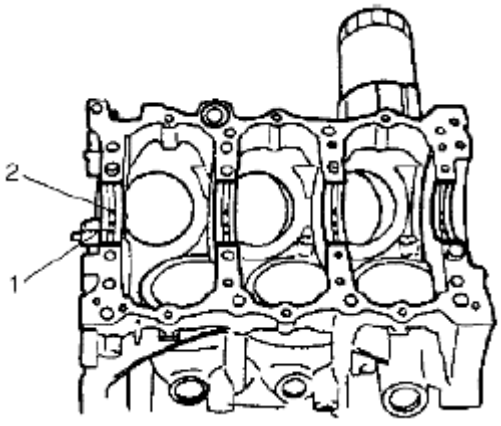


Fig. 211: Identifying Bearing And Oil Groove
Courtesy of SUZUKI OF AMERICA CORP.

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- Lower half of bearing does not have oil groove.

Visual Inspection

Check bearings for pitting, scratches, wear or damage.

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

Main Bearing Clearance

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

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

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

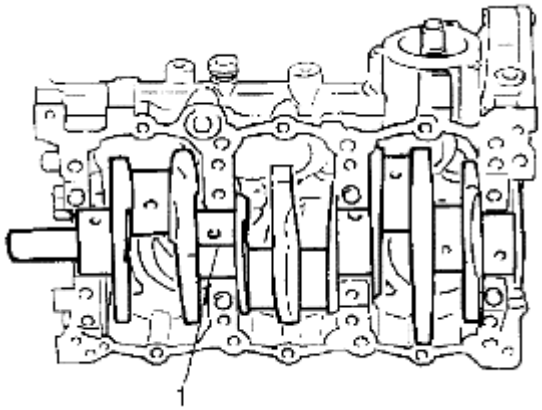


Fig. 212: Identifying Gauging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

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

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

   After selecting new bearing, recheck clearance.

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Main bearing clearance

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

Undersize: 0.0240 - 0.0420 mm (0.0010 - 0.0016 in.)

Limit: 0.0550 mm (0.0021 in.)

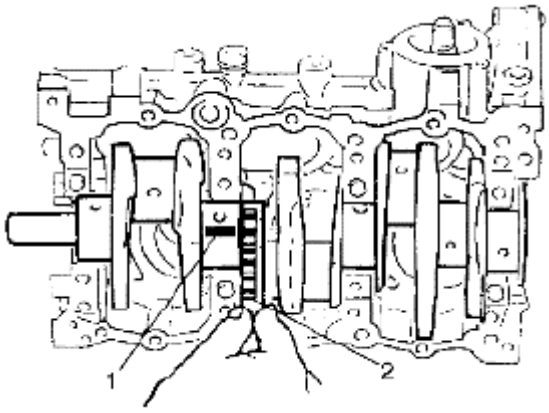


Fig. 213: Identifying Scale & Gauging Plastic
Courtesy of SUZUKI OF AMERICA CORP.

Selection of Main Bearings

Standard bearing

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

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

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

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

1. First check journal diameter. As shown in figure, crank web has stamped numbers and alphabet at the center.

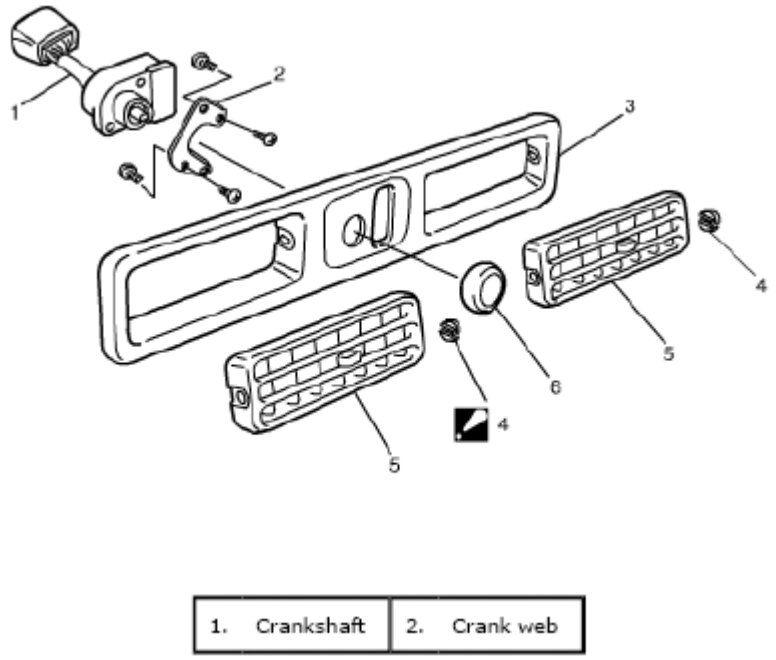
   Six kinds of numbers ("4" through "9") represent the following journal diameters.

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Journal diameter

JOURNAL DIAMETER SPECIFICATION

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



1. Crankshaft	2. Crank web

Fig. 214: Identifying Crankshaft And Crank Web
Courtesy of SUZUKI OF AMERICA CORP.

2. Next, check journal bore diameter.

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

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

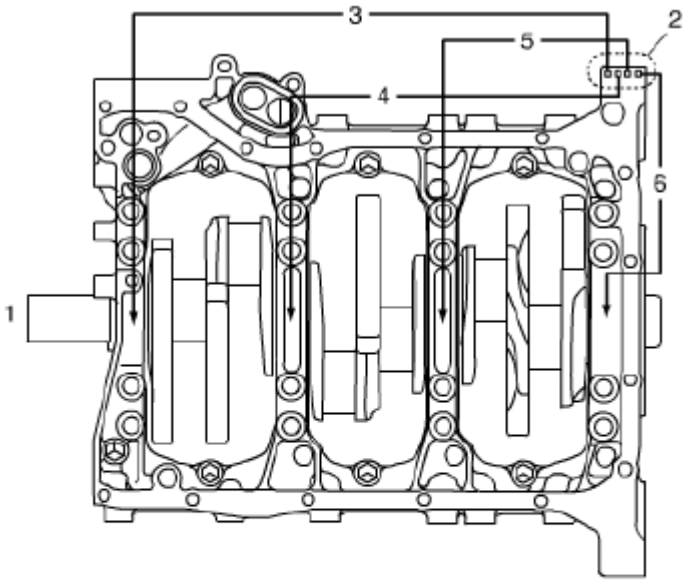
   Journal bore diameter

   JOURNAL BORE DIAMETER SPECIFICATION

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

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C	70.0121 - 70.0180 mm (2.75638 - 2.75660 in.)



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

Fig. 215: Identifying Crankshaft Pulley Side, Stamped Alphabets & Bearings
Courtesy of SUZUKI OF AMERICA CORP.

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

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

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

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

Standard size main bearing thickness

MAIN BEARING THICKNESS STANDARD SIZE SPECIFICATION

Color painted	Bearing thickness
Black	2.4970 - 2.5000 mm (0.09831 - 0.09842 in.)
Colorless (no paint)	2.5000 - 2.5030 mm (0.09843 - 0.09854 in.)

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Yellow	2.5030 - 2.5060 mm (0.09855 - 0.09866 in.)
Blue	2.5060 - 2.5090 mm (0.09867 - 0.09877 in.)
Pink	2.5090 - 2.5120 mm (0.09878 - 0.09889 in.)
Brown	2.5120 - 2.5150 mm (0.09890 - 0.09901 in.)

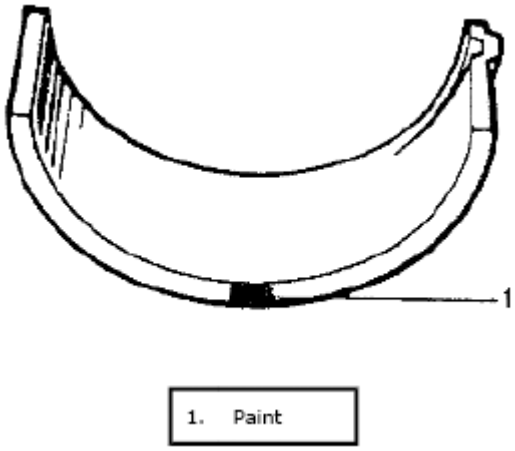


Fig. 216: Identifying Paint Mark On Bearing
Courtesy of SUZUKI OF AMERICA CORP.

4. From number stamped on crank webs at its center and alphabets stamped on cylinder block lower side, determine new standard bearing to be installed to journal referring to cross-reference table below. For example, if number stamped on crank webs is "5" and alphabet stamped on cylinder block is "A", install new standard bearing painted in "Black" to cylinder block side journal and "Colorless" to lower crankcase side journal.

Main bearing cross-reference table (standard bearing)

MAIN BEARING CROSS-REFERENCE TABLE (STANDARD BEARING)

		Stamped number on crank web					
		4	**5**	**6**	**7**	**8**	**9**
Stamped alphabet on lower crankcase	A	Upper: Black Lower: Colorless	Colorless	Upper: Colorless Lower: Yellow	Yellow	Upper: Yellow Lower: Blue	Blue
	B	Upper: Colorless Lower: Yellow	Yellow	Upper: Yellow Lower: Blue	Blue	Upper: Blue Lower: Pink	Pink
	C	Upper: Yellow Lower: Blue	Blue	Upper: Blue Lower: Pink	Pink	Upper: Pink Lower: Brown	Upper: Pink Lower: Brown

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

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BEARING CLEARANCE.

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

Undersize bearing (0.25 mm)

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

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

Undersize main bearing thickness

MAIN BEARING THICKNESS UNDERSIZE SPECIFICATION

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

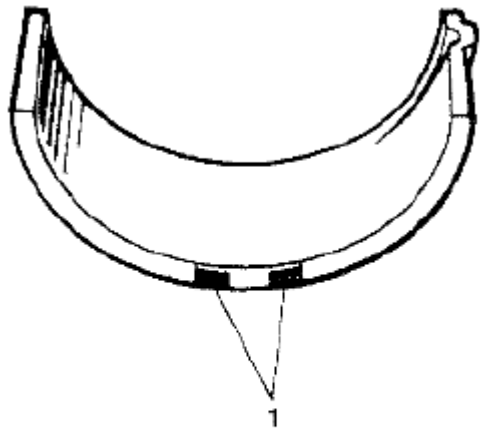


Fig. 217: Identifying Paint Mark On Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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

  Finished journal diameter

  64.7380 - 64.7560 mm (2.54874 - 2.54944 in.)

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b. Using micrometer, measure reground journal diameter.

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

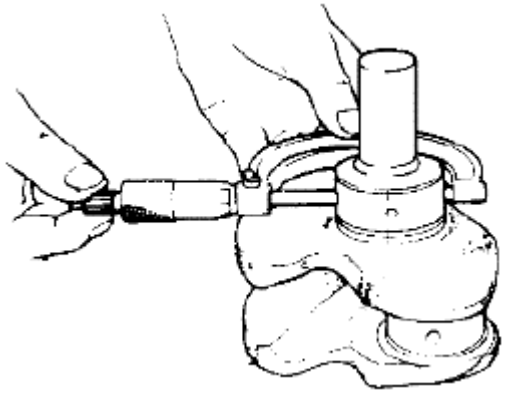


Fig. 218: Measuring Reground Journal Diameter
Courtesy of SUZUKI OF AMERICA CORP.

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

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

Main bearing cross-reference table (undersize bearing)

MAIN BEARING CROSS-REFERENCE TABLE (UNDERSIZE BEARING)

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

REAR OIL SEAL AND FLYWHEEL INSPECTION

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

Rear Oil Seal

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

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Fig. 219: Identifying Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

Flywheel

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

Flywheel runout

Limit: 0.2 mm (0.0078 in.)

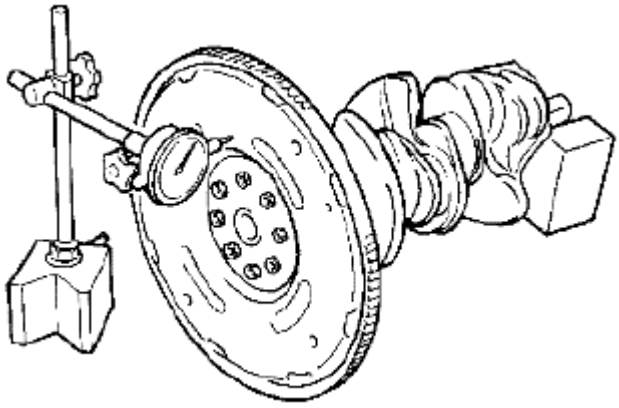


Fig. 220: Checking Flywheel Runout
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER BLOCK INSPECTION

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

Distortion of Gasketed Surface

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

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Gasketed surface flatness

Limit: 0.06 mm (0.0024 in.)

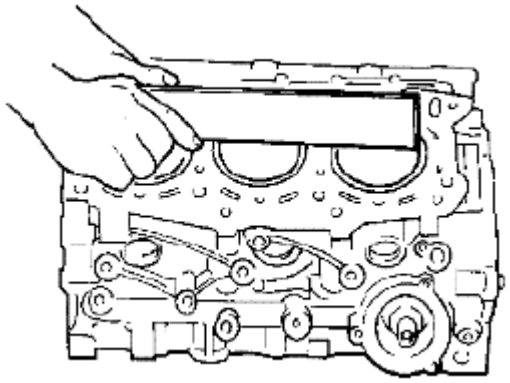


Fig. 221: Checking Gasketed Surface Flatness
Courtesy of SUZUKI OF AMERICA CORP.

Honing or reboring cylinders

1. When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2. Select oversized piston according to amount of cylinder wear.

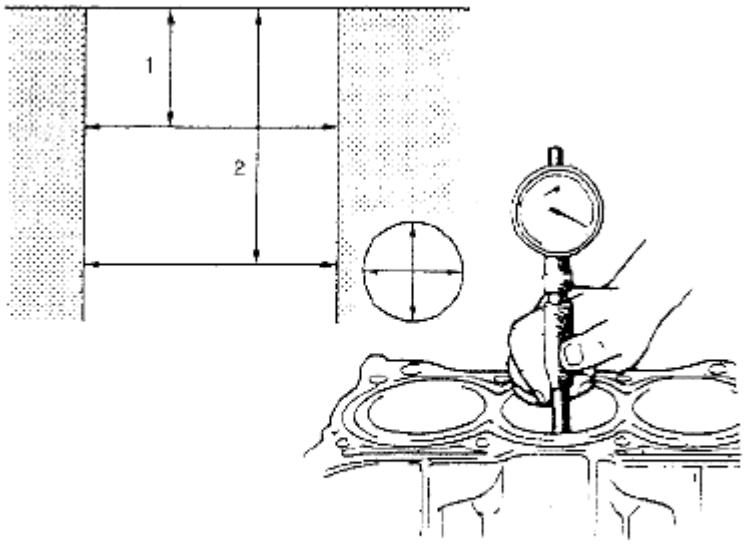
   Oversize piston diameter specifications

   OVERSIZE PISTON DIAMETER SPECIFICATIONS

Standard	Oversize 0.50
83.970 - 83.990 mm (3.3059 - 3.3067 in.)	84.470 - 84.490 mm (3.3256 - 3.3264 in.)

3. Using micrometer, measure piston diameter.

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1. 50 mm (1.97 in.)	2. 90 mm (3.54 in.)

Fig. 222: Measuring Piston Diameter
Courtesy of SUZUKI OF AMERICA CORP.

4. Calculate cylinder bore diameter to be rebored as follows.

   D = A + B - C

   D: Cylinder bore diameter to be rebored

   A: Piston diameter as measured

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

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

5. Rebore and hone cylinder to calculated dimension.

   NOTE: Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6. Measure piston clearance after honing.

ENGINE BLOCK HEATER (IF EQUIPPED) REMOVAL AND INSTALLATION

Removal

1. Disconnect negative (-) cable at battery.
2. Drain engine coolant referring to **COOLANT DRAINING** .

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3. Remove strut tower bar. if equipped. Refer to **STRUT DAMPER REMOVAL AND INSTALLATION** .
4. Remove right side exhaust manifold. Refer to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
5. Disconnect engine block heater and remove engine block heater (1).

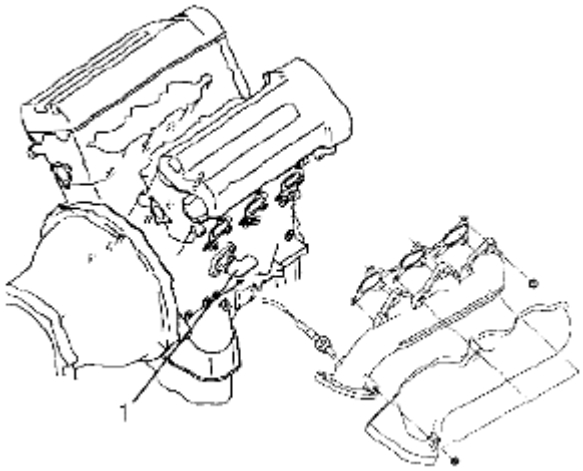


Fig. 223: Identifying Engine Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Reverse removal procedure for installation, noting the followings.

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

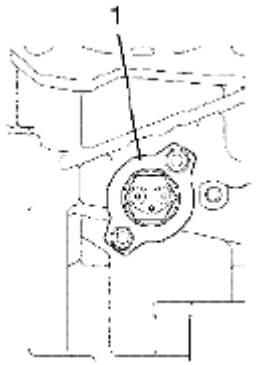


Fig. 224: Identifying Engine Block Heater
Courtesy of SUZUKI OF AMERICA CORP.

- Tighten engine block heater mounting bolt to specified torque.

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a. Apply thread lock cement to block heater bolt (1).

"A": Thread lock cement 99000-32020 Thread Lock Cement Super 1333B

b. Tighten engine block heater mounting bolt to specified torque.

Tightening torque

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

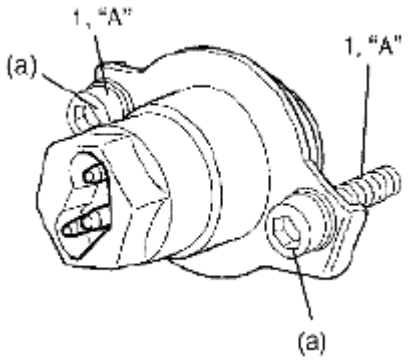


Fig. 225: Identifying Engine Block Heater Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

- Use new exhaust manifold gasket.
- Tighten exhaust manifold mounting bolts and nuts to specified torque referring to **EXHAUST MANIFOLD REMOVAL AND INSTALLATION.**
- Refill coolant referring to **COOLING SYSTEM FLUSH AND REFILL** .
- Refill P/S fluid and bleed air in P/S system referring to **P/S SYSTEM AIR BLEEDING PROCEDURE** .
- Refill engine oil referring to **ENGINE OIL AND FILTER CHANGE.**
- Refill front differential gear oil referring to **FRONT DIFFERENTIAL GEAR OIL INSPECTION AND CHANGE** : Front.
- Finally, start engine and check for engine coolant leaks and exhaust gas leakage.

ENGINE BLOCK HEATER (IF EQUIPPED) INSPECTION

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

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

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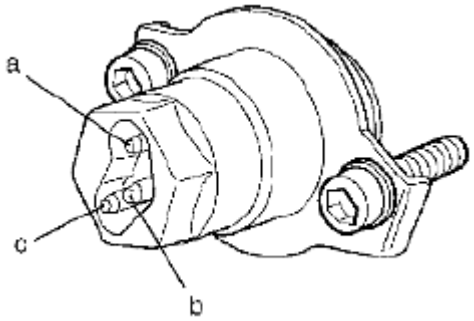


Fig. 226: Identifying Engine Block Heater Terminals
Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

TIGHTENING TORQUE SPECIFICATIONS

TIGHTENING TORQUE SPECIFICATIONS

Fastening part	Tightening torque			Note
	N.m	kgf-m	lb-ft	
Strut tower bar mounting bolts	50	5.0	36.5	
Cylinder head cover nut	10.5	1.1	7.5	
Timing chain cover bolt	11	1.1	8.0	
CKP sensor bolt	6	0.6	4.5	
Crankshaft pulley bolt	150	15	108.5	
Timing chain guide No.4 bolt	11	1.1	8.0	
Camshaft timing sprocket bolt	80	8.0	58.0	
Timing chain tensioner adjuster No.3 bolt	Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure			
Timing chain tensioner adjuster No.3 nut	Tighten 55 N.m (5.5 kgf-m, 40.0 lb-ft) by the specified procedure			
RH bank 1st timing chain intake camshaft sprocket bolt	80	8.0	58.0	
Timing chain tensioner nut	27	2.7	19.5	
Idler sprocket No.1	45	4.5	32.5	

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bolt				
Timing chain tensioner adjuster No.1 bolt	11	1.1	8.0	
Timing chain guide No.1 and No.2 bolt	9	0.9	6.5	
Timing chain tensioner adjuster No.2 bolt	11	1.1	8.0	
Camshaft housing bolt	Tighten 12 N.m (1.2 kgf-m, 9.0 lb-ft) by the specified procedure			
Timing chain guide No.3 bolt	11	1.1	8.0	
Cylinder head bolt	Tighten 53 N.m (5.3 kgf-m, 38.5 lb-ft), 84 N.m (8.4 kgf-m, 61.0 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 53 N.m (5.3 kgf-m, 38.5 lb-ft) and 105 N.m (10.5 kgf-m, 76.0 lb-ft) by the specified procedure			
Cylinder head bolt (hex hole bolt)	Tighten 11 N.m (1.1 kgf-m, 7.5 lb-ft) by the specified procedure			
Connecting rod bearing cap nut	45	4.5	32.5	
Engine side mounting bracket nut	55	5.5	40.0	
Transmission case bolt and nut	85	8.5	61.5	for M/T vehicle
Transmission case bolt and nut	80	8.0	58.0	for A/T vehicle
Torque converter bolt	65	6.5	47.0	
Exhaust No.1 pipe bolt and nut	50	5.0	36.5	
Crankcase bolt	Tighten 42 N.m (4.2 kgf-m, 30.5 lb-ft), 0 N.m (0 kgf-m, 0 lb-ft), 42 N.m (4.2 kgf-m, 30.5 lb-ft) and 60 N.m (6.0 kgf-m, 43.5 lb-ft) by the specified procedure			10 mm (0.39 in.) thread diameter
Crankcase bolt	Tighten 27 N.m (2.7 kgf-m, 19.5 lb-ft) by the specified procedure			8 mm (0.31 in.) thread diameter
Flywheel (or drive plate) bolt	70	7.0	51.0	
Engine block heater mounting bolt	11	1.1	8.0	

NOTE: The specified tightening torque is also described in the following.

TIMING CHAIN COVER COMPONENTS

LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Components

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1st Timing Chain and Chain Tensioner Components

RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Components

CAMSHAFTS AND VALVE LASH ADJUSTERS COMPONENTS

VALVES AND CYLINDER HEADS COMPONENTS

PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS COMPONENTS

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

Reference:

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

SPECIAL TOOLS AND EQUIPMENT

RECOMMENDED SERVICE MATERIAL

RECOMMENDED SERVICE MATERIAL SPECIFICATION

Material	SUZUKI recommended product or Specification	
Sealant	SUZUKI Bond No.1215	P/No.: 99000-31110
Thread lock cement	Thread Lock Cement Super 1333B	P/No.: 99000-32020
Water tight sealant	SUZUKI Bond No.1207B	P/No.: 99000-31140
	SUZUKI Bond No.1207F	P/No.: 99000-31250

NOTE: **Required service material is also described in the following.**

TIMING CHAIN COVER COMPONENTS

LH (No.1) Bank 2nd Timing Chain and Chain Tensioner Components

1st Timing Chain and Chain Tensioner Components

RH (No.2) Bank 2nd Timing Chain and Chain Tensioner Components

CAMSHAFTS AND VALVE LASH ADJUSTERS COMPONENTS

VALVES AND CYLINDER HEADS COMPONENTS

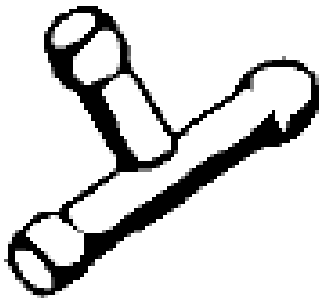
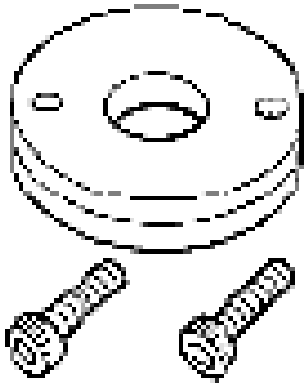
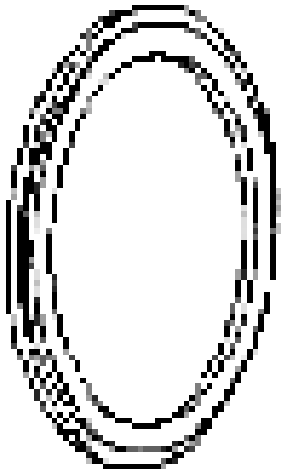
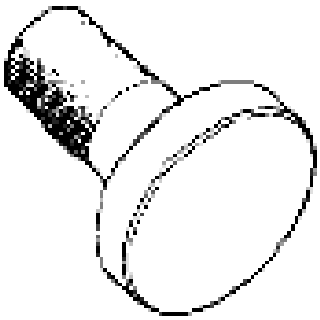
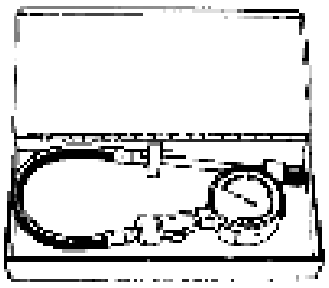
PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS COMPONENTS

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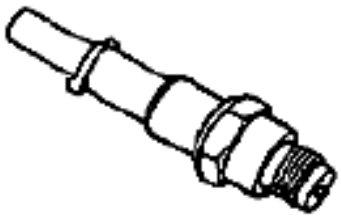
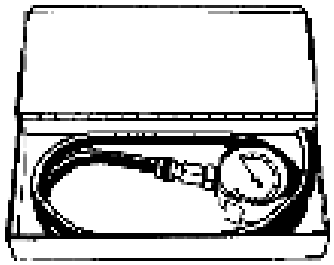
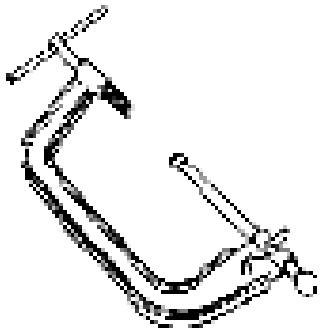
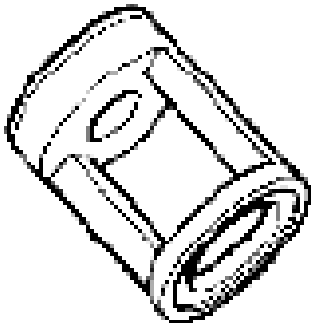
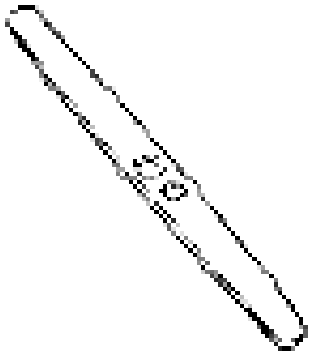
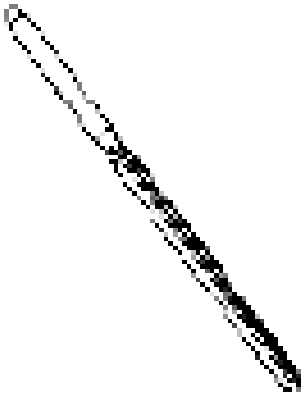
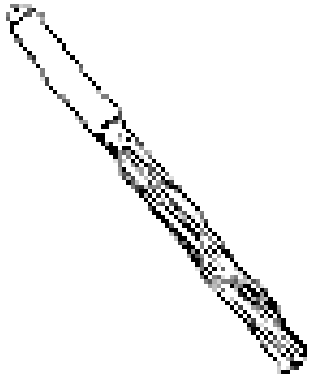
MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK COMPONENTS

SPECIAL TOOL

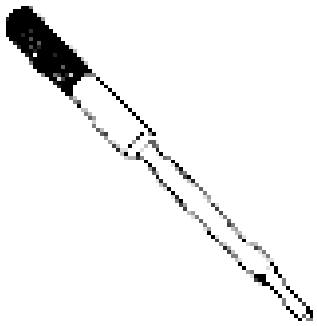
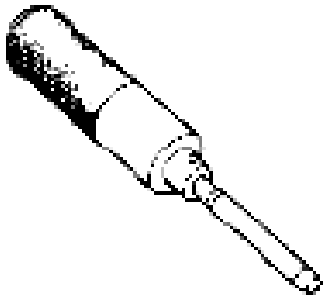
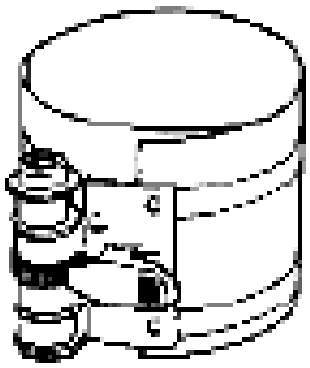
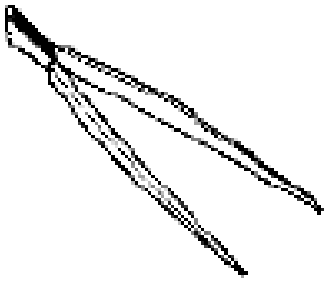
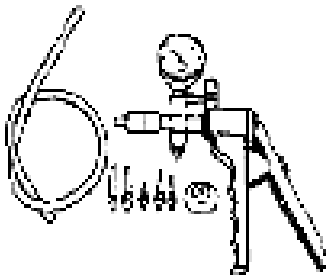
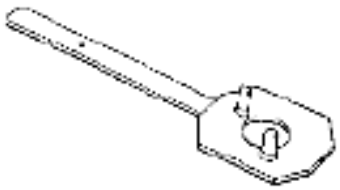
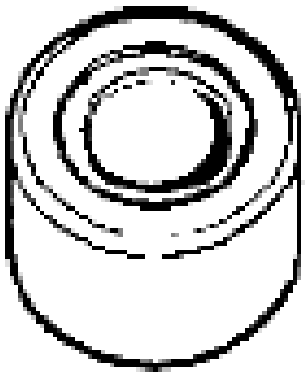
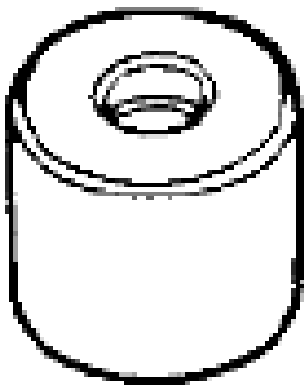
SPECIAL TOOLS DESCRIPTION

09355-35754-600 Hose		09367-04002 3-way joint	
09911-97710 Oil seal guide		09911-97811 Oil seal installer	
09913-75510 Bearing installer		09915-64510 Compression gauge set (0-20 kg/cm^2 , M14)	
09915-64530 Compression gauge hose		09915-67010 Compression gauge attachment (C)	

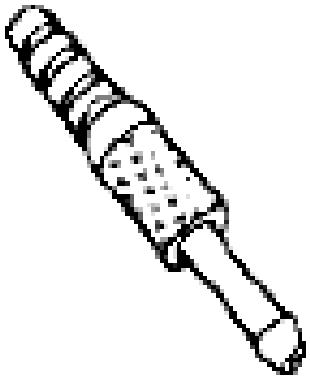
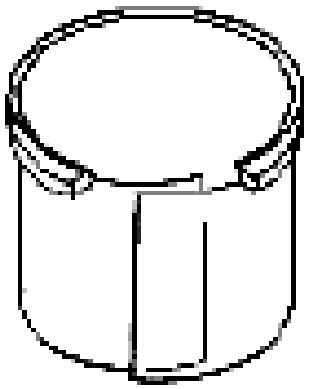
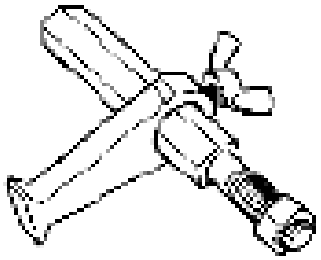
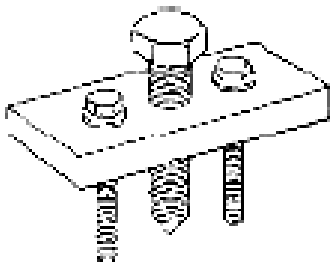
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09915-67311 Vacuum gauge		09916-14510 Valve lifter	
09916-14910 Valve spring compressor attachment		09916-34542 Reamer handle	
09916-37810 Valve guide reamer (6 mm)		09916-38210 Valve guide reamer (11 mm)	
09916-44910 Valve guide installer		09916-58210 Valve guide installer	

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& remover		handle	
09916-77310 Piston ring compressor (50-125 mm)		09916-84511 Forceps	
09917-47011 Vacuum pump gauge		09917-68221 Camshaft pulley holder	
09917-87810 Valve guide installer attachment (protrusion: 13.5 mm)		09917-98221 Valve guide stem attachment	
09918-08210		09919-28610	

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Vacuum gauge hose joint		Protector sleeve	
09924-17811		09926-58010	
Flywheel holder		Bearing remover attachment	
09944-36011			
Steering wheel remover			

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