

2006-08 ENGINE**Engine Mechanical - Forenza - Reno****GENERAL DESCRIPTION****CYLINDER HEAD AND GASKET DESCRIPTION**

The cylinder head is made of an aluminum alloy. The cylinder head uses cross-flow intake and exhaust ports. A spark plug is located in the center of each combustion chamber. The cylinder head houses the dual camshafts.

CRANKSHAFT DESCRIPTION

The crankshaft has eight integral weights which are cast with it for balancing. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, the bearings, the pistons, and the other components. The end thrust load is taken by the thrust washers installed at the center journal.

TIMING BELT DESCRIPTION

The timing belt coordinates the crankshaft and the dual overhead camshafts and keeps them synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so that there is no slippage between them. There are two idler pulleys. An automatic tensioner pulley maintains the timing belt's correct tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.

INTAKE MANIFOLD DESCRIPTION

The intake manifold has four independent long ports and utilizes an inertial supercharging effect to improve engine torque at low and moderate speeds.

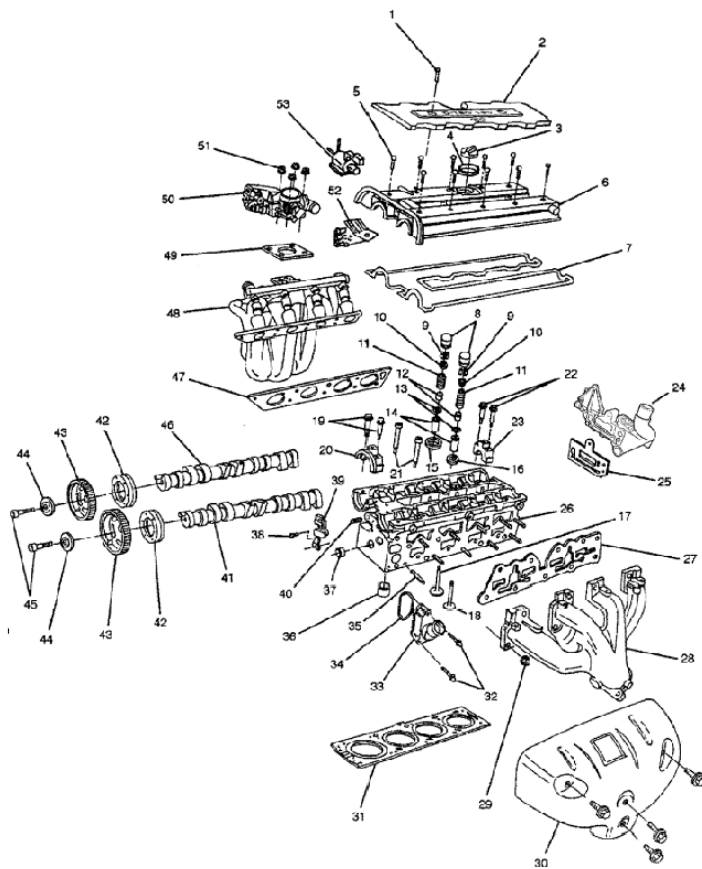
CAMSHAFTS DESCRIPTION

This engine is a Dual Overhead Camshaft (DOHC) type, which means there are two camshafts. One camshaft operates the intake valves, and the other camshaft operates the exhaust valves. The camshafts sit in journals on the top of the engine (in the cylinder head) and are held in place by camshaft caps. The camshaft journals of the cylinder head are drilled for oil passages. Engine oil travels to the camshafts under pressure where it lubricates each camshaft journal. The oil returns to the oil pan through drain holes in the cylinder head. The camshaft lobes are machined into the solid camshaft to precisely open and close the intake and the exhaust valves the correct amount at the correct time. The camshaft lobes are oiled by splash action from pressurized oil escaping from the camshaft journals.

COMPONENT LOCATION**UPPER END LOCATION**

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno



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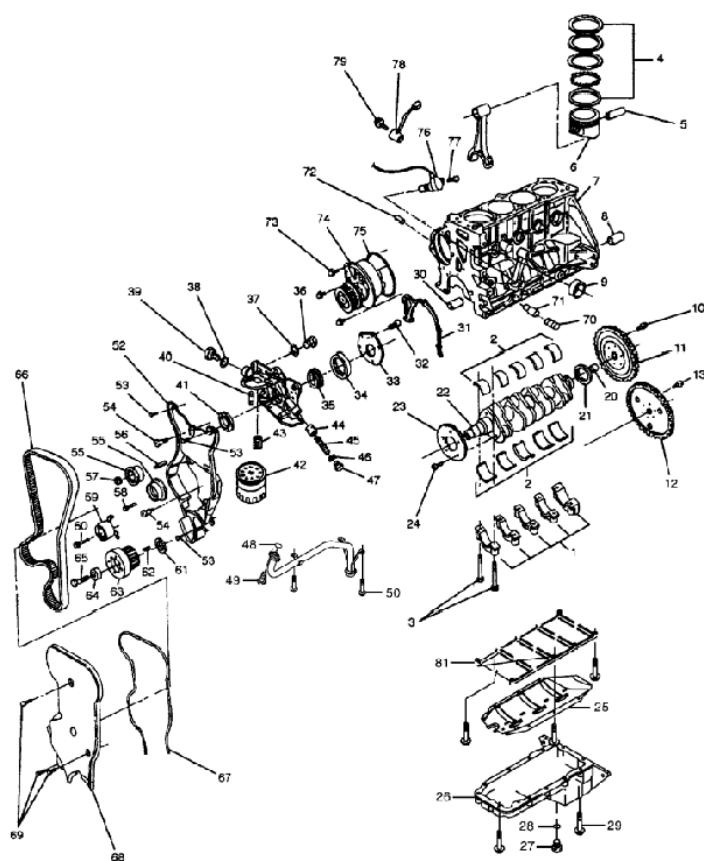
1. Bolt	19. Bolt	37. Plug
2. Spark Plug Cover	20. Front Camshaft Cap	38. Bolt
3. Oil Filler Cap	21. Head Bolt	39. Camshaft Position Sensor
4. Oil Filler Cap Seal	22. Bolt	40. Oil Gallery Plug
5. Bolt	23. Intermediate Camshaft Cap	41. Exhaust Camshaft
6. Camshaft Cover	24. Exhaust Gas Recirculation Adapter	42. Seal Ring
7. Camshaft Cover Gasket	25. Exhaust Gas Recirculation Adapter Gasket	43. Camshaft Gear
8. Tappet Adjuster	26. Cylinder Head	44. Washer
9. Valve Key	27. Exhaust Manifold Gasket	45. Camshaft Gear Bolt
10. Valve Spring Cap	28. Exhaust Manifold	46. Intake Camshaft
11. Valve Spring	29. Nut	47. Intake Manifold Gasket
12. Valve Stem Seal	30. Exhaust Manifold Heat Shield	48. Intake Manifold
13. Valve Spring Seat	31. Cylinder Head Gasket	49. Throttle Body Gasket
14. Valve Guide	32. Bolt	50. Throttle Body
15. Intake Valve Seat Ring	33. Thermostat Housing	51. Nut
16. Exhaust Valve Seat Ring	34. Thermostat Housing Gasket	52. Charcoal Canister Purge Solenoid
17. Intake Valve	35. Stud	53. Exhaust Gas Recirculation Solenoid
18. Exhaust Valve	36. Sleeve	

Fig. 1: Identifying Engine Component Exploded View- Upper End Location
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LOWER END LOCATION

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno



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1. Connecting Rod	32. Bolt	57. Nut
2. Bearing Set	33. Oil Pump Cover	58. Bolt
3. Connecting Rod Bolt	34. Ring Gear	59. Tensioner
4. Piston Ring Set	35. Gear	60. Bolt
5. Piston Pin	36. Oil Pressure Switch	61. Thrust Inner Washer
6. Piston	37. Washer	62. Woodruff Key
7. Engine Block	38. Washer	63. Crankshaft Gear
8. Sleeve	39. Oil Duct Outlet Plug	64. Thrust Outer Washer
9. Water Jacket Cap	40. Connecting Piece	65. Bolt
10. Bolt (Manual Transaxle)	41. Seal Ring	66. Camshaft Drive Belt
11. Flywheel (Manual Transaxle)	42. Oil Filter	67. Gasket
12. Flexible Plate (Automatic Transaxle)	43. Bypass Valve	68. Front Timing Belt Cover
13. Bolt (Automatic Transaxle)	44. Pressure Relief Valve Plunger	69. Bolt
20. Needle Sleeve	45. Pressure Relief Valve Spring	70. Bushing Plug
21. Crankshaft Rear Seal	46. Seal Ring	71. Bushing
22. Crankshaft	47. Pressure Relief Valve Plug	72. Oil Gallery Plug
23. Transmitter Disk	48. Seal Ring	73. Bolt
24. Bolt	49. Bolt	74. Water Pump
25. Oil Pan Scraper	50. Oil Suction Pipe	75. Seal Ring
26. Oil Pan	51. Bolt	76. Crankshaft Position Sensor
27. Drain Plug	52. Rear Timing Belt Cover	77. Bolt
28. Washer	53. Pressure Relief Valve Plug	78. Knock Sensor*
29. Bolt	54. Special Bolt	79. Bolt
30. Sleeve	55. Idler Pulley	80. Bolt
31. Gasket	56. Stud	81. Crankshaft Bearing Bridge

Fig. 2: Identifying Engine Component Exploded View- Lower End Location
Courtesy of SUZUKI OF AMERICA CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

COMPRESSION TEST

WARNING: Disconnect the Crankshaft Position (CKP) Sensor connector to disable the fuel and the ignition systems.

Test the compression pressure for each cylinder. Low compression pressure may be the fault of the valves or the pistons. The following conditions should be considered when you check the cylinder compression:

- The engine should be at normal operating temperature.
 - The throttle must be wide open.
 - All the spark plugs should be removed.
 - The battery must be at or near full charge.
1. Place approximately three squirts of oil from a plunger-type oiler into each spark plug port.
 2. Insert the engine compression gauge into each spark plug port.
 3. Crank test each cylinder with four to five compression strokes using the starter motor.
 4. The lowest reading should not be less than 70% of the highest reading. The compression gauge reading should not be less than 689 kPa (100 psi) for any of the cylinders.
 5. Examine the gauge readings obtained after the four "puffs" per cylinder are obtained from cranking the starter motor. The readings are explained in the following descriptions:
 - Normal Condition - Compression builds up quickly and evenly to the specified compression on each cylinder.
 - Piston Rings Faulty - Compression is low on the first stroke and tends to build up on following strokes, but the compression pressure does not reach normal. The compression pressure improves considerably with the addition of oil into the cylinder.
 - Valves Faulty - Low compression pressure on the first stroke. The compression pressure does not tend to build up on the following strokes. The compression pressure does not improve much with the addition of oil into the cylinder.

KNOCK DIAGNOSIS**Definition for Knock**

Engine knock refers to various types of engine noise. Heavy knock is usually very loud and the result of broken or excessively worn internal engine components. Light knock is a noticeable noise, but not as loud. Light knock can be caused by worn internal engine components. Loose or broken external engine components can also cause heavy or light knock.

Engine Knocks Cold and Continues for Two-Three Minutes and/or Knock Increases with Engine Torque**ENGINE KNOCKS COLD AND CONTINUES FOR TWO-THREE MINUTES AND/OR KNOCK INCREASES WITH ENGINE TORQUE**

Step	Action	Value(s)	Yes	No
	Does the engine knock when it is cold and continue for			

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno

1	two to three minutes or does the knock increase with torque?	-	Go to Step 2	System OK
2	Inspect the flywheel. Is the flywheel contacting the splash shield?	-	Go to Step 3	Go to Step 4
3	Reposition the splash shield. Is the repair complete?	-	Go to Step 1	-
4	Inspect the balancer and the drive pulleys. Is either the balancer or the drive pulleys loose or broken?	-	Go to Step 5	Go to Step 6
5	Tighten or replace the balancer or the drive pulleys. Is the repair complete?	-	Go to Step 1	-
6	Inspect the piston-to-bore clearance. Is the clearance more than the specified value?	0.010 - 0.030 mm (0.00039 - 0.00110 in.)	Go to Step 7	Go to Step 8
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete? ⁽¹⁾	-	Go to Step 1	-
8	Inspect the connecting rod. Is the connecting rod bent?	-	Go to Step 9	System OK
9	Replace the connecting rod. Is the repair complete?	-	Go to Step 1	-
(1) Cold engine piston knock usually disappears when the cylinder is grounded out. Cold engine piston knock, which disappears in about 1.5 minutes, is considered acceptable.				

Heavy Knock Hot with Torque Applied

HEAVY KNOCK HOT WITH TORQUE APPLIED

Step	Action	Value(s)	Yes	No
1	Is there a heavy knock when the engine is hot and torque is applied?	-	Go to Step 2	System OK
2	Inspect the balancer and the pulley hub. Is the balancer or the pulley hub broken?	-	Go to Step 3	Go to Step 4
3	Replace the broken balancer or the pulley hub. Is the repair complete?	-	Go to Step 1	-
4	Inspect the torque converter bolts. Are the bolts tightened to specified value?	45 N.m (33 lb-ft)	Go to Step 5	Go to Step 6
5	Tighten the torque converter bolts. Is the repair complete?	-	Go to Step 1	-
6	Inspect the accessory drive belts. Are the belts too tight or nicked?	-	Go to Step 7	Go to Step 8
7	Replace and/or tension the belts to specifications, as necessary. Is the repair complete?	-	Go to Step 1	-

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno

8	Inspect the exhaust system. Is the system grounded?	-	Go to Step 9	Go to Step 10
9	Reposition the system, as necessary. Is the repair complete?	-	Go to Step 1	-
10	Inspect the flywheel. Is the flywheel cracked?	-	Go to Step 11	Go to Step 12
11	Replace the flywheel. Is the repair complete?	-	Go to Step 1	-
12	Inspect the main bearing clearance. Is the clearance more than the specified value?	0.015 - 0.040 mm (0.00059 - 0.00157 in.)	Go to Step 13	Go to Step 14
13	Replace the main bearings, as necessary. Is the repair complete?	-	Go to Step 1	-
14	Inspect the rod bearing clearance. Is the clearance more than the specified value?	0.019 - 0.070 mm (0.0007 - 0.0028 in.)	Go to Step 15	System OK
15	Replace the rod bearings, as necessary. Is the repair complete?	-	Go to Step 1	-

Light Knock Hot**LIGHT KNOCK HOT REFERENCE CHART**

Step	Action	Value(s)	Yes	No
1	Is there a light knock when the engine is hot?	-	Go to Step 2	System OK
2	Is detonation or spark knock evident?	-	Go to Step 3	Go to Step 4
3	Check the engine timing and the fuel quality. Was the problem found?	-	Go to Step 1	-
4	Inspect the torque converter bolts. Are the bolts tightened to the specified value?	45 N.m (33 lb-ft)	Go to Step 5	Go to Step 6
5	Tighten the torque converter bolts. Is the repair complete?	-	Go to Step 1	-
6	Inspect the manifold. Is there an exhaust leak at the manifold?	-	Go to Step 7	Go to Step 8
7	Tighten the bolts or replace the gasket. Is the repair complete?	-	Go to Step 1	-
8	Check the rod bearing clearance. Is the clearance within the specified value?	0.019 - 0.070 mm (0.0007 - 0.0028 in.)	Go to Step 9	System OK
9	Replace the rod bearings, as necessary. Is the repair complete?	-	Go to Step 1	-

Knocks During Initial Start-Up But Last Only a Few Seconds

KNOCKS DURING INITIAL START-UP BUT LAST ONLY A FEW SECONDS REFERENCE CHART

Step	Action	Value(s)	Yes	No
1	Does the engine knock during initial startup but last only a few seconds?	-	Go to Step 2	System OK
2	Check the engine oil. Is the proper viscosity oil used in the crankcase?	-	Go to Step 4	Go to Step 3
3	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	-	Go to Step 1	-
4	Inspect the hydraulic lifters. Is there evidence of hydraulic lifter bleed-down?	-	Go to Step 5	Go to Step 6
5	Clean, test and replace the lifters, as necessary. Is the repair complete? ⁽¹⁾	-	Go to Step 1	-
6	Inspect the crankshaft end clearance. Is the clearance more than specified value?	0.070 - 0.302 mm (0.0027 - 0.0118 in.)	Go to Step 7	Go to Step 8
7	Replace the crankshaft thrust bearing. Is the repair complete?	-	Go to Step 1	-
8	Inspect the front main bearing clearance. Is the clearance more than the specified value?	0.015 - 0.040 mm (0.00059 - 0.00157 in.)	Go to Step 9	System OK
9	Replace the worn parts of the front main bearing. Is the repair complete?	-	Go to Step 1	-

(1) When the engine is stopped, some valves will be open. Spring pressure against the lifters will tend to bleed lifter down. Attempts to repair this should be made only if the problem is consistent.

An engine that is only operated for short periods between start-ups may have lifter noise that lasts for a few minutes. This is a normal condition.

Knocks at Idle Hot
KNOCKS AT IDLE HOT REFERENCE

Step	Action	Value(s)	Yes	No
1	Does the engine knock at idle when hot?	-	Go to Step 2	System OK
2	Inspect the drive belts. Are the belts loose or worn?	-	Go to Step 3	Go to Step 4
3	Tension or replace the belts, as necessary. Is the repair complete?	-	Go to Step 1	-
4	Inspect the A/C compressor and the generator. Is either the compressor or the generator faulty?	-	Go to Step 5	Go to Step 6
5	Replace the faulty A/C compressor or the generator. Is the repair complete?	-	Go to Step 1	-

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno

6	Inspect the valve train. Are valve train components faulty?	-	Go to Step 7	Go to Step 8
7	Replace the faulty valve train components. Is the repair complete?	-	Go to Step 1	-
8	Check the engine oil. Is the proper viscosity oil used in the crankcase?	-	Go to Step 10	Go to Step 9
9	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	-	Go to Step 1	-
10	Inspect the piston pin clearance. Is the clearance more than the specified value?	0.0035 - 0.0140 mm (0.00013 - 0.00055 in.)	Go to Step 11	Go to Step 12
11	Replace the piston and the pin. Is the repair complete?	-	Go to Step 1	-
12	Check the connecting rod alignment. Is the alignment faulty?	-	Go to Step 13	Go to Step 14
13	Check and replace rods, as necessary. Is the repair complete?	-	Go to Step 1	-
14	Inspect the piston-to-bore clearance. Is the clearance within the specified value?	0.010 - 0.030 mm (0.00039 - 0.00111 in.)	Go to Step 16	Go to Step 15
15	Hone the bore and fit a new piston. Is the repair complete?		Go to Step 1	-
16	Inspect the crankshaft balancer. Is the balancer loose?	-	Go to Step 17	Go to Step 18
17	Torque or replace worn parts. Is the repair complete?	-	Go to Step 1	-
18	Check the piston pin offset. Is the offset at the specified value?	1.0 mm (0.04 in.) Toward Thrust Side	Go to Step 19	System OK
19	Install the correct piston. Is the repair complete?	-	Go to Step 1	-

NOISE DIAGNOSIS

Main Bearing Noise

MAIN BEARING NOISE REFERENCE CHART

Step	Action	Value(s)	Yes	No
1	Are dull thuds or knocks heard with every engine revolution?	-	Go to Step 2	System OK
2	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to <u>OIL PRESSURE TEST</u> .	Go to Step 3
3	Inspect the crankshaft end play. Does the crankshaft end play exceed the specified value?	0.070 - 0.0302 mm (0.0027 - 0.0118 in.)	Go to <u>Crankshaft Disassembly and Assembly</u> .	Go to Step 4
	Inspect the crankshaft journals.			

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno

4	Are the crankshaft journals out-of-round?	0.003 mm (0.0001 in.) Max.	Go to <u>Crankshaft Disassembly and Assembly.</u>	Go to Step 5
5	Inspect the belt tension. Does the belt tension exceed the specified value?	-	Go to <u>Timing Belt Removal and Installation.</u>	Go to Step 6
6	Inspect the crankshaft pulley. Is the crankshaft pulley loose?	-	Go to <u>Crankshaft Disassembly and Assembly.</u>	System OK

Connecting Rod Bearing Noise Symptom

CONNECTING ROD BEARING NOISE SYMPTOM CHART

Step	Action	Value(s)	Yes	No
1	Is a knock noise heard under all engine speeds?	-	Step 2 System OK	System OK
2	Inspect the crankshaft connecting rod journal. Is the crankshaft connecting rod journal worn?	-	Go to <u>Crankshaft Disassembly and Assembly.</u>	Go to Step 3
3	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to <u>OIL PRESSURE TEST.</u>	Go to Step 4
4	Inspect the crankshaft connecting rod journals. Are the journals out-of-round?	-	Go to <u>Crankshaft Disassembly and Assembly.</u>	Go to Step 5
5	Inspect the connecting rods. Is there a misaligned connecting rod?	-	Go to <u>Pistons and Rods Removal and Installation.</u>	Go to Step 6
6	Inspect the connecting rod bolts. Are the connecting rod bolts torqued properly?	-	System OK	Go to <u>Pistons and Rods Removal and Installation.</u>

Piston Noises

PISTON NOISES REFERENCE CHART

Step	Action	Value (s)	Yes	No
1	Are any of the following noises heard: a sharp double knock when the engine is idling, a light ticking with no load on the engine, or a "slapping" noise when the engine is cold?	-	Go to Step 2	System OK
2	Inspect the piston pin and the bushing. Is the piston pin or the bushing worn or loose?	-	Go to <u>Pistons and Rods Removal and Installation.</u>	Go to Step 3
3	Inspect the piston. Is the piston broken or cracked?	-	Go to <u>Pistons and Rods Removal and Installation.</u>	Go to Step 4
4	Inspect the connecting rods. Is there a misaligned connecting rod?	-	Go to <u>Pistons and Rods Removal and Installation.</u>	Go to Step 5
5	Inspect the piston position. Is the piston 180° out of position?	-	Go to <u>Pistons and Rods Removal and Installation.</u>	System OK

Valve Mechanism or Valve Train Noises

VALVE MECHANISM OR VALVE TRAIN NOISES

Step	Action	Value (s)	Yes	No
1	Is a light tapping sound heard from the engine?	-	Go to Step 2	System OK
2	Inspect the valve springs. Are the springs weak or broken?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 3
3	Inspect the valves. Are the valves sticking or warped?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 4
4	Inspect the valve lifters. Are the valve lifters dirty, stuck or worn?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 5
5	Inspect the camshaft lobes. Are the camshaft lobes damaged or improperly machined?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 6
6	Check the oil supply to the valve train. Is the oil supply insufficient or poor?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 7
7	Inspect the valve guides. Are the valve guides worn?	-	Go to <u>Cylinder Head and Valve Train Components Disassembly and Assembly.</u>	Go to Step 8
8	Inspect the valve spring seat.	-	Go to <u>Cylinder Head and Valve Train</u>	System

Is the valve spring seat incorrect?

Components Disassembly and Assembly.

OK

REPAIR INSTRUCTIONS

CAMSHAFT COVER REMOVAL AND INSTALLATION

Removal

1. Disconnect the negative battery cable.
2. Disconnect the breather tube from the valve cover.
3. Disconnect all of the necessary vacuum lines.
4. Remove the spark plug cover bolts.
5. Remove the spark plug cover.

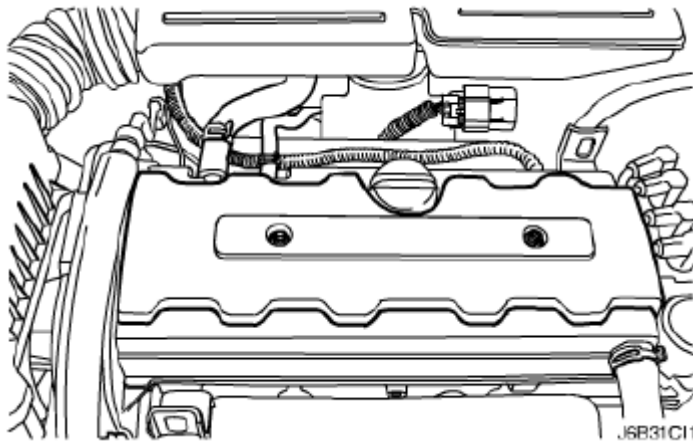


Fig. 3: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect the ignition wires from the spark plugs.
7. Disconnect the camshaft position sensor connector.
8. Remove the camshaft cover bolts.

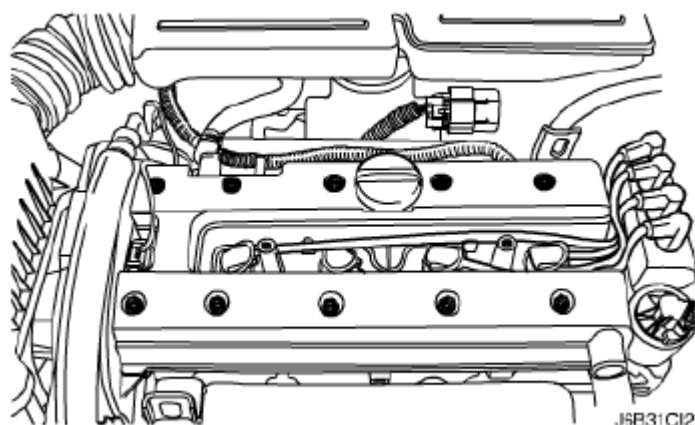


Fig. 4: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the camshaft cover.
10. Remove the camshaft cover gasket from the camshaft cover.

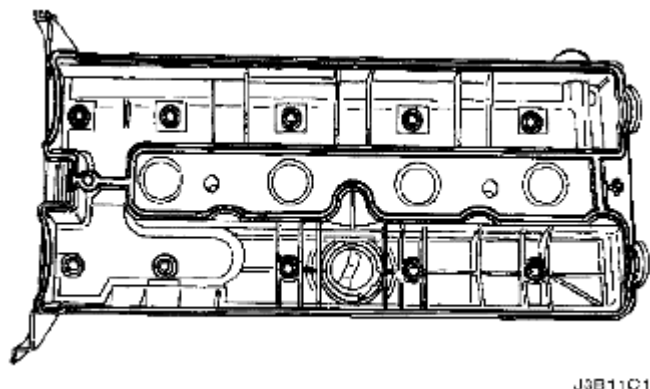
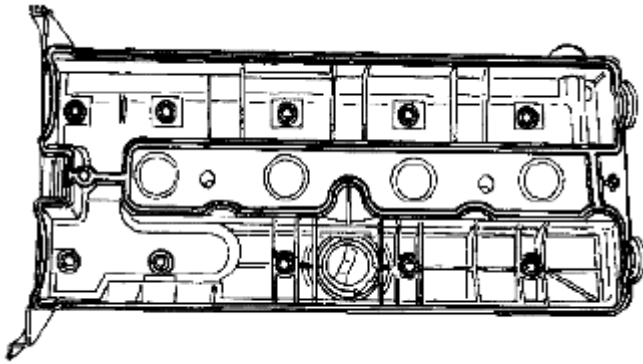


Fig. 5: Identifying Camshaft Cover Gasket From Camshaft Cover (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Apply a small amount of gasket sealant to the corners of the front camshaft caps and the top of the rear camshaft cover-to-cylinder head seal.
2. Install the new camshaft cover gasket to the camshaft cover.



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Fig. 6: Identifying Camshaft Cover Gasket From Camshaft Cover (2 Of 2)
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3. Install the camshaft cover.
4. Install the camshaft cover bolts.

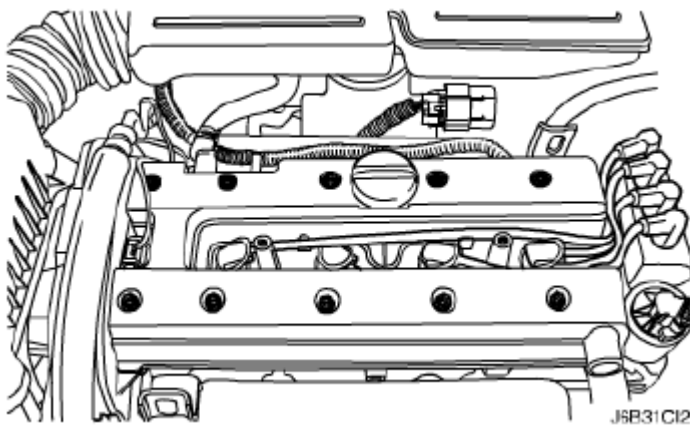
Tighten:

Tighten the camshaft cover bolts to 8 N.m (71 lb-in).

5. Connect the ignition wires to the spark plugs.
6. Install the spark plug cover.

Tighten:

Tighten the spark plug cover bolts to 8 N.m (71 lb-in).



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Fig. 7: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the spark plug cover bolts.
8. Connect the camshaft position sensor connector.

9. Connect all of the necessary vacuum lines.
10. Connect the breather tube to the camshaft cover.
11. Connect the negative battery cable.

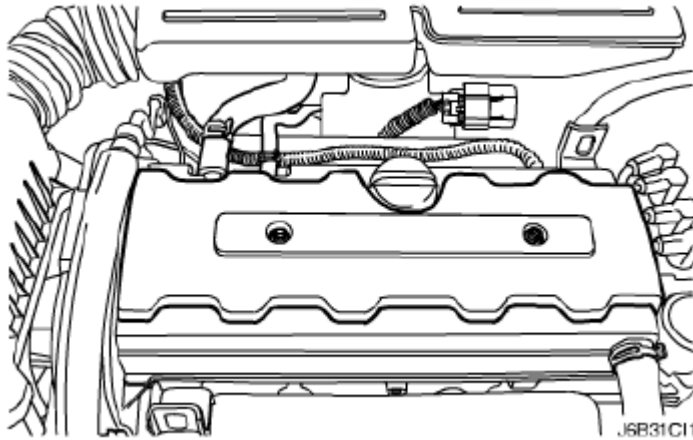


Fig. 8: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION

Refer to CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION .

CYLINDER HEAD AND GASKET CLEANING

1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to Cylinder Head Inspection.

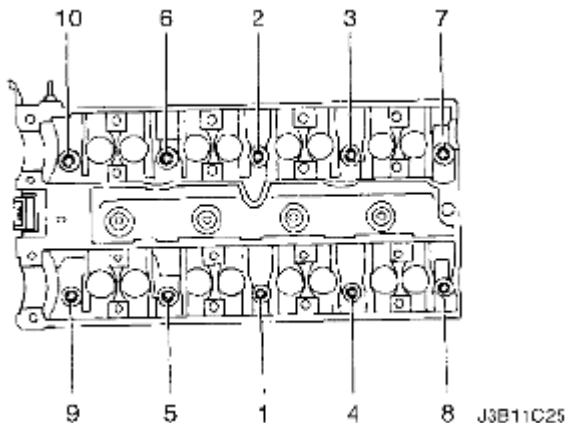


Fig. 9: Identifying Cylinder Head Bolts

Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFTS REMOVAL AND INSTALLATION

Removal

1. Remove the timing belt. Refer to **Timing Belt Removal and Installation**.
2. Disconnect the breather tube at the camshaft cover.
3. Disconnect the engine ventilation hose at the camshaft cover.
4. Remove the spark plug cover bolts.
5. Remove the spark plug cover.
6. Disconnect the ignition wires from the spark plugs.
7. Remove the camshaft cover bolts.
8. Remove the camshaft cover washers.
9. Remove the camshaft cover and the camshaft cover gasket.

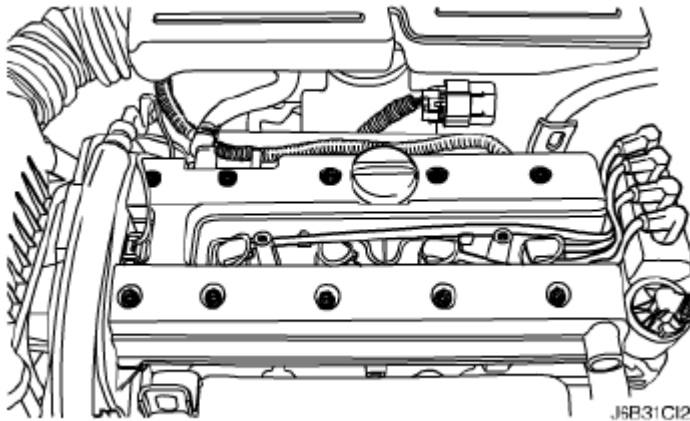


Fig. 10: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

10. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
11. Remove the intake camshaft gear.
12. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
13. Remove the exhaust camshaft gear.

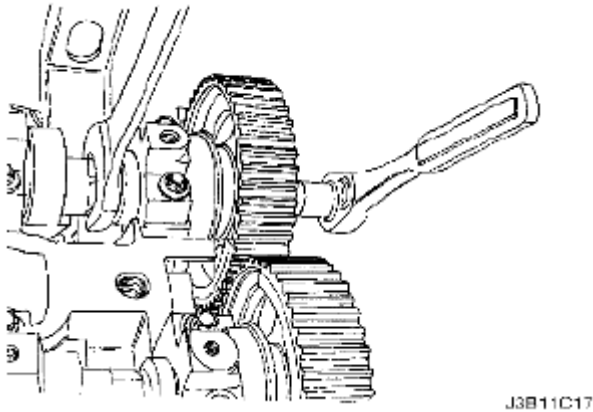


Fig. 11: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

14. Loosen the camshaft bearing cap bolts in stages of one-half to one turn.
15. Remove the camshaft bearing cap bolts from the cylinder head.
16. Remove the camshafts.
17. Remove the seal ring from the camshafts.
18. Check the camshaft and bearing seats for wear and replace them if necessary.

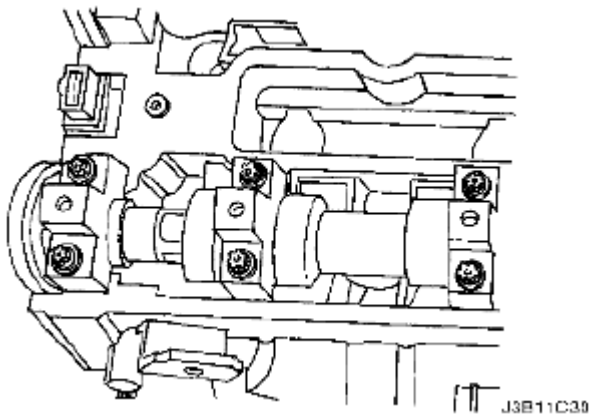


Fig. 12: Identifying Seal Ring From Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

Installation

CAUTION: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

1. Lubricate the camshaft journals and the camshaft caps with engine oil.
2. Install the intake camshaft.
3. Install the intake camshaft caps in their original positions.

4. Install the intake camshaft cap bolts.
5. Install the exhaust camshaft.
6. Install the exhaust camshaft caps in their original positions.
7. Install the exhaust camshaft cap bolts.
8. Tighten the camshaft cap bolts gradually and in the sequence shown for each camshaft cap.

Tighten:

Tighten the camshaft bearing cap bolts to 8 N.m (71 lb-in).

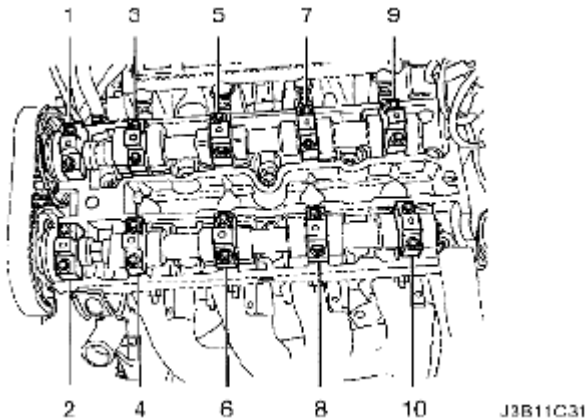
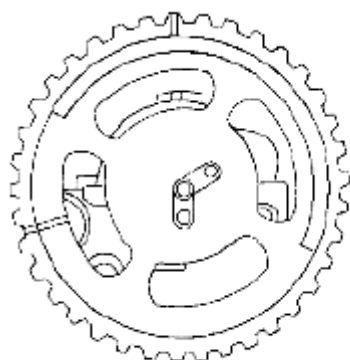


Fig. 13: Identifying Camshaft Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

9. Measure the intake camshaft end play and the exhaust camshaft end play. Refer to **Engine Specifications**.
10. Install the intake camshaft gear.
11. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

Tighten:

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.



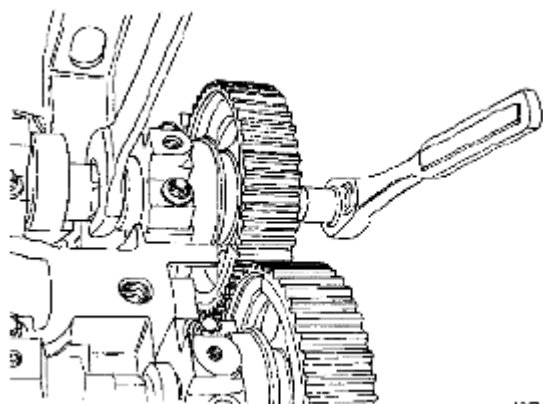
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Fig. 14: Identifying Intake Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

12. Install the exhaust camshaft gear.
13. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten:

Tighten the exhaust camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.



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Fig. 15: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the camshaft cover and the camshaft cover gasket.
15. Install the camshaft cover washers.
16. Install the camshaft cover bolts.

Tighten:

Tighten the camshaft cover bolts to 8 N.m (71 lb-in).

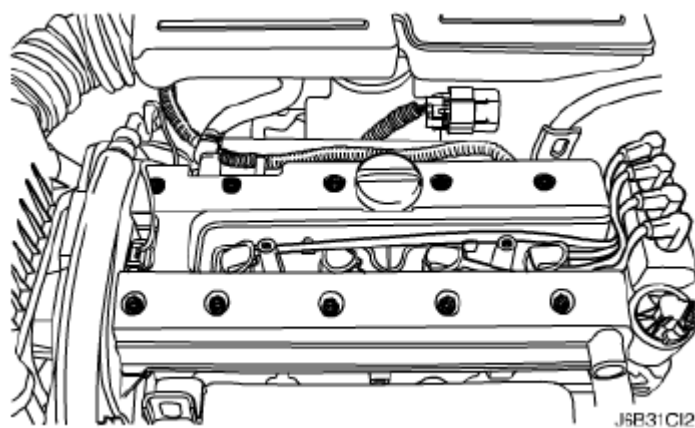


Fig. 16: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

17. Connect the ignition wires to the spark plugs.
18. Install the spark plug cover.
19. Install the spark plug cover bolts.

Tighten:

Tighten the spark plug cover bolts to 8 N.m (71 lb-in).

20. Connect the breather tube to the camshaft cover.
21. Connect the engine ventilation hose to the camshaft cover.
22. Install the timing belt. Refer to **Timing Belt Removal and Installation**.

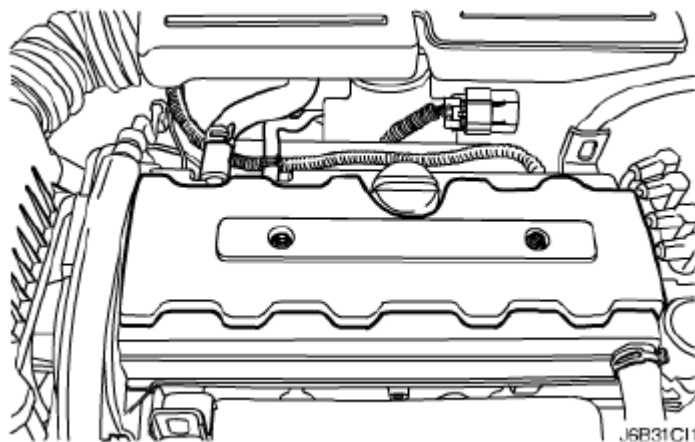


Fig. 17: Identifying Camshaft Cover (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

TIMING BELT CHECK AND ADJUST

1. Disconnect the negative battery cable.
2. Disconnect the Manifold Air Temperature (MAT) sensor connector.
3. Remove the air cleaner outlet hose from the throttle body.
4. Remove the breather tube from the camshaft cover.

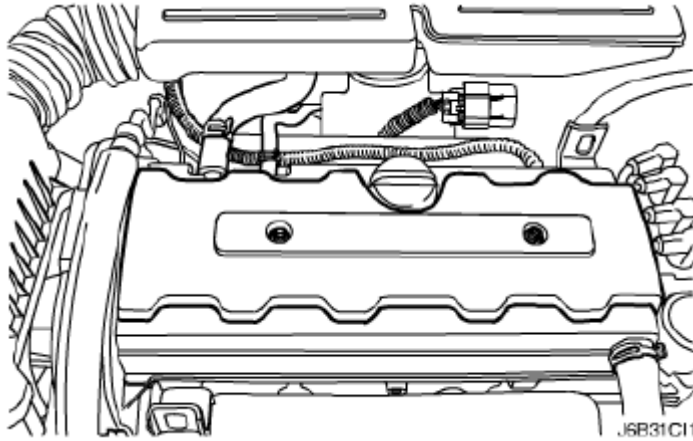


Fig. 18: Identifying Camshaft Cover (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.
7. Remove the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION**.
8. Remove the right front wheel well splash shield.

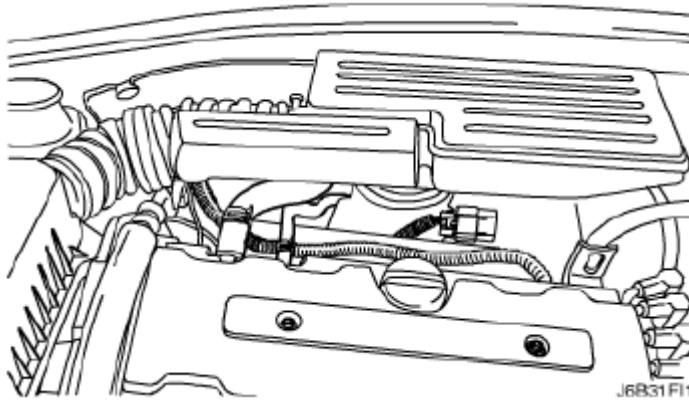


Fig. 19: Identifying Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION**.
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.

12. Remove the right engine mount bracket. Refer to **Engine Mount Removal and Installation**.

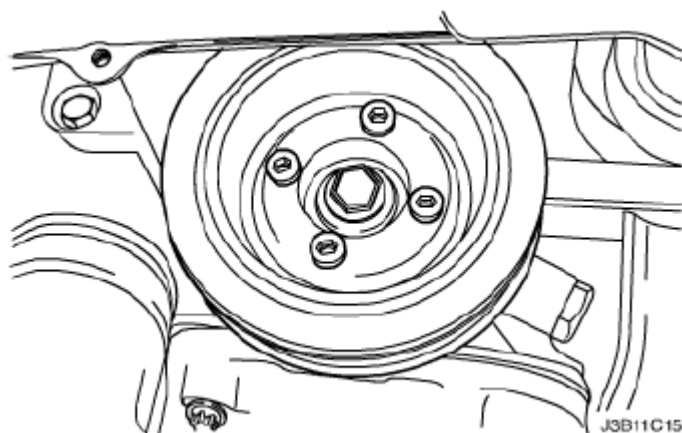


Fig. 20: Identifying Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.

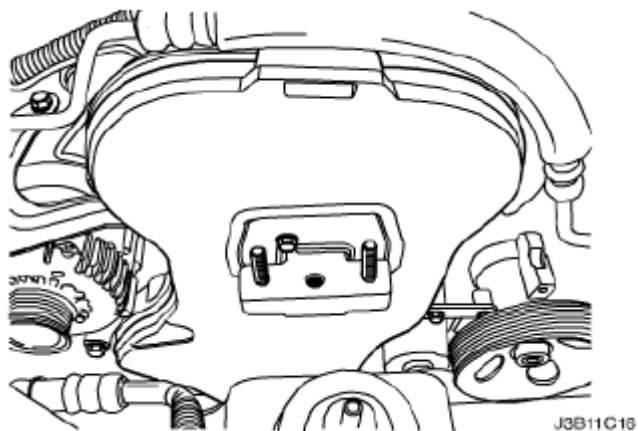


Fig. 21: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

15. Rotate the crankshaft at least one full turn clockwise using the crankshaft gear bolt.
16. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.

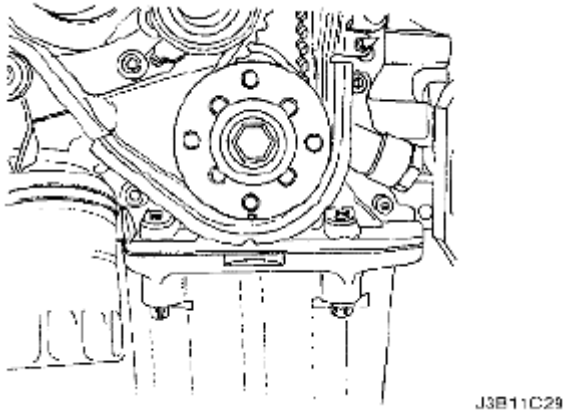


Fig. 22: Identifying Crankshaft Gear With Notch At Bottom Of Rear Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

17. Align the camshaft gear timing marks. Use the exhaust gear mark for the exhaust gear and the intake gear mark for the intake gear, since the gears are interchangeable.

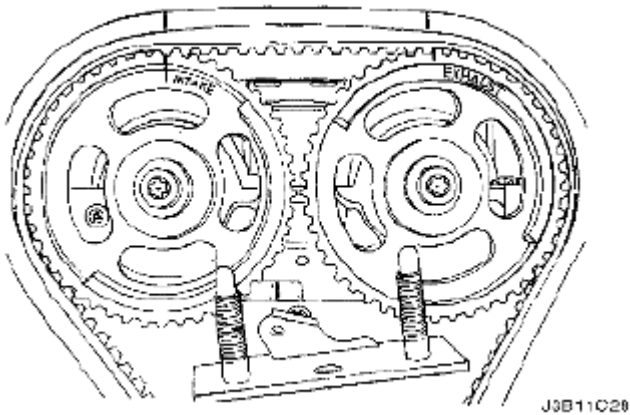


Fig. 23: Identifying Camshaft Gear Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

18. Loosen the automatic tensioner bolt. To relieve the belt tension, turn the hex-key tab counterclockwise.
19. Rotate the automatic tensioner hex-key tab clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.

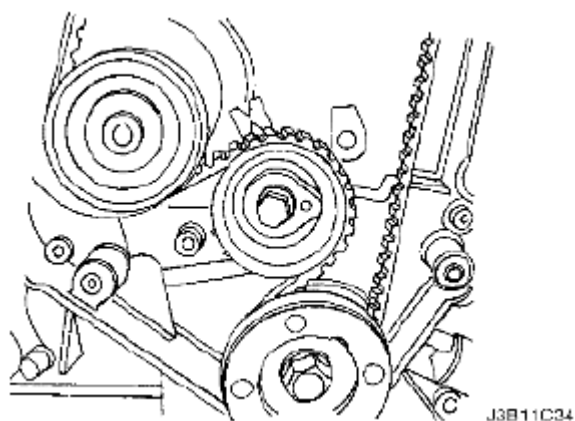


Fig. 24: Identifying Timing Belt Automatic Tensioner Bracket
Courtesy of SUZUKI OF AMERICA CORP.

20. Tighten the automatic tensioner bolt.
21. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.
22. Check the automatic tensioner pointer.

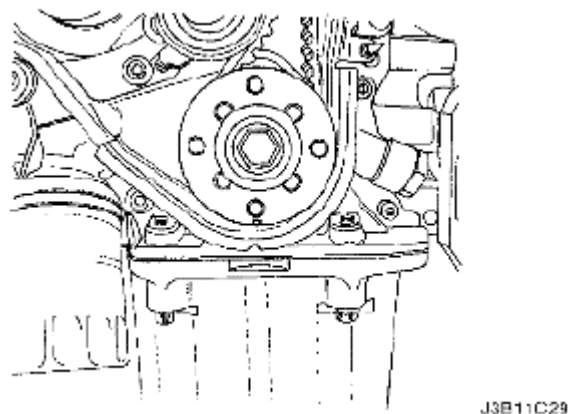


Fig. 25: Identifying Automatic Tensioner Pointer
Courtesy of SUZUKI OF AMERICA CORP.

23. When the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch on the timing belt automatic tensioner bracket, the belt is tensioned correctly.

Tighten:

Tighten the automatic tensioner bolt to 25 N.m (18 lb-ft).

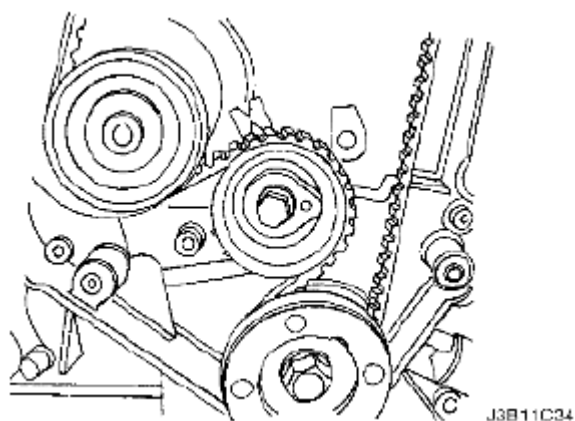


Fig. 26: Identifying Timing Belt Automatic Tensioner Bracket
Courtesy of SUZUKI OF AMERICA CORP.

24. Install the front timing belt cover.
25. Install the front timing belt cover bolts.

Tighten:

Tighten the front timing belt cover bolts to 6 N.m (53 lb-in).

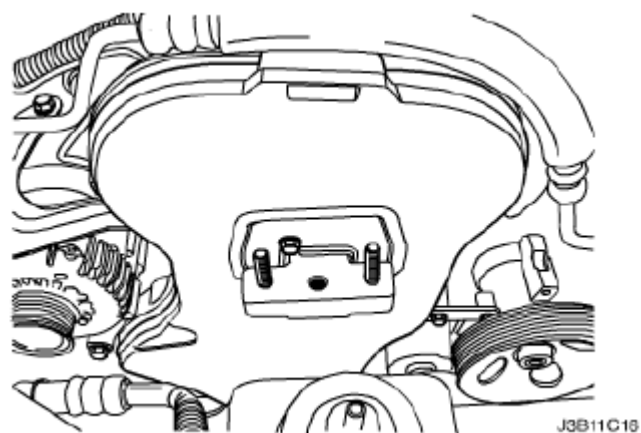


Fig. 27: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

26. Install the crankshaft pulley.
27. Install the crankshaft pulley bolt.

Tighten:

Tighten the crankshaft pulley bolt to 20 N.m (15 lb-ft).

28. Install the right engine mount bracket. Refer to **Engine Mount Removal and Installation**.

29. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .

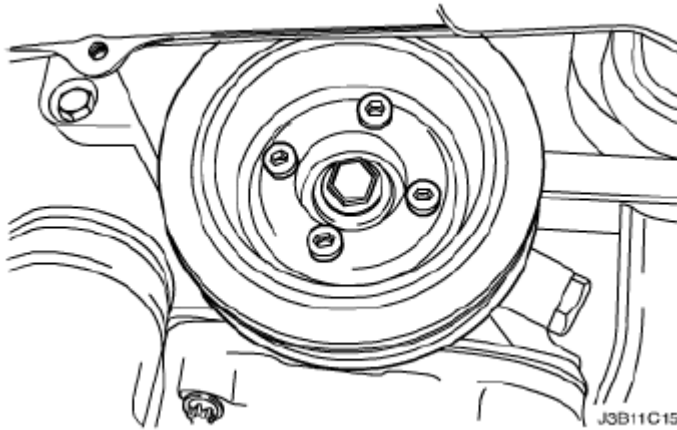


Fig. 28: Identifying Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

30. Install the right front wheel well splash shield.
31. Install the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION** .
32. Install the air cleaner housing.
33. Install the air cleaner housing bolts.

Tighten:

Tighten the air cleaner housing bolts to 10 N.m (89 lb-in).

34. Connect the air cleaner outlet hose to the throttle body.

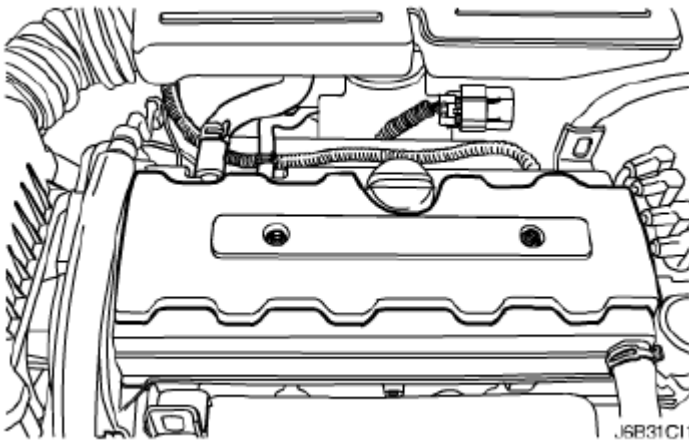


Fig. 29: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

35. Connect the breather tube to the camshaft cover.
36. Connect the MAT sensor connector.
37. Connect the negative battery cable.

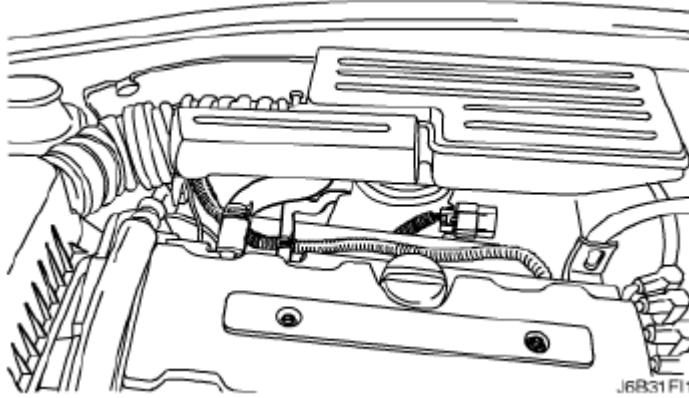


Fig. 30: Identifying Breather Tube To Camshaft Cover (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

TIMING BELT REMOVAL AND INSTALLATION

Removal

1. Disconnect the negative battery cable.
2. Disconnect the Manifold Air Temperature (MAT) sensor connector.
3. Disconnect the air cleaner outlet hose from the throttle body.
4. Disconnect the breather tube from the camshaft cover.

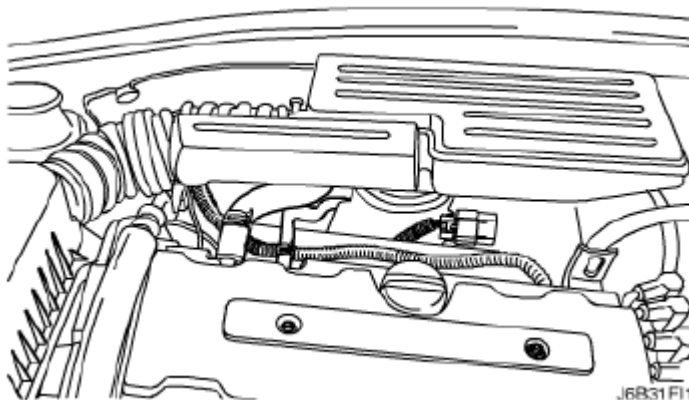


Fig. 31: Identifying Breather Tube To Camshaft Cover (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.

7. Remove the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION** .
8. Remove the right front wheel well splash shield.

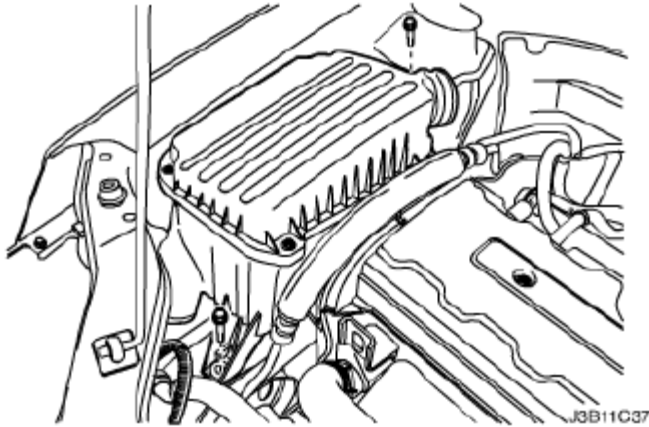


Fig. 32: Identifying Air Cleaner Housing And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to **Engine Mount Removal and Installation**.

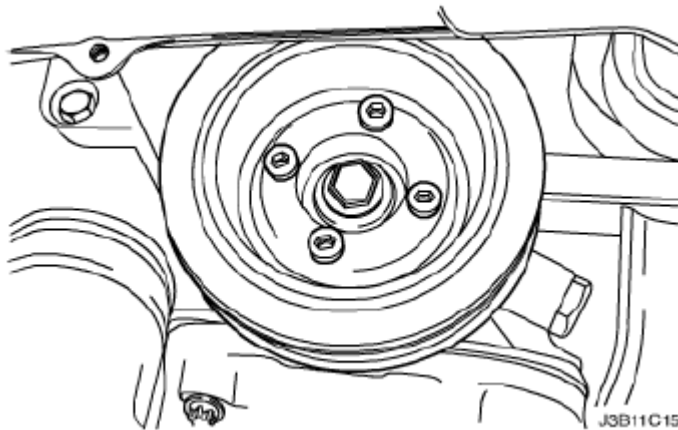


Fig. 33: Identifying Crankshaft Pulley And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.

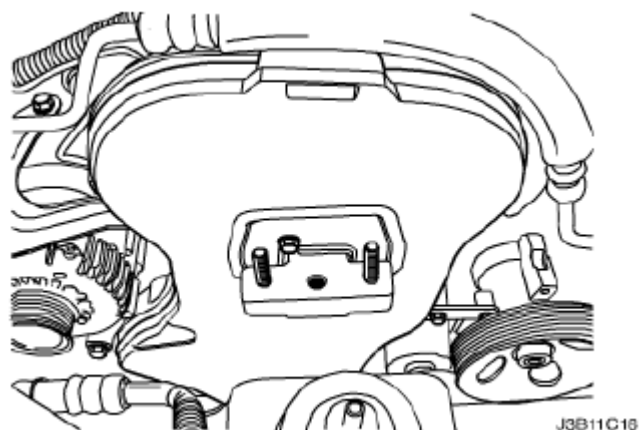


Fig. 34: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

15. Using the crankshaft gear bolt, rotate the crankshaft clockwise until the timing mark on the crankshaft gear is aligned with the notch at the bottom of the rear timing belt cover.

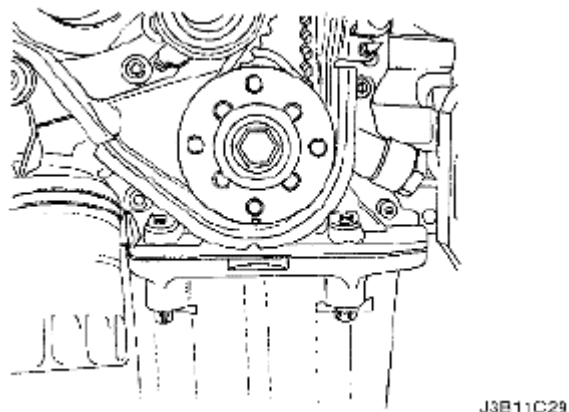


Fig. 35: Identifying Crankshaft Gear With Notch At Bottom Of Rear Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

16. Align the camshaft gears with the notch on the camshaft cover.

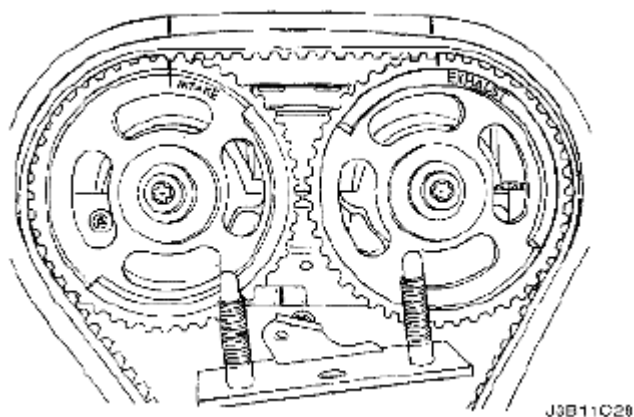


Fig. 36: Identifying Camshaft Gears With Notch On Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

17. Remove the timing belt.
18. Loosen the automatic tensioner bolt. Turn the hex-key tab to relieve belt tension.

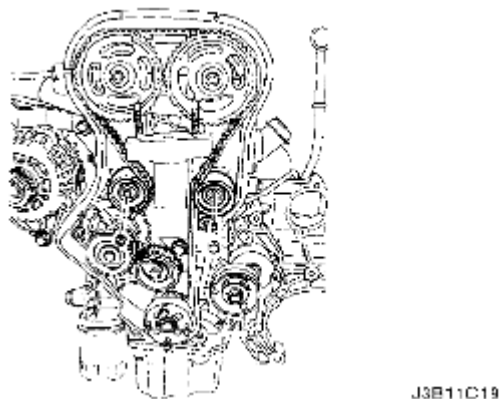


Fig. 37: Identifying Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Align the timing mark on the crankshaft gear with the notch on the bottom of the rear timing belt cover.

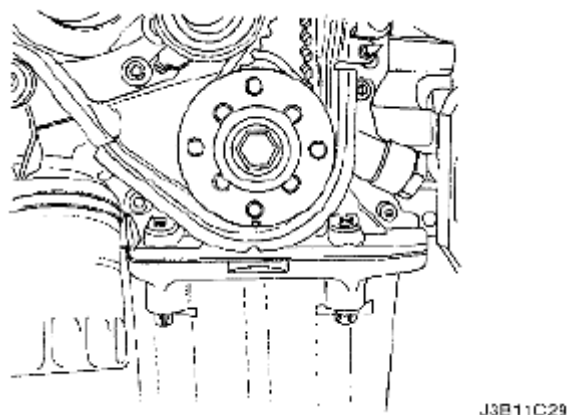


Fig. 38: Identifying Timing Mark On Crankshaft Gear With Notch On Bottom Of Rear Timing Belt Cover

Courtesy of SUZUKI OF AMERICA CORP.

2. Align the timing marks on the camshaft gears, using the intake gear mark for the intake gear and the exhaust gear mark for the exhaust gear.

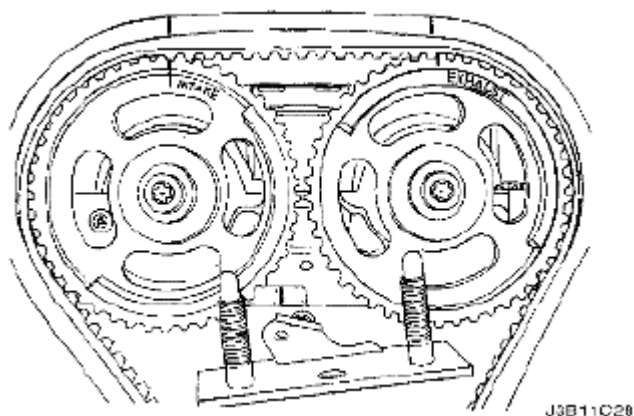
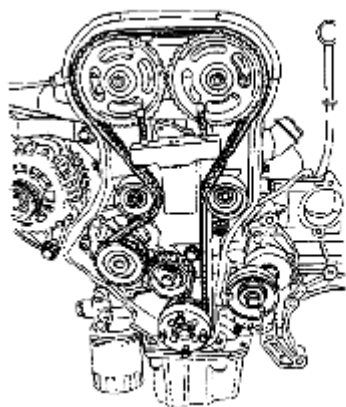


Fig. 39: Identifying Timing Marks On Camshaft Gears

Courtesy of SUZUKI OF AMERICA CORP.

3. Install the timing belt.



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Fig. 40: Identifying Timing Belt

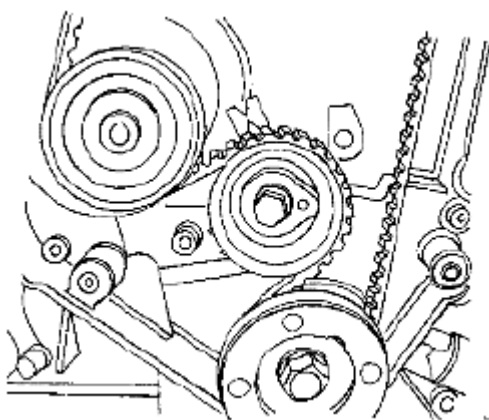
Courtesy of SUZUKI OF AMERICA CORP.

4. Turn the hex-key tab in a clockwise direction to tension the belt. Turn until the pointer aligns with the notch.
5. Install the automatic tensioner bolt.

Tighten:

Tighten the automatic tensioner bolt to 25 N.m (18 lb-ft).

6. Rotate the crankshaft two full turns clockwise using the crankshaft pulley bolt.
7. Recheck the automatic tensioner pointer.



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Fig. 41: Identifying Automatic Tensioner Pointer

Courtesy of SUZUKI OF AMERICA CORP.

8. Install the front timing belt cover.
9. Install the front timing belt cover bolts.

Tighten:

Tighten the front timing belt cover bolts to 6 N.m (53 lb-in).

10. Install the right engine mount bracket. Refer to

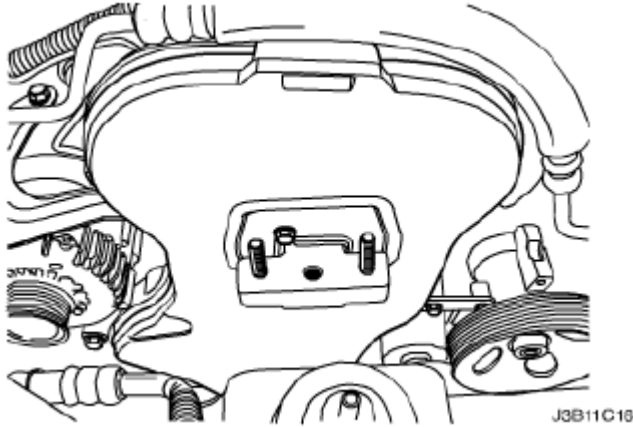


Fig. 42: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the crankshaft pulley.
12. Install the crankshaft pulley bolts.

Tighten:

Tighten the crankshaft pulley bolts to 20 N.m (15 lb-ft).

13. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
14. Install the right front wheel well splash shield.
15. Install the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION** .
16. Install the air cleaner housing.
17. Install the air cleaner housing bolts.

Tighten:

Tighten the air cleaner housing bolts to 10 N.m (89 lb-in).

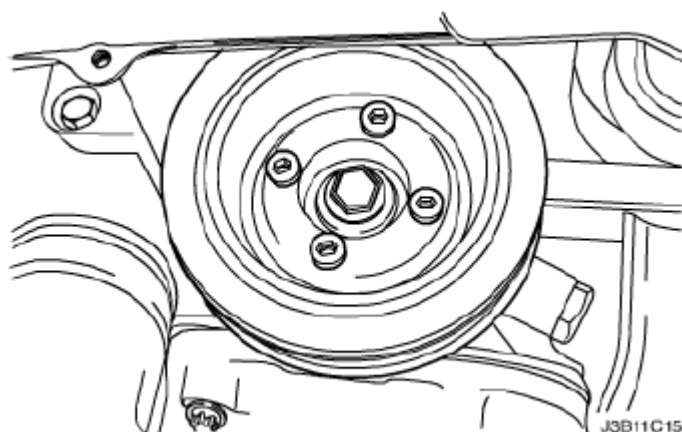


Fig. 43: Identifying Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

18. Connect the air cleaner outlet hose to the throttle body.
19. Connect the breather tube to the camshaft cover.
20. Connect the MAT sensor connector.
21. Connect the negative battery cable.

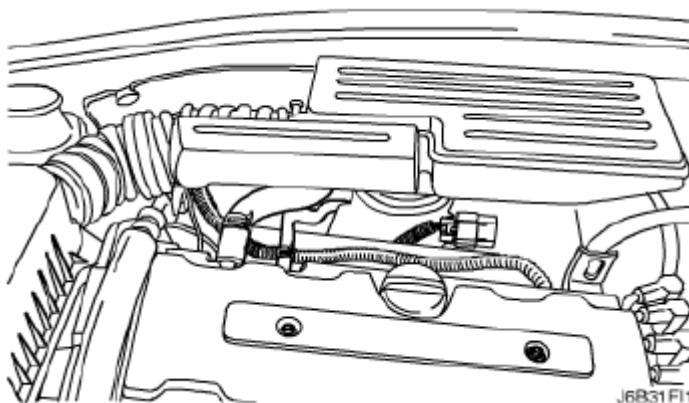


Fig. 44: Identifying Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE MOUNT REMOVAL AND INSTALLATION

Tools Required:

DW110-060 Engine Assembly Support Fixture

Removal

1. Disconnect the negative battery cable.
2. Support the engine assembly using the engine assembly support fixture DW110-060.

3. Disconnect the Manifold Air Temperature (MAT) sensor connector.
4. Disconnect the air cleaner outlet hose from the throttle body.
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.

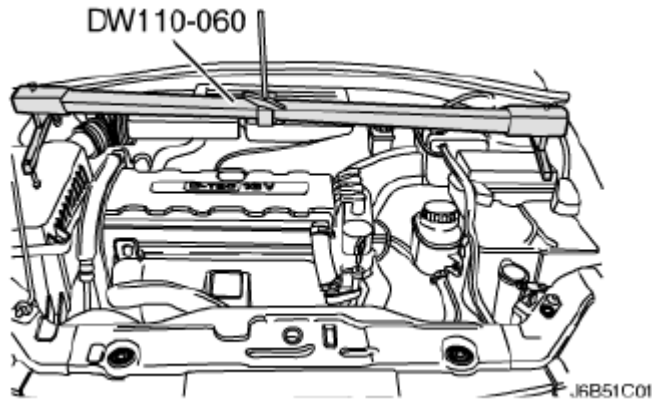


Fig. 45: Identifying Engine Assembly Support Fixture (Dw110-060)
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove the right front splash shield.
8. Remove the engine mount bracket retaining bolts.
9. Remove the engine mount bracket.
10. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION**.

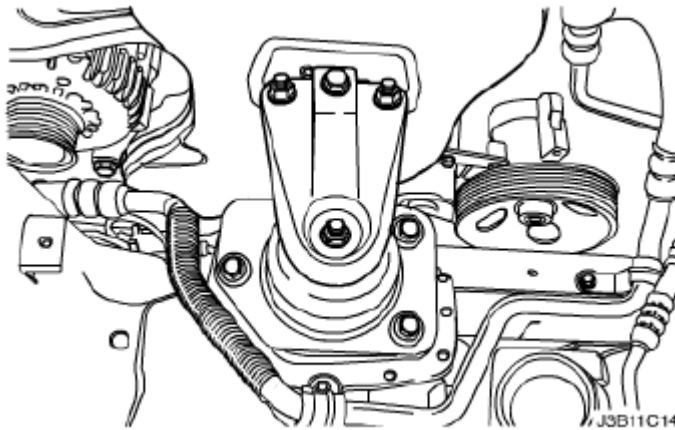


Fig. 46: Identifying Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove the front timing belt cover bolts.
12. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.

13. Loosen the timing belt automatic tensioner bolt.
14. Turn the hex-key tab to relieve belt tension.
15. Remove the timing belt idler pulley bolt and nut.
16. Remove the timing belt idler pulley.
17. Remove the engine mount retaining bolts.
18. Remove the engine mount.

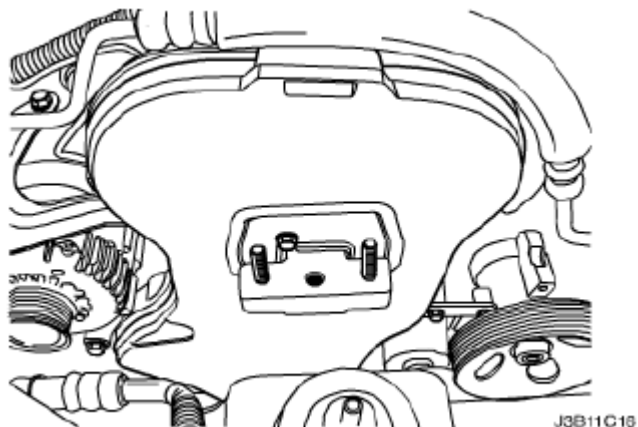


Fig. 47: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install the engine mount.
2. Install the engine mount retaining bolts.

Tighten:

Tighten the engine mount retaining bolts to 45 N.m (33 lb-ft).

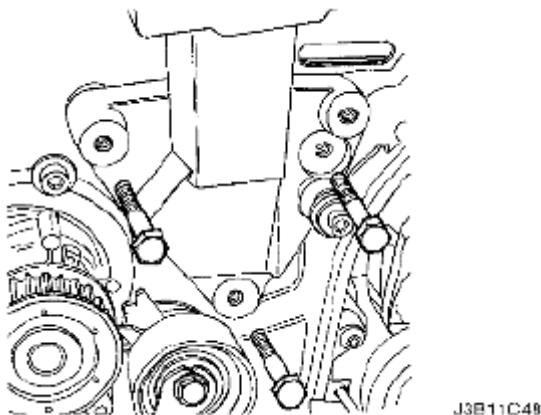


Fig. 48: Identifying Engine Mount Retaining Bolts

Courtesy of SUZUKI OF AMERICA CORP.

3. Install the timing belt idler pulleys.
4. Install the timing belt idler pulley bolt and nut.

Tighten:

Tighten the timing belt idler pulley bolt and nut to 25 N.m (18 lb-ft).

5. Tension the timing belt by turning the timing belt automatic tensioner hex-key tab counterclockwise until the pointer is aligned to the indicator.

Tighten:

Tighten the timing belt automatic tensioner bolt to 25 N.m (18 lb-ft).

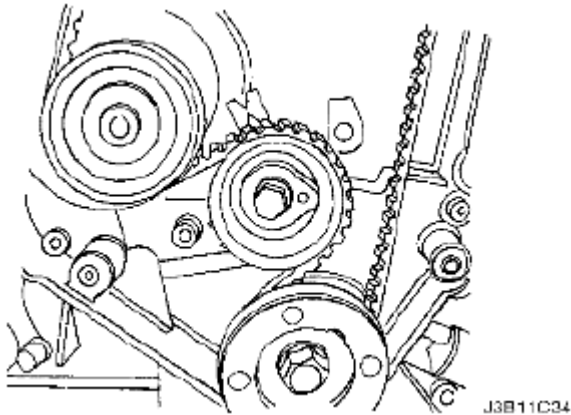


Fig. 49: Identifying Timing Belt Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the front timing belt cover.
7. Install the front timing belt cover bolts.

Tighten:

Tighten the front timing belt cover bolts to 6 N.m (53 lb-in).

8. Install the engine mount bracket and retaining bolts.

Tighten:

Tighten the engine mount bracket retaining bolts to 55 N.m (41 lb-ft).

9. Remove the engine assembly support fixture DW110-060.
10. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT**

REMOVAL AND INSTALLATION .

11. Connect the negative battery cable.

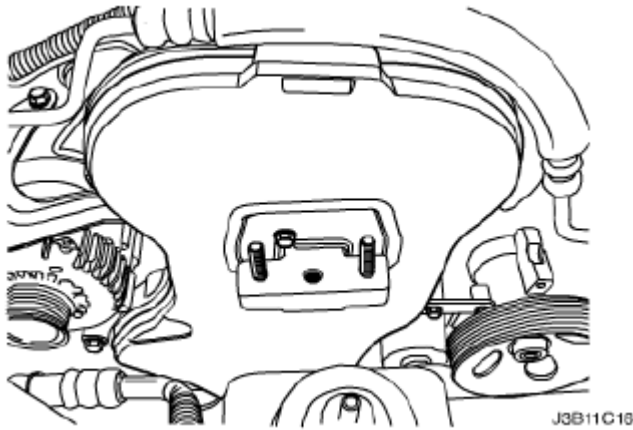


Fig. 50: Identifying Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

INTAKE MANIFOLD REMOVAL AND INSTALLATION**Removal**

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the Charcoal Canister Purge (CCP) and Exhaust Gas Recirculation (EGR) solenoid from the intake manifold and loosen the bracket bolt.
5. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM .**

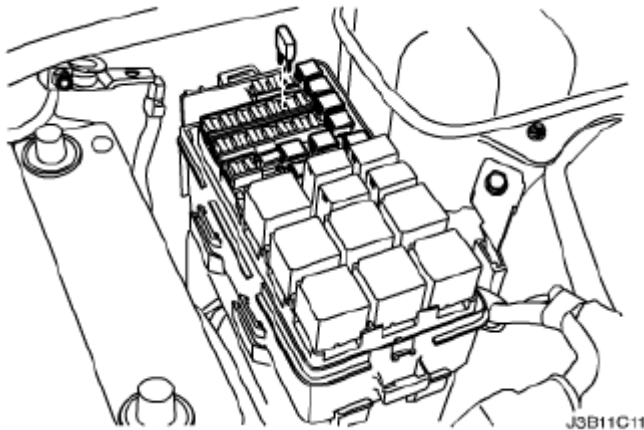


Fig. 51: Identifying Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect the Manifold Air Temperature (MAT) sensor connector.
7. Disconnect the air cleaner outlet hose from the throttle body.

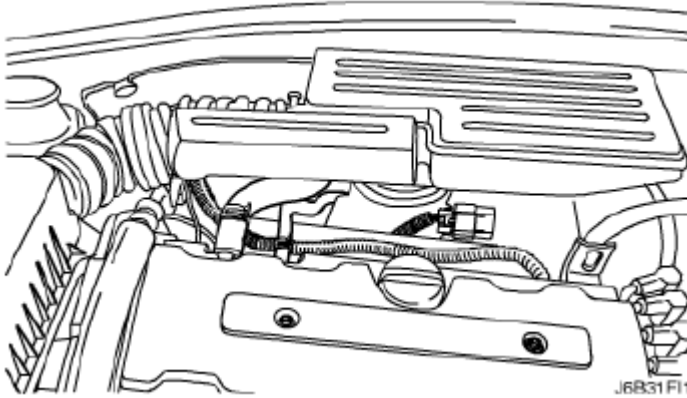


Fig. 52: Identifying Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

8. Disconnect the Idle Air Control (IAC) valve connector.
9. Disconnect the Manifold Absolute Pressure (MAP) sensor connector.
10. Disconnect the coolant hoses at the throttle body.

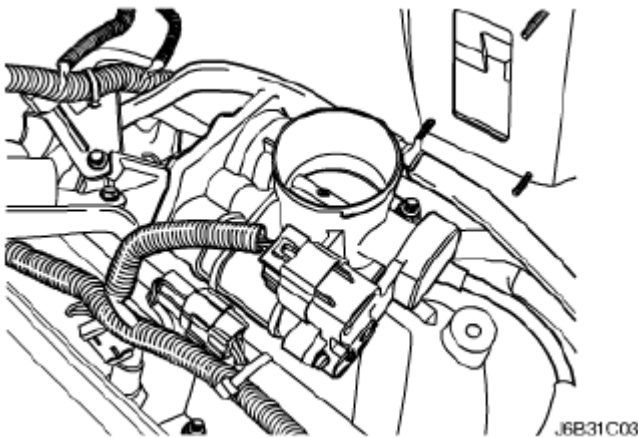


Fig. 53: Identifying Coolant Hoses To Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

11. Disconnect all of the necessary vacuum hoses, including the vacuum hose at the fuel pressure regulator and the brake booster vacuum hose at the intake manifold.
12. Remove the generator-to-intake manifold strap bracket bolts and strap.
13. Remove the fuel rail as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
14. Remove the generator-to-intake manifold support bracket bolts.
15. Remove the generator-to-intake manifold support bracket.

16. Remove the intake manifold support bracket bolt at the engine block and the intake manifold.
17. Remove the intake manifold support bracket.

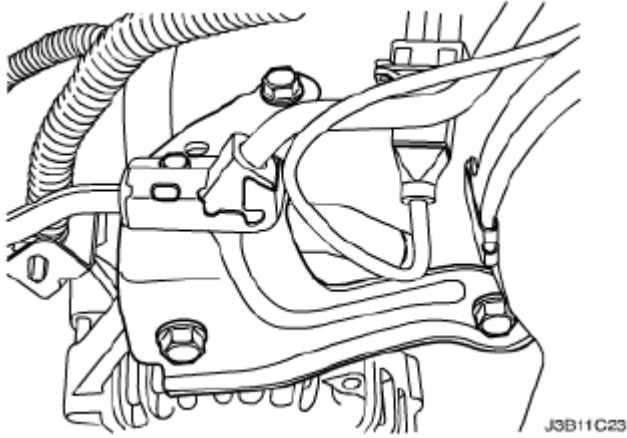


Fig. 54: Identifying Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

18. Remove the intake manifold retaining bolt and nuts in the sequence shown.
19. Remove the intake manifold.
20. Remove the intake manifold gasket.
21. Clean the sealing surfaces of the intake manifold and the cylinder head.

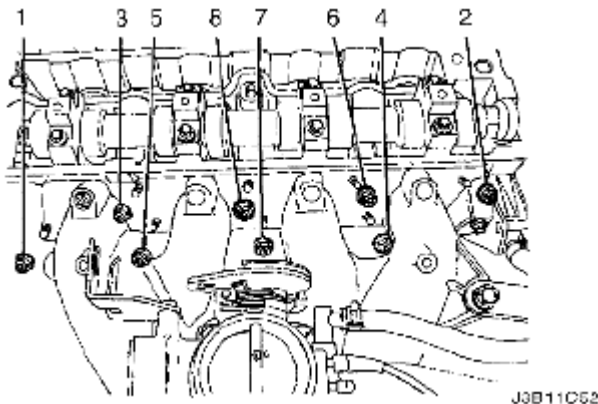


Fig. 55: Identifying Intake Manifold Retaining Bolt And Nuts In Sequence (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install the intake manifold gasket.
2. Install the intake manifold.
3. Install the intake manifold retaining bolt and nuts in the sequence shown.

Tighten:

Tighten the intake manifold retaining bolt and nuts to 22 N.m (16 lb-ft).

4. Install the generator-to-intake manifold strap bracket and bolts.

Tighten:

Tighten the generator-to-intake manifold strap bracket bolts to 22 N.m (16 lb-ft).

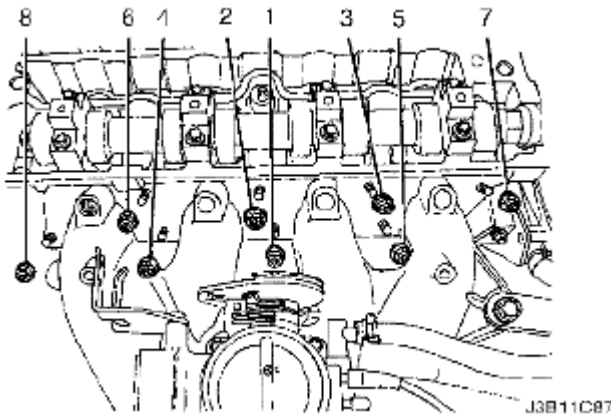


Fig. 56: Identifying Intake Manifold Retaining Bolt And Nuts In Sequence (2 Of 2)
 Courtesy of SUZUKI OF AMERICA CORP.

5. Install the intake manifold support bracket.
6. Install the intake manifold support bracket upper bolts to the intake manifold.

Tighten:

Tighten the intake manifold support bracket upper bolts to the intake manifold to 25 N.m (18 lb-ft).

7. Install the intake manifold support bracket lower bolt to the engine block.

Tighten:

Tighten the intake manifold support bracket lower bolt to the engine block to 25 N.m (18 lb-ft).

8. Install the generator-to-intake manifold support bracket and bolts.

Tighten:

Tighten the generator-to-intake manifold support bracket bolts to 37 N.m (27 lb-ft).

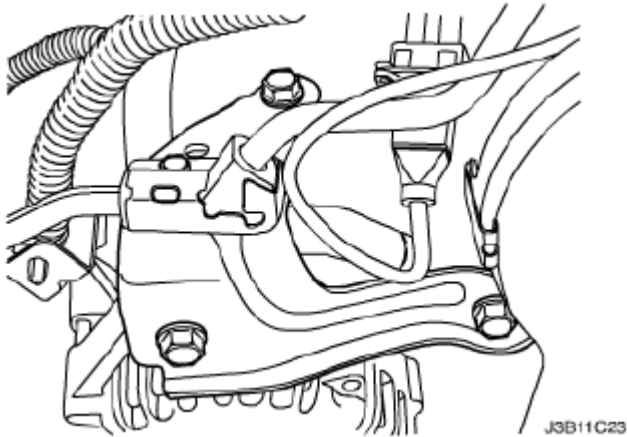


Fig. 57: Identifying Intake Manifold Support Bracket
 Courtesy of SUZUKI OF AMERICA CORP.

9. Install the fuel rail and injector cover as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
10. Connect all of the necessary vacuum lines that were previously disconnected.
11. Connect the MAP sensor connector.
12. Connect the coolant hoses to the throttle body.
13. Connect the ETC connector.

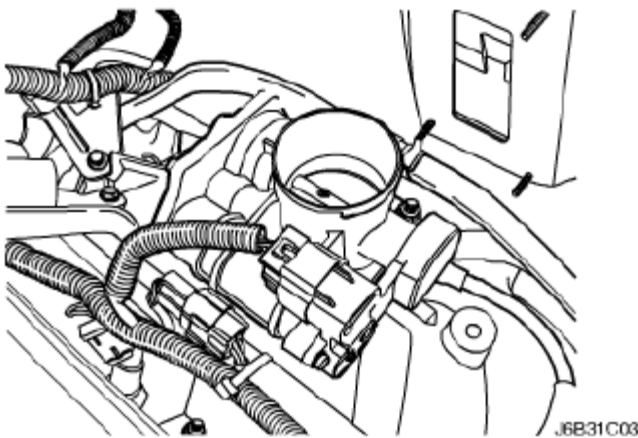


Fig. 58: Identifying Coolant Hoses To Throttle Body
 Courtesy of SUZUKI OF AMERICA CORP.

14. Connect the air cleaner outlet hose to the throttle body.
15. Connect the MAT sensor connector.
16. Connect the CCP and EGR solenoid at the intake manifold and tighten the bracket bolt.

Tighten:

Tighten the charcoal canister purge and exhaust gas recirculation solenoid bracket bolt to 5 N.m (44 lb-

in).

17. Install the fuel pump fuse.
18. Connect the negative battery cable.
19. Refill the engine cooling system. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .

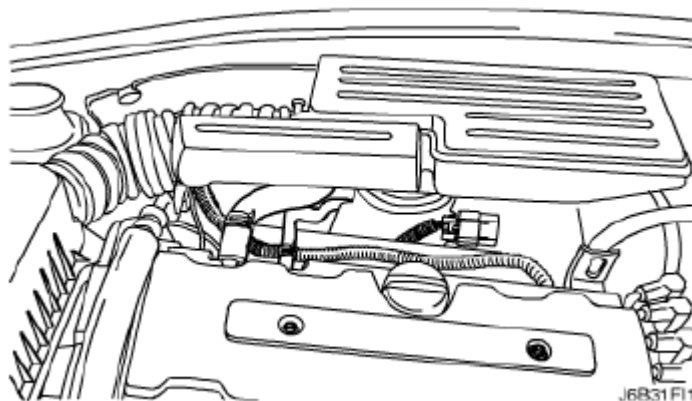


Fig. 59: Identifying Negative Battery Cable
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFT GEARS REMOVAL AND INSTALLATION

Removal

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to **Timing Belt Removal and Installation**.
3. Remove the spark plug cover bolts.
4. Remove the spark plug cover.
5. Disconnect the ignition wires from the spark plugs.
6. Disconnect the breather tubes from the camshaft cover.

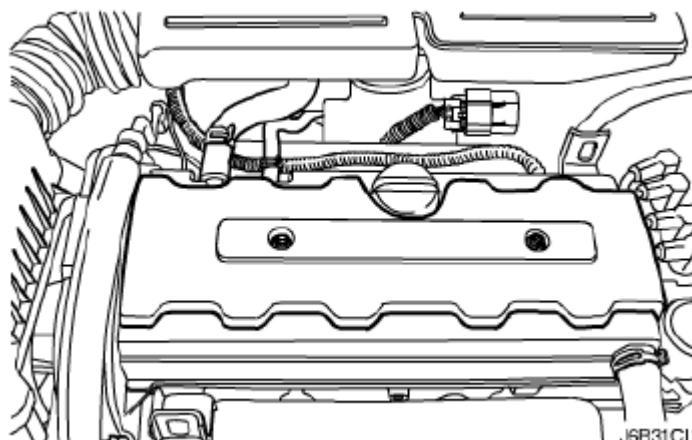


Fig. 60: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove the camshaft cover bolts.
8. Remove the camshaft cover washers.
9. Remove the camshaft cover and the camshaft cover gasket.

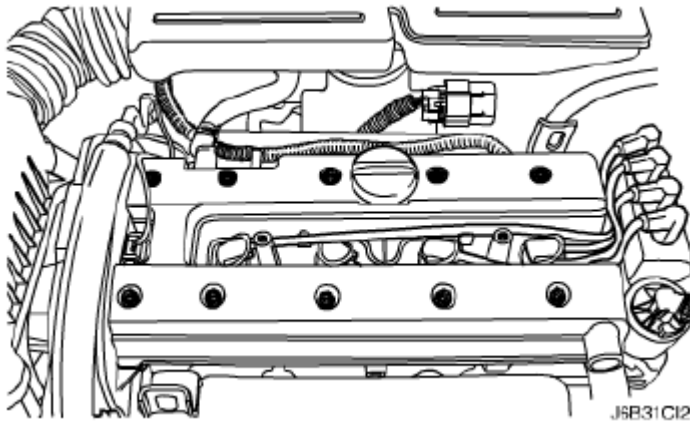


Fig. 61: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

10. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
11. Remove the intake camshaft gear.
12. Remove the Camshaft Position (CMP) sensor.
13. Remove the water pump.
14. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
15. Remove the exhaust camshaft gear.

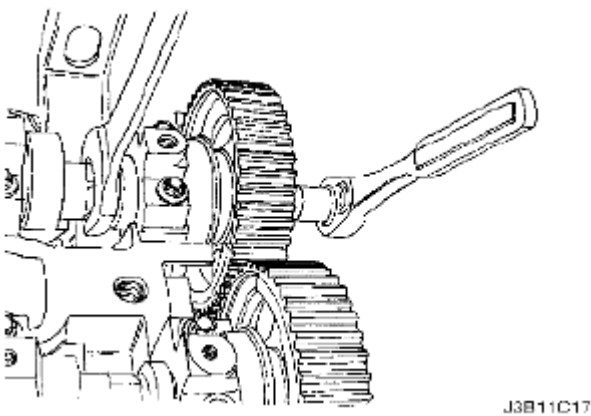


Fig. 62: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

Installation

CAUTION: Take extreme care to prevent any scratches, nicks or damage to the camshafts.

1. Install the intake camshaft gear.
2. While holding the intake camshaft firmly in place, install the intake camshaft gear bolt.

Tighten:

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.

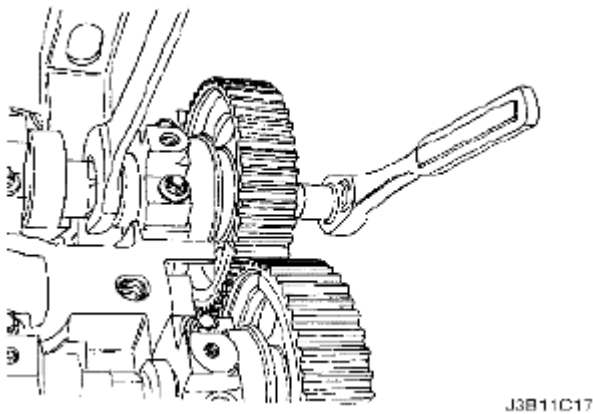


Fig. 63: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the Camshaft Position (CMP) sensor.
4. Install the water pump.
5. Install the exhaust camshaft gear.
6. While holding the exhaust camshaft firmly in place, install the exhaust camshaft gear bolt.

Tighten:

Tighten the exhaust camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.

7. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear camshaft cover-to-cylinder head seal.
8. Install the camshaft cover and the camshaft cover gasket.
9. Install the camshaft cover washers.
10. Install the camshaft cover bolts.

Tighten:

Tighten the camshaft cover bolts to 8 N.m (71 lb-in).

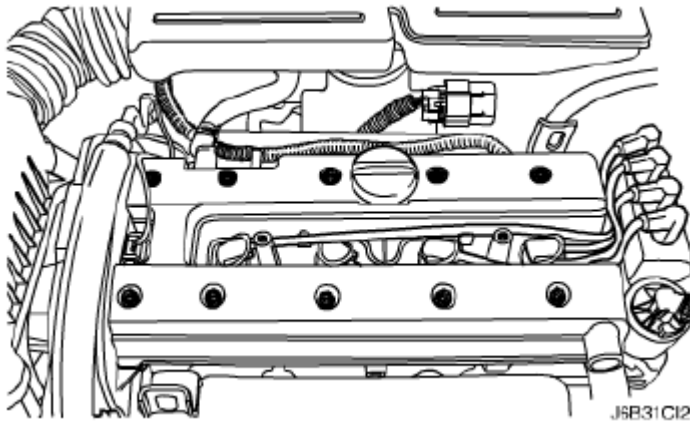


Fig. 64: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

11. Connect the crankcase breather tubes to the camshaft cover.
12. Connect the ignition wires to the spark plugs.
13. Install the spark plug cover.
14. Install the spark plug cover bolts.

Tighten:

Tighten the spark plug cover bolts to 8 N.m (71 lb-in).

15. Install the timing belt. Refer to **Timing Belt Removal and Installation**.
16. Connect the negative battery cable.

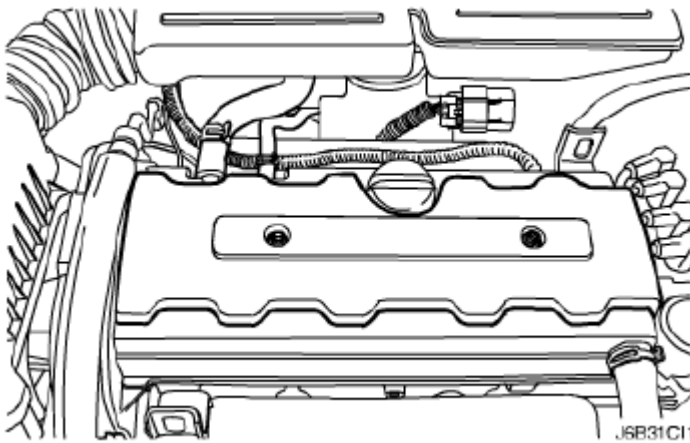


Fig. 65: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

REAR TIMING BELT COVER REMOVAL AND INSTALLATION**Tools Required:****KM-470-B Angular Torque Gauge****Removal**

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to **Timing Belt Removal and Installation**.
3. Remove the camshaft gears. Refer to **Camshaft Gears Removal and Installation**.
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.

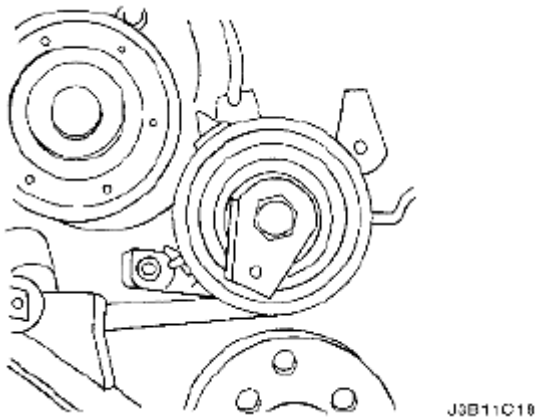
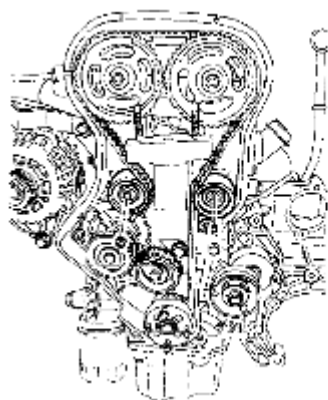


Fig. 66: Identifying Timing Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

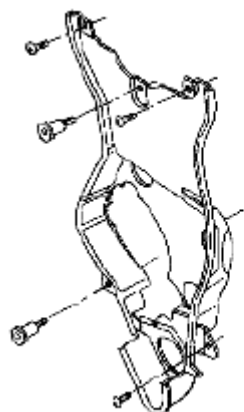
6. Remove the timing belt idler pulley bolt and nut.
7. Remove the timing belt idler pulleys.
8. Remove the engine mount retaining bolts.
9. Remove the engine mount.
10. Remove the crankshaft gear bolt.
11. Remove the crankshaft gear.



J3B11C19

Fig. 67: Identifying Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the rear timing belt cover bolts.
13. Remove the rear timing belt cover.



J3B11C20

Fig. 68: Identifying Rear Timing Belt Cover Bolts (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install the rear timing belt cover.
2. Install the rear timing belt cover bolts.

Tighten:

Tighten the rear timing belt cover bolts to 7 N.m (62 lb-in).

3. Install the engine mount and retaining bolts.

Tighten:

Tighten the engine mount retaining bolts to 45 N.m (33 lb-ft).

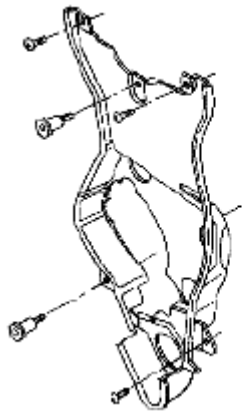


Fig. 69: Identifying Rear Timing Belt Cover Bolts (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

4. Install the timing belt idler pulleys.
5. Install the timing belt idler pulley bolt and nut.

Tighten:

- Tighten the timing belt idler pulley bolt to 25 N.m (18 lb-ft).
 - Tighten the timing belt idler pulley nut to 25 N.m (18 lb-ft).
6. Install the crankshaft timing belt drive gear and bolt.

Tighten:

Tighten the crankshaft gear bolt to 145 N.m (107 lb-ft) plus 30° and plus 15° using the angular torque gauge KM-470-B.

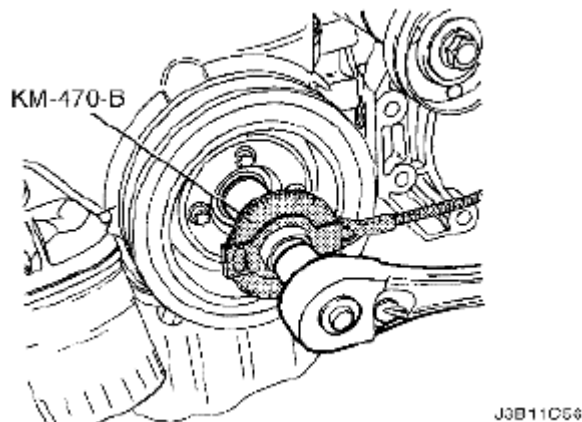


Fig. 70: Identifying Angular Torque Gauge (KM-470-B)
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the timing belt automatic tensioner and bolt.
8. Install the camshaft gears. Refer to **Camshaft Gears Removal and Installation**.
9. Install the timing belt and timing belt cover. Refer to **Timing Belt Removal and Installation**.
10. Connect the negative battery cable.

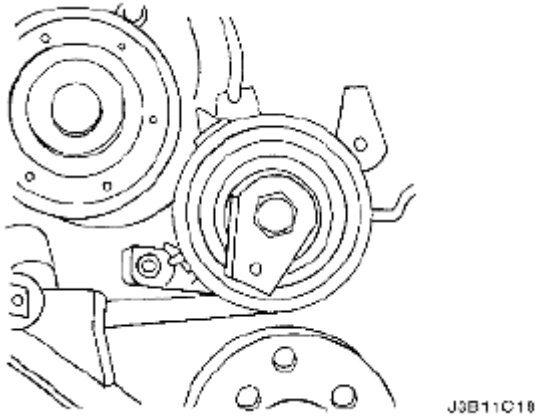


Fig. 71: Identifying Timing Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE REMOVAL AND INSTALLATION

Removal

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the hood. Refer to **HOOD REMOVAL AND INSTALLATION**.
4. Drain the engine oil.
5. Disconnect the negative battery cable.

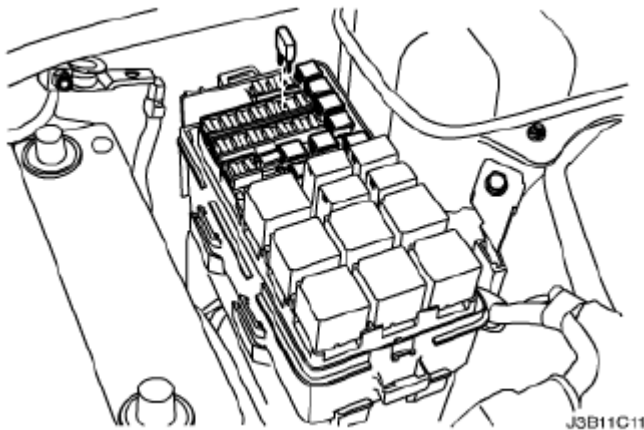


Fig. 72: Identifying Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

6. Discharge the air conditioning (A/C) system, if equipped. Refer to **DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEM** .
7. Disconnect the Manifold Air Temperature (MAT) sensor connector.
8. Remove the air cleaner outlet hose from the throttle body and air cleaner housing.
9. Disconnect the breather tubes from the camshaft cover.
10. Remove the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION** .
11. Remove the right front wheel well splash shield.
12. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .

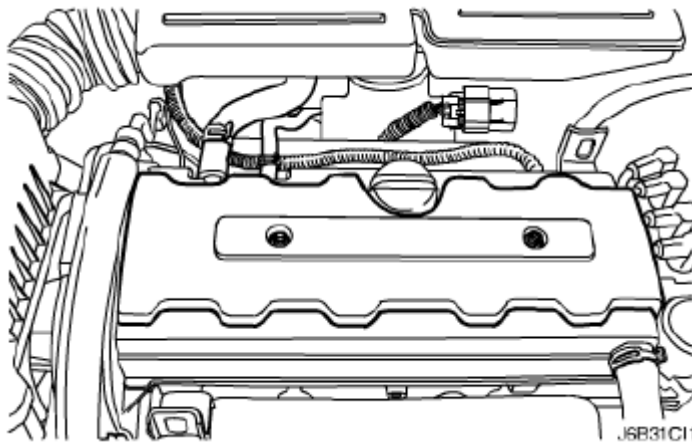


Fig. 73: Identifying Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

13. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
14. Remove the cooling system radiator and the engine cooling fans. Refer to **RADIATOR REMOVAL AND INSTALLATION** .
15. Disconnect the upper radiator hose from the thermostat housing.
16. Disconnect the power steering return hose from the power steering pump.
17. Disconnect the power steering pressure hose from the power steering pump.
18. Disconnect the electrical connector at the Direct Ignition System (DIS) coil and the Engine Control Module (ECM) ground terminal and at the starter motor.

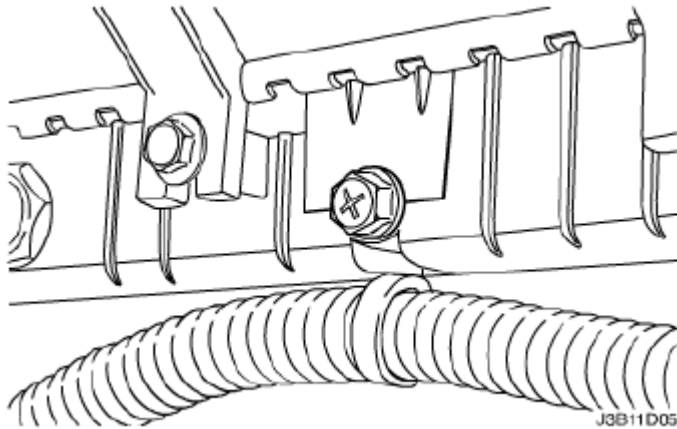


Fig. 74: Identifying Upper Radiator Hose From Thermostat Housing
Courtesy of SUZUKI OF AMERICA CORP.

19. Disconnect the Oxygen (O2) sensor connector, if equipped.
20. Disconnect the Electric Throttle Control (ETC) connector.
21. Disconnect the engine Coolant Temperature Sensor (CTS) connector.
22. Disconnect the generator voltage regulator connector and power lead.

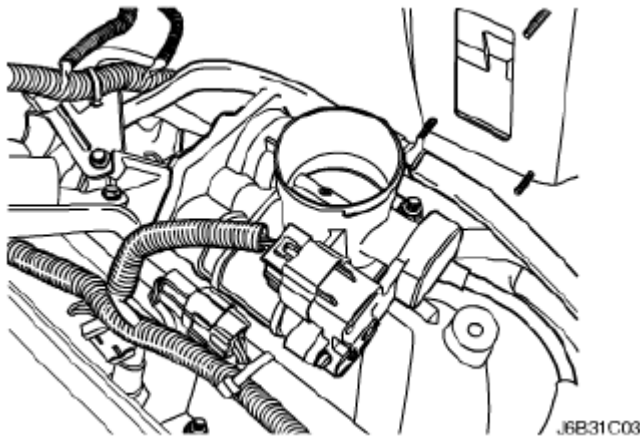


Fig. 75: Identifying Coolant Hoses To Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

23. Disconnect all of the necessary vacuum lines, including the brake booster vacuum hose.
24. Disconnect the fuel return line at the fuel rail.
25. Disconnect the fuel feed line at the fuel rail.
26. Remove the fuel rail and injector channel cover as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
27. Disconnect the coolant hose at the throttle body.
28. Disconnect the heater outlet hose at the coolant pipe.
29. Disconnect the coolant bypass hose from the cylinder head.

30. Disconnect the surge tank coolant hose from the coolant pipe.
31. Disconnect the lower radiator hose from the coolant pipe.
32. Disconnect the starter solenoid "S" terminal wire and power lead.
33. Remove the A/C compressor. Refer to **COMPRESSOR REMOVAL AND INSTALLATION**.

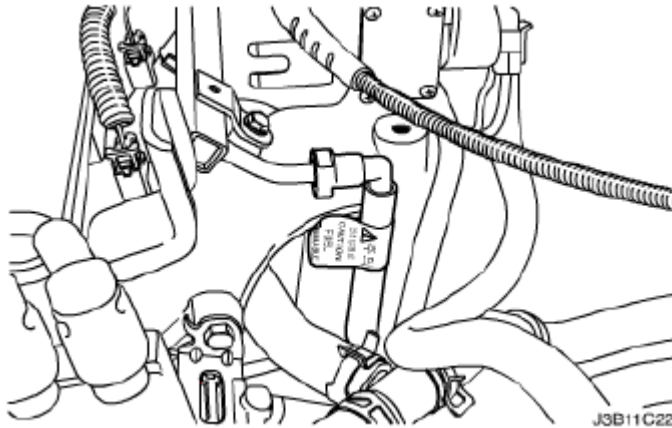


Fig. 76: Identifying Lower Radiator Hose From Coolant Pipe
Courtesy of SUZUKI OF AMERICA CORP.

34. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.
35. Remove the exhaust flex pipe retaining nuts from the catalytic converter or the connecting pipe.
36. Remove the exhaust flex pipe.

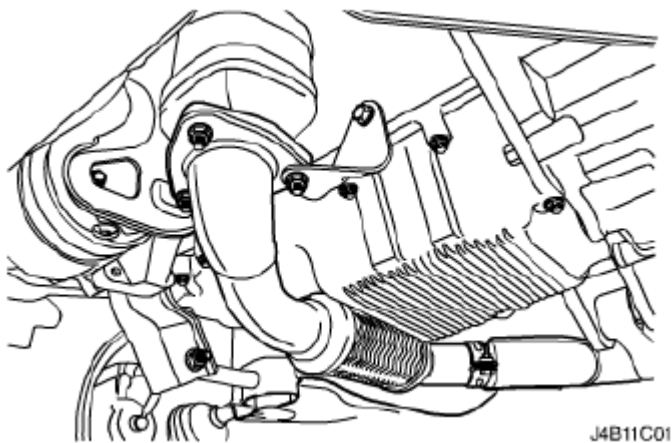


Fig. 77: Identifying Catalytic Converter To Connecting Pipe
Courtesy of SUZUKI OF AMERICA CORP.

37. Remove the crankshaft pulley bolts.
38. Remove the crankshaft pulley.
39. Disconnect the vacuum lines at the charcoal canister purge solenoid.
40. Disconnect the electrical connector at the Charcoal Canister Purge (CCP) and the Exhaust Gas

Recirculation (EGR) solenoid.

41. Disconnect the electrical connector at the oil pressure switch.
42. Disconnect the Crankshaft Position Sensor (CPS) connector.
43. Disconnect the knock sensor connector.

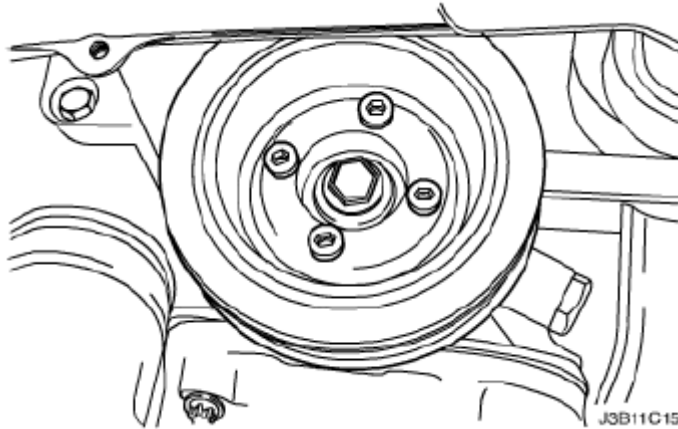


Fig. 78: Identifying Crankshaft Pulley And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

44. Remove the lower reaction rod bracket bolts.
45. Remove the lower reaction rod bracket.
46. Remove the lower reaction rod mount bolt.
47. Remove the lower reaction rod mount.

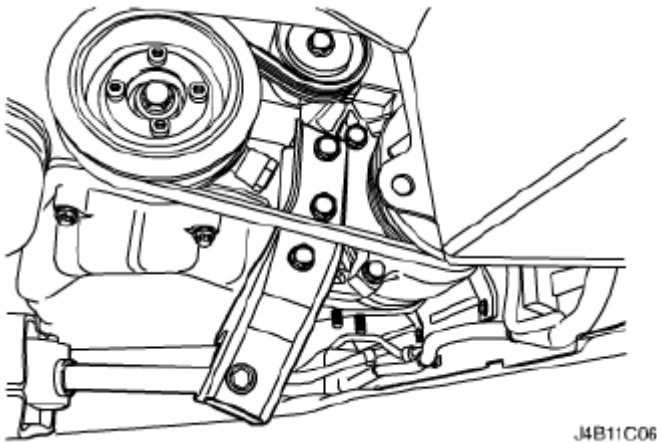


Fig. 79: Identifying Lower Reaction Rod Mount
Courtesy of SUZUKI OF AMERICA CORP.

48. Remove the rubber cover as a service hole.
49. Remove the transaxle torque converter bolts through the service hole, if automatic transaxle equipped.
50. Remove the transaxle bell housing bolts and the oil pan flange bolts.

51. Support the transaxle with a floor jack.
52. Install the engine lifting device.

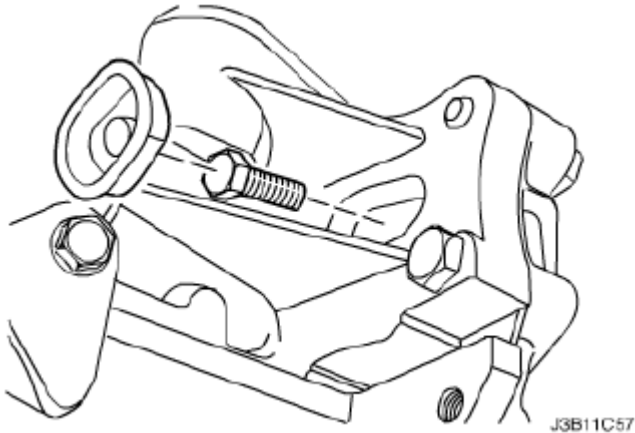


Fig. 80: Removing/Installing Transaxle Torque Converter Bolt Through Service Hole
Courtesy of SUZUKI OF AMERICA CORP.

53. Disconnect the right engine mount bracket from the engine mount by removing the retaining bolt.
54. Remove the right engine mount bracket from the engine block and frame mount. Refer to **Engine Mount Removal and Installation**.
55. Separate the engine block from the transaxle. Remove the engine.

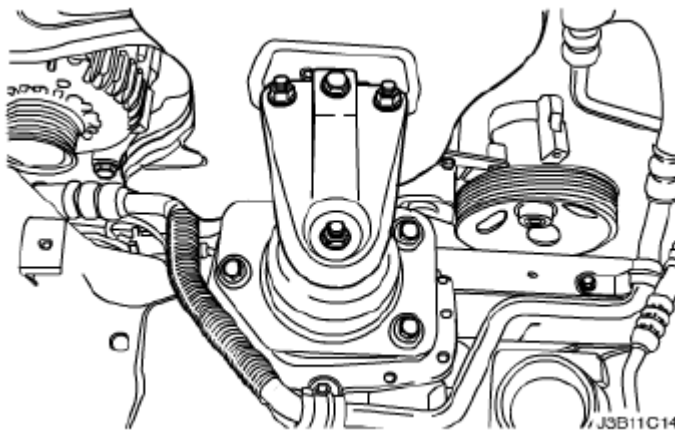


Fig. 81: Identifying Engine Block From Transaxle
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install the engine into the engine compartment.
2. Align the engine alignment pins to the transaxle.
3. Install the transaxle bell housing bolts.

Tighten:

Tighten the transaxle bell housing bolts to 75 N.m (55 lb-ft).

4. Install the oil pan flange-to-transaxle bolts.

Tighten:

Tighten the oil pan flange-to-transaxle bolts to 40 N.m (30 lb-ft).

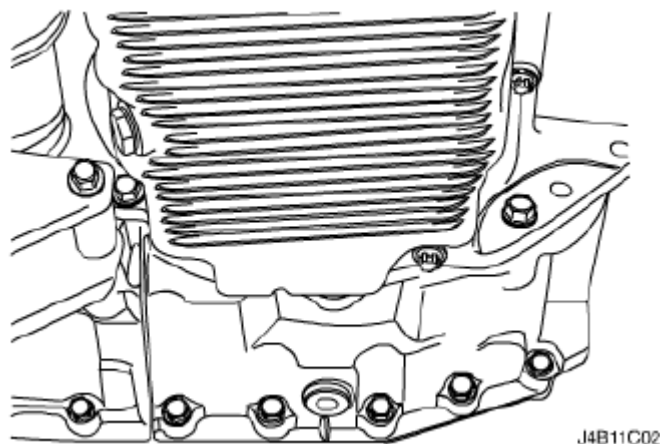


Fig. 82: Identifying Oil Pan Flange-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the right engine mount to the engine block mount and the frame mount.
6. Install the right engine mount bracket retaining bolts and nuts.

Tighten:

Tighten the engine mount bracket retaining bolts and nuts to 55 N.m (41 lb-ft).

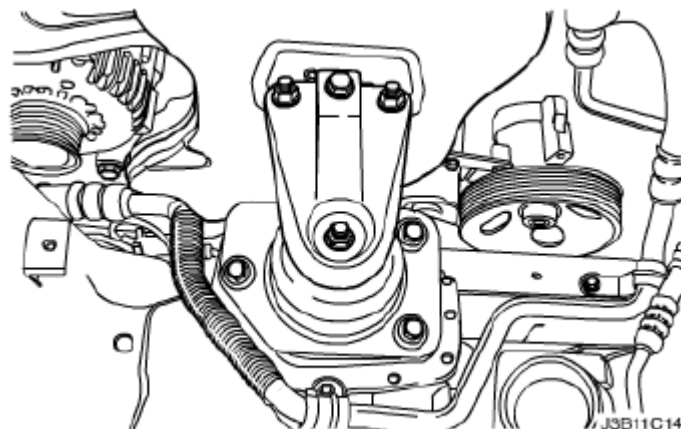


Fig. 83: Identifying Engine Block From Transaxle

Courtesy of SUZUKI OF AMERICA CORP.

7. Remove the floor jack used for support of the transmission.
8. Remove the engine lifting device.
9. Install the transaxle torque converter bolts, if automatic transaxle equipped.

Tighten:

Tighten the transaxle torque converter bolts to 60 N.m (44 lb-ft).

10. Install the rubber cover as a service hole.

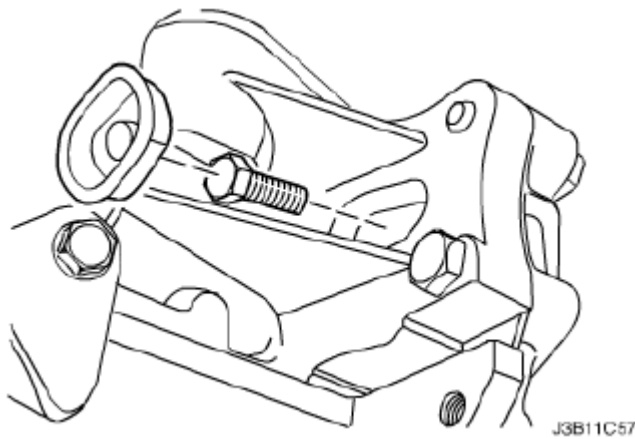


Fig. 84: Identifying Transaxle Torque Converter Bolts
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the lower reaction rod mount.
12. Install the lower reaction rod mount bolt.

Tighten:

Tighten the lower reaction rod mount bolt to 55 N.m (41 lb-ft).

13. Install the lower reaction rod bracket.
14. Install the lower reaction rod bracket bolts.

Tighten:

Tighten the lower reaction rod bracket bolt to 69 N.m (49 lb-ft).

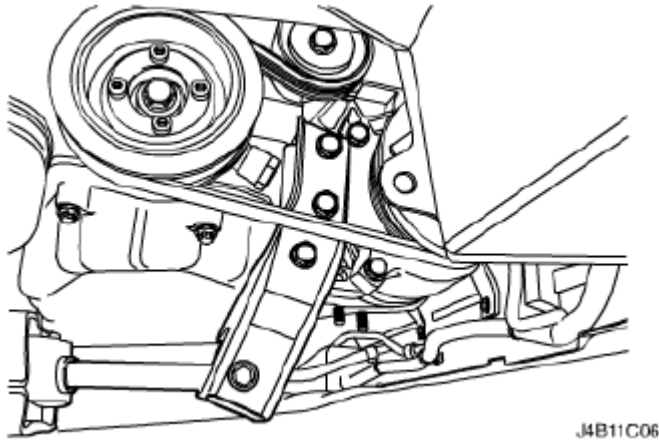


Fig. 85: Identifying Lower Reaction Rod Mount
Courtesy of SUZUKI OF AMERICA CORP.

15. Connect the vacuum lines at the CCP solenoid.
16. Connect the electrical connector to the CCP and the EGR solenoid.
17. Connect the oil pressure switch connector.
18. Install the crankshaft pulley.
19. Install the crankshaft pulley bolts.

Tighten:

Tighten the crankshaft pulley bolts to 20 N.m (15 lb-ft) using a torque wrench.

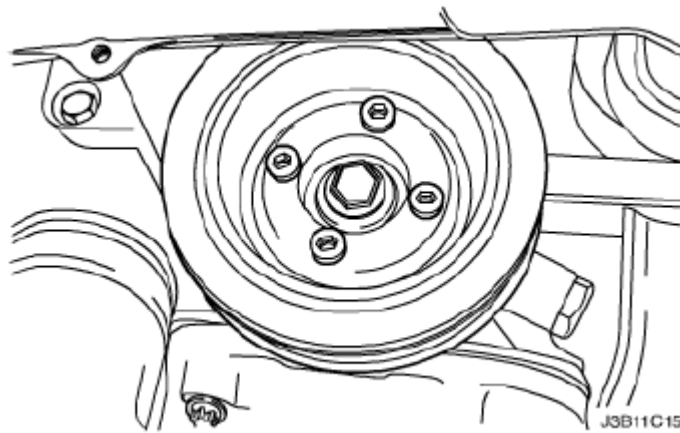


Fig. 86: Identifying Crankshaft Pulley And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

20. Connect the CPS connector.
21. Install the exhaust flex pipe.
22. Install the exhaust flex pipe retaining nuts to the exhaust manifold studs.

Tighten:

Tighten the exhaust flex pipe-to-exhaust manifold retaining nuts to 35 N.m (26 lb-ft).

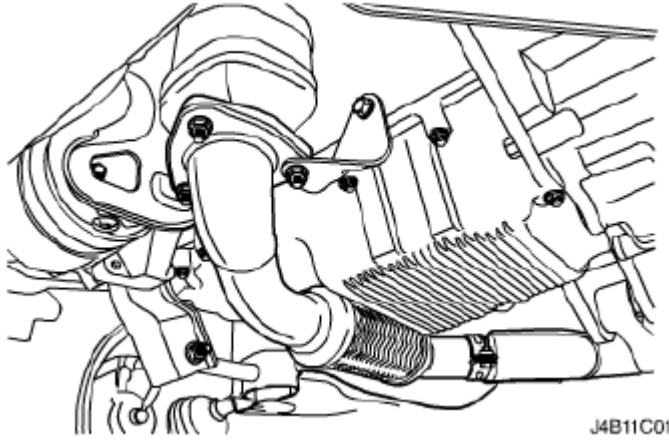


Fig. 87: Identifying Catalytic Converter To Connecting Pipe
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the exhaust flex pipe retaining nuts to the catalytic converter or the connecting pipe.

Tighten:

Tighten the exhaust flex pipe-to-catalytic converter or connecting pipe retaining nuts to 35 N.m (26 lb-ft).

24. Connect the power steering pressure hose.
25. Connect the power steering return hose.
26. Install the A/C compressor, if equipped. Refer to **COMPRESSOR REMOVAL AND INSTALLATION** .

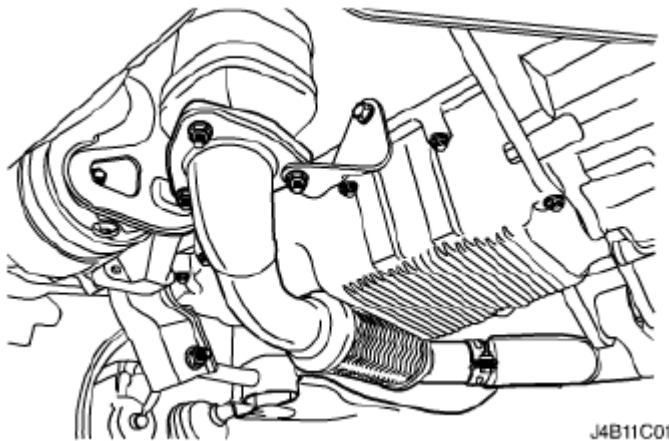


Fig. 88: Identifying Catalytic Converter To Connecting Pipe
Courtesy of SUZUKI OF AMERICA CORP.

27. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
28. Install the right front wheel well splash shield.
29. Install the right front wheel. Refer to **WHEEL REMOVAL AND INSTALLATION** .
30. Connect the fuel feed line to the fuel rail.
31. Connect the fuel return line to fuel rail.
32. Install the fuel rail and injector channel cover as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION** .

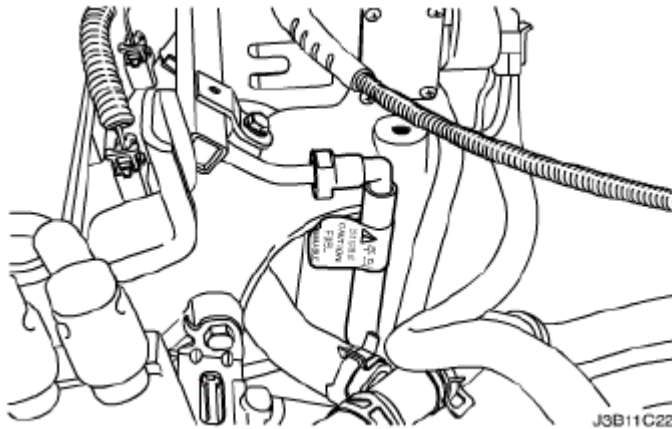


Fig. 89: Identifying Lower Radiator Hose From Coolant Pipe
Courtesy of SUZUKI OF AMERICA CORP.

33. Connect all of the necessary vacuum lines including the brake booster vacuum hose.
34. Connect the O2 sensor connector, if equipped.
35. Connect the starter solenoid "S" terminal wire and power lead.
36. Connect the generator voltage regulator connector.
37. Connect the CTS connector.
38. Connect the engine CTS connector.
39. Connect the ETC connector.
40. Connect the MAP sensor connector.
41. Connect the knock sensor, if necessary.

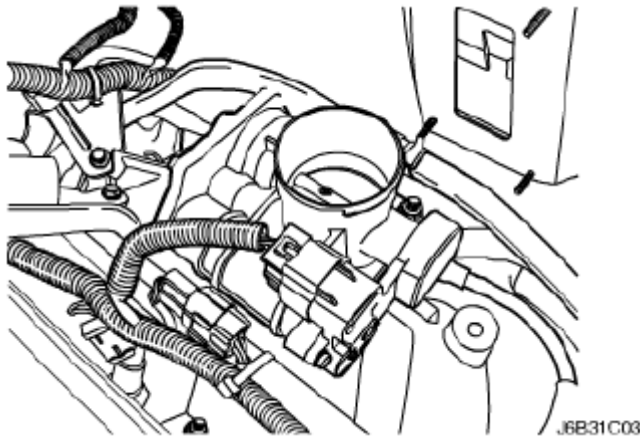


Fig. 90: Identifying Coolant Hoses To Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

42. Connect the electrical connector at the DIS ignition coil and the ECM ground terminal and at the starter motor.
43. Install the air cleaner outlet hose between the throttle body and the air cleaner housing.
44. Connect the breather tubes to the camshaft cover.
45. Connect the MAT sensor connector.
46. Install the cooling system radiator and the engine cooling fans. Refer to **RADIATOR REMOVAL AND INSTALLATION**.

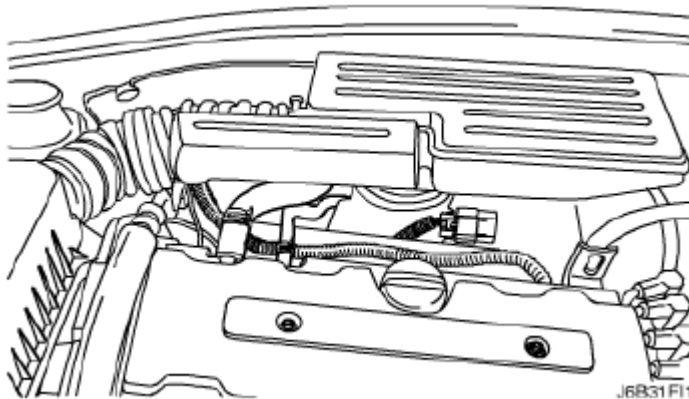


Fig. 91: Identifying Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

47. Connect the lower radiator hose to the coolant pipe.
48. Connect the upper radiator hose to the thermostat housing.
49. Connect the heater inlet hose to the cylinder head.
50. Connect the heater outlet hose to the coolant pipe.
51. Connect the coolant surge tank hose to the coolant pipe.
52. Connect the coolant hose to the throttle body.

53. Install the fuel pump fuse.
54. Connect the negative battery cable.
55. Refill the engine crankcase with engine oil.
56. Refill the engine coolant system. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
57. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .
58. Refill the A/C refrigerant system, if equipped. Refer to **DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEM** .
59. Install the hood. Refer to **HOOD REMOVAL AND INSTALLATION** .

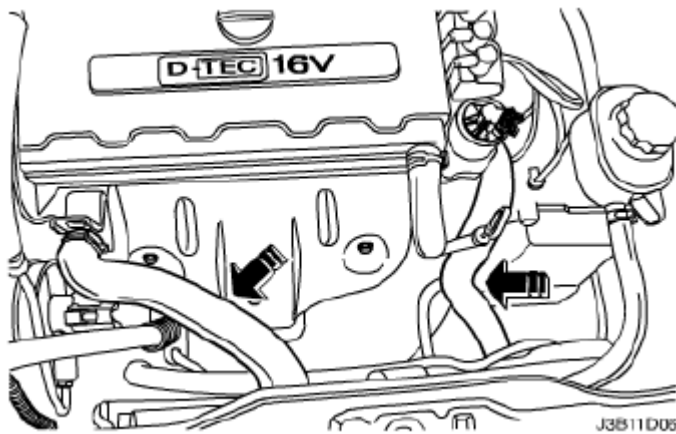


Fig. 92: Identifying Lower Radiator Hose To Coolant Pipe
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS AND RODS REMOVAL AND INSTALLATION

Tools Required:

J-8037 Universal Piston Ring Compressor

J-8087 Cylinder Bore Check Gauge

KM-427 Piston Pin Service Set

KM-470-B Angular Torque Gauge

Removal

1. Remove the cylinder head with the intake manifold and exhaust manifold attached. Refer to **CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION** .
2. Remove the oil pan. Refer to **OIL PAN REMOVAL AND INSTALLATION** .
3. Remove the oil suction pipe bolts and support bracket bolts.
4. Remove the oil suction pipe.

5. Remove the crankshaft bearing bridge and the oil pan scraper bolts.
6. Remove the crankshaft bearing bridge and the oil pan scraper.

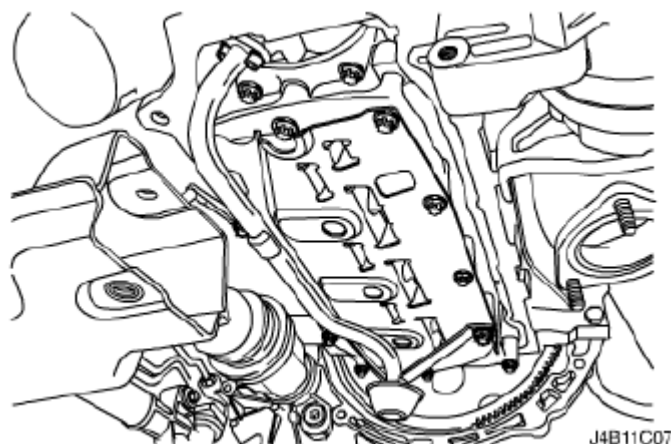


Fig. 93: Identifying Crankshaft Bearing Bridge And Oil Pan Scraper Bolts
Courtesy of SUZUKI OF AMERICA CORP.

7. Move the piston to the bottom of the piston stroke.
8. Mark the connecting rod cap for position.
9. Remove the connecting rod cap bolts.
10. Remove the connecting rod cap and the lower connecting rod bearing.
11. Remove the upper piston connecting rod bearing.
12. Ridge ream the cylinder wall.

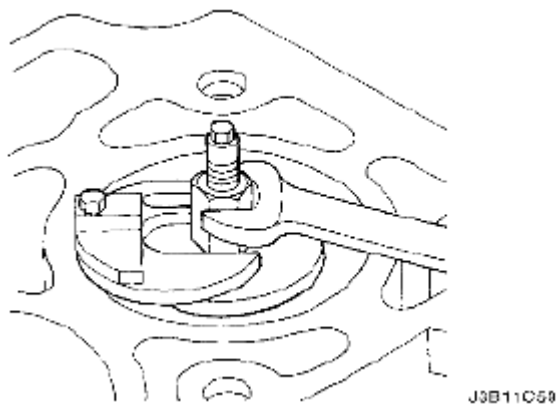


Fig. 94: Removing Connecting Rod Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.
15. Remove the piston rings.

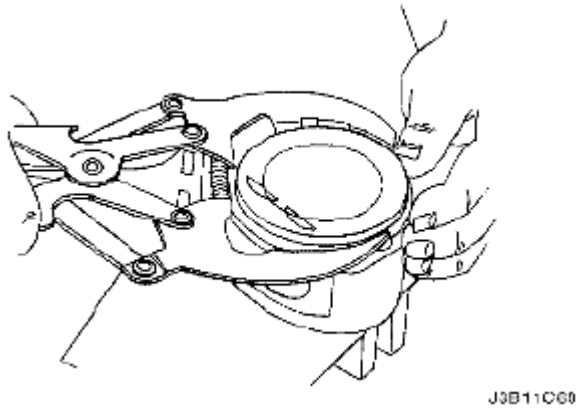


Fig. 95: Removing Piston Rings
Courtesy of SUZUKI OF AMERICA CORP.

16. Remove the piston pin from the piston and connecting rod assembly using the piston pin service set KM-427.
17. Separate the piston from the connecting rod.

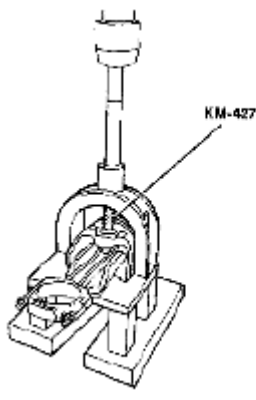


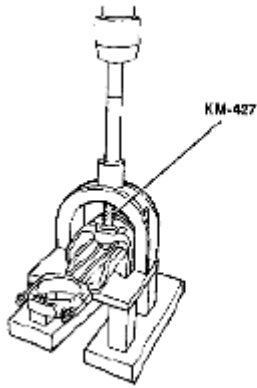
Fig. 96: Identifying Piston Pin Service Set (KM-427) (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Installation

CAUTION: For ease of installation of the piston pin, the connecting rod should be heated to 280 °C. Heat the upper connecting rod only. Use commercial thermocolor material to determine the correct temperature. When the thermocolor material changes from black to green, the temperature is correct for installation.

1. Align the notch on the piston and connecting rod so that the proper sides will be facing the front of the engine.
2. Install the piston pin guide through the piston and the connecting rod.
3. Coat the piston pin with clean oil.

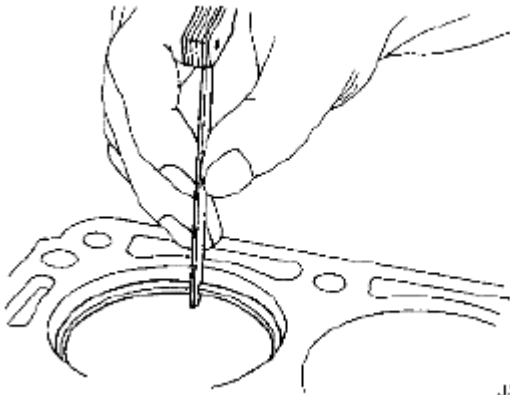
4. Install the piston pin into the opposite side of the piston.



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Fig. 97: Identifying Piston Pin Service Set (KM-427) (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

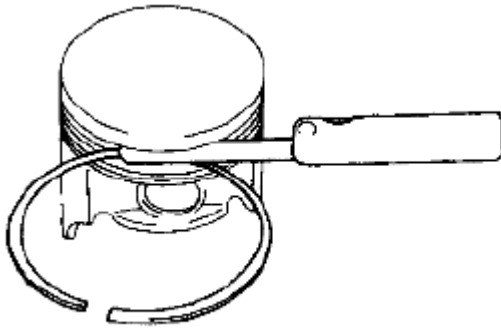
5. Install the piston pin into the piston and connecting rod assembly using the piston pin service set KM-427.
6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gauge. Refer to **Engine Specifications**.
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.



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Fig. 98: Measuring Piston Ring Gap
Courtesy of SUZUKI OF AMERICA CORP.

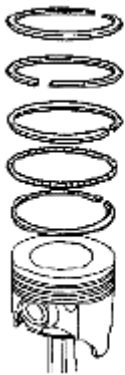
9. Measure the piston ring side clearance using a feeler gauge. Refer to **Engine Specifications**.
10. If the piston ring is too thick, try another piston ring.
11. If no piston ring can be found that fits to specifications, the piston ring may be ground to size with emery paper placed on a sheet of glass.



J3B11C06

Fig. 99: Measuring Piston Ring Side Clearance Using Feeler Gauge
 Courtesy of SUZUKI OF AMERICA CORP.

12. Install a piston oil ring, the expander, then the second piston oil ring to the bottom ring groove of the piston.
13. Install the second compression ring to the middle ring groove of the piston.
14. Install the top compression ring to the top ring groove of the piston.



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Fig. 100: Identifying Top Compression Ring To Top Ring Groove Of Piston
 Courtesy of SUZUKI OF AMERICA CORP.

15. Use a piston ring expander to install the piston rings. Do not expand the piston rings beyond the expansion necessary for installation.
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.

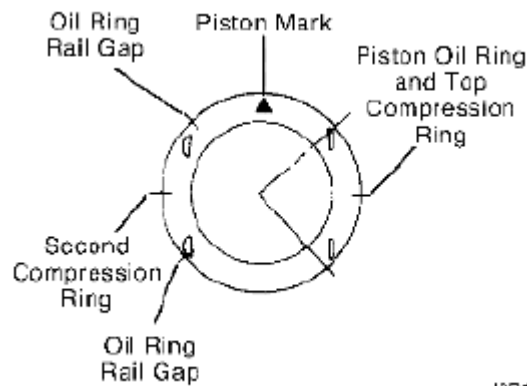


Fig. 101: Identifying Piston Oil Rings, Oil Ring Rail Gaps And Second Compression Ring
Courtesy of SUZUKI OF AMERICA CORP.

17. Lubricate the cylinder wall and the piston rings with clean engine oil.
18. Install the piston using the universal piston ring compressor J-8037 and a wood handle. Guide the lower connecting rod end to prevent damaging the crankshaft journal.
19. Install the connecting rod cap and bearings. Refer to **Crankshaft Bearings and Connecting Rod Bearings - Gauging Plastic Inspection.**

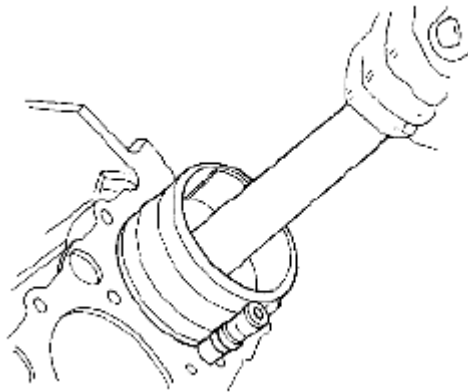


Fig. 102: Installing Connecting Rod Cap And Bearings
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the connecting rod cap bolts.

Tighten:

Tighten the connecting rod bearing cap bolts to 35 N.m (26 lb-ft). Using the angular torque gauge KM470-B, tighten the bolts one turn of 45° plus one turn of 15°.

21. Install the crankshaft bearing bridge/oil pan scraper bolts.

Tighten:

Tighten the crankshaft bearing bridge/oil pan scraper bolts to 20 N.m (15 lb-ft) plus 45° using the angular torque gauge KM-470-B.

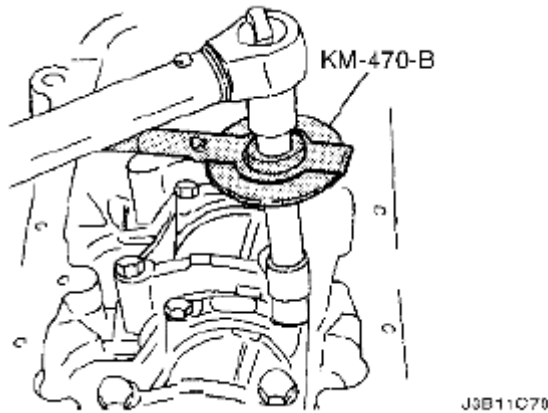


Fig. 103: Tightening Crankshaft Bearing Bridge/Oil Pan Scraper Bolts
Courtesy of SUZUKI OF AMERICA CORP.

22. Install the oil suction pipe.
23. Install the oil suction pipe bolts.

Tighten:

Tighten the oil suction pipe bolts to 8 N.m (71 lb-in) and the oil suction pipe bracket bolt to 6 N.m (53 lb-in).

24. Install the oil pan. Refer to **OIL PAN REMOVAL AND INSTALLATION** .
25. Install the cylinder head with the intake manifold and exhaust manifold attached. Refer to **CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION** .

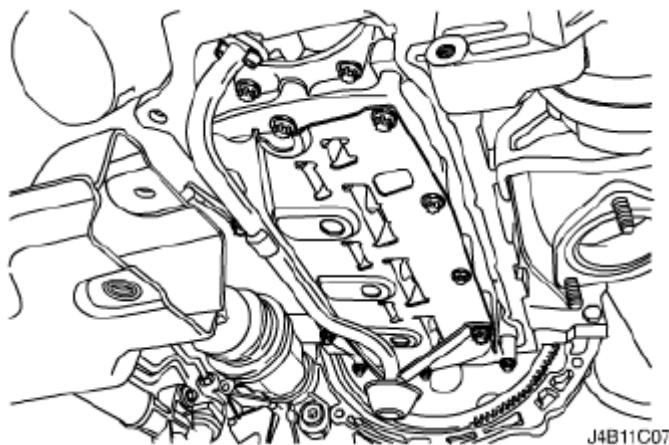
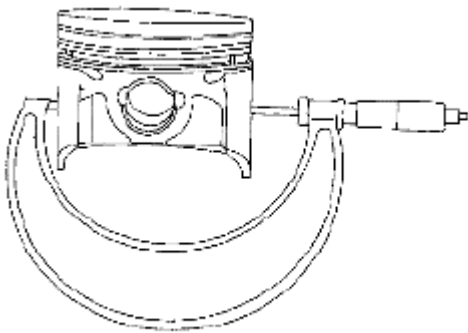


Fig. 104: Identifying Cylinder Head With Intake Manifold And Exhaust Manifold
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS AND RODS INSPECTION

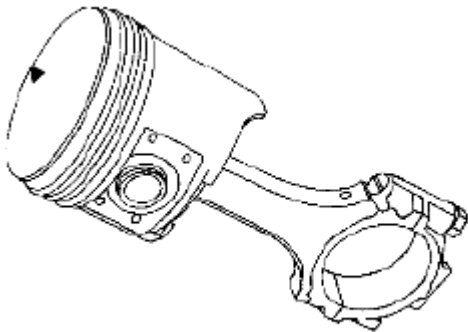
1. Inspect the connecting rod for bending or twisting. If the connecting rod is bent or twisted, replace the connecting rod.
2. Inspect the connecting rod bearings.
3. Inspect the connecting rod lower end for wear.
4. Inspect the connecting rod upper end for scoring.
5. Inspect the crankshaft rod bearing journal for wear. Refer to **Engine Specifications**.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.



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Fig. 105: Inspecting Piston For Taper
Courtesy of SUZUKI OF AMERICA CORP.

8. Inspect the piston for fit to the connecting rod.



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Fig. 106: Identifying Piston For Fit To Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to **Engine Specifications**.
10. Inspect the bearing bore for concentricity and alignment using cylinder bore check gauge J-8087. Refer to **Engine Specifications**. If the bearing bore is beyond specifications, replace the engine block.

11. Inspect the engine block cylinder bore for wear, runout, ridging and taper using a bore gauge. Refer to **Engine Specifications**.
12. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.

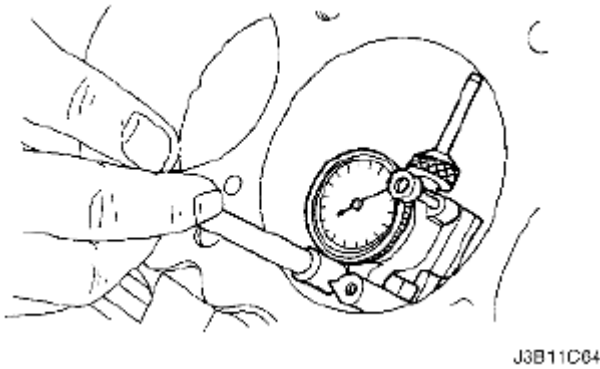


Fig. 107: Inspecting Engine Block Cylinder Bore For Glazing
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY

Tools Required:

KM-571-B Gauge

KM-340-0 Cutter Set

KM-340-7 Guide Drift

KM-340-13 Cutters

KM-340-26 Cutters

KM-348 Valve Spring Compressor

KM-653 Adapter

KM-805 Valve Guide Reamer

Disassembly

1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to **CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION**.
2. Remove the exhaust manifold heat shield bolts.
3. Remove the exhaust manifold heat shield.
4. Remove the exhaust manifold retaining nuts in the sequence shown.
5. Remove the exhaust manifold.

6. Remove the exhaust manifold gasket.
7. Remove the exhaust manifold studs.

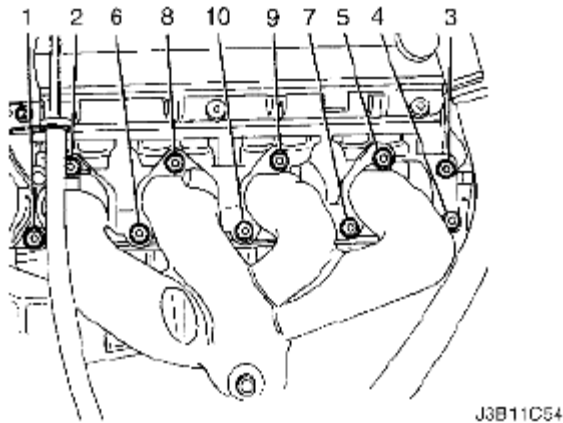


Fig. 108: Identifying Exhaust Manifold Studs
 Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the thermostat housing mounting bolts.
9. Remove the thermostat housing assembly.
10. Remove the fuel rail assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
11. Remove the coolant bypass housing mounting bolts and the housing.

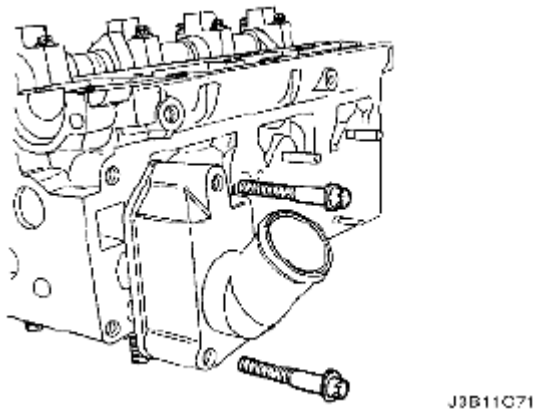


Fig. 109: Identifying Coolant Bypass Housing Mounting Bolts And Housing
 Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the intake manifold retaining nuts and retaining bolt in the sequence shown.
13. Remove the intake manifold.
14. Remove the intake manifold gasket.

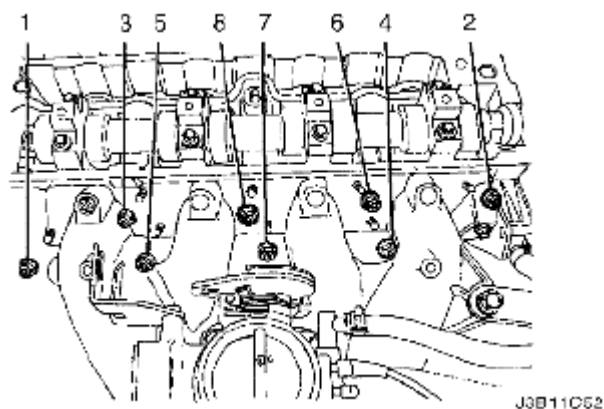


Fig. 110: Identifying Intake Manifold Retaining Nuts And Retaining Bolt Removal Sequence
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove the Direct Ignition System (DIS) coil and the Exhaust Gas Recirculation (EGR) mounting bracket bolts.
16. Remove the DIS ignition coil and the EGR mounting bracket and ignition wires.
17. Remove the intake manifold studs.
18. Remove the spark plugs.

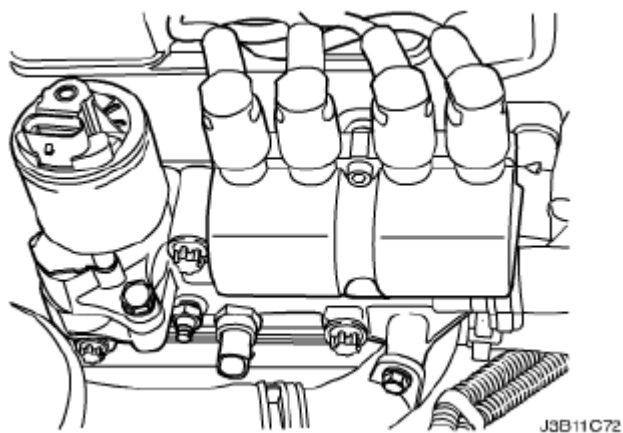


Fig. 111: Identifying DIS Ignition Coil And EGR Mounting Bracket And Ignition Wires
Courtesy of SUZUKI OF AMERICA CORP.

19. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

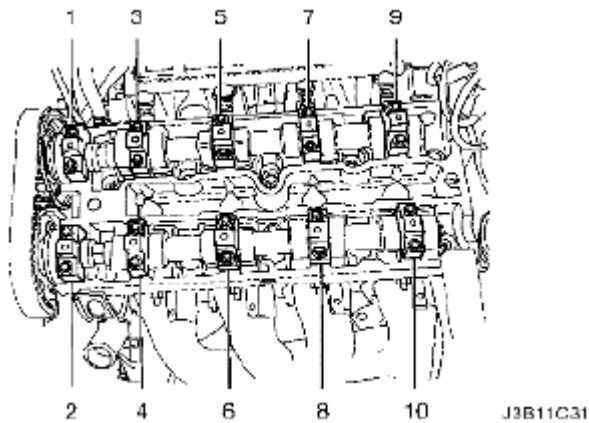


Fig. 112: Identifying Camshaft Bearing Cap Bolt Removal Sequence
Courtesy of SUZUKI OF AMERICA CORP.

20. Remove the intake camshaft caps. Maintain the correct positions for installation.
21. Remove the intake camshaft.
22. Remove the intake valve tappet adjusters.
23. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
24. Remove the exhaust camshaft.
25. Remove the exhaust valve tappet adjusters.

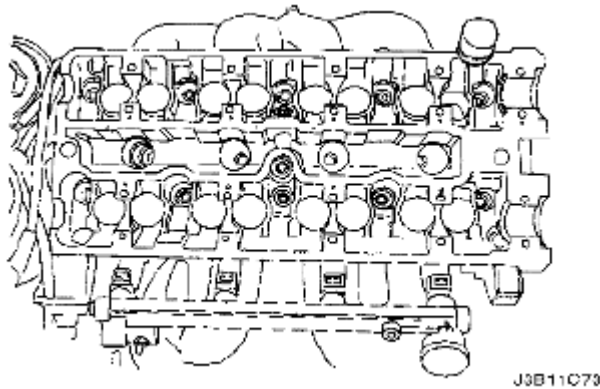


Fig. 113: Identifying Exhaust Camshaft Caps
Courtesy of SUZUKI OF AMERICA CORP.

26. Compress the valve springs with the valve spring compressor KM-348 and the adapter KM-653.
27. Remove the valve retainers.
28. Remove the valve spring compressor KM-348 and the adapter KM-653.
29. Remove the valve spring caps.
30. Remove the valve springs. Maintain the original position of the valve springs for installation.

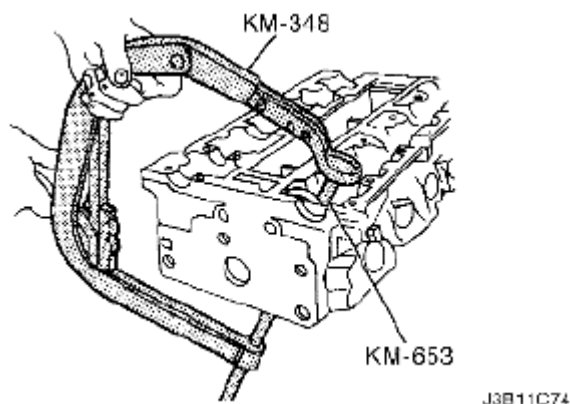


Fig. 114: Removing Valve Springs
Courtesy of SUZUKI OF AMERICA CORP.

31. Remove the valves. Maintain the original position of the valves for installation.
32. Remove the valve stem seals.

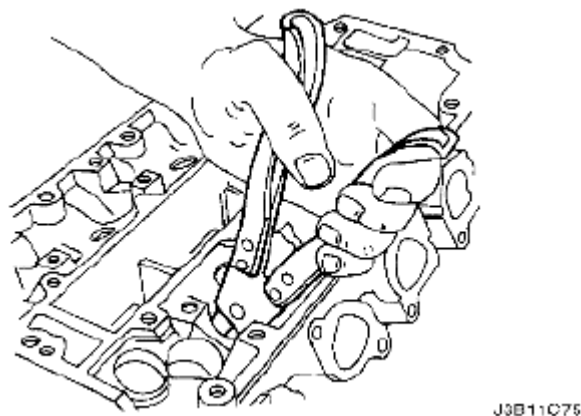
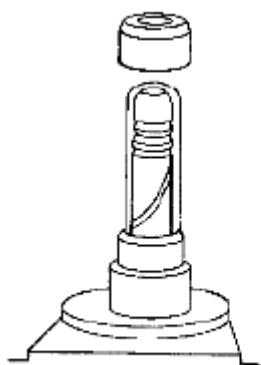


Fig. 115: Removing Valve Stem Seals
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

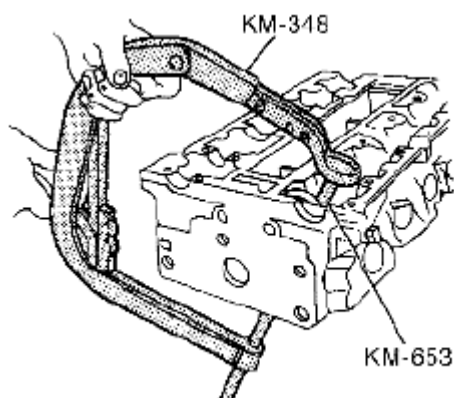
1. Coat the valve stems with engine oil.
2. Insert the valves in the cylinder head in their original positions.
3. Insert the valve spring seats.
4. Push the accompanying assembly sleeve onto the valve stem.
5. Insert the new valve stem seat.
6. Carefully drive the valve stem seal onto the stop with light taps.
7. Install the valve springs in their original positions.
8. Install the valve spring caps.



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Fig. 116: Identifying Valve Spring Caps
 Courtesy of SUZUKI OF AMERICA CORP.

9. Compress the valve springs with the valve spring compressor KM-348 and adapter KM-653.
10. Install the valve keys.
11. Remove the valve spring compressor KM-348 and adapter KM-653.



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Fig. 117: Removing Valve Stem Seals
 Courtesy of SUZUKI OF AMERICA CORP.

12. Lubricate the valve tappet adjusters with engine oil.
13. Install the valve tappet adjusters.

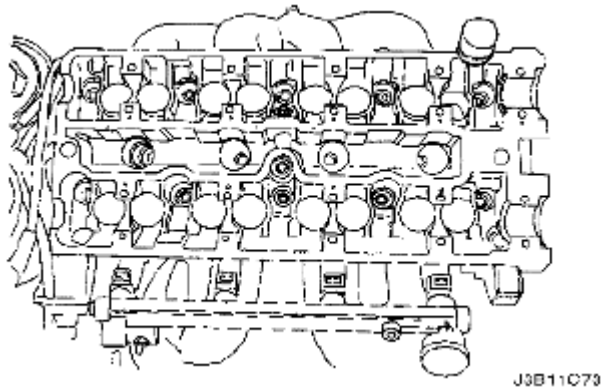


Fig. 118: Identifying Valve Tappet Adjusters
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the intake camshaft.
15. Install the intake camshaft bearing caps in their original positions.
16. Install the exhaust camshaft.
17. Install the exhaust camshaft bearing caps in their original positions.
18. Install the camshaft bearing cap bolts.
19. Tighten the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.

Tighten:

Tighten the camshaft bearing cap bolts to 8 N.m (71 lb-in).

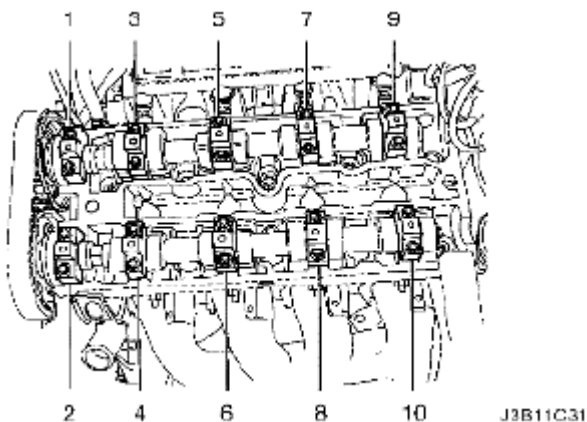


Fig. 119: Identifying Camshaft Bearing Cap Bolts Installation Sequence
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the spark plugs.

Tighten:

Tighten the spark plugs to 20 N.m (15 lb-ft).

21. Install the DIS coil and EGR mounting bracket.
22. Install the DIS coil and EGR mounting bracket bolts.

Tighten:

Tighten the direct ignition system coil and exhaust gas recirculation mounting bracket bolts to 25 N.m (18 lb-ft).

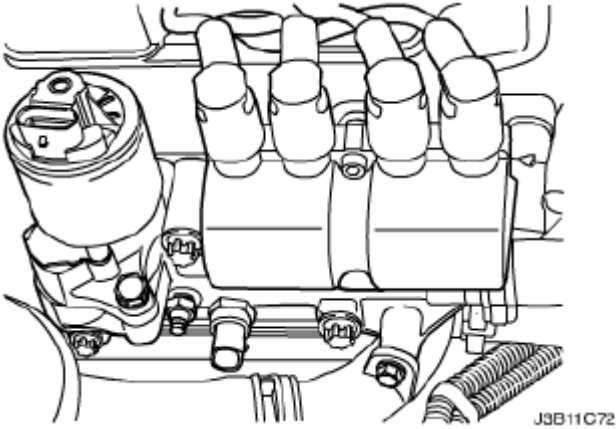


Fig. 120: Identifying DIS Ignition Coil And EGR Mounting Bracket And Ignition Wires
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the intake manifold studs.
24. Install the intake manifold gasket.
25. Install the intake manifold.
26. Install the intake manifold retaining nuts and retaining bolt in the sequence shown.

Tighten:

Tighten the intake manifold retaining nuts and retaining bolt to 22 N.m (16 lb-ft).

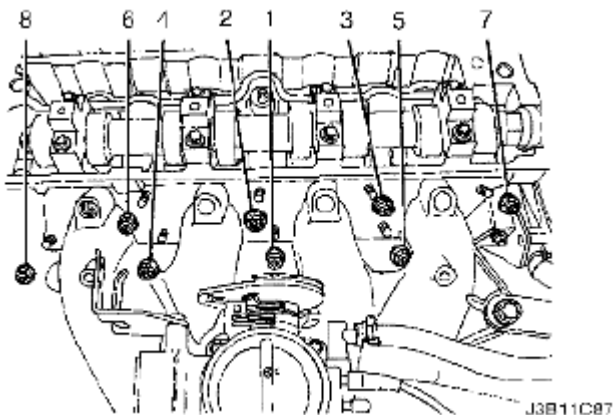


Fig. 121: Identifying Intake Manifold Retaining Nuts And Retaining Bolt Installation Sequence

Courtesy of SUZUKI OF AMERICA CORP.

27. Install the fuel rail assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
28. Install the thermostat housing assembly.
29. Install the thermostat housing mounting bolts.

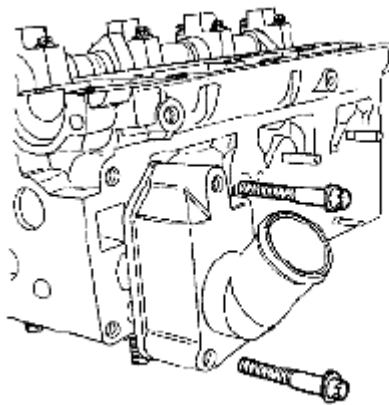
Tighten:

Tighten the thermostat housing mounting bolts to 15 N.m (11 lb-ft).

30. Install the coolant bypass housing and mounting bolts.

Tighten:

Tighten the coolant bypass housing bolts to 15 N.m (11 lb-ft).



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Fig. 122: Identifying Coolant Bypass Housing And Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

31. Install the exhaust manifold studs.
32. Install the exhaust manifold gasket.
33. Install the exhaust manifold.
34. Install the exhaust manifold retaining nuts in the sequence shown.

Tighten:

Tighten the exhaust manifold retaining nuts to 22 N.m (16 lb-ft).

35. Install the exhaust manifold heat shield.
36. Install the exhaust manifold heat shield bolts.

Tighten:

Tighten the exhaust manifold heat shield bolts to 8 N.m (71 lb-in).

37. Install the cylinder head with the intake manifold and the exhaust manifold attached. Refer to **CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION** .

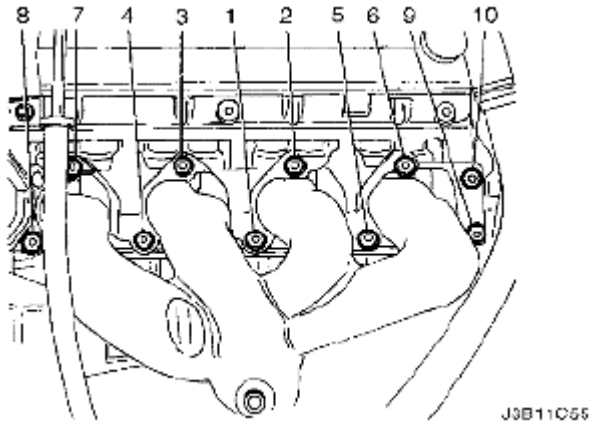


Fig. 123: Identifying Manifold Retaining Nuts Installation Sequence
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD INSPECTION

1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation and warpage. The cylinder head sealing surfaces must be flat within 0.025 mm (0.001 in.) maximum.

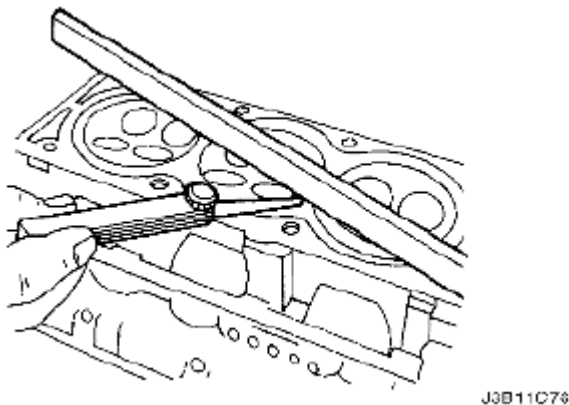
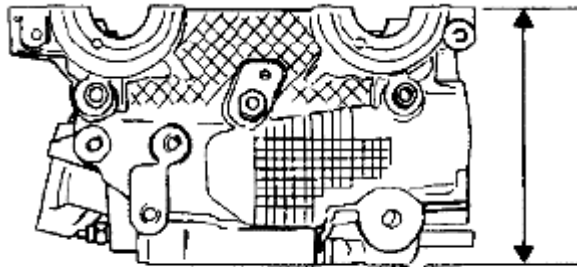


Fig. 124: Inspecting Length And Width Of Cylinder Head For Deformation And Warpage
Courtesy of SUZUKI OF AMERICA CORP.

6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height

should be 133.975 - 134.025 mm (5.274 - 5.276 in.). If the cylinder head height is less than 133.9 mm (5.271 in.), replace the cylinder head.

7. Inspect all threaded holes for damage.
8. Inspect valve seats for excessive wear and burned spots.

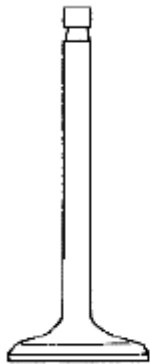


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Fig. 125: Measuring Height Of Cylinder Head From Sealing Surface To Sealing Surface
 Courtesy of SUZUKI OF AMERICA CORP.

VALVE INSPECTION

1. Inspect the valve stem tip for wear.
2. Inspect the valve key grooves and the oil seal grooves for chips and wear.
3. Inspect the valves for burns or cracks.
4. Inspect the valve stem for burrs and scratches.
5. Inspect the valve stem. The valve stem must be straight.
6. Inspect the valve face for grooving. If the groove is so deep that refacing the valve would result in a sharp edge, replace the valve.
7. Inspect the valve spring. If the valve spring ends are not parallel, replace the valve spring.
8. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.

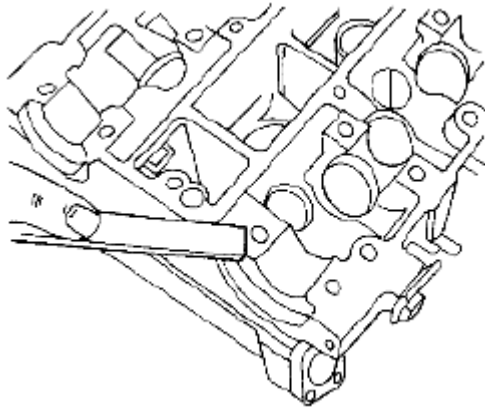


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Fig. 126: Identifying Valve
 Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD AND VALVE TRAIN COMPONENTS CLEANING

1. Clean the cylinder head.
2. Clean the valve guides.
3. Clean all of the threaded holes.
4. Clean the valves of carbon, oil, and varnish.

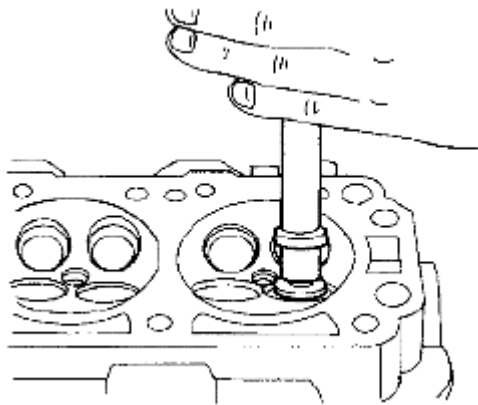


J3B11C79

Fig. 127: Cleaning Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD OVERHAUL**Valve Grind-in**

1. Lubricate the valve seat using a fine-grained paste.
2. Lift the valve rhythmically from the seat with a commercially available valve grinding tool in order to distribute the paste.

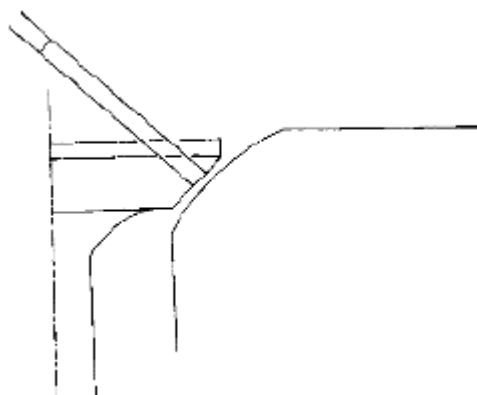


J3B11C80

Fig. 128: Lubricating Valve Seat With Fine-Grained Paste
Courtesy of SUZUKI OF AMERICA CORP.

3. Check the contact pattern on the valve head and in the cylinder head.

4. Clean the valves the valve guides and the cylinder head.

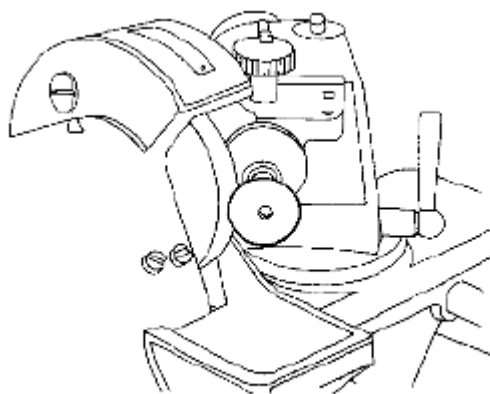


J3B11C81

Fig. 129: Identifying Contact Pattern On Valve Head And Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

Valve Grind

1. Ensure that there are no crater line burns on the valve cone.
2. The valve may be reground only two times. Do not grind the valve stem end.
3. Ensure that the angle at the valve face is 45°.
4. Inspect the assembly height of the intake valves and the exhaust valves.



J3B11C02

Fig. 130: Identifying Valve Grind
Courtesy of SUZUKI OF AMERICA CORP.

Valve Guide - Ream

1. Measure the diameter of the valve guide using gauge KM-571-B and a commercially available inside micrometer.

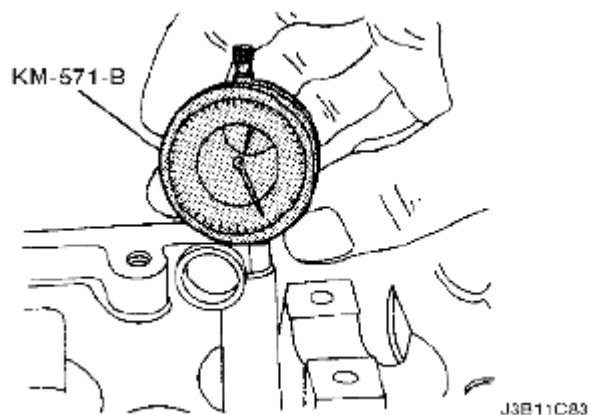


Fig. 131: Measuring Diameter Of Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

2. An oversize service code is on the valve guide and the valve stem end. The following table gives the correct size, reamer, and production code for each service.

VALVE GUIDE AND VALVE STEM END REFERENCE CHART

Size	Reamer	Production Code	Service Code
Normal	-	-	K
0.075	KM-805	1	K1
0.150	-	2	K2

3. Ream the valve guide from the upper side of the cylinder head to the next oversize.
4. After reaming, cross out the code and emboss the valve guide with the new code.

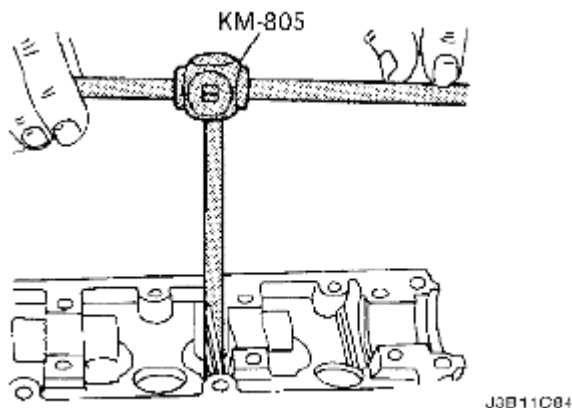


Fig. 132: Identifying Valve Guide Reamer (KM-805) On Upper Side Of Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

Valve Seat - Cut

1. Place the cylinder head on wooden blocks.

2. Cut the intake and the exhaust valve seats using the guide drift KM-340-7 as follows:
 - Valve seat - A 45° surface using the cutter KM-340-13.
 - Upper correction angle - A 30° surface using the cutter KM-340-13.
 - Lower correction angle - A 60° surface using the cutter KM-340-26.
3. Clean the chippings from the cylinder head.

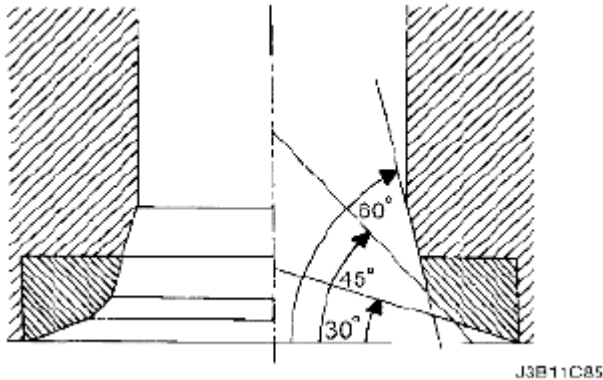


Fig. 133: Identifying Upper Correction Angle And Lower Correction Angle
Courtesy of SUZUKI OF AMERICA CORP.

4. Inspect the dimension for the valve seat width.
 - Intake: 1.2 - 1.4 mm (0.047 - 0.055 in.)
 - Exhaust: 1.4 - 1.8 mm (0.055 - 0.070 in.)
5. Inspect the assembly height of the intake valves and the exhaust valves. If the dimension is exceeded, install new valves. Inspect the assembly height of the intake valves and the exhaust valves again. If the valve assembly height is still too large despite replacing the valves, replace the cylinder head.

CRANKSHAFT DISASSEMBLY AND ASSEMBLY

CAUTION: Take extreme care to prevent any scratches, nicks, or damage to the camshafts.

Tools Required:

KM-412 Engine Overhaul Stand

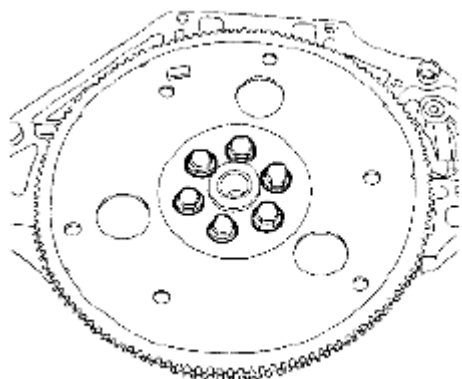
KM-470-B Angular Torque Gauge

J-36792 or KM-635 Crankshaft Rear Oil Seal Installer

Disassembly

1. Remove the engine. Refer to **Engine Removal and Installation**.
2. Remove the flywheel or flexible plate bolts.

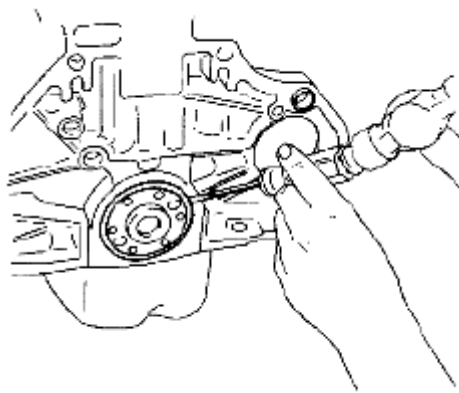
3. Remove the flywheel or the flexible plate.



J3B11C89

Fig. 134: Identifying Flywheel Or Flexible Plate With Bolts
Courtesy of SUZUKI OF AMERICA CORP.

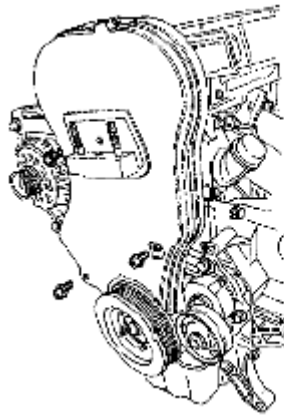
4. Remove the crankshaft rear oil seal.
5. Mount the engine assembly on the engine overhaul stand KM-412.



J3B11C89

Fig. 135: Removing Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

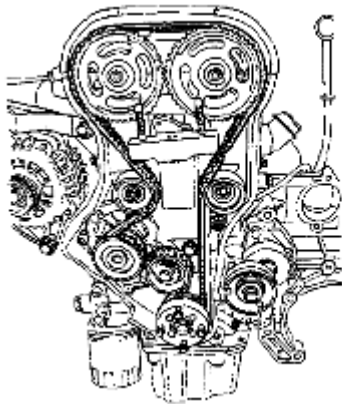
6. Remove the front timing belt cover bolts.
7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.



J3B11C90

Fig. 136: Identifying Front Timing Belt Cover And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

10. Loosen the timing belt automatic tensioner bolt.
11. Rotate the timing belt automatic tensioner hex-key clockwise to release the tension.
12. Remove the timing belt idler pulley bolt and nut.
13. Remove the timing belt idler pulleys.
14. Remove the timing belt.
15. Remove the engine mount retaining bolts.
16. Remove the engine mount.



J3B11C91

Fig. 137: Identifying Timing Belt, Idler Pulleys, Automatic Tensioner, Associated Nuts and Bolts
Courtesy of SUZUKI OF AMERICA CORP.

17. Disconnect the breather tubes from the camshaft cover.
18. Remove the spark plug cover bolts.
19. Remove the spark plug cover.
20. Disconnect the ignition wires from the spark plugs.
21. Remove the camshaft cover bolts.
22. Remove the camshaft cover washers.

23. Remove the camshaft cover and the camshaft cover gasket.

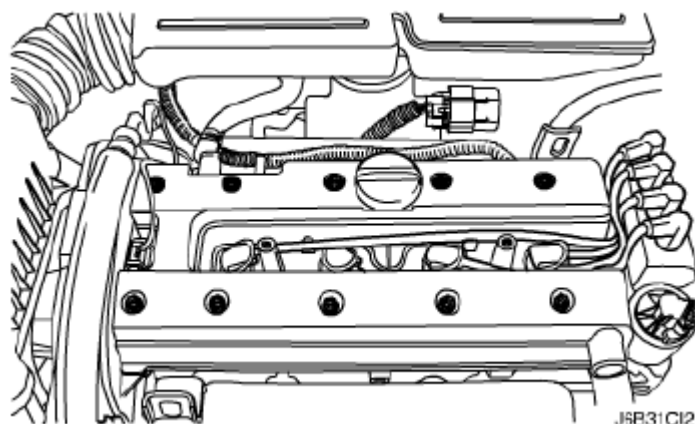


Fig. 138: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.

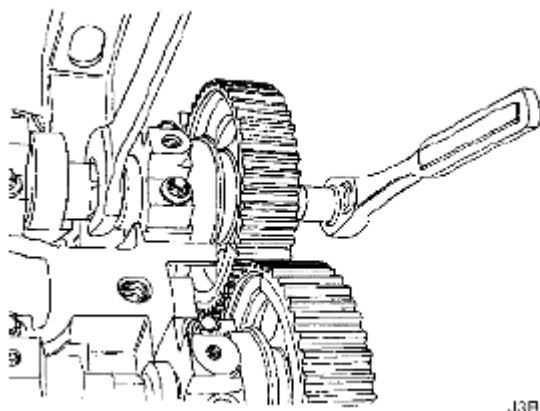
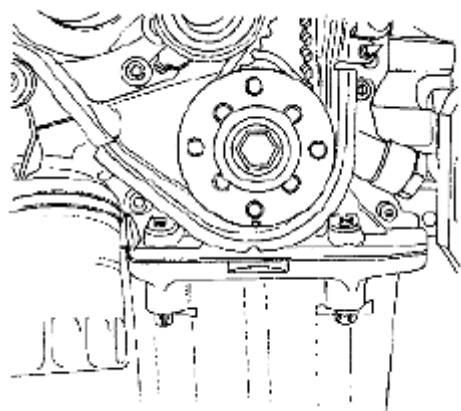


Fig. 139: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

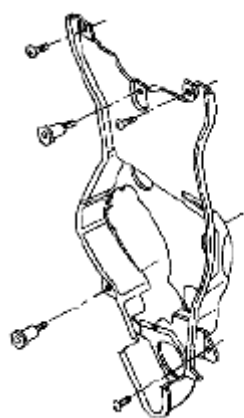
28. Remove the crankshaft timing belt gear.



J3B11C29

Fig. 140: Identifying Crankshaft Timing Belt Gear
 Courtesy of SUZUKI OF AMERICA CORP.

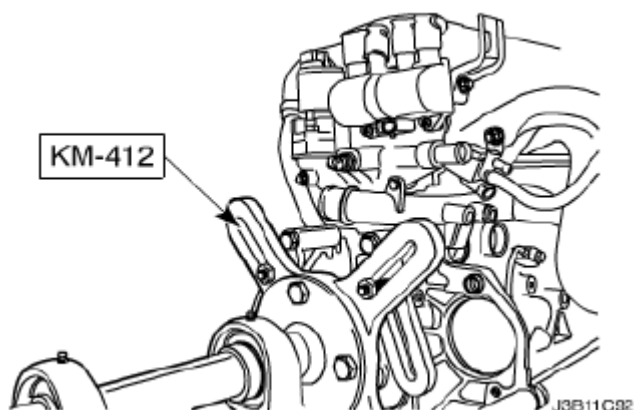
29. Remove the rear timing belt cover bolts and cover.



J3B11C20

Fig. 141: Identifying Rear Timing Belt Cover Bolts And Cover
 Courtesy of SUZUKI OF AMERICA CORP.

30. Rotate the engine on the engine overhaul stand KM-412.



J3B11C32

Fig. 142: Identifying Engine On Engine Overhaul Stand KM-412
Courtesy of SUZUKI OF AMERICA CORP.

31. Remove the oil pan retaining bolts.
32. Remove the oil pan.
33. Remove the oil suction pipe and support bracket bolts.
34. Remove the oil suction pipe.
35. Remove the crankshaft bearing bridge and oil pan scraper bolts.
36. Remove the oil pan scraper.
37. Remove the crankshaft bearing bridge bolts.
38. Remove the crankshaft bearing bridge.

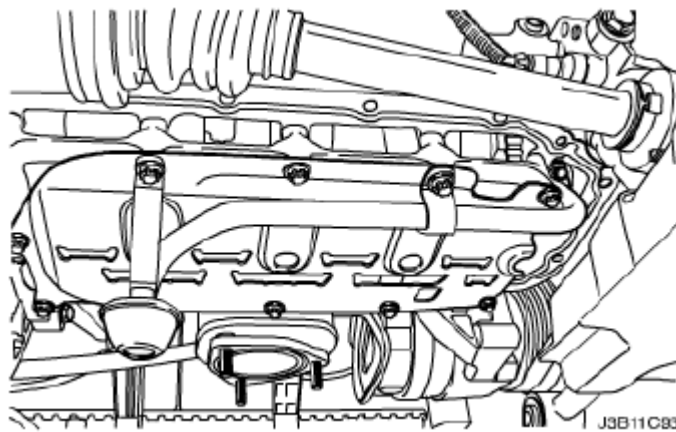


Fig. 143: Identifying Crankshaft Bearing Bridge
Courtesy of SUZUKI OF AMERICA CORP.

39. Remove the oil pump retaining bolts.
40. Remove the oil pump.

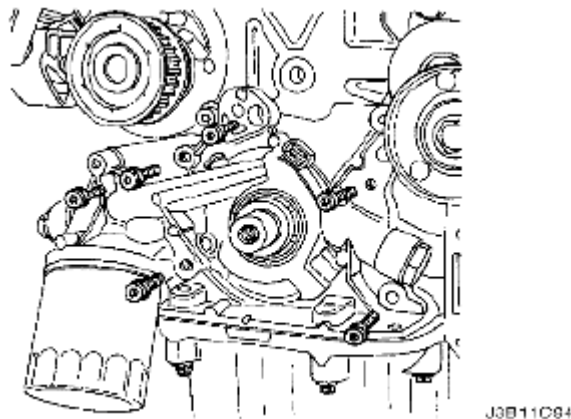


Fig. 144: Identifying Oil Pump And Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

41. Mark the order of the connecting rod bearing caps.
42. Remove the connecting rod bearing cap bolts for all of the pistons.
43. Remove the connecting rod bearing caps and the lower connecting rod bearings.

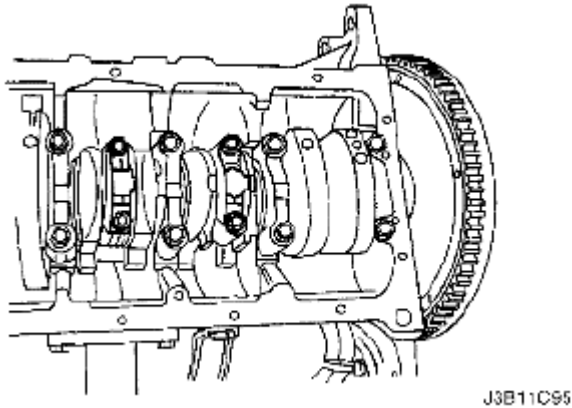


Fig. 145: Identifying Connecting Rod Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

44. Mark the order of the crankshaft bearing caps.
45. Remove the crankshaft bearing cap bolts.
46. Remove the crankshaft bearing caps and the lower crankshaft bearings.
47. Remove the crankshaft.
48. Clean the parts, as needed.

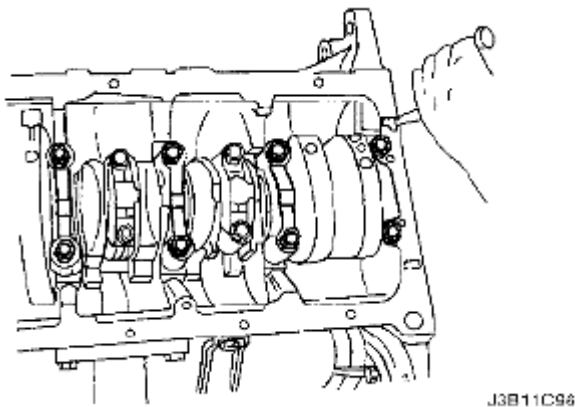


Fig. 146: Identifying Crankshaft Bearing Caps And Lower Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.

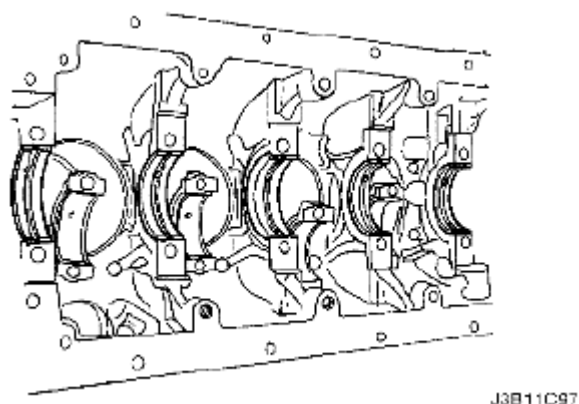


Fig. 147: Identifying Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to **Engine Specifications**.

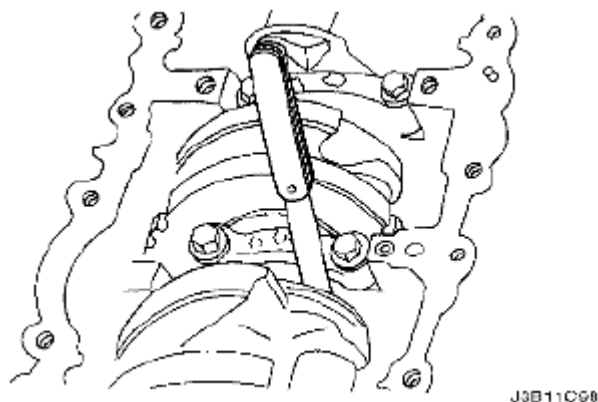


Fig. 148: Inspecting Crankshaft End Play
Courtesy of SUZUKI OF AMERICA CORP.

7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to **Engine Specifications**.

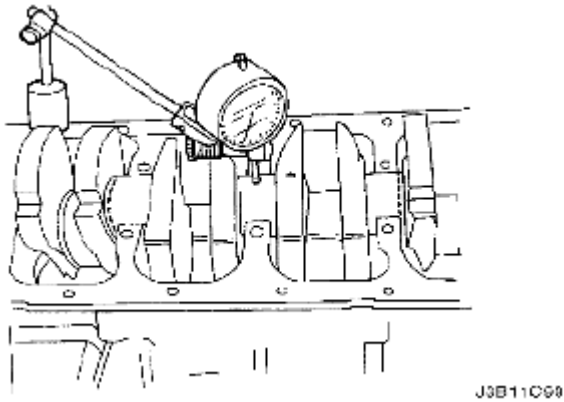


Fig. 149: Checking Middle Crankshaft Journal For Permissible Out-Of-Round (Runout)
Courtesy of SUZUKI OF AMERICA CORP.

8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.
10. Install the crankshaft bearing caps and the bolts.

Tighten:

Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft) plus 45° and 15°.

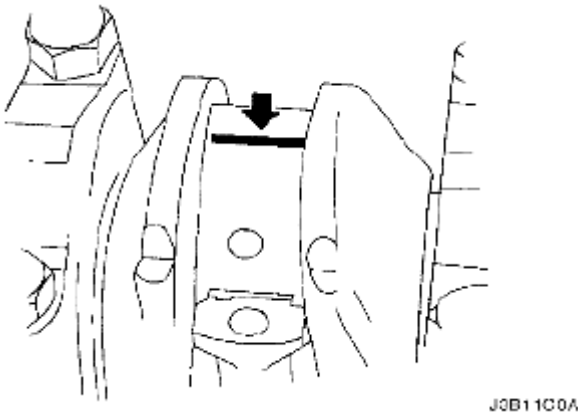


Fig. 150: Identifying Plastic Gauging Thread At Length Of Bearing Width
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove the crankshaft bearing cap bolts and the caps.
12. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
13. Inspect the bearing clearance for permissible tolerance ranges. Refer to **Engine Specifications**.

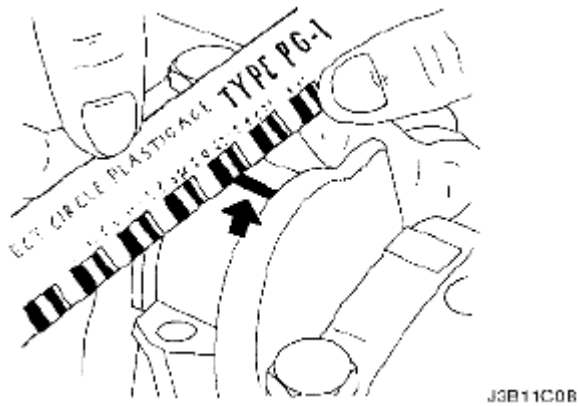


Fig. 151: Locating Bearing Clearance For Permissible Tolerance Ranges
 Courtesy of SUZUKI OF AMERICA CORP.

14. Apply a bead of adhesive sealing compound to the grooves of the crankshaft bearing caps.
15. Install the crankshaft bearing caps to the engine block.
16. Tighten the crankshaft bearing caps using new bolts.

Tighten:

Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the crankshaft bearings another 45° and 15°.

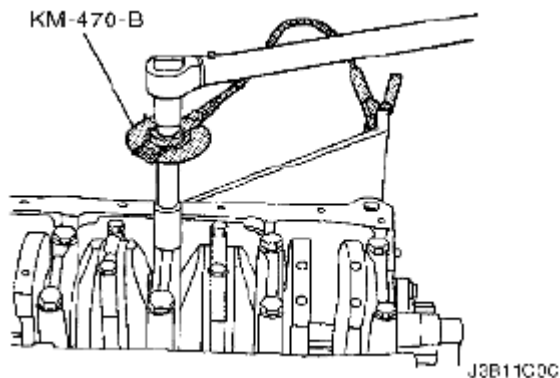
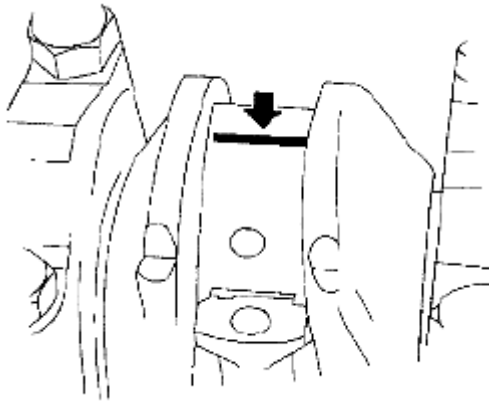


Fig. 152: Tightening Crankshaft Bearing Cap Bolts
 Courtesy of SUZUKI OF AMERICA CORP.

17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.
19. Install the connecting rod bearing caps.

Tighten:

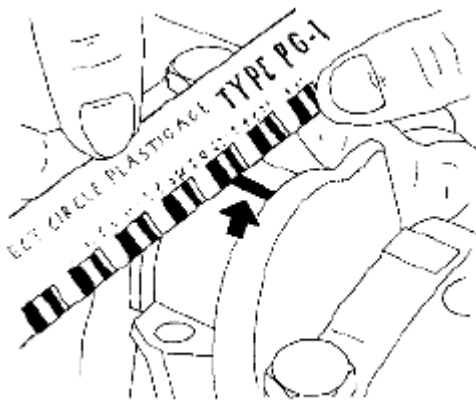
Tighten the connecting rod bearing cap bolts to 35 N.m (26 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the connecting rod bearing cap bolts another 45° plus 15°.



J3B11C0A

Fig. 153: Identifying Plastic Gauging Thread At Length Of Bearing Width
Courtesy of SUZUKI OF AMERICA CORP.

20. Remove the connecting rod bearing caps.
21. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
22. Inspect the bearing clearance for permissible tolerance ranges. Refer to **Engine Specifications**.



J3B11C0B

Fig. 154: Locating Bearing Clearance For Permissible Tolerance Ranges
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the connecting rod bearing caps to the connecting rods.
24. Tighten the connecting rod bearing caps using new bolts.

Tighten:

Tighten the connecting rod bearing cap bolts to 35 N.m (26 lb-ft) using a torque wrench. Use the angular torque gauge KM-470-B to tighten the connecting rod cap bolts another 45° plus 15°.

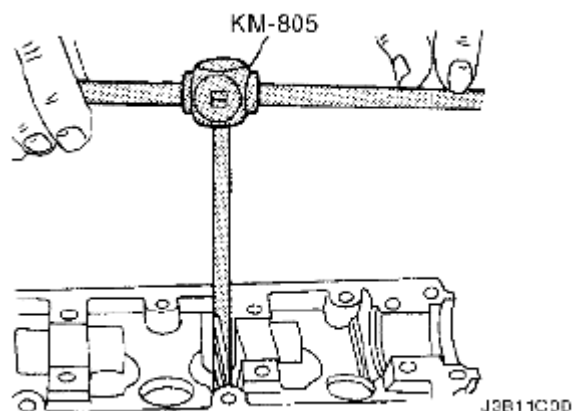


Fig. 155: Tightening Connecting Rod Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

25. Install the oil pump.
26. Install the oil pump retaining bolts.

Tighten:

Tighten the oil pump retaining bolts to 10 N.m (89 lb-in).

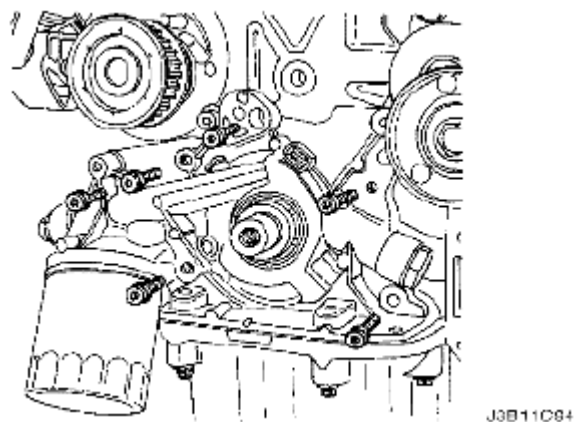


Fig. 156: Identifying Oil Pump And Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

27. Install the crankshaft bearing bridge and bolts.

Tighten:

Tighten the crankshaft bearing bridge bolts to 20 N.m (15 lb-ft) plus 45° using the angular torque gauge KM-470-B.

28. Install the crankshaft bearing bridge and oil pan scraper bolts.

Tighten:

Tighten the crankshaft bearing bridge and oil scraper bolts to 20 N.m (15 lb-ft) plus 45° using the angular torque gauge KM-470-B.

29. Install the oil suction pipe.
30. Install the oil suction pipe and support bracket bolts.

Tighten:

Tighten the oil suction pipe bolts to 8 N.m (81 lb-in) and oil suction pipe support bracket bolt to 6 N.m (53 lb-in).

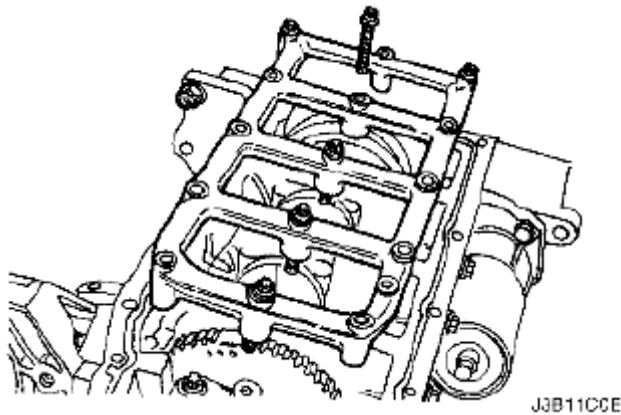


Fig. 157: Identifying Oil Suction Pipe And Support Bracket Bolts
Courtesy of SUZUKI OF AMERICA CORP.

31. Coat the new oil pan gasket with sealant.
32. Install the oil pan gasket to the oil pan.
33. Install the oil pan.
34. Install the oil pan retaining bolts.

Tighten:

Tighten the oil pan retaining bolts to 10 N.m (89 lb-in).

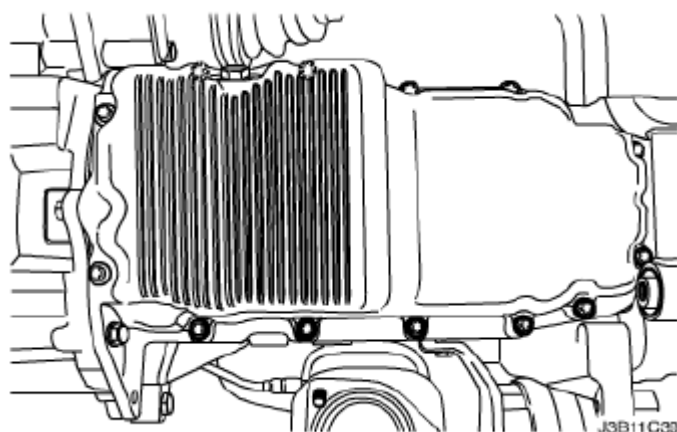


Fig. 158: Identifying Oil Pan Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

35. Rotate the engine on the engine overhaul stand KM-412.

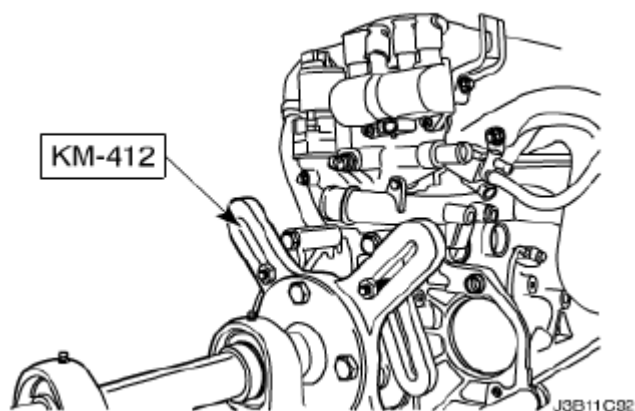


Fig. 159: Identifying Engine On Engine Overhaul Stand (KM-412)
Courtesy of SUZUKI OF AMERICA CORP.

36. Install the rear timing belt cover.
37. Install the rear timing belt cover bolts.

Tighten:

Tighten the rear timing belt cover bolts to 7 N.m (62 lb-in).

38. Install the crankshaft gear and bolt.

Tighten:

Tighten the crankshaft gear bolt to 145 N.m (107 lb-ft) plus 30° plus 15° using the angular torque gauge KM-470-B.

39. Install the engine mount and retaining bolts.

Tighten:

Tighten the engine mount retaining bolts to 45 N.m (33 lb-ft).

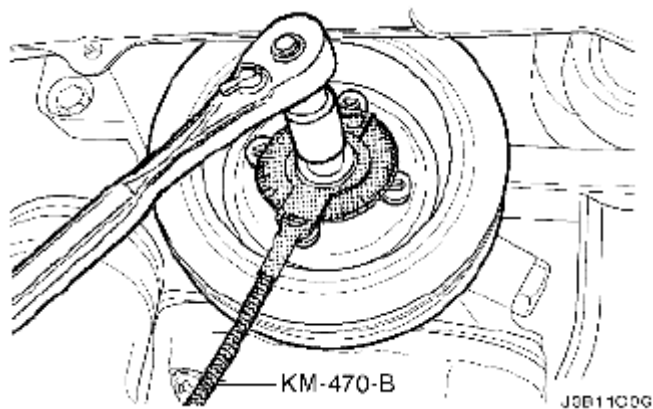


Fig. 160: Tightening Engine Mount Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

40. Install the timing belt automatic tensioner.
41. Install the timing belt automatic tensioner bolts.

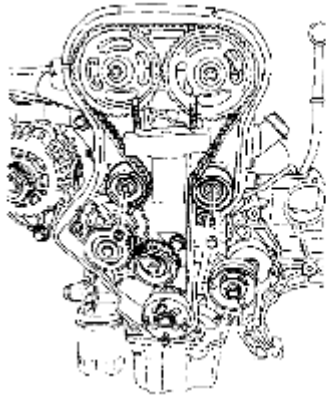
Tighten:

Tighten the timing belt automatic tensioner bolts to 25 N.m (18 lb-ft).

42. Install the timing belt idler pulley.
43. Install the timing belt idler pulley bolt and nut.

Tighten:

Tighten the timing belt idler pulley nut to 25 N.m (18 lb-ft).



J3B11C19

Fig. 161: Identifying Automatic Tensioner, Timing Belt And Pulley
Courtesy of SUZUKI OF AMERICA CORP.

44. Install the intake camshaft gear.
45. Install the intake camshaft gear bolt while holding the intake camshaft firmly in place.

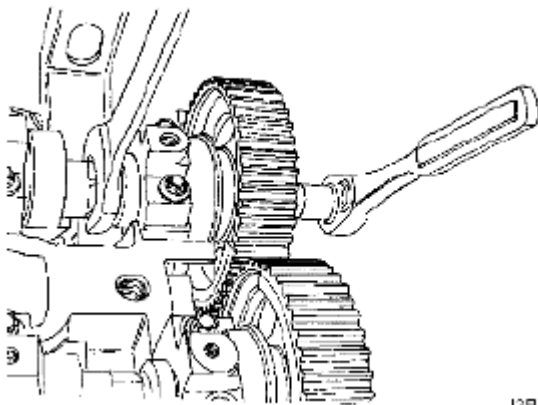
Tighten:

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.

46. Install the exhaust camshaft gear.
47. Install the exhaust camshaft gear bolt while holding the exhaust camshaft firmly in place.

Tighten:

Tighten the exhaust camshaft gear bolt to 50 N.m (37 lb-ft) plus 60° and 15° using the angular torque gauge KM-470-B.



J3B11C17

Fig. 162: Identifying Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

48. Install the timing belt. Refer to **Timing Belt Removal and Installation.**
49. Adjust the timing belt tension. Refer to **Timing Belt Check and Adjust.**
50. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear camshaft cover to cylinder head seal.
51. Install the camshaft cover and the camshaft cover gasket.
52. Install the camshaft cover washers.
53. Install the camshaft cover bolts.

Tighten:

Tighten the camshaft cover bolts to 8 N.m (71 lb-in).

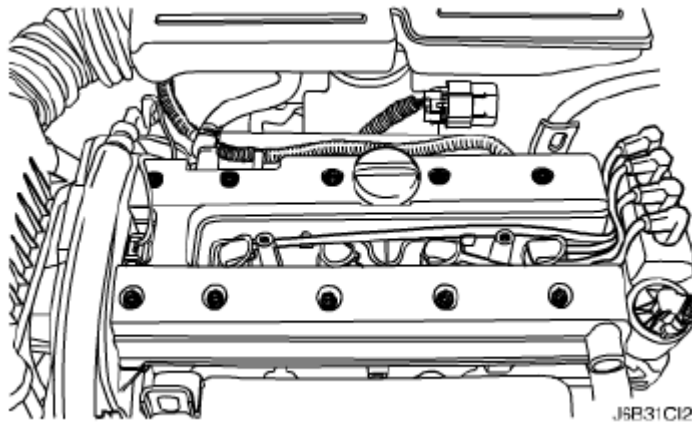


Fig. 163: Identifying Camshaft Cover Bolts Location
Courtesy of SUZUKI OF AMERICA CORP.

54. Connect the ignition wires to the spark plugs.
55. Install the spark plug cover.
56. Install the spark plug cover bolts.

Tighten:

Tighten the spark plug cover bolts to 8 N.m (71 lb-in).

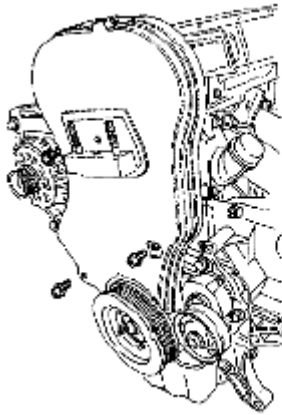
57. Connect the breather tube to the camshaft cover.
58. Install the front timing belt cover.
59. Install the front timing belt cover bolts.

Tighten:

Tighten the front timing belt cover bolts to 8 N.m (71 lb-in).

60. Install the engine lifting device.

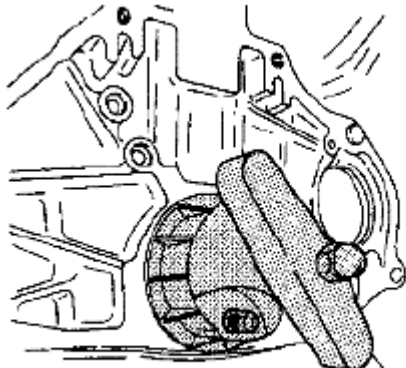
61. Remove the engine from the engine overhaul stand KM-412.



J3B11C90

Fig. 164: Identifying Front Timing Belt Cover And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

62. Install a new crankshaft rear oil seal using installer J-36792.



J-36792 J4B11C08

Fig. 165: Identifying Crankshaft Rear Oil Seal Using Installer (J-36792)
Courtesy of SUZUKI OF AMERICA CORP.

63. Install the flywheel or flexible plate.
64. Install the flywheel or the flexible plate bolts.

Tighten:

Tighten the flywheel bolts to 65 N.m (48 lb-ft). Use the angular torque gauge KM-470-B to tighten the flywheel bolts another 30° plus 15°. For the automatic transmission, tighten the flexible plate bolts to 45 N.m (33 lb-ft).

65. Install the engine. Refer to **Engine Removal and Installation**.

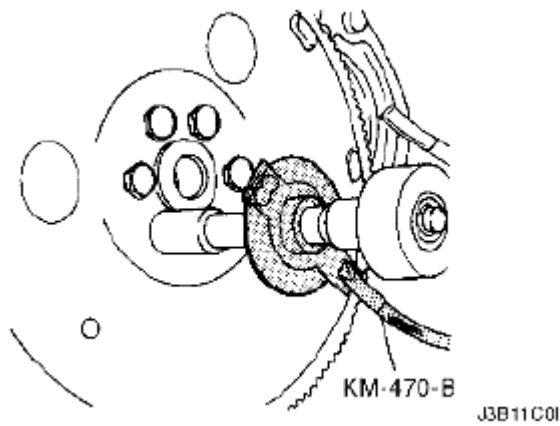


Fig. 166: Identifying Flywheel Or Flexible Plate Bolts
Courtesy of SUZUKI OF AMERICA CORP.

CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS - GAUGING PLASTIC INSPECTION

Tools Required:

KM-470-B Angular Torque Gauge

Inspection - Crankshaft

1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to **Engine Specifications**.

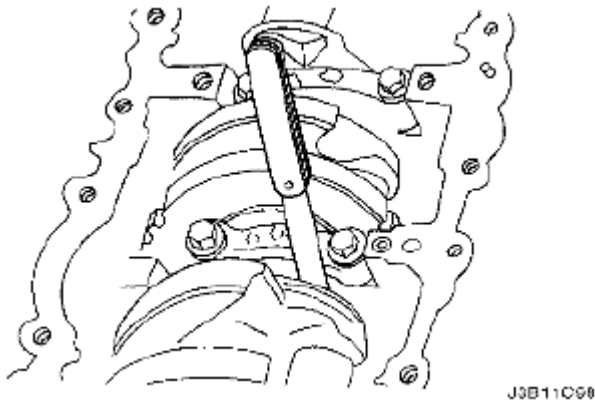


Fig. 167: Identifying Crankshaft End Play
Courtesy of SUZUKI OF AMERICA CORP.

7. With the crankshaft mounted on the front and rear crankshaft bearings, check the middle crankshaft journal for permissible out-of-round (runout). Refer to **Engine Specifications**.

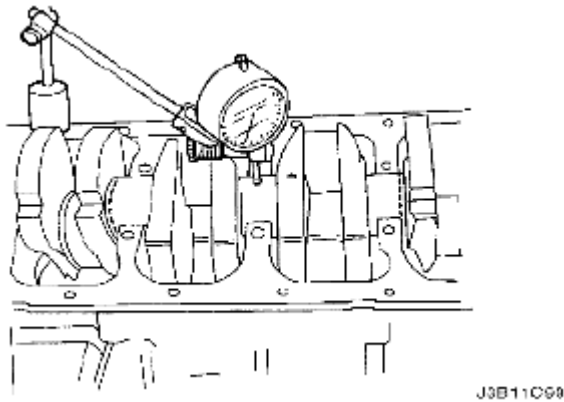


Fig. 168: Checking Middle Crankshaft Journal For Permissible Out-Of-Round (Runout)
 Courtesy of SUZUKI OF AMERICA CORP.

8. Inspect all of the crankshaft bearing clearances using a commercially available plastic gauging (ductile plastic threads).
9. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the crankshaft journals and the crankshaft bearings.

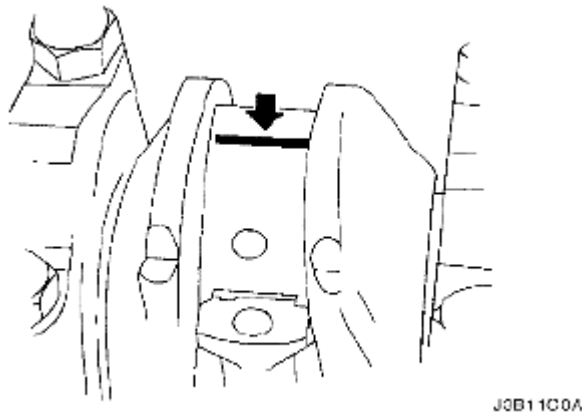


Fig. 169: Identifying Plastic Gauging Thread To Length Of Bearing Width
 Courtesy of SUZUKI OF AMERICA CORP.

10. Install the crankshaft bearing caps.
11. Install the crankshaft bearing cap bolts.

Tighten:

Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft). Using the angular torque gauge KM-470-B, tighten the crankshaft bearing cap bolts another 45° plus 15°.

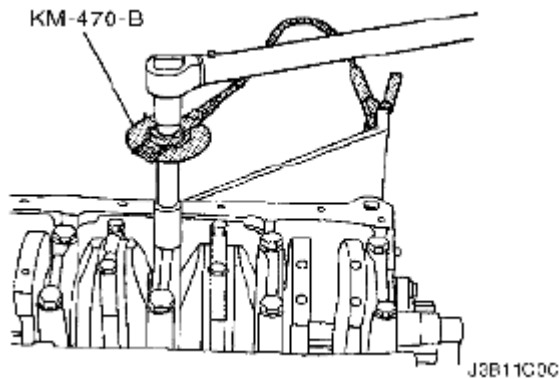


Fig. 170: Installing Crankshaft Bearing Cap Bolts Using Angular Torque Gauge (KM-470-B)
 Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the crankshaft bearing caps.
13. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
14. Inspect the bearing clearances for permissible tolerance ranges. Refer to **Engine Specifications**.

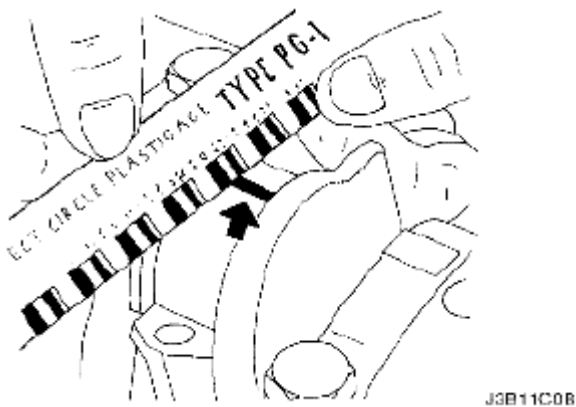


Fig. 171: Locating Bearing Clearance For Permissible Tolerance Ranges
 Courtesy of SUZUKI OF AMERICA CORP.

Inspection - Connecting Rods

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.
4. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
5. Cut the plastic gauging threads to the length of the bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.

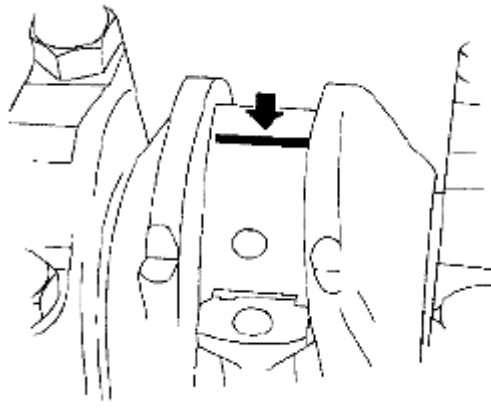


Fig. 172: Identifying Plastic Gauging Thread To Length Of Bearing Width
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the connecting rod bearing caps.
7. Install the connecting rod bearing cap bolts.

Tighten:

Tighten the connecting rod bearing cap bolts to 35 N.m (26 lb-ft). Using the angular torque gauge KM470-B, tighten the connecting rod bearing cap bolts another 45° plus 15°.

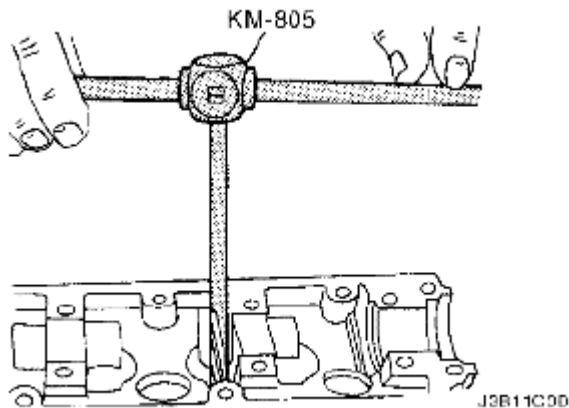


Fig. 173: Tightening Connecting Rod Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the connecting rod bearing caps.
9. Measure the width of the flattened plastic thread of the plastic gauging using a ruler. (Plastic gauging is available for different tolerance ranges.)
10. Inspect the bearing clearance for permissible tolerance ranges. Refer to **Engine Specifications**.

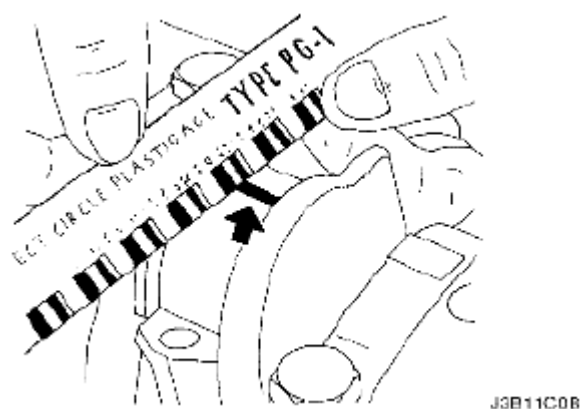


Fig. 174: Locating Bearing Clearance For Permissible Tolerance Ranges
 Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

ENGINE SPECIFICATIONS

ENGINE SPECIFICATIONS

Application	Description
General Data:	
Engine Type	U20SED
Displacement	1,998 cm ³ (121.92 in ³)
Bore Stroke	86 x 86 mm (3.38 x 3.38 in.)
Compression Ratio	9.6 ± 0.02:1
Firing Order	1-3-4-2
Cylinder Bore:	
Diameter	85.975 - 86.025 mm (3.3848 - 3.3868 in.)
Out of Round (Maximum)	0.013 mm (0.0005 in.)
Taper (Maximum)	0.013 mm (0.0005 in.)
Piston:	
Diameter	85.955 - 86.485 mm (3.384 - 3.404 in.)
Clearance to Bore	0.0100 - 0.0300 mm (0.00039 - 0.00110 in.)
Piston Protrusion	0.5 mm (0.019 in.) Maximum
Piston Taper	0.013 (0.0005 in.)
Piston Rings:	
Ring, End Gap: Top Compression	0.2 - 0.35 mm (0.008 - 0.014 in.)
Ring, End Gap: Second Compression	0.3 - 0.5 mm (0.011 - 0.019 in.)
Ring, End Gap: Oil	0.25 - 0.76 mm (0.01 - 0.03 in.)
Piston Pin:	
Diameter	20.9970 - 20.9985 mm (0.82665 - 0.82671 in.)
Pin Offset	1.0 mm (0.04 in.) Towards Thrust Side

2006 Suzuki Forenza Premium

2006-08 ENGINE Engine Mechanical - Forenza - Reno

Clearance: In Piston	0.0035 - 0.0140 mm (0.00013 - 0.00055 in.)
Clearance: In Rod	Interference Fit in Rod
Length	61.5 mm (2.42 in.)
Camshaft:	
Lift - Intake	9.2 mm (0.36 in.)
Lift - Exhaust	9.2 mm (0.36 in.)
End Play	0.040 - 0.14 mm (0.0015 - 0.0055 in.)
Bearing Journal OD	42.455 - 43.470 mm (1.6714 - 1.7114 in.)
Crankshaft:	
Main Journal: Diameter (All) Out of Round (Maximum)	57.974 - 57.995 mm (2.2824 - 2.2832 in.) 0.003 mm (0.0001 in.)
Main Bearing Clearance (All)	0.015 - 0.040 mm (0.00059 - 0.00157 in.)
Crankshaft End Play	0.070 - 0.302 mm (0.0027 - 0.0118 in.)
Service Oversize	Available in 2 sizes 0.25 mm and 0.50 mm (0.0098 and 0.0196 in.)
Connecting Rod Journal: Diameter (All) Out of Round (Maximum)	48.970 - 48.988 mm (1.9279 - 1.9287 in.) 0.004 mm (0.00015 in.)
Cylinder Head:	
Valve Stem Protrusion	39.2 - 39.8 mm (1.54 - 1.56 in.)
Valve Guide Height	13.7 - 14.0 mm (0.54 - 0.57 in.)
Overall Height	134 ± 0.025 mm (5.2755 ± 0.0009 in.)
Minimum Overall Height After Machining	133.9 mm (5.27 in.)
Valve System:	
Valve Lash Compensators	Hydraulic Tappet
Seat Runout (Maximum, All)	0.03 mm (0.00118 in.)
Face Runout (Maximum, All)	0.03 mm (0.00118 in.)
Valve Stem Diameter:	
Intake	5.945 - 5.960 mm (0.2341 - 0.2346 in.)
Exhaust	5.945 - 5.960 mm (0.2341 - 0.2346 in.)
Valve Diameter:	
Intake	32 ± 0.1 mm (1.2598 ± 0.0039 in.)
Exhaust	29 ± 0.1 mm (1.1417 ± 0.0039 in.)
Valve Seat Width:	
Intake	1.0 - 1.5 mm (0.039 - 0.059 in.)
Exhaust	1.7 - 2.2 mm (0.066 - 0.086 in.)
Valve Face Angle	44°
Valve Guide Inside Diameter	6.000 - 6.012 mm (0.236 - 0.237 in.)
Sealants and Adhesives:	
Rear Main Bearing Cap	GE p/n RTV 159
Camshaft Carrier to Cylinder Head	HN 1581 (Loctite® 515)
Coolant Jacket Caps and Plugs (Freeze Plugs)	HN 1756 (Loctite® 176)
Exhaust Manifold Studs/Nuts	Anti-seize Compound (HMC Spec HN1325)

TIGHTENING TORQUE SPECIFICATIONS

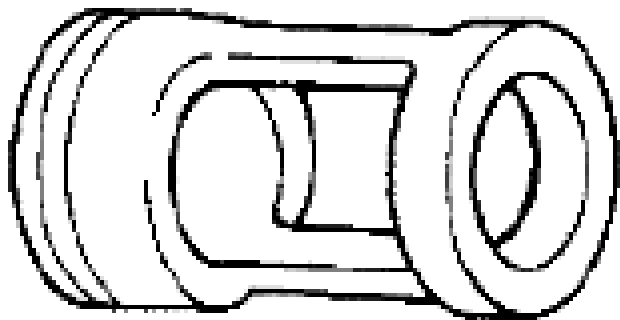
TIGHTENING TORQUE SPECIFICATIONS

Application	N.m	lb-ft	lb-in
Air Cleaner Element Cover Screw	2	-	17.7
Air Cleaner Housing Bolts	10	-	89
Automatic Tensioner Bolt	25	18	-
Crankshaft Bearing Bridge and Oil Pan Scraper Bolts	20 + 45°	15 + 45°	-
Camshaft Bearing Cap Bolts	8	-	71
Camshaft Cover Bolts	8	-	71
Charcoal Canister Purge and Exhaust Gas Recirculation Solenoid Bracket Bolt	5	-	44
Connecting Rod Bearing Cap Bolts	35 + 45° + 15°	26 + 45° + 15°	-
Crankshaft Bearing Cap Bolts	50 + 45° + 15°	37 + 45° + 15°	-
Crankshaft Pulley Bolts	20	15	-
Crankshaft Gear Bolt	145 + 30° + 15°	107 + 30° + 15°	-
Cylinder Head Bolts	25 + 90°+ 90° + 90°	18 + 90°+ 90° + 90°	-
Engine Mount Bracket Retaining Bolts	55	41	-
Engine Mount Retaining Bolts	45	33	-
Exhaust Camshaft Gear Bolt	50 + 60° + 15°	37 + 60° + 15°	-
Flywheel Bolts	65 + 30° + 15°	48 + 30° + 15°	-
Front Timing Belt Cover Bolts	6	-	53
Generator-to-Intake Manifold Support Bracket Bolt	22	16	-
Generator-to-Intake Manifold Support Bracket Bolts	37	27	-
Intake Camshaft Gear Bolt	50 + 60° + 15°	37 + 60° + 15°	-
Intake Manifold Retaining Bolt and Nuts	22	16	-
Intake Manifold Support Bracket Lower Bolt	25	18	-
Intake Manifold Support Bracket Upper Bolts	25	18	-
Rear Timing Belt Cover Bolts	7	-	62
Spark Plug Cover Bolts	8	-	71
Spark Plugs	20	15	-
Timing Belt Automatic Tensioner Bolts	25	18	-
Timing Belt Idler Pulley Bolt	25	18	-
Timing Belt Idler Pulley Nut	25	18	-
Transaxle Torque Converter Bolts	60	44	-
Exhaust Flex Pipe-to-Exhaust Manifold Retaining Nut	35	26	-
Lower Reaction Rod Mount Bolt	55	41	-

2006 Suzuki Forenza Premium

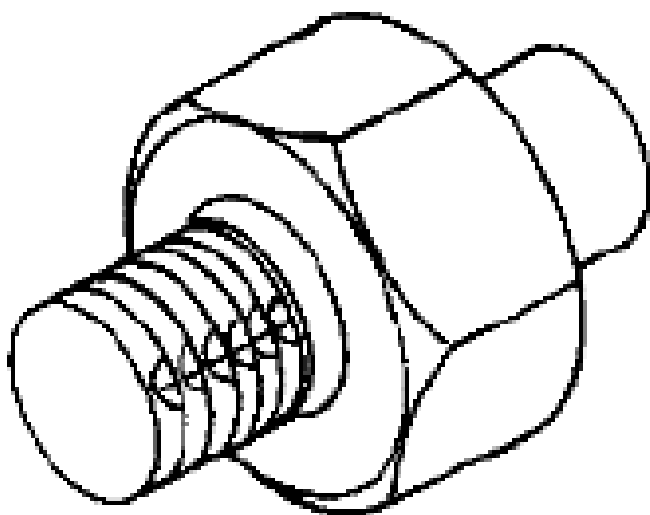
2006-08 ENGINE Engine Mechanical - Forenza - Reno

Lower Reaction Rod Bracket Bolt	69	49	-
Exhaust Flex Pipe-to-Catalytic Converter or Connecting Pipe Retaining Nut	35	26	-
Oil Suction Pipe Bolt	8	-	71
Oil Suction Pipe Bracket Bolt	6	-	53
Direct Ignition System Coil and Exhaust Gas Recirculation Mounting Bracket Bolt	25	18	-
Exhaust Manifold Retaining Nut	22	16	-
Exhaust Manifold Heat Shield Bolt	8	-	71
Oil Pan Retaining Bolt	10	-	89
Transaxle Bell Housing Bolts	75	55	-
Oil Pan Flange-to-Transaxle Bolts	40	30	-
Thermostat Housing Mounting Bolts	15	11	-
Coolant Bypass Housing Bolts	15	11	-
Oil Pump Retaining Bolts	10	-	89

SPECIAL TOOLS AND EQUIPMENT**SPECIAL TOOL****SPECIAL TOOL**

J3B11C01

KM-653 Adapter



KM-135 Adapter

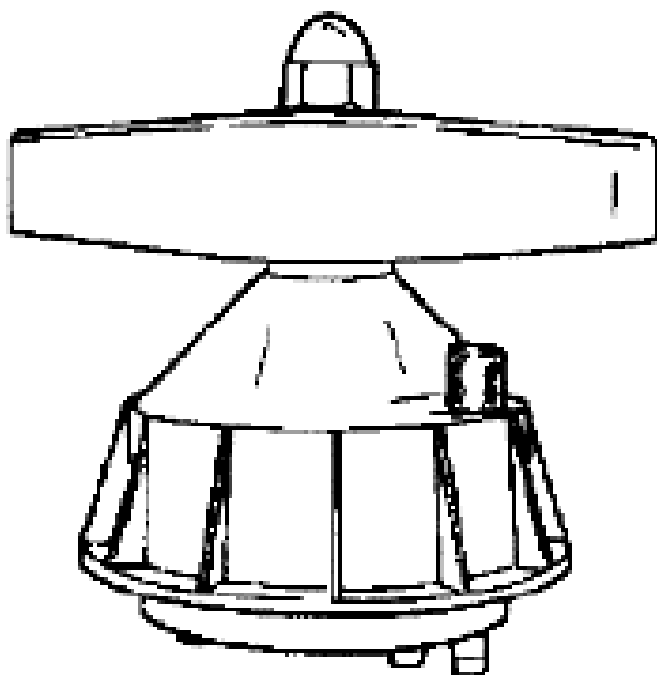
KM135



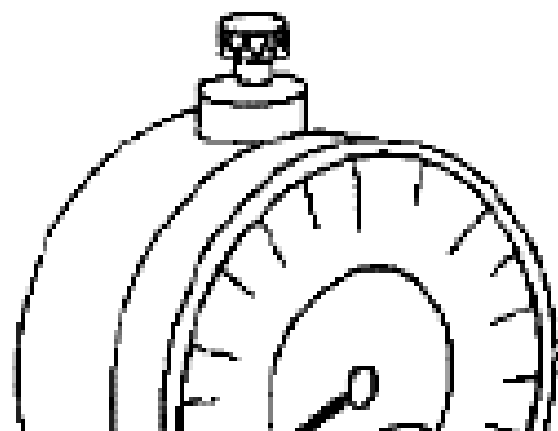
KM-805 Valve Guide Reamer

J3B11C02

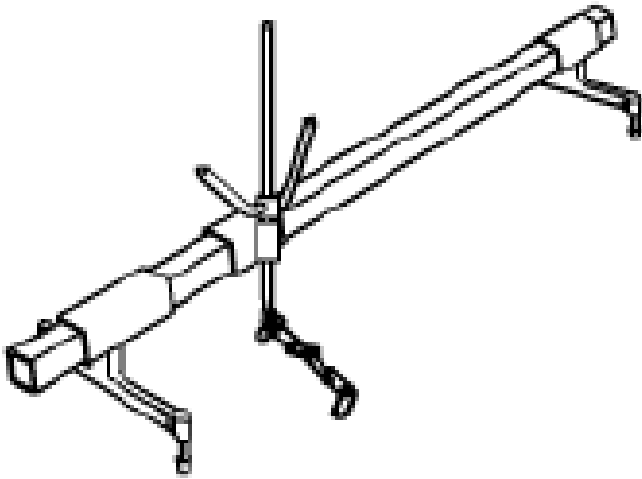
J-36792 Crankshaft Rear Oil Seal Installer



J38972

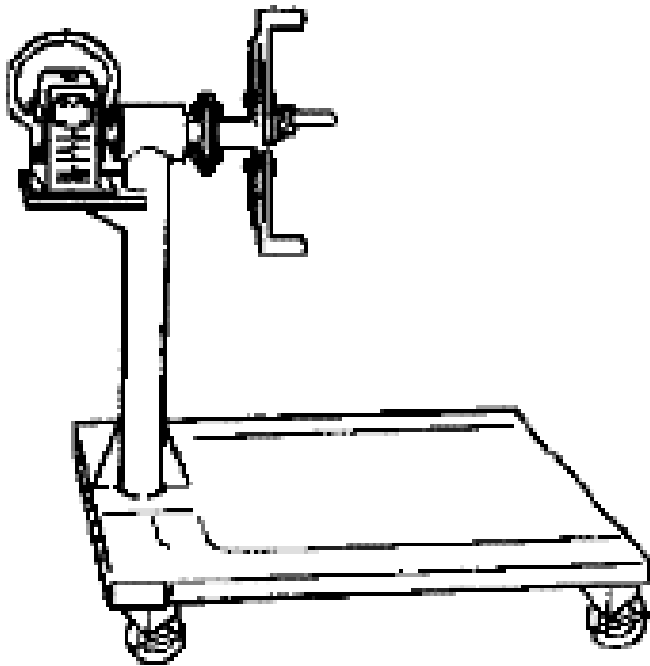


KM-571-B Gauge



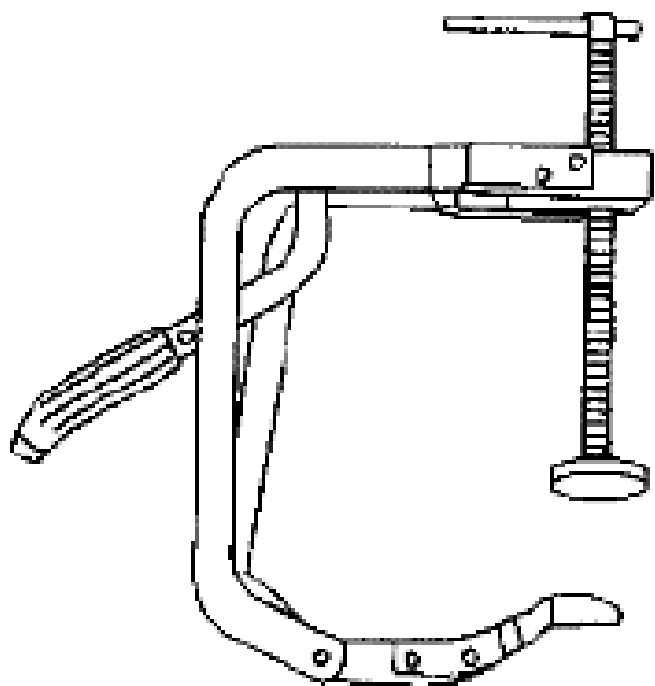
DW110-060 Engine Assembly Support Fixture

DW110060



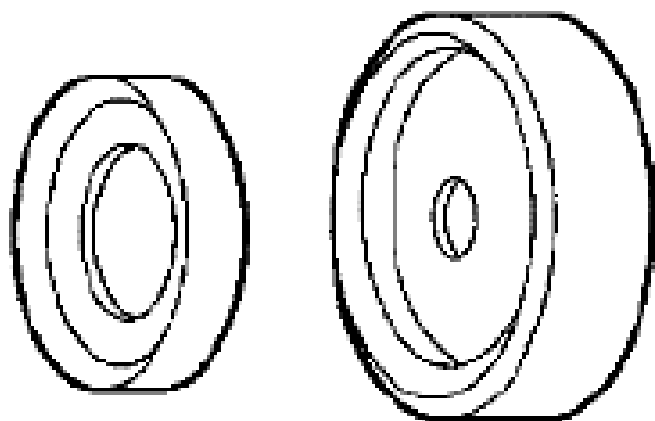
KM-412 Engine Overhaul Stand

KM412



KM348

KM-348 Valve Spring Compressor

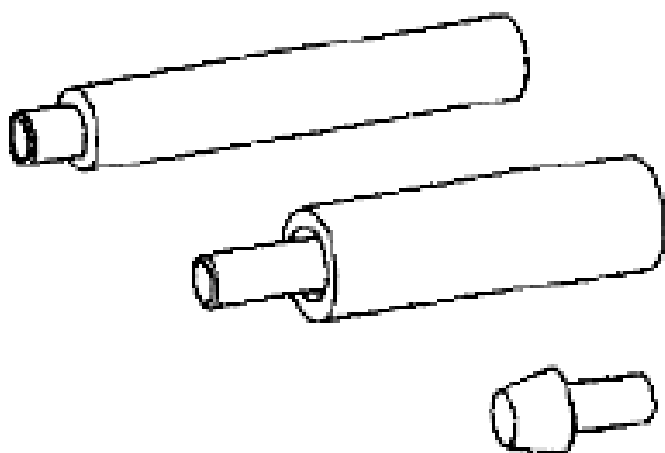


KM635

KM-635 Crankshaft Rear Oil Seal Installer

2006 Suzuki Forenza Premium

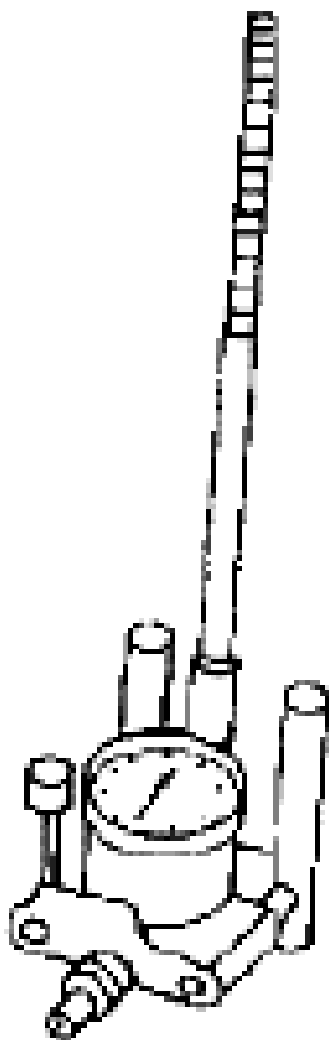
2006-08 ENGINE Engine Mechanical - Forenza - Reno



KM427

KM-427 Piston Pin Service Set

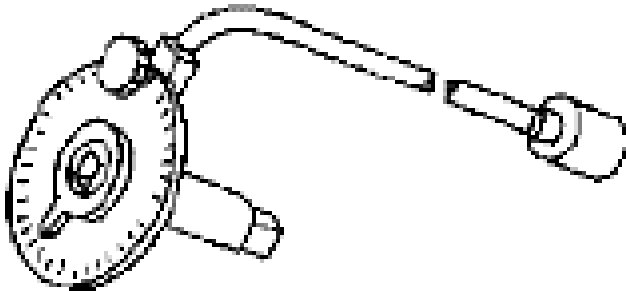
J-8087 Cylinder Bore Check Gauge



J3B11C04

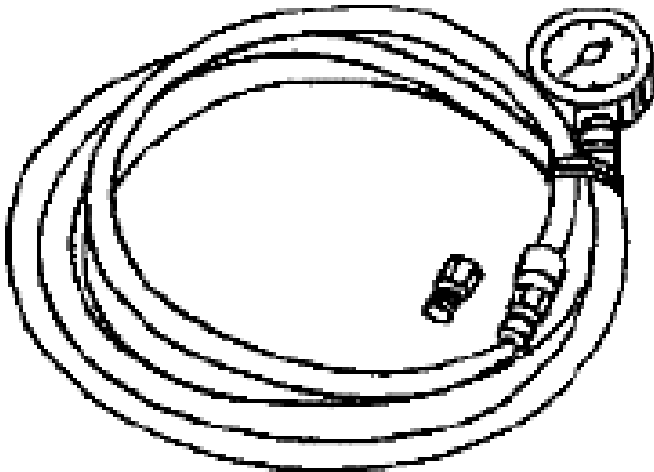


KM-340-0 Cutter Set Includes: KM-340-7 Guide
Drift KM-340-13 Cutters KM-340-26 Cutters



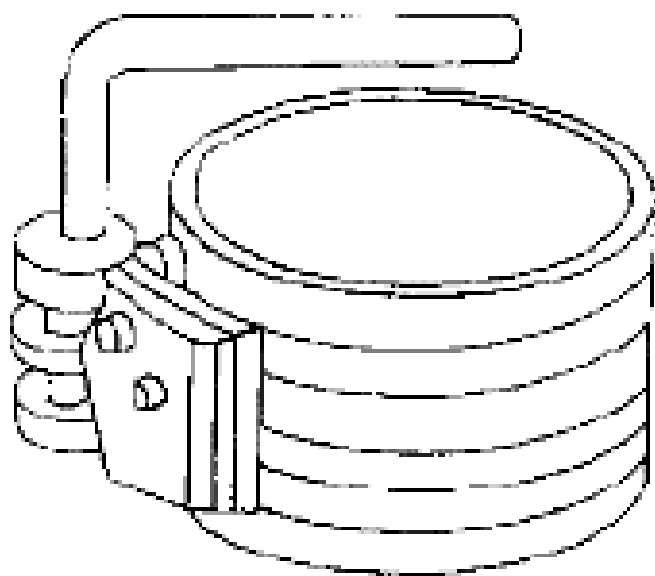
KM-470-B Angular Torque Gauge

KM470B



KM-498-B Pressure Gauge

KM498B



J3B11C05

J-8037 Universal Piston Ring Compressor