

2004 ENGINES**2.0L 4-Cylinder****ENGINE MECHANICAL****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.

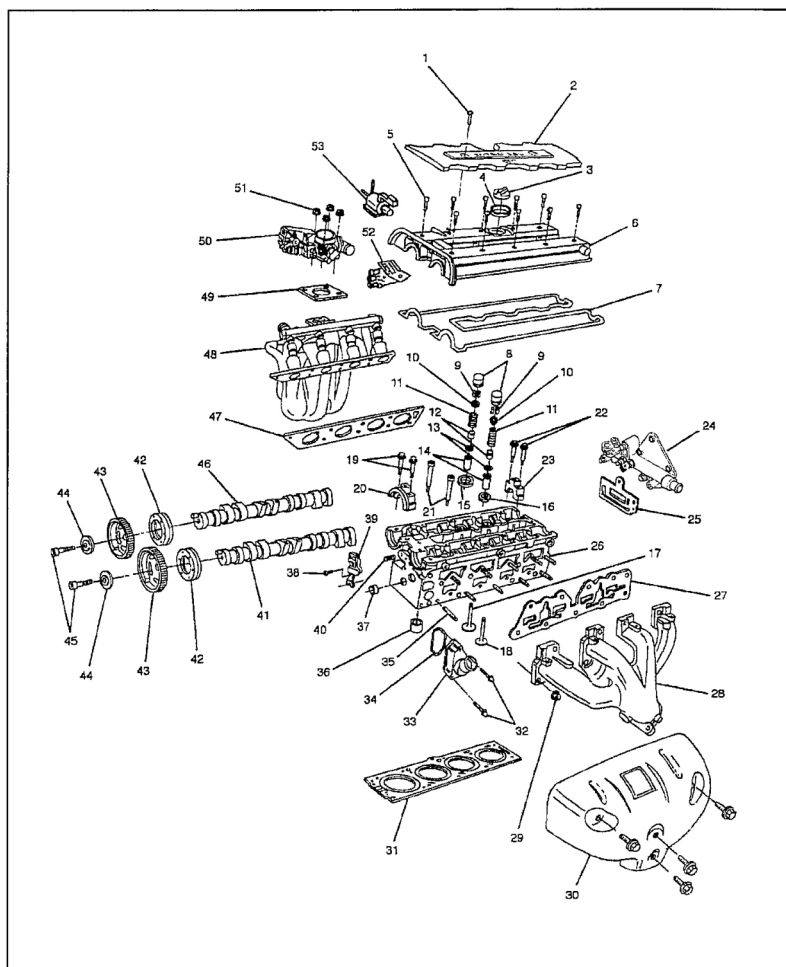
Intake Manifold Description

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**



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	

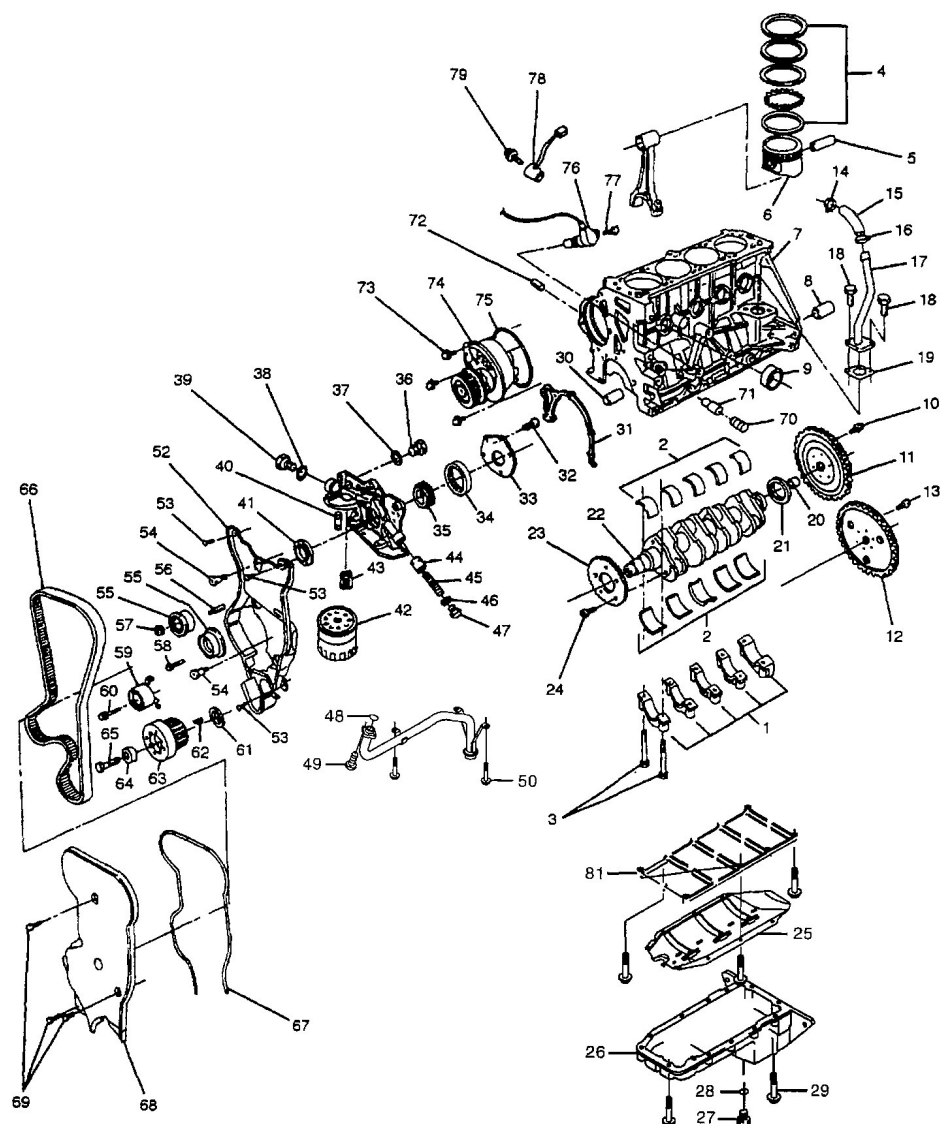
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Fig. 1: Exploded View Of Upper Components
Courtesy of SUZUKI OF AMERICA CORP.

Lower End Location

2004 Suzuki Forenza LX

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

*: 2.0L DOHC Engine

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Fig. 2: Exploded View Of Lower Components
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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

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Step	Action	Value(s)	Yes	No
1	Does the engine knock when it is cold and continue for 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?	0.030 mm (0.001 in.)	Go to Step 7	Go to Step 8

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Fig. 3: Engine Knocks Cold And Continues For Two-Three Minutes And/Or Knock Increases With Engine Torque Chart (1 Of 2)

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Step	Action	Value(s)	Yes	No
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete?*	-	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	-

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Fig. 4: Engine Knocks Cold And Continues For Two-Three Minutes And/Or Knock Increases With Engine Torque Chart (2 Of 2)

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* 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

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

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 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.	-
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?	0.026~0.046 mm (0.0010~ 0.0018 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	-

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Fig. 5: Heavy Knock Hot With Torque Applied Chart
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Light Knock Hot

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

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	-

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Fig. 6: Light Knock Hot Chart
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Knocks during Initial Start-Up But Last Only A Few Seconds

Step	Action	Value(s)	Yes	No
1	Does the engine knock during initial start-up 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?*	-	Go to Step 1	-
6	Inspect the crankshaft end clearance. Is the clearance more than specified value?	0.1 mm (0.0039 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?	0.026~0.046 mm (0.0010~ 0.0018 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	-

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Fig. 7: Knocks During Initial Start-Up But Last Only A Few Seconds Chart
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* 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

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

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	-

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Fig. 8: Knocks At Idle Hot Chart (1 Of 2)
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Step	Action	Value(s)	Yes	No
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?	0.020 mm (0.0008 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?	0.030 mm (0.0012 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?	0.5 ± 0.1 mm (0.020 ~ 0.003 in.) Toward Thrust Side	Go to Step 19	System OK
19	Install the correct piston. Is the repair complete?	-	Go to Step 1	-

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Fig. 9: Knocks At Idle Hot Chart (2 Of 2)
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Noise Diagnosis**Main Bearing Noise**

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

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 "Oil Pressure Test: "	Go to Step 3
3	Inspect the crankshaft end play. Does the crankshaft end play exceed the specified value?	0.1 mm (0.0039 in.)	Go to "Crankshaft Disassembly and Assembly: "	Go to Step 4
4	Inspect the crankshaft journals. Are the crankshaft journals out-of-round?	0.004 mm (0.0002 in.) max.	Go to "Crankshaft Disassembly and Assembly: "	Go to Step 5
5	Inspect the belt tension. Does the belt tension exceed the specified value?	-	Go to "Timing Belt Removal and Installation: "	Go to Step 6
6	Inspect the crankshaft pulley. Is the crankshaft pulley loose?	-	Go to "Crankshaft Disassembly and Assembly: "	System OK

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Fig. 10: Main Bearing Noise Chart
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Connecting Rod Bearing Noise Symptom

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

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Fig. 11: Connecting Rod Bearing Noise Symptom Chart
Courtesy of SUZUKI OF AMERICA CORP.

Piston Noises

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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 "Pistons and Rods Removal and Installation: ".	Go to Step 3
3	Inspect the piston. Is the piston broken or cracked?	-	Go to "Pistons and Rods Removal and Installation: ".	Go to Step 4
4	Inspect the connecting rods. Is there a misaligned connecting rod?	-	Go to "Pistons and Rods Removal and Installation: ".	Go to Step 5
5	Inspect the piston position. Is the piston 180° out of position?	-	Go to "Pistons and Rods Removal and Installation: ".	System OK

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Fig. 12: Piston Noises Chart
Courtesy of SUZUKI OF AMERICA CORP.

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 "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 3
3	Inspect the valves. Are the valves sticking or warped?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 4
4	Inspect the valve lifters. Are the valve lifters dirty, stuck or worn?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 5
5	Inspect the camshaft lobes. Are the camshaft lobes damaged or improperly machined?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 6

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Fig. 13: Valve Mechanism or Valve Train Noises Chart (1 Of 2)
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Step	Action	Value(s)	Yes	No
6	Check the oil supply to the valve train. Is the oil supply insufficient or poor?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 7
7	Inspect the valve guides. Are the valve guides worn?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	Go to Step 8
8	Inspect the valve spring seat. Is the valve spring seat incorrect?	-	Go to "Cylinder Head and Valve Train Components Disassembly and Assembly: ".	System OK

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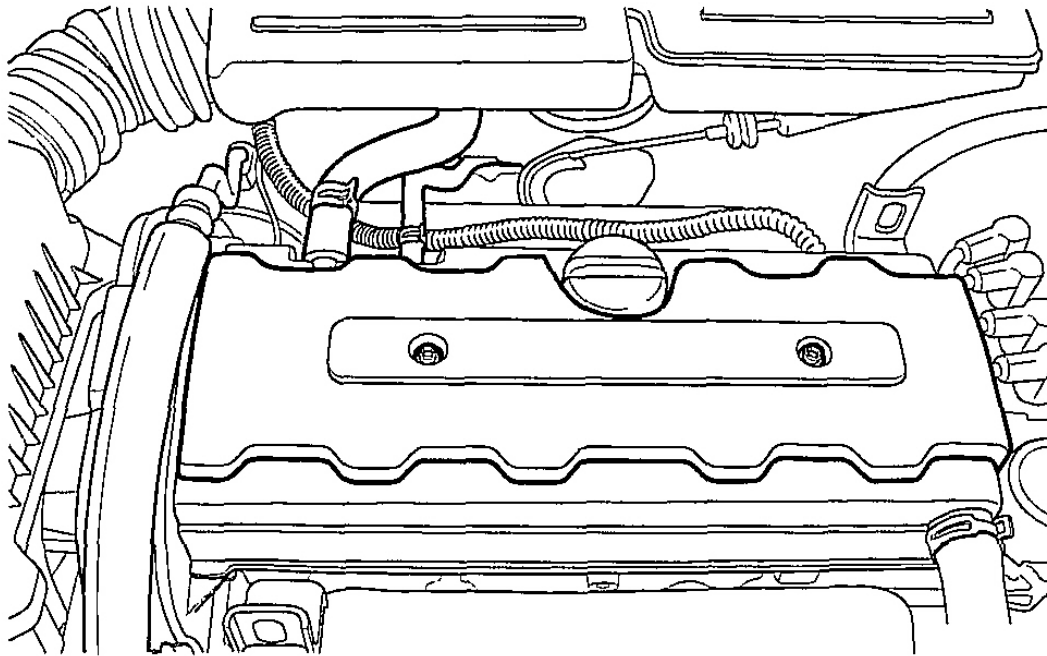
Fig. 14: Valve Mechanism or Valve Train Noises Chart (2 Of 2)
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REPAIR INSTRUCTIONS

Camshaft Cover Removal and Installation

Removal

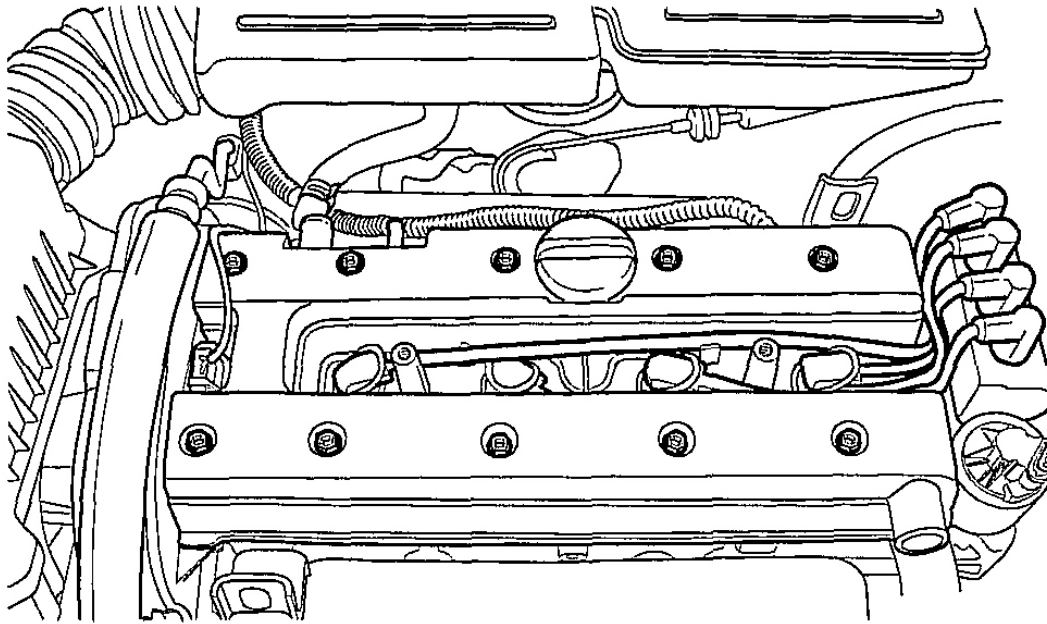
1. Disconnect the negative battery cable.
2. Disconnect the breather tube from the valve cover.
3. Disconnect all of the necessary vacuum lines.
4. Remove the spark plug cover bolts.
5. Remove the spark plug cover.



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Fig. 15: Removing The Spark Plug Cover
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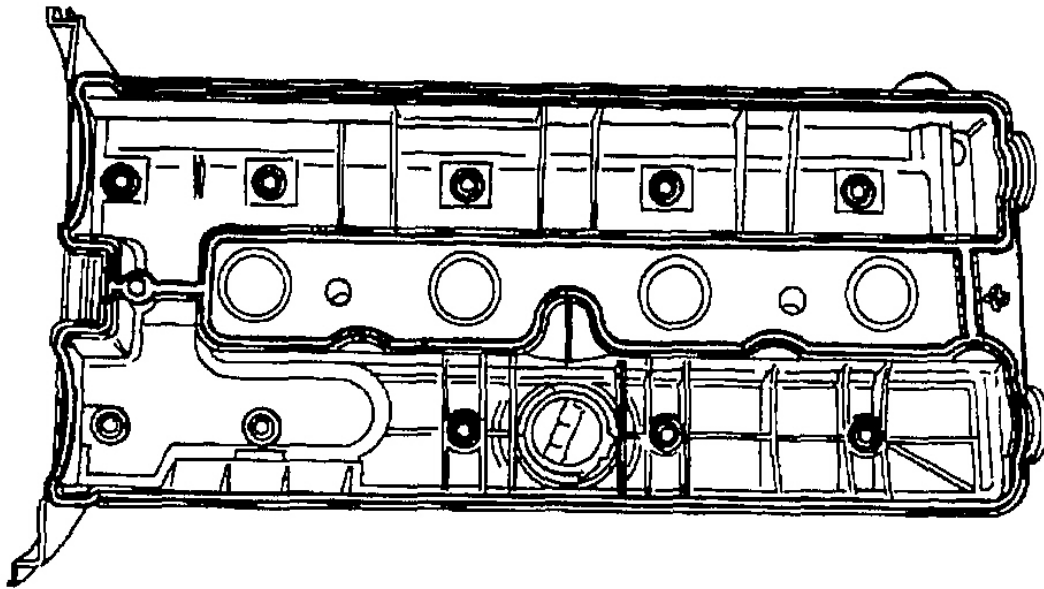
6. Disconnect the ignition wires from the spark plugs.
7. Disconnect the camshaft position sensor connector.
8. Remove the camshaft cover bolts.



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Fig. 16: Removing The Camshaft Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

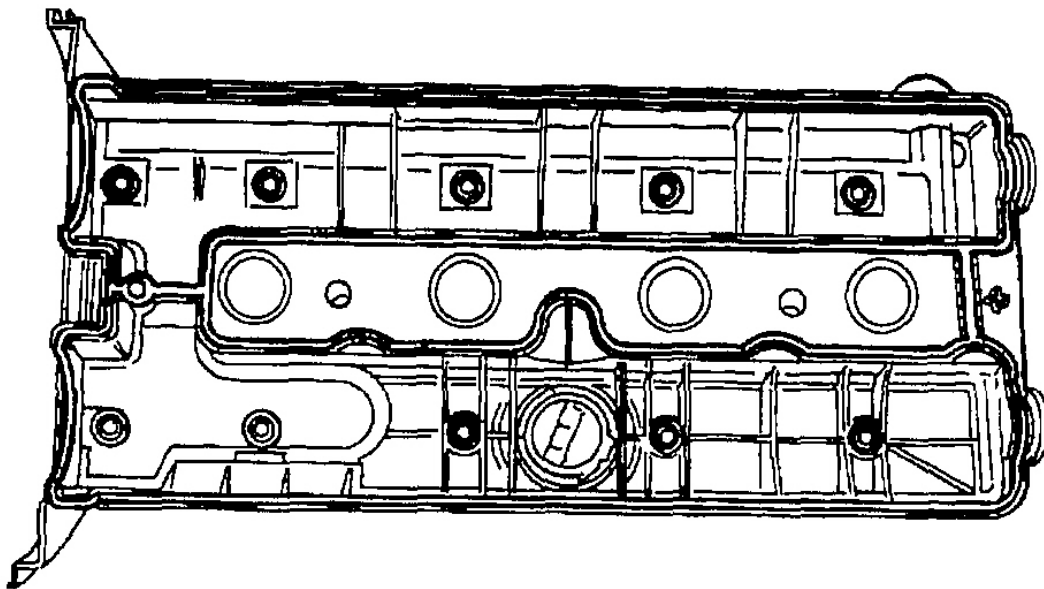


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Fig. 17: Removing Camshaft Cover Gasket From The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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. 18: Installing New Camshaft Cover Gasket To The Camshaft Cover
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3. Install the camshaft cover.
4. Install the camshaft cover bolts.

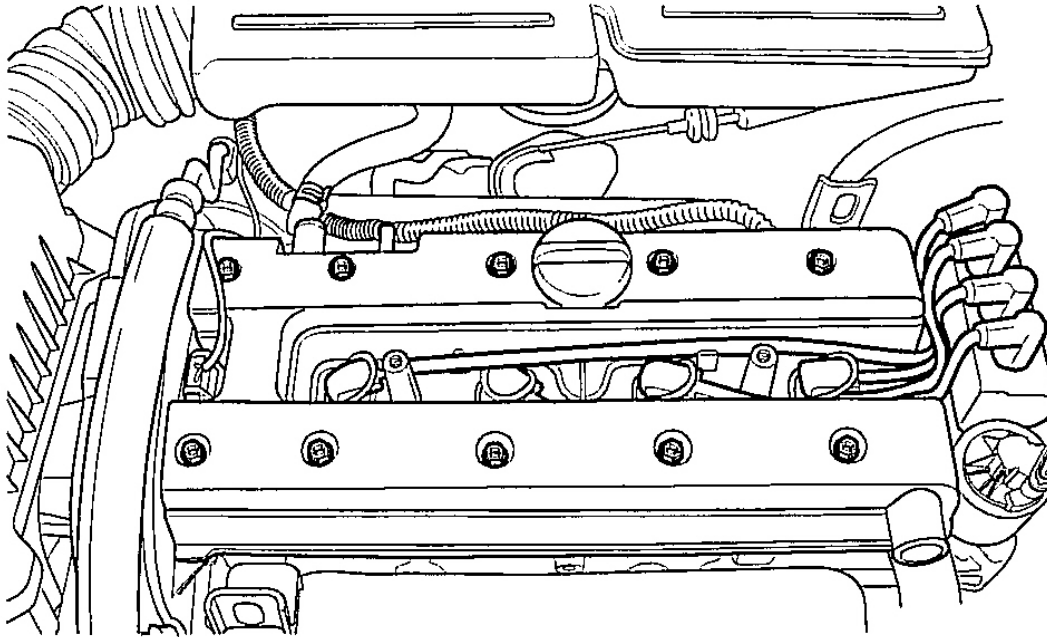
Tighten

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

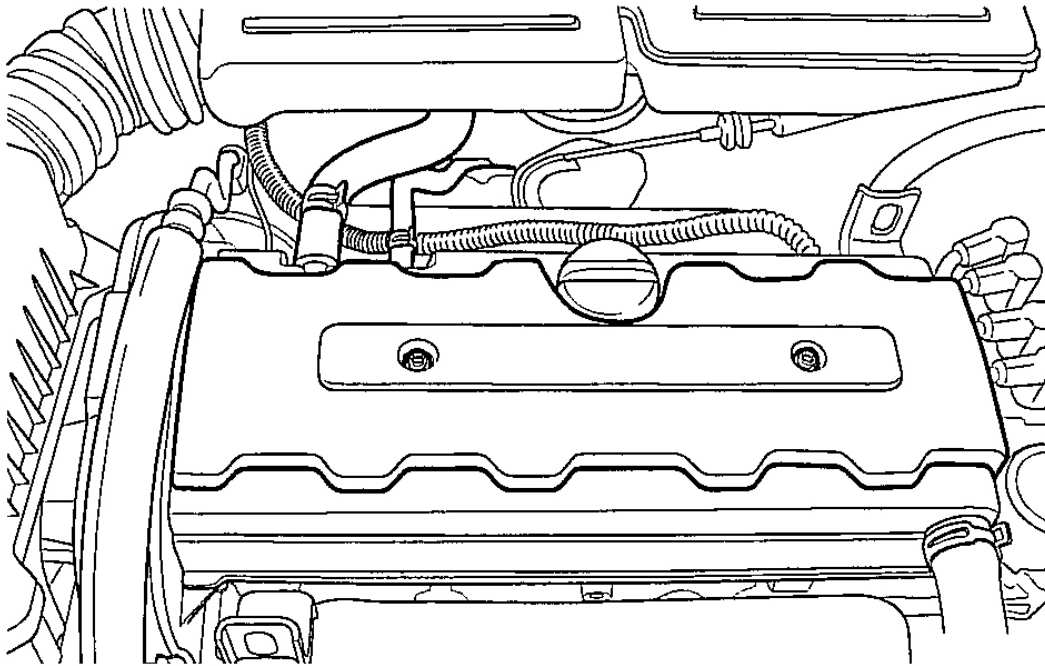
Tighten the spark plug cover bolts to 8 N.m (71 lb-in)



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Fig. 19: Tightening The Spark Plug Cover Bolts
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.



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Fig. 20: Connecting The Breather Tube To The Camshaft Cover
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11. Connect the negative battery cable.

Cylinder Head and Gasket Removal and Installation

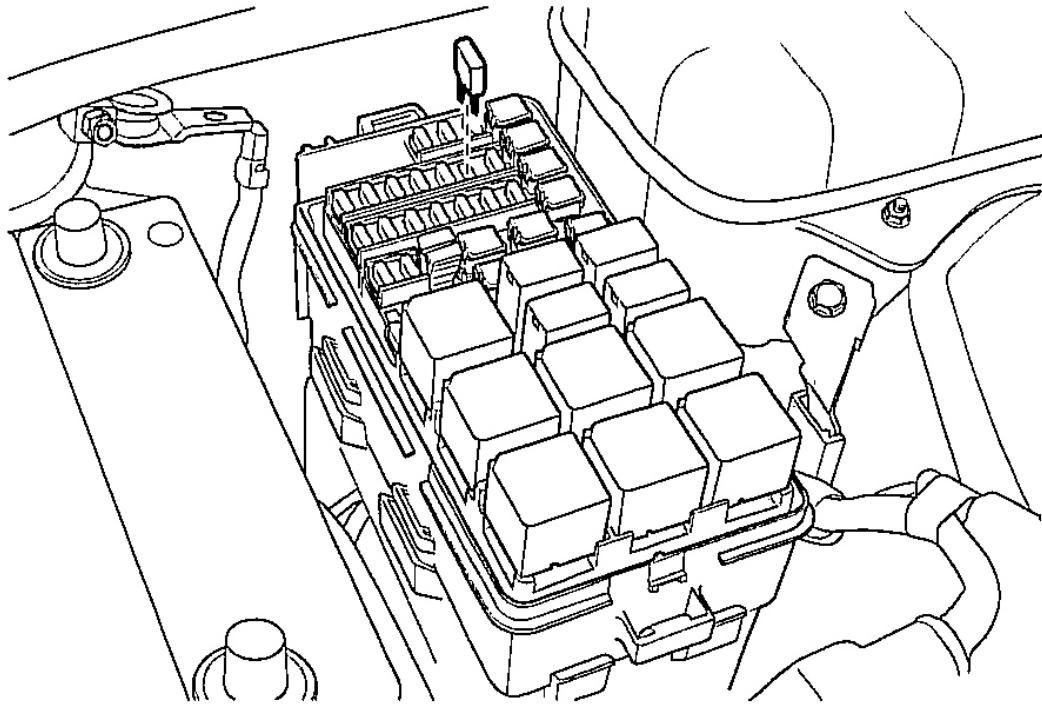
Tools Required

KM-470-B Angular Torque Gauge

J-28467-B Engine Assembly Support Fixture

Removal

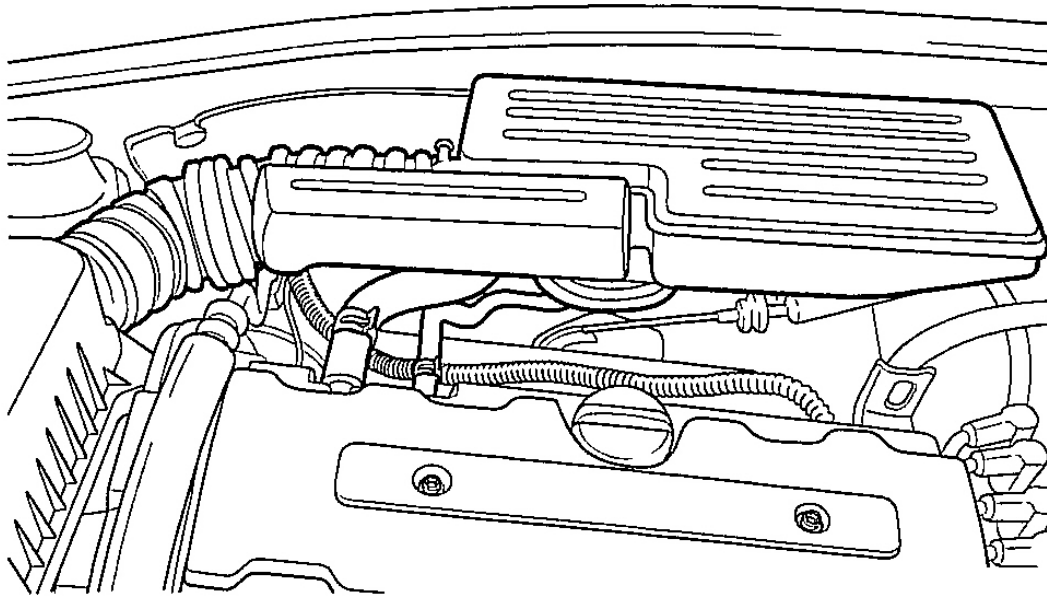
1. Remove the fuel pump fuse.



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Fig. 21: Removing The Fuel Pump Fuse
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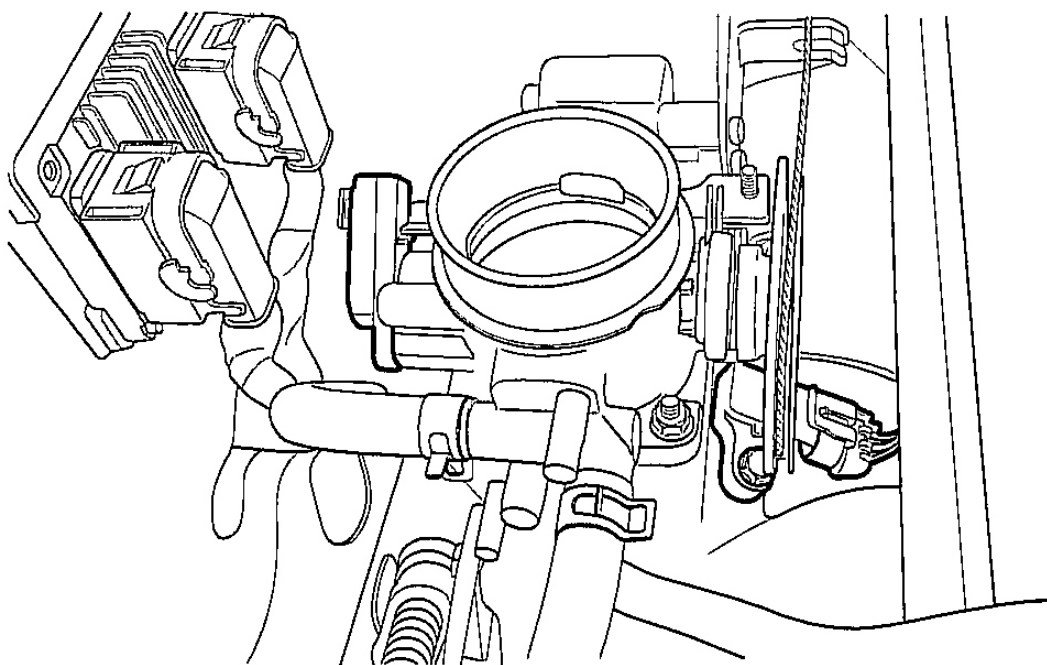
2. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
3. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
4. Disconnect the negative battery cable.
5. Disconnect the electronic control module (ECM) ground terminal.
6. Disconnect the manifold air temperature (MAT) sensor connector.
7. Disconnect the breather tube from the camshaft cover.



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Fig. 22: Disconnecting The Breather Tube From The Camshaft Cover
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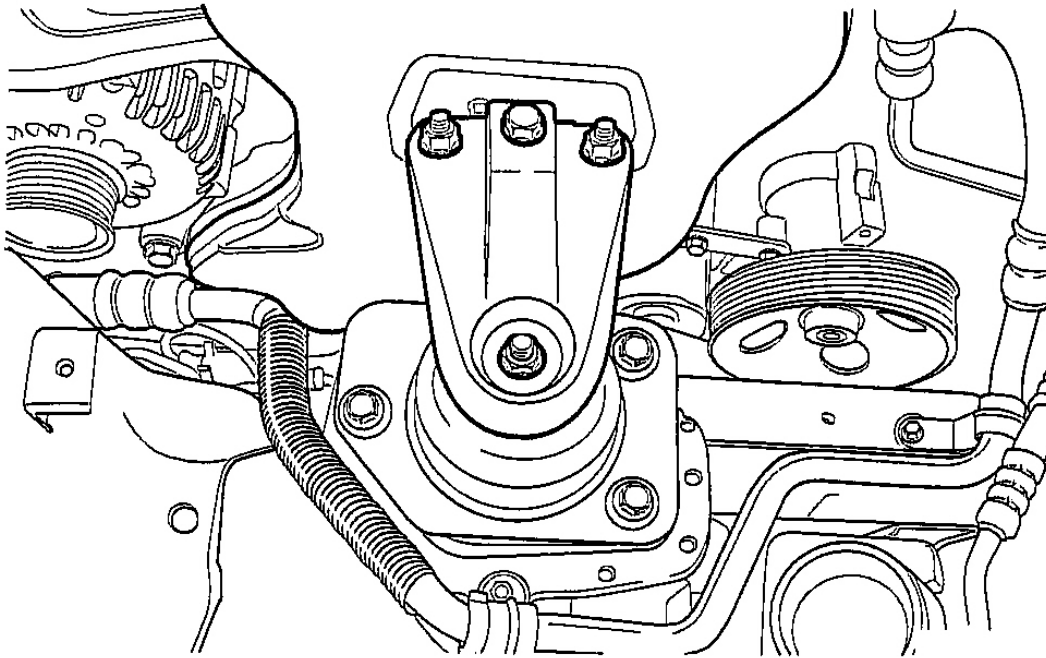
8. Disconnect the air cleaner outlet hose from the throttle body.
9. Disconnect the direct ignition system (DIS) coil connector.
10. Disconnect the oxygen (O2) sensor connector, if equipped.
11. Disconnect the idle air control (IAC) valve connector.



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Fig. 23: Disconnecting The Idle Air Control (IAC) Valve Connector
Courtesy of SUZUKI OF AMERICA CORP.

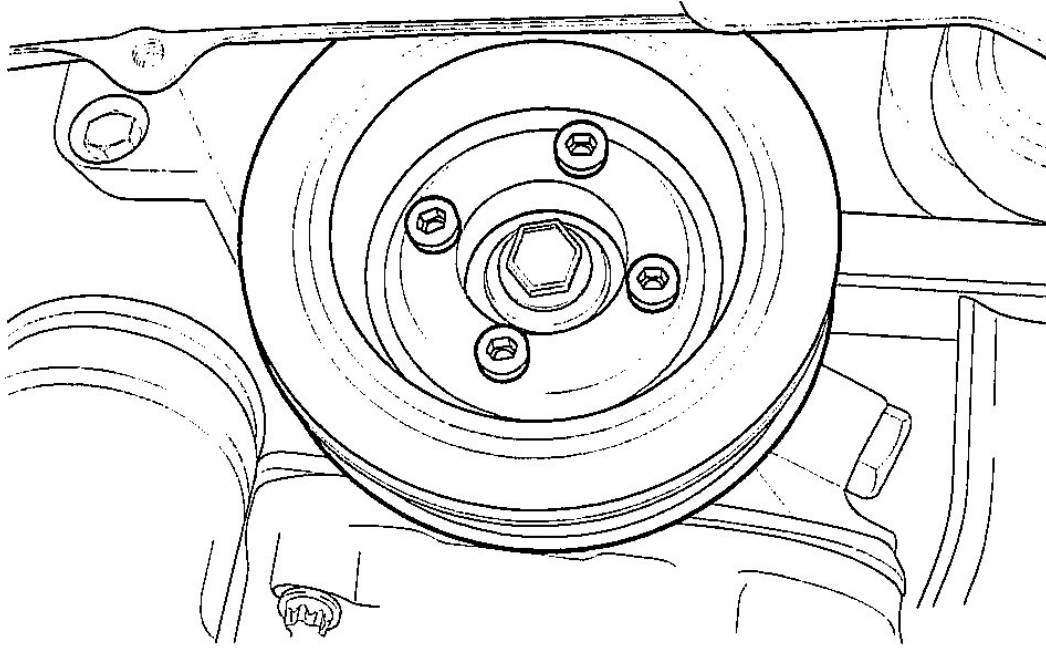
12. Disconnect the throttle position sensor (TPS) connector.
13. Disconnect the engine coolant temperature (ECT) sensor connector.
14. Disconnect the coolant temperature sensor (CTS) connector.
15. Remove the air cleaner housing bolts.
16. Remove the air cleaner housing.
17. Remove the right front wheel. Refer to Wheel Removal and Installation .
18. Remove the right front wheel well splash shield.
19. Install the engine assembly support fixture J-28467-B.
20. Remove the right engine mount bracket and bolts.



G00767233

Fig. 24: Removing The Right Engine Mount Bracket And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

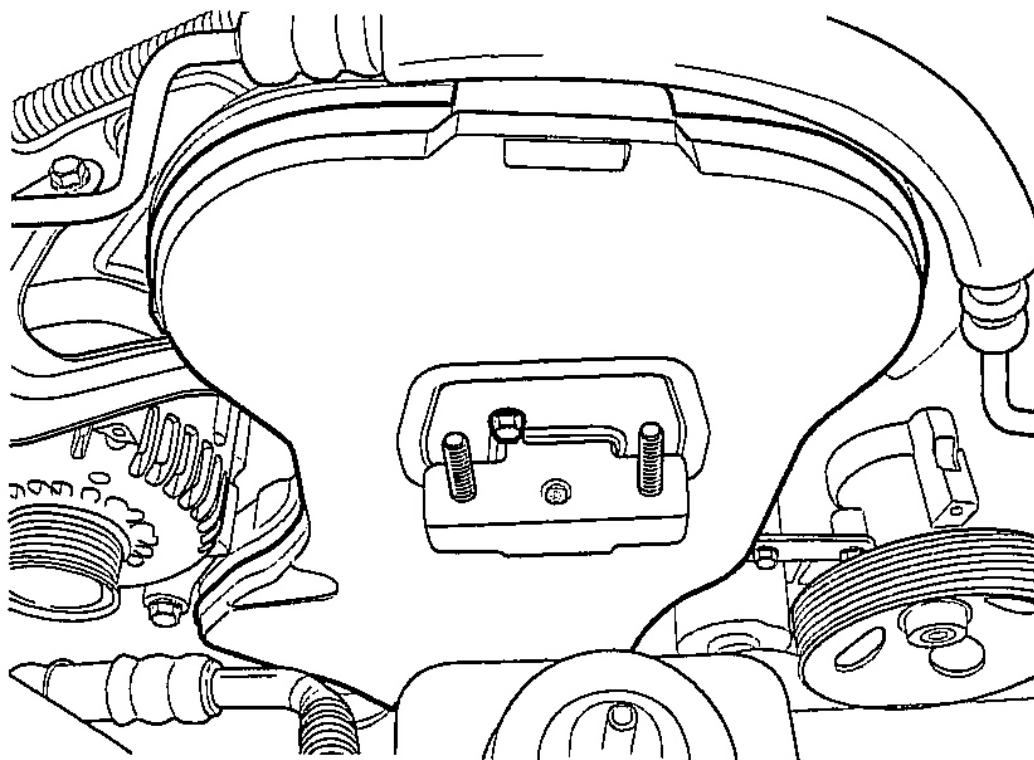
21. Disconnect the upper radiator hose at the thermostat housing.
22. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
23. Remove the crankshaft pulley bolts.
24. Remove the crankshaft pulley.



G00767234

Fig. 25: Removing The Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

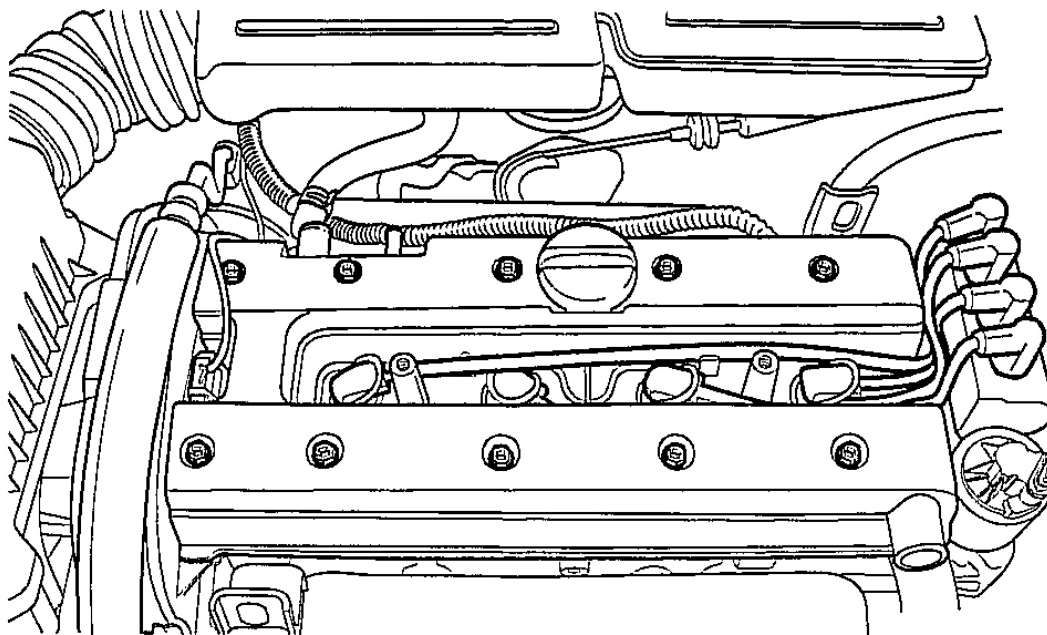
25. Remove the front timing belt cover bolts.
26. Remove the front timing belt cover.



G00767235

Fig. 26: Removing The Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

27. Remove the timing belt. Refer to **TIMING BELT REMOVAL AND INSTALLATION**.
28. Disconnect the breather tube at the camshaft cover.
29. Remove the spark plug cover bolts.
30. Remove the spark plug cover.
31. Disconnect the ignition wires from the spark plugs.
32. Remove the camshaft cover bolts.
33. Remove the camshaft cover and the camshaft cover gasket.

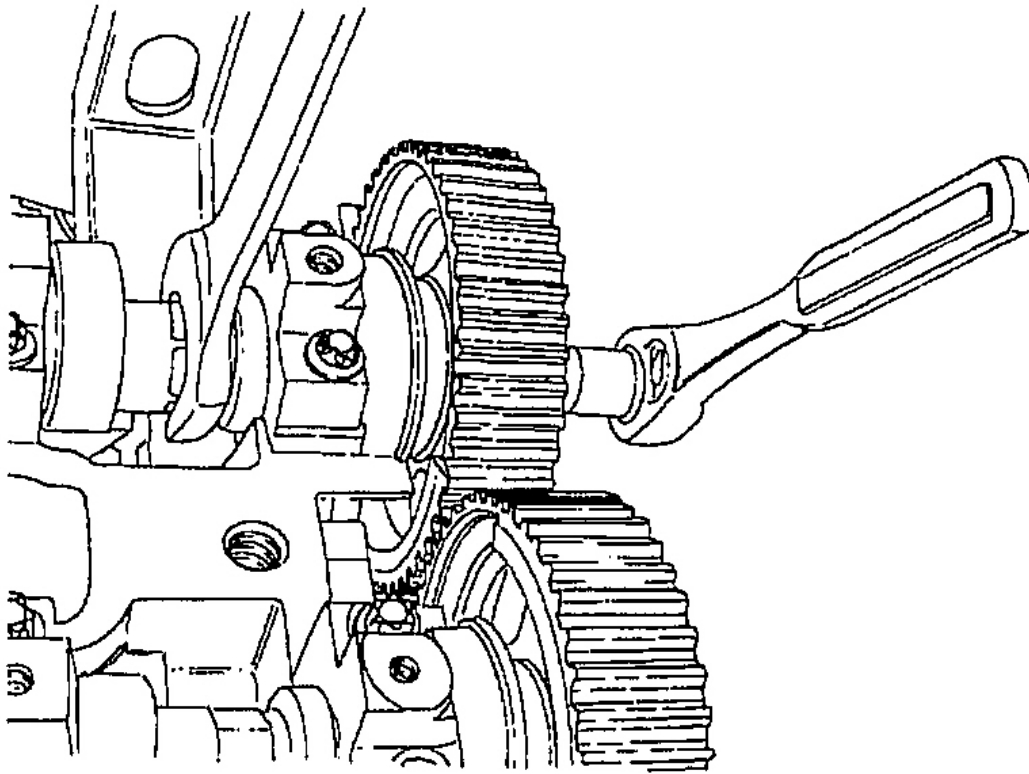


G00767236

Fig. 27: Removing The Camshaft Cover And The Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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

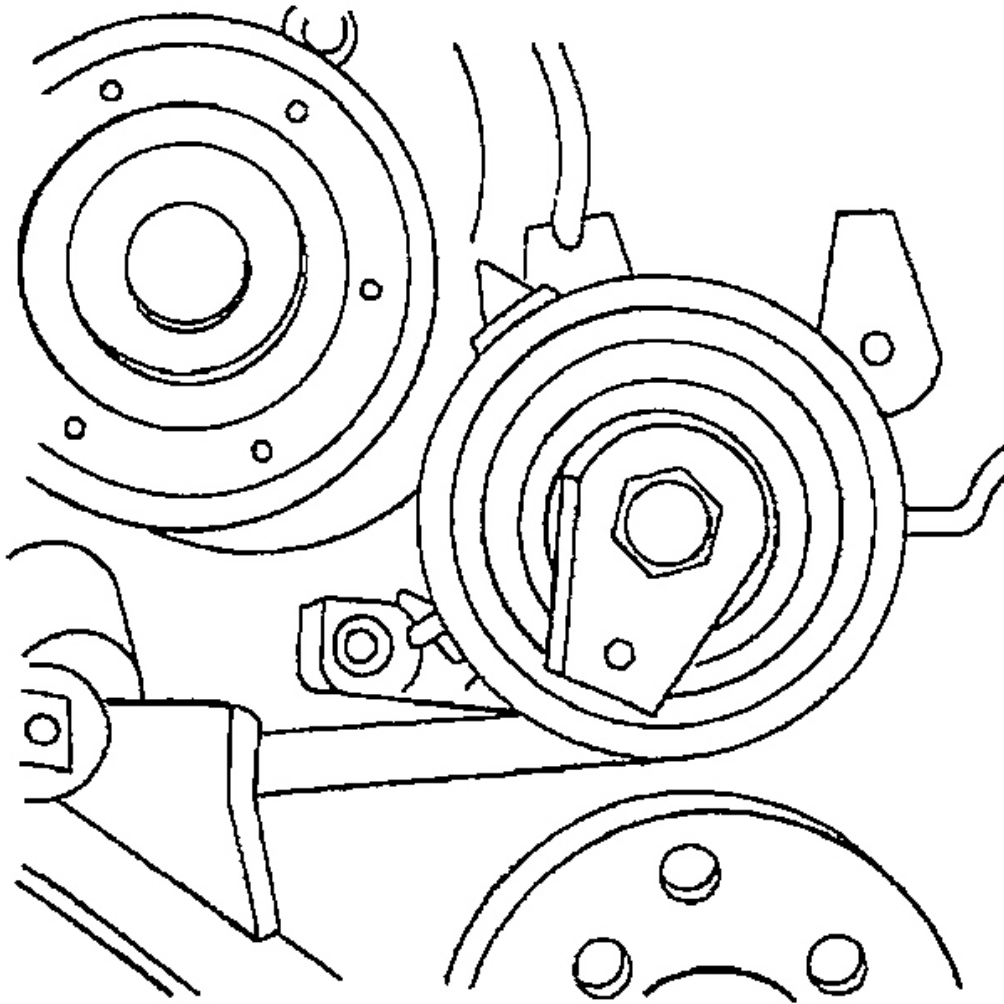
34. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
35. Remove the intake camshaft gear.
36. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
37. Remove the exhaust camshaft gear.



G00767237

Fig. 28: Removing The Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

38. Remove the timing belt automatic tensioner bolts.
39. Remove the timing belt automatic tensioner.

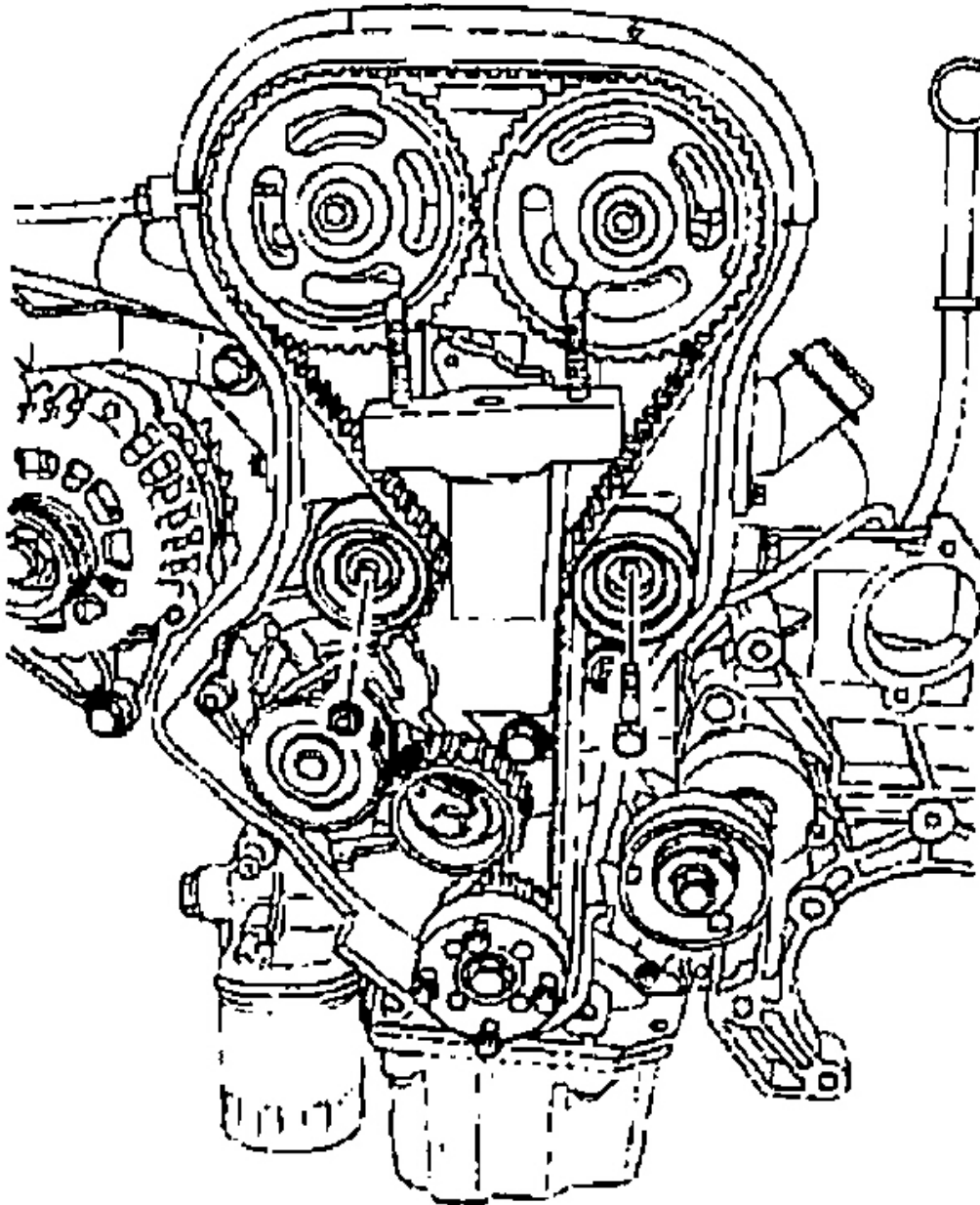


G00767238

Fig. 29: Removing The Timing Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

40. Remove the timing belt idler pulley bolt and nut.
41. Remove the timing belt idler pulleys.
42. Remove the engine mount bolts.
43. Remove the engine mount.
44. Remove the crankshaft gear.
45. Remove the CMP sensor.

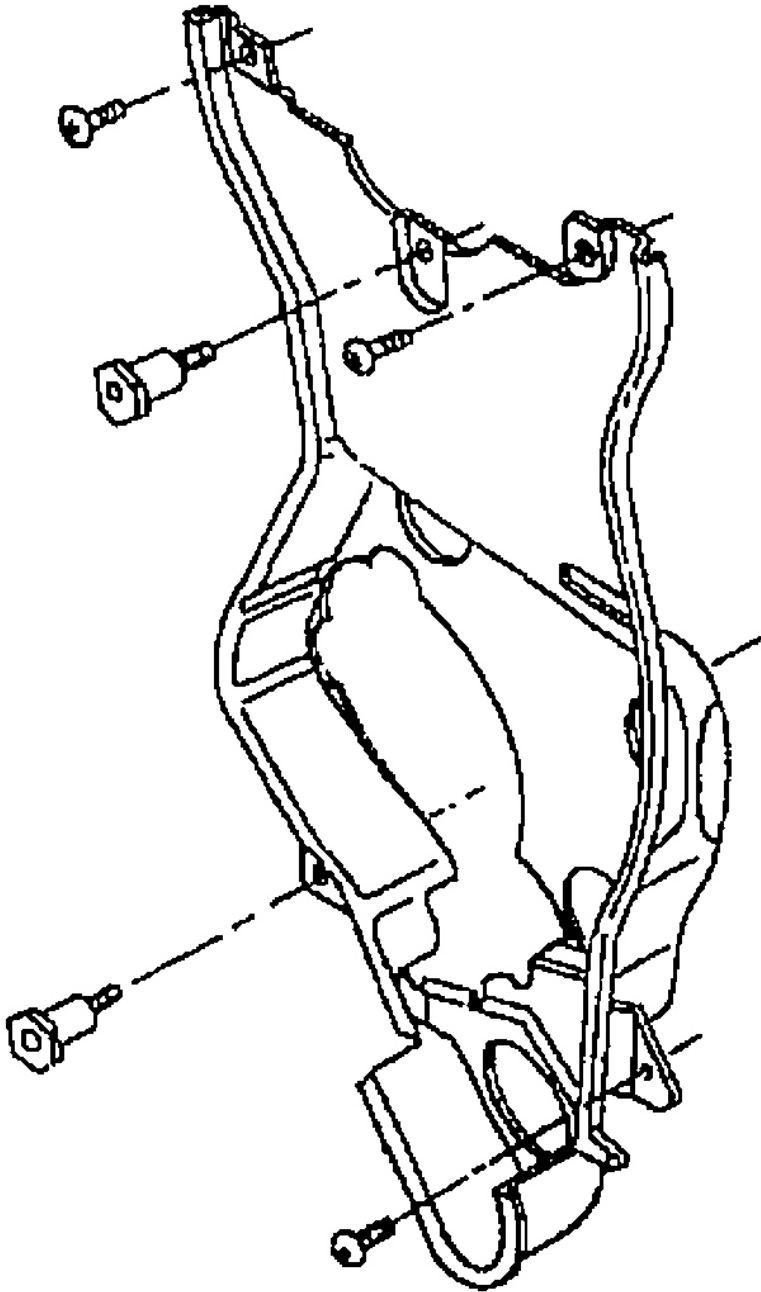
46. Remove the water pump.



G00767239

Fig. 30: Identifying Timing Components
Courtesy of SUZUKI OF AMERICA CORP.

47. Remove the rear timing belt cover bolts.
48. Remove the rear timing belt cover.

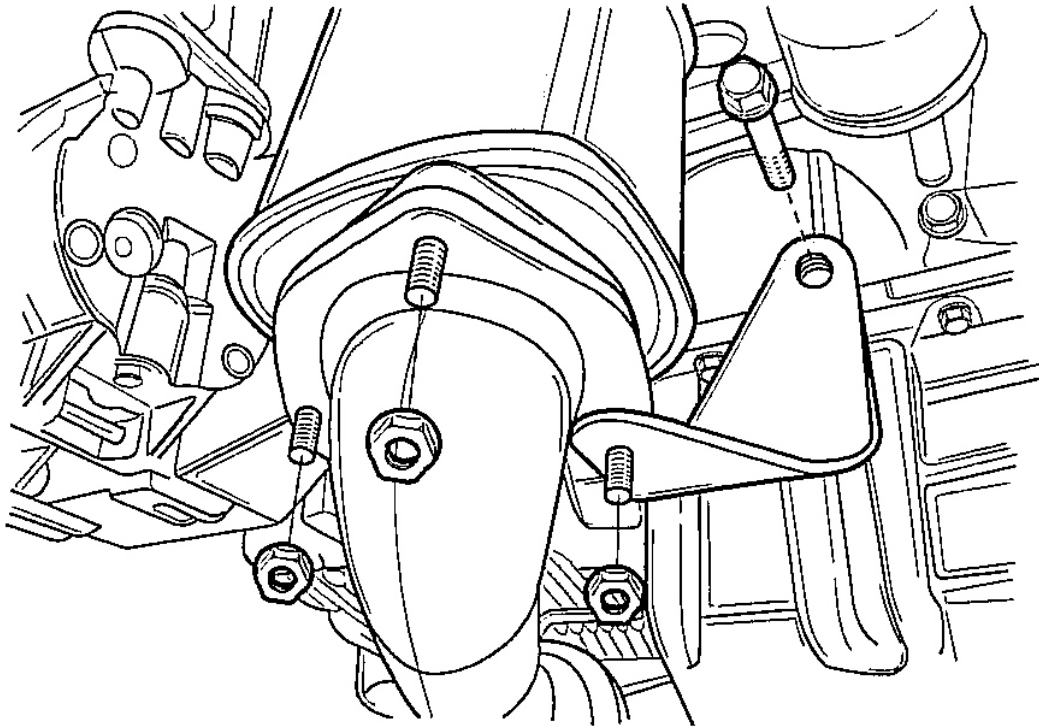


G00767240

Fig. 31: Removing The Rear Timing Belt Cover

Courtesy of SUZUKI OF AMERICA CORP.

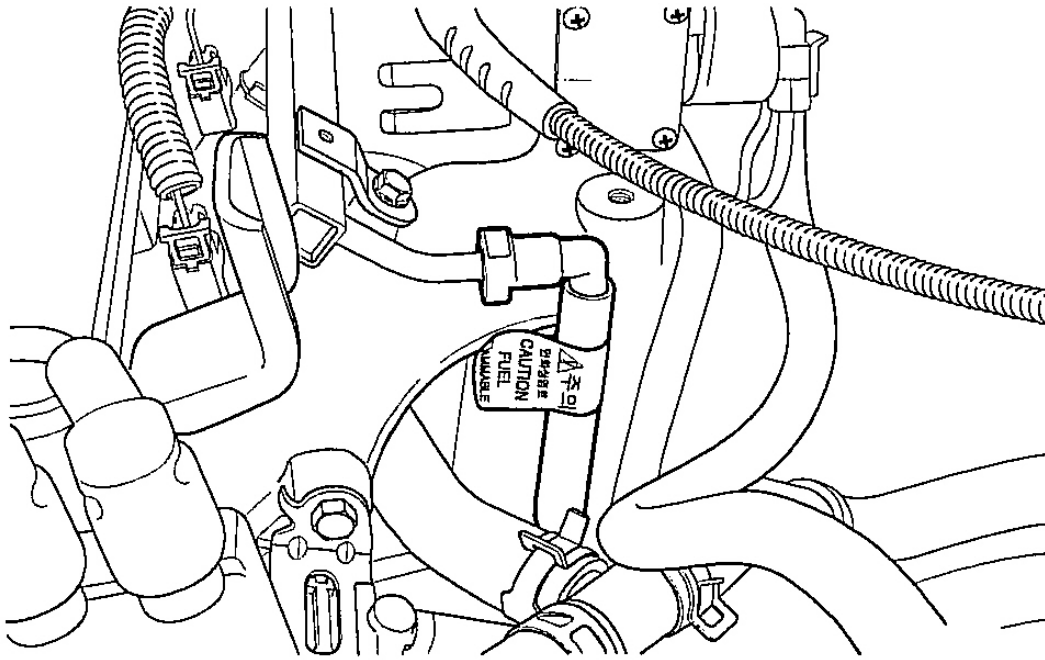
49. Remove the exhaust flex pipe retaining nuts at the exhaust manifold studs.
50. Disconnect all of the necessary vacuum hoses.



G00767241

Fig. 32: Removing The Exhaust Flex Pipe Retaining Nuts At The Exhaust Manifold Studs
Courtesy of SUZUKI OF AMERICA CORP.

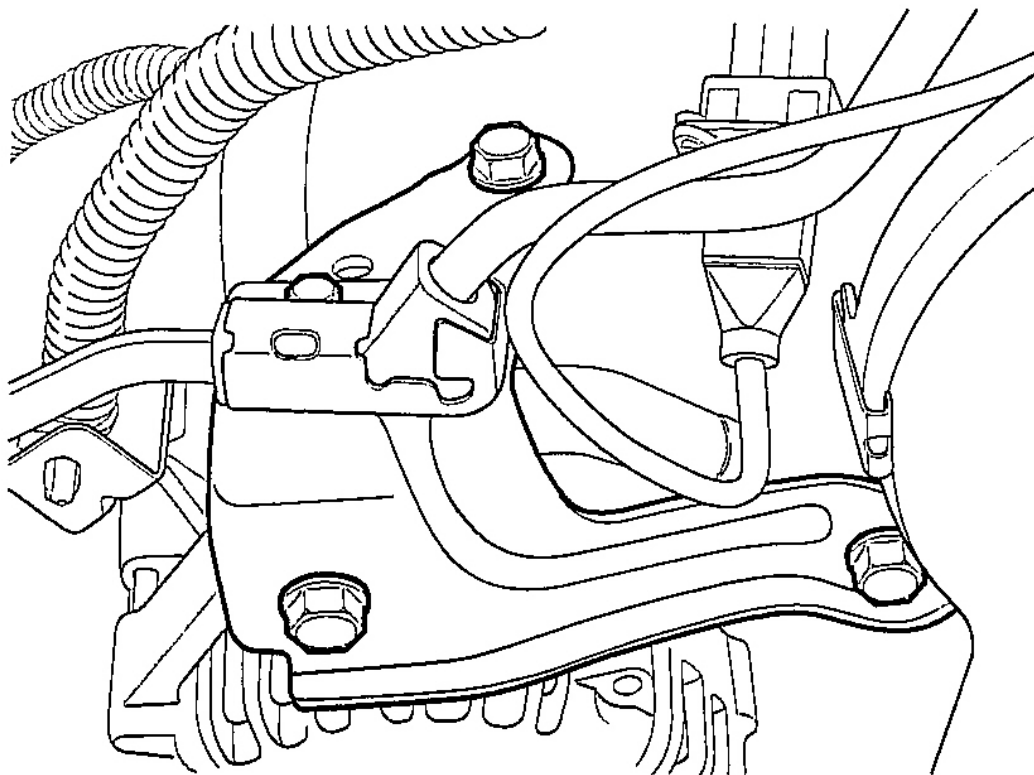
51. Disconnect the fuel feed line at the fuel rail.



G00767242

Fig. 33: Disconnecting The Fuel Feed Line At The Fuel Rail
Courtesy of SUZUKI OF AMERICA CORP.

52. Remove the generator adjusting bracket retaining bolt and the bracket.
53. Disconnect the coolant hose at the rear cylinder head and ignition coil exhaust gas recirculation (EGR) bracket.
54. Disconnect the surge tank coolant hose at the throttle body.
55. Remove the fuel rail assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
56. Remove the generator-to-intake manifold support bracket bolts at the cylinder head and the intake manifold.
57. Remove the generator support bracket.
58. Remove the intake manifold-to-generator strap bracket bolt and loosen the bolt on the generator.
59. Move the strap clear of the intake manifold.
60. Remove the charcoal canister purge (CCP) and EGR solenoid bracket bolt and move the bracket clear.



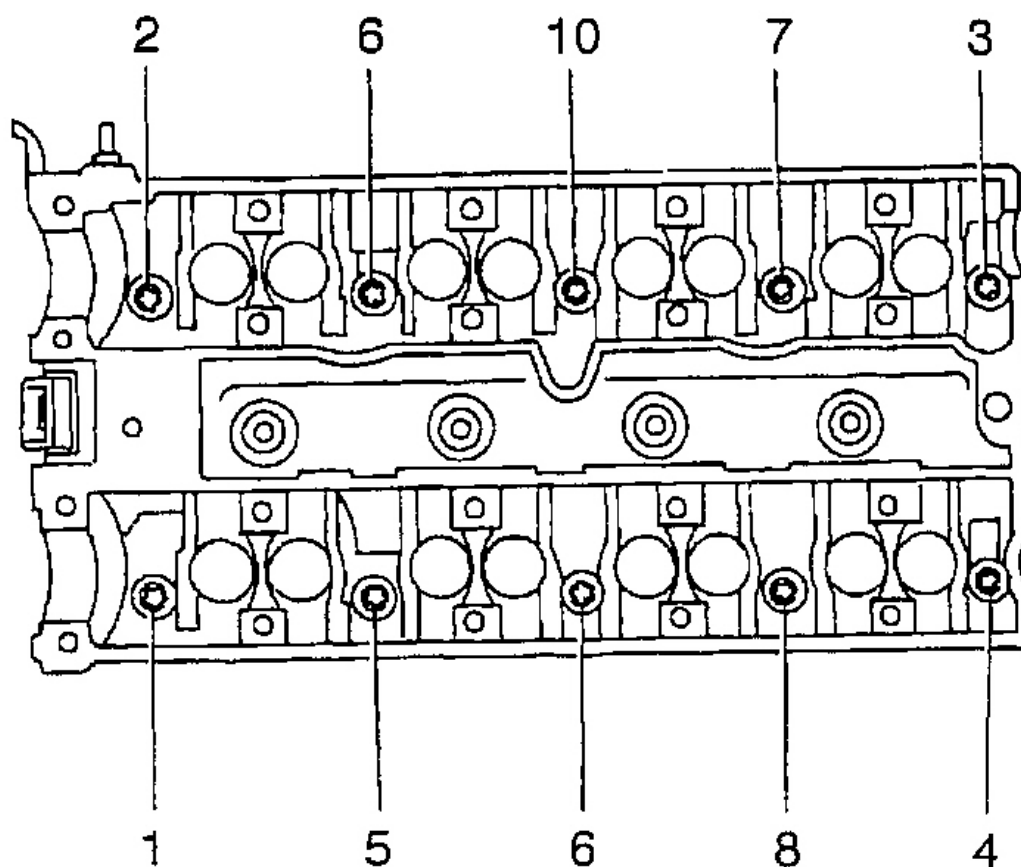
G00767243

Fig. 34: Removing The Intake Manifold-To-Generator Strap Bracket
Courtesy of SUZUKI OF AMERICA CORP.

61. Disconnect the throttle cable at the throttle body and the intake manifold.

NOTE: Before replacing the cylinder head, be sure to install the engine mount and remove the engine support.

62. Loosen all of the cylinder head bolts gradually and in the sequence shown.
63. Remove the camshaft.
64. Remove the cylinder head bolts.



G00767244

Fig. 35: Removing The Cylinder Head Bolts In Sequence

Courtesy of SUZUKI OF AMERICA CORP.

65. Remove the cylinder head with the intake manifold and the exhaust manifold attached.

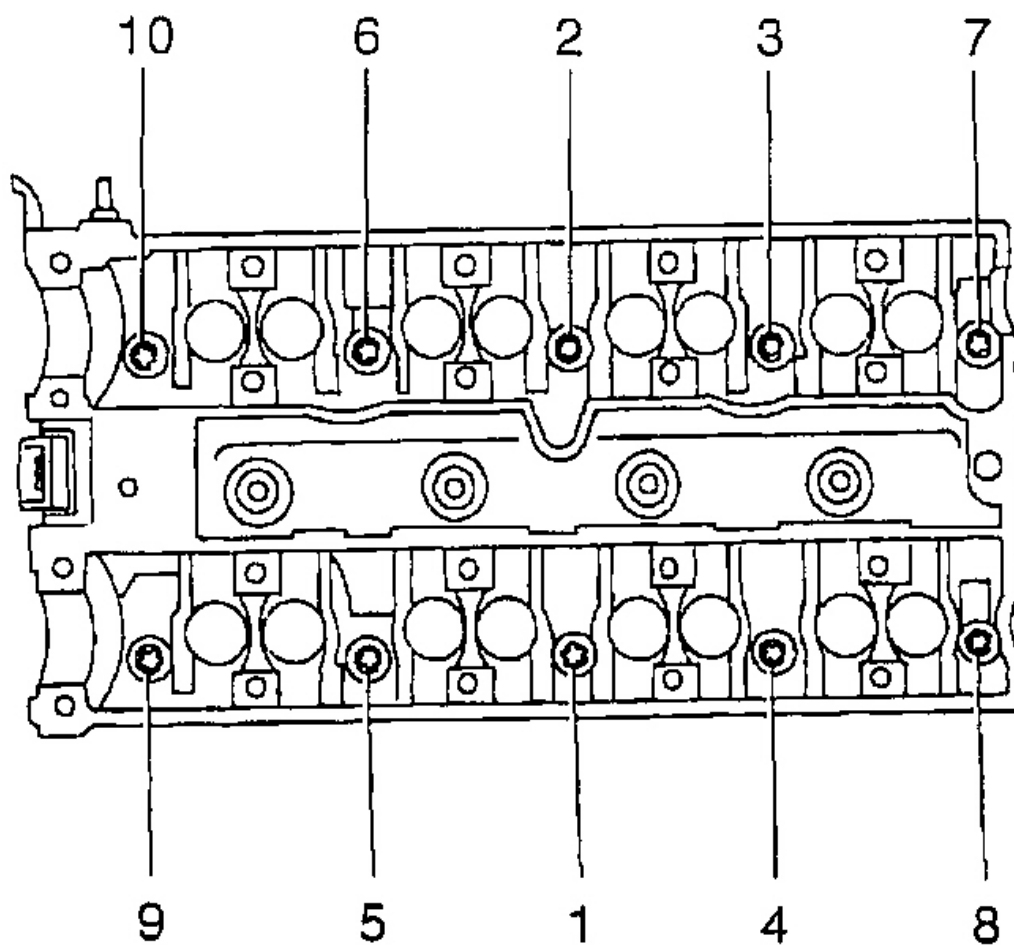
NOTE: Prevent any engine oil or coolant from entering the cylinders when removing the cylinder head.

66. Remove the cylinder head gasket.

Installation

1. Install the cylinder head gasket.
2. Install the cylinder head with the intake manifold and the exhaust manifold attached.
3. Install the cylinder head bolts.

4. Tighten the cylinder head bolts gradually and in the sequence shown.



G00767261

Fig. 36: Tightening Cylinder Head Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

Tighten the cylinder head bolts to 25 N.m (18 lb-ft) and turn the bolts another 3 turns of 90 degrees using the angular torque gauge KM-470-B.

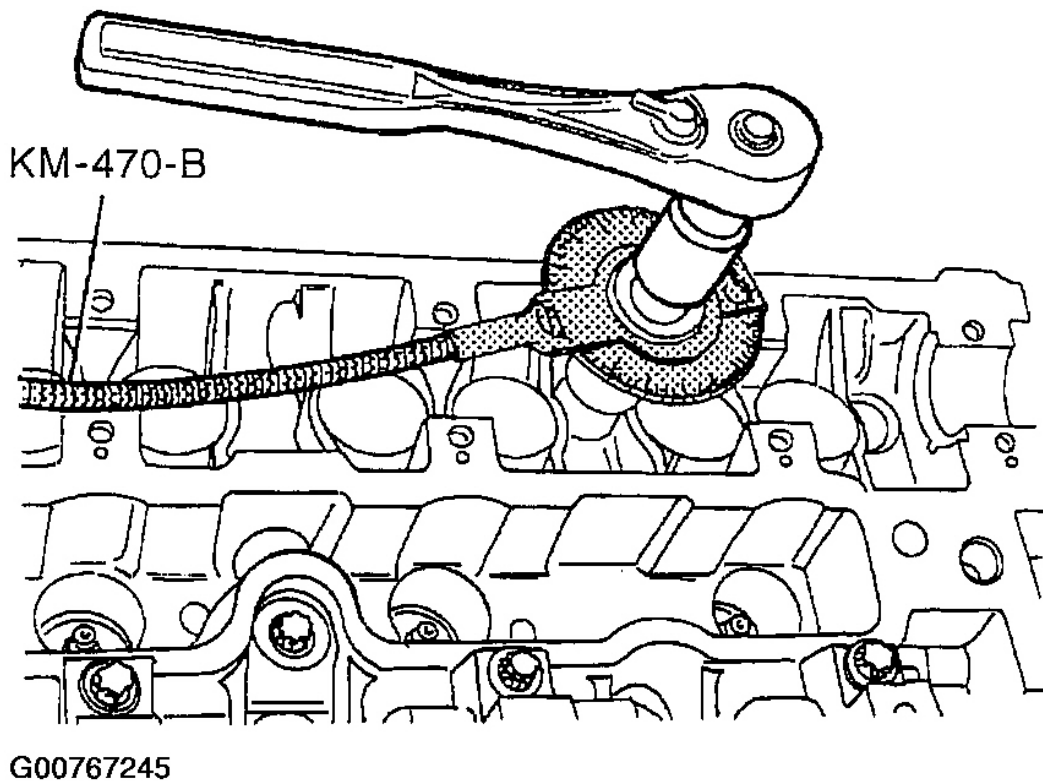


Fig. 37: Tightening The Cylinder Head Bolts Using The Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the camshaft.
6. Connect the throttle cable at the throttle body and the intake manifold.
7. Install the generator-to-intake manifold support bracket.
8. Install the intake generator-to-manifold support bracket bolts.

Tighten

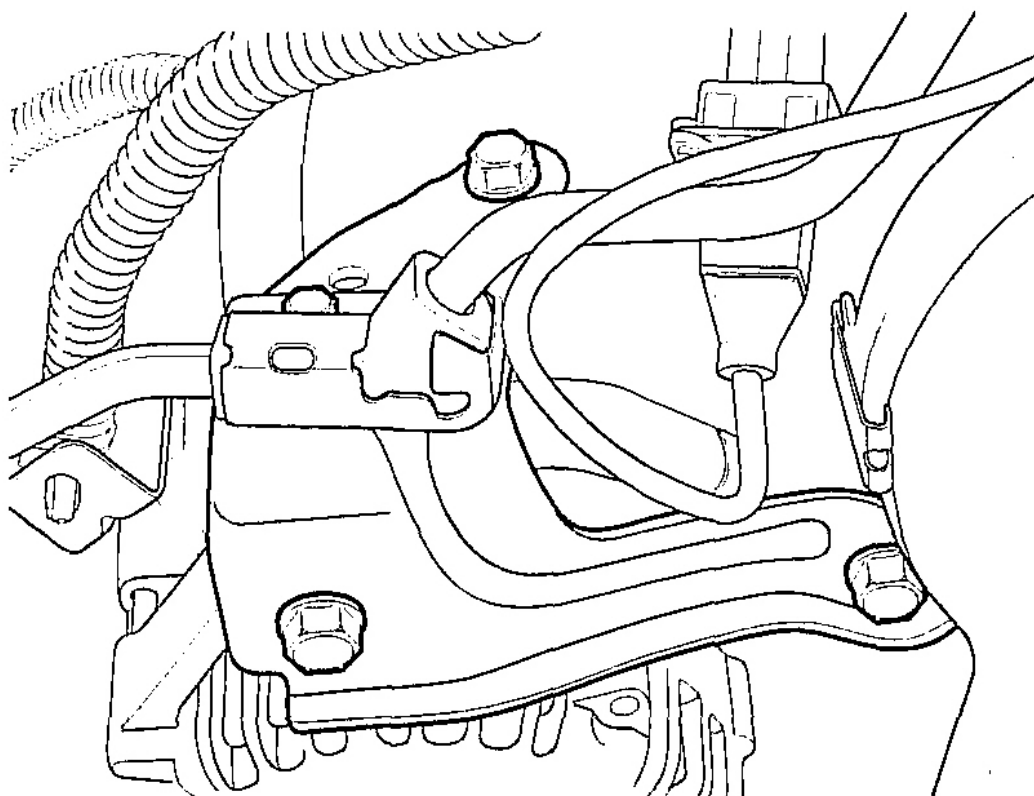
Tighten the generator-to-intake manifold support bracket bolts to the intake manifold to 37 N.m (27 lb-ft).

9. Install the intake manifold support bracket bolt to the generator.

Tighten

Tighten the generator-to-intake manifold support bracket bolt at the generator to 22 N.m (16 lb-ft).

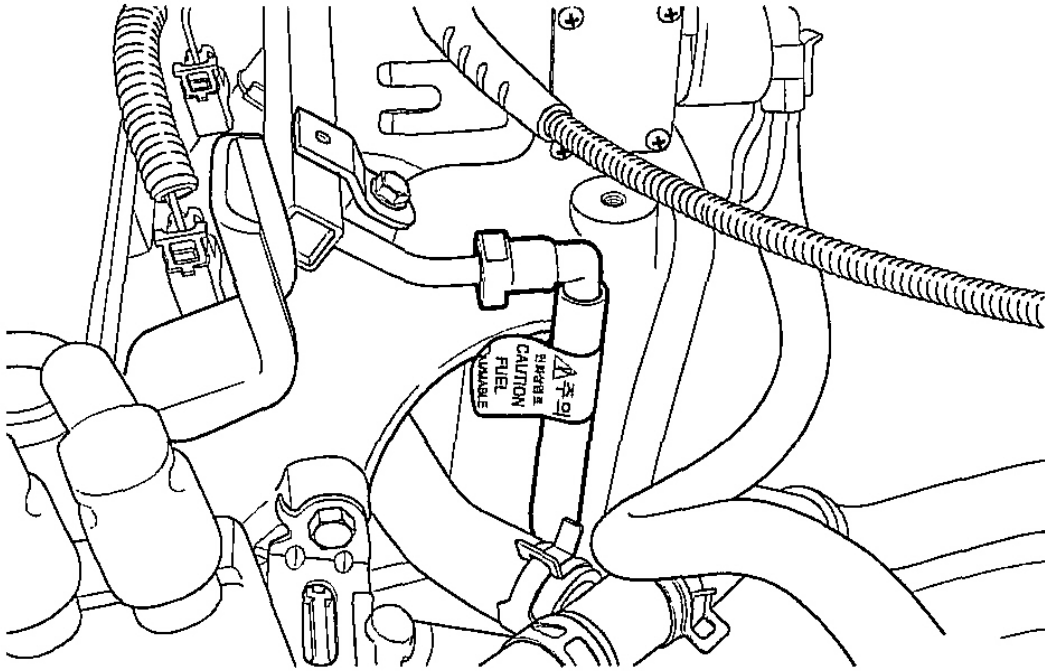
10. Connect the surge tank coolant hose at the throttle body.
11. Connect the coolant hose to the rear cylinder head and ignition coil EGR bracket.



G00767246

Fig. 38: Installing The Intake Manifold-To-Generator Strap Bracket
Courtesy of SUZUKI OF AMERICA CORP.

12. Connect the fuel feed line at the fuel rail.



G00767247

Fig. 39: Installing Fuel Feed Line At The Fuel Rail
Courtesy of SUZUKI OF AMERICA CORP.

13. Connect the fuel return line at the fuel rail.
14. Connect all of the necessary vacuum hoses.
15. Install the fuel rail assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
16. Install the exhaust flex pipe retaining nuts at the exhaust manifold studs.

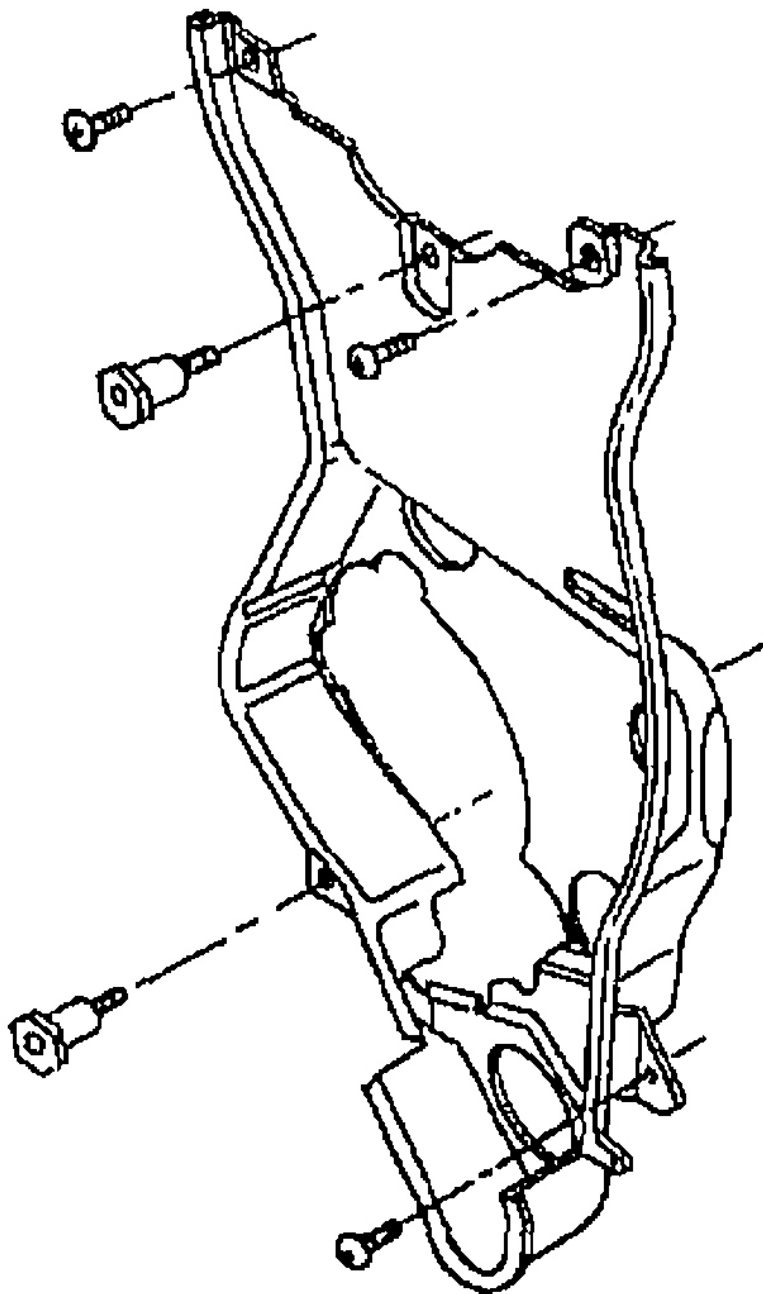
Tighten

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

17. Install the rear timing belt cover.
18. Install the rear timing belt cover bolts.

Tighten

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



G00767248

Fig. 40: Installing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the engine mount and the retaining bolts.

Tighten

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

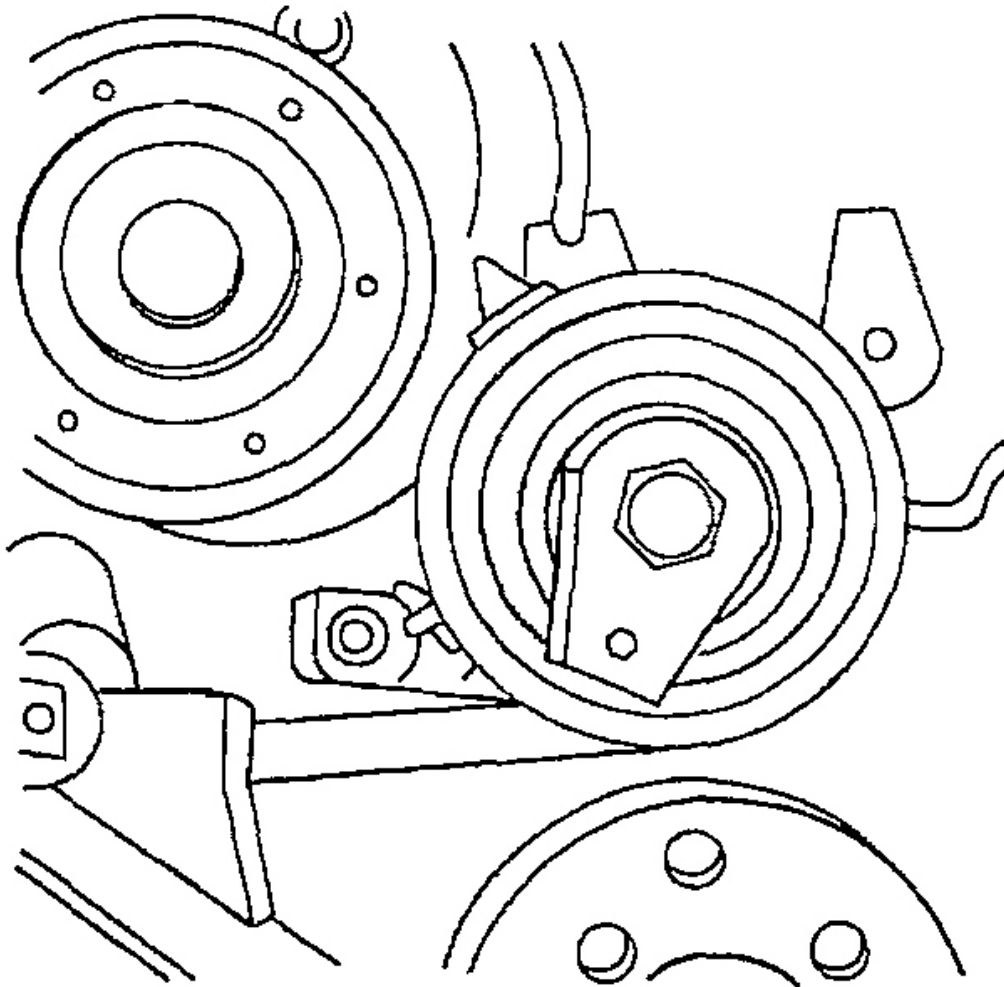
20. Install the camshaft position (CMP) sensor.
21. Install the crankshaft gear.
22. Install the water pump.
23. Install the timing belt automatic tensioner.
24. Install the timing belt automatic tensioner bolt.

Tighten

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

25. Install the timing belt idler pulleys.
26. Install the timing belt idler pulley bolt and nut.

Tighten

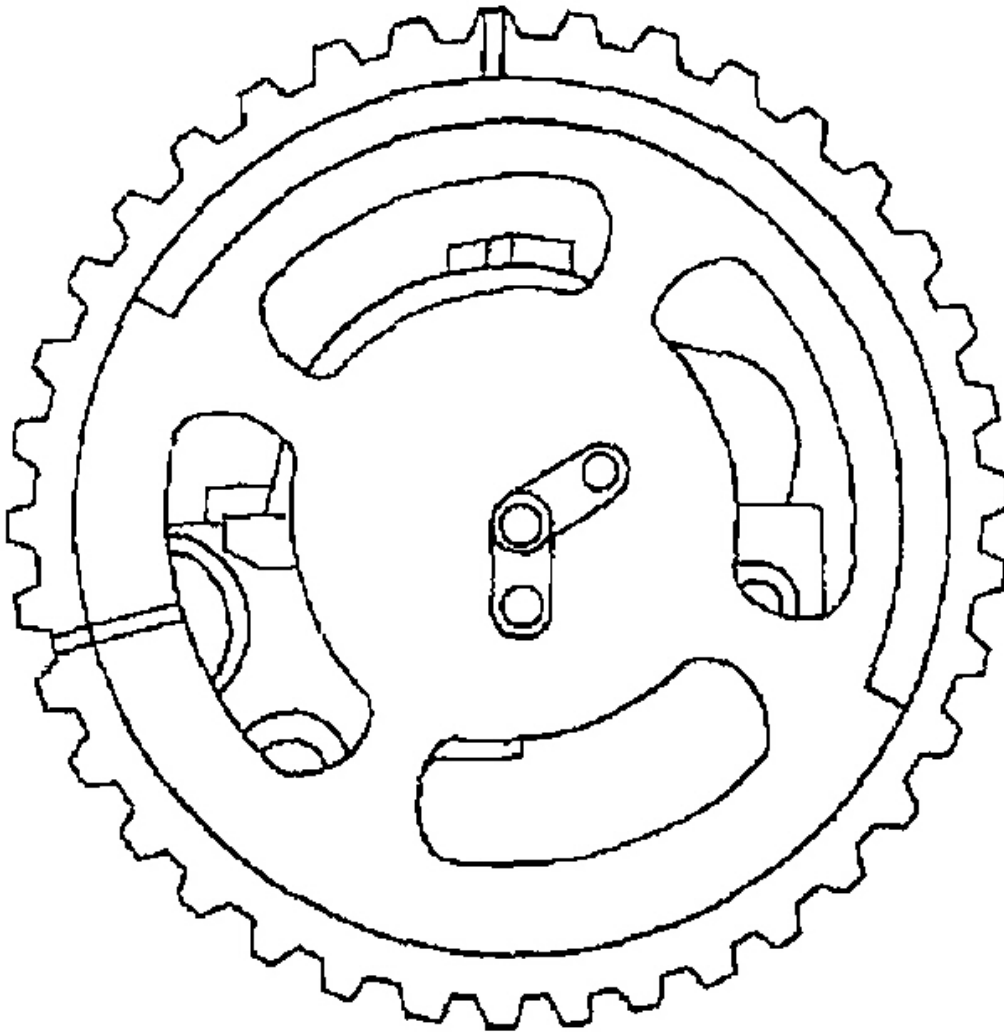


G00767249

Fig. 41: Installing Timing Belt Idler Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

27. Install the camshaft gears with the timing marks at the front.
28. Insert the guide pin of the intake camshaft into the "IN" bore.
29. Insert the guide pin of the exhaust camshaft into the "EX" bore.



G00767250

Fig. 42: Installing Camshaft Gears

Courtesy of SUZUKI OF AMERICA CORP.

30. Install the camshaft gears by counterholding on the hex of the camshaft with an open-ended wrench.
31. Install the camshaft gear with a new bolt to the camshaft.

Tighten

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) turn the bolt another 60 degrees and 15 degrees using the angular torque gauge.

32. 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) turn the bolt another 60 degrees and 15 degrees using the angular torque gauge.

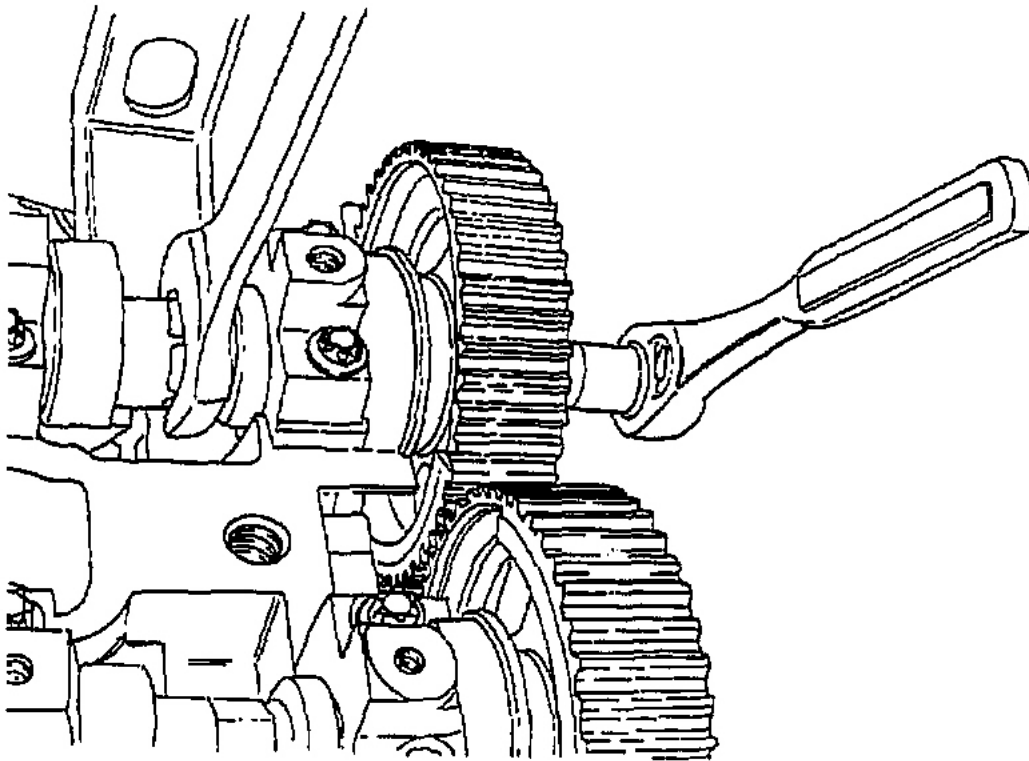
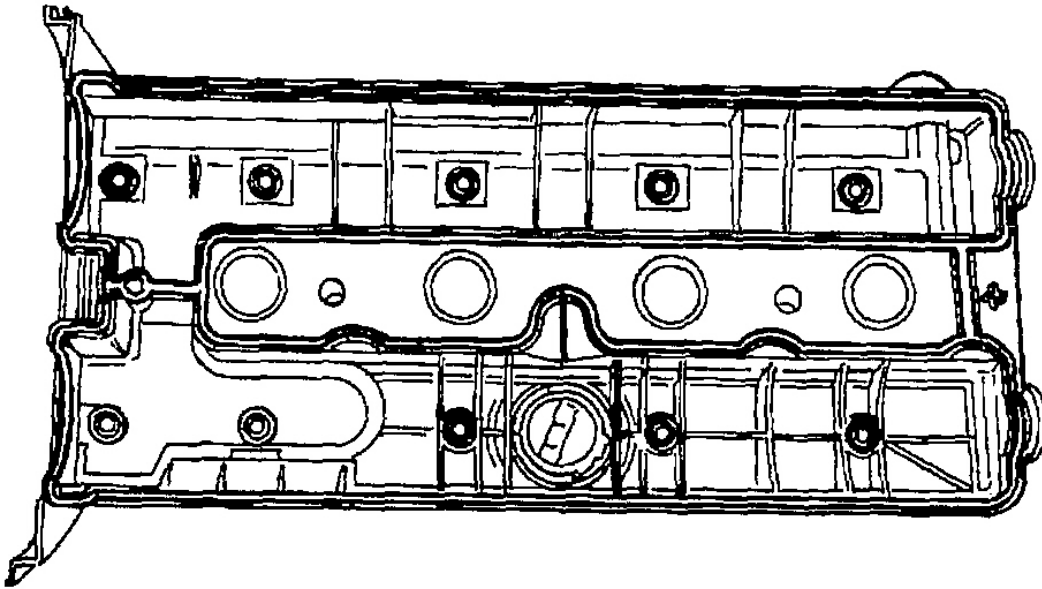
**G00767251**

Fig. 43: Installing Camshaft Gear Bolt
Courtesy of SUZUKI OF AMERICA CORP.

33. 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.
34. Install the camshaft cover and the camshaft cover gasket.



G00767252

Fig. 44: Installing Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

35. Install the camshaft cover washers.
36. Install the camshaft cover bolts.

Tighten

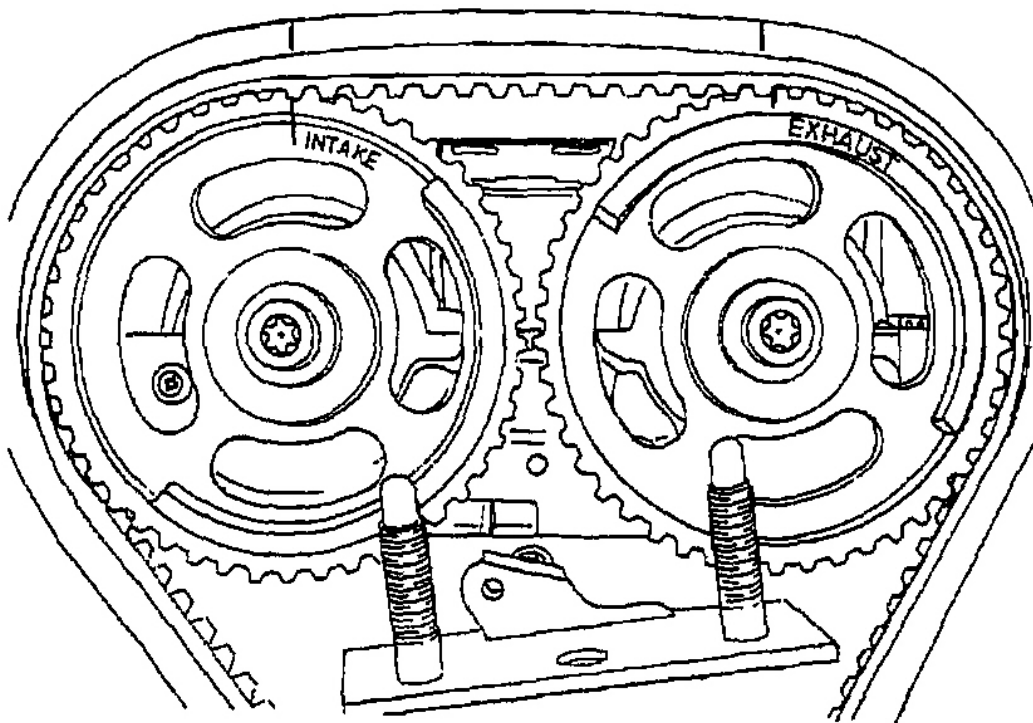
Tighten the camshaft cover bolts to 8 N.m (71 lb-in).

37. Connect the ignition wires to the spark plugs.
38. Install the spark plug cover.
39. Install the spark plug cover bolts.

Tighten

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

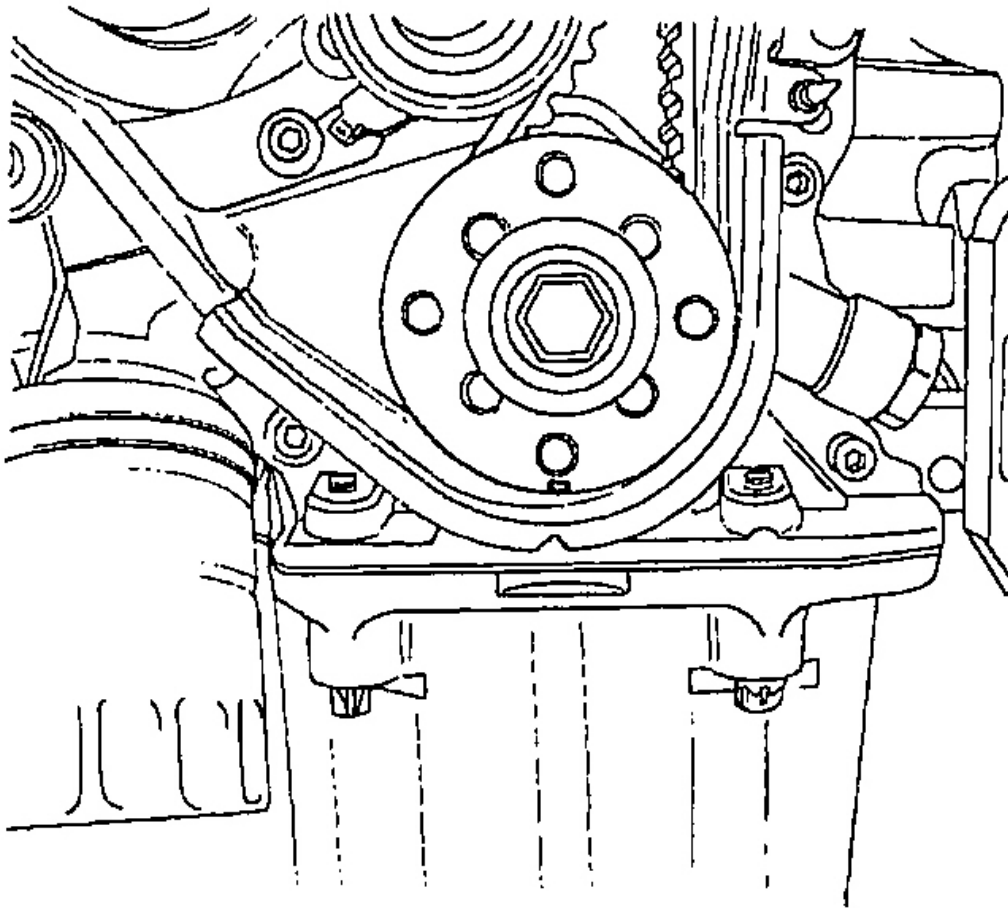
40. Connect the breather tube to the camshaft cover.
41. Align the timing marks on the camshaft gears to the notches on the camshaft cover, using the intake gear mark for the intake gear and the exhaust gear mark for the exhaust gear.



G00767253

Fig. 45: Aligning The Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

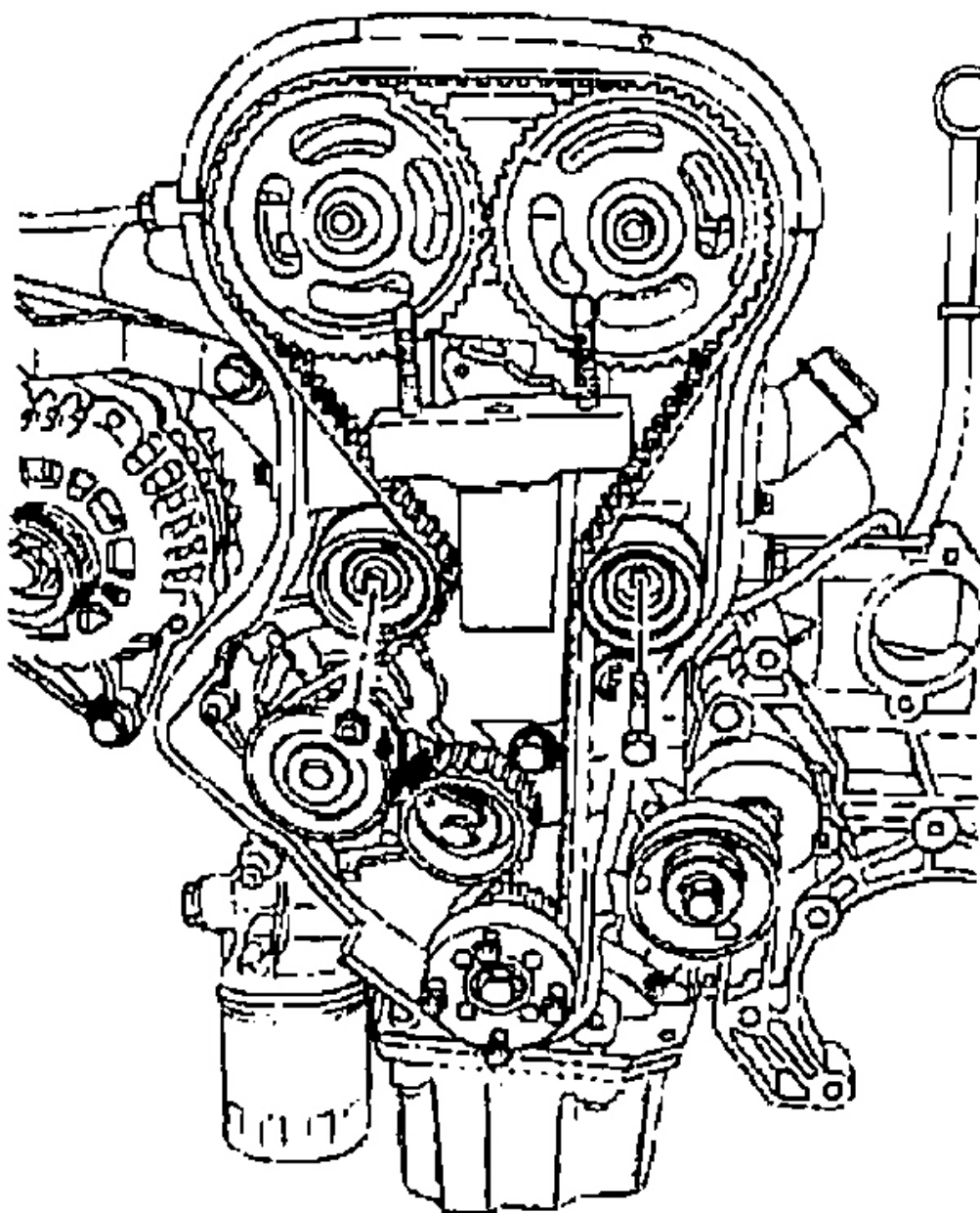
42. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



G00767254

Fig. 46: Aligning The Mark On The Crankshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

43. Install the timing belt.
44. Check and adjust the timing belt tension. Refer to **TIMING BELT CHECK AND ADJUST**.



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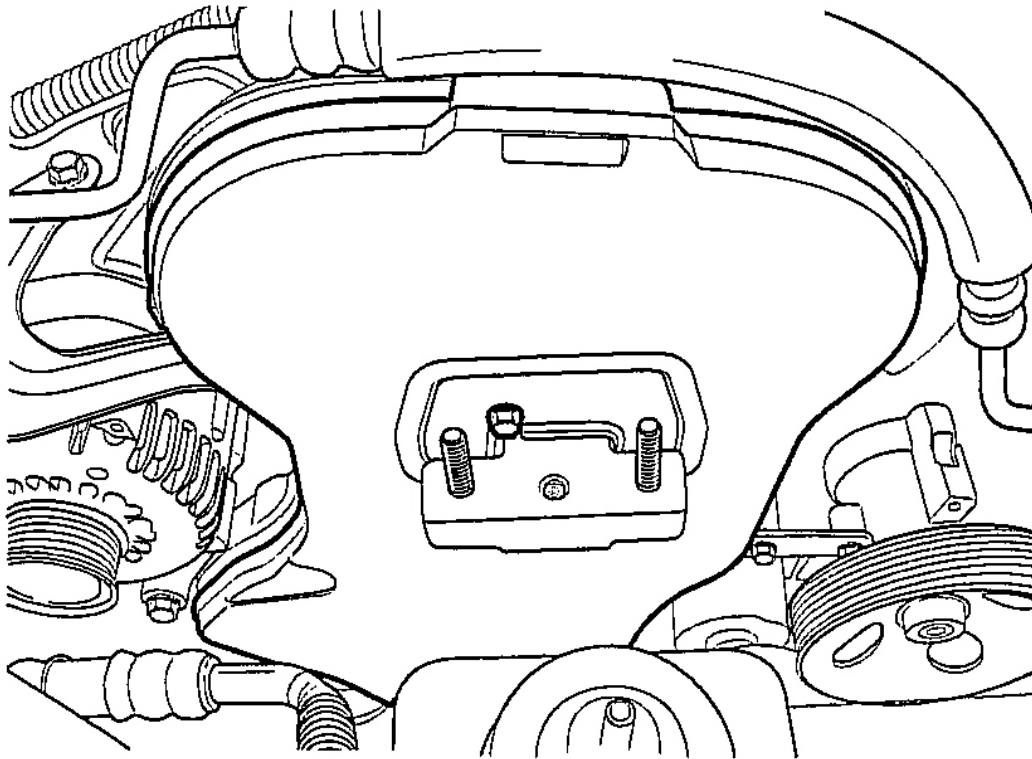
Fig. 47: Adjusting The Timing Belt Tension
Courtesy of SUZUKI OF AMERICA CORP.

45. Install the front timing belt cover.

46. Install the front timing belt cover bolts.

Tighten

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



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Fig. 48: Installing Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

47. Install the crankshaft pulley.
48. Install the crankshaft pulley bolts.

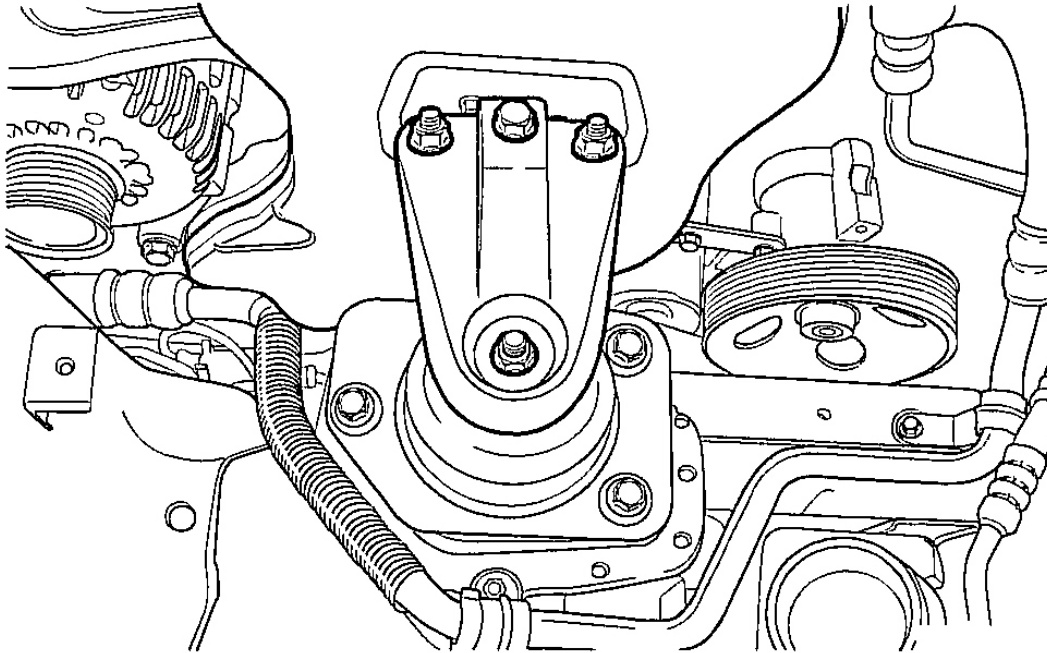
Tighten

Tighten the crankshaft pulley bolts to 12 N.m (106 lb-in).

49. Install the right engine mount bracket and retaining bolts.

Tighten

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



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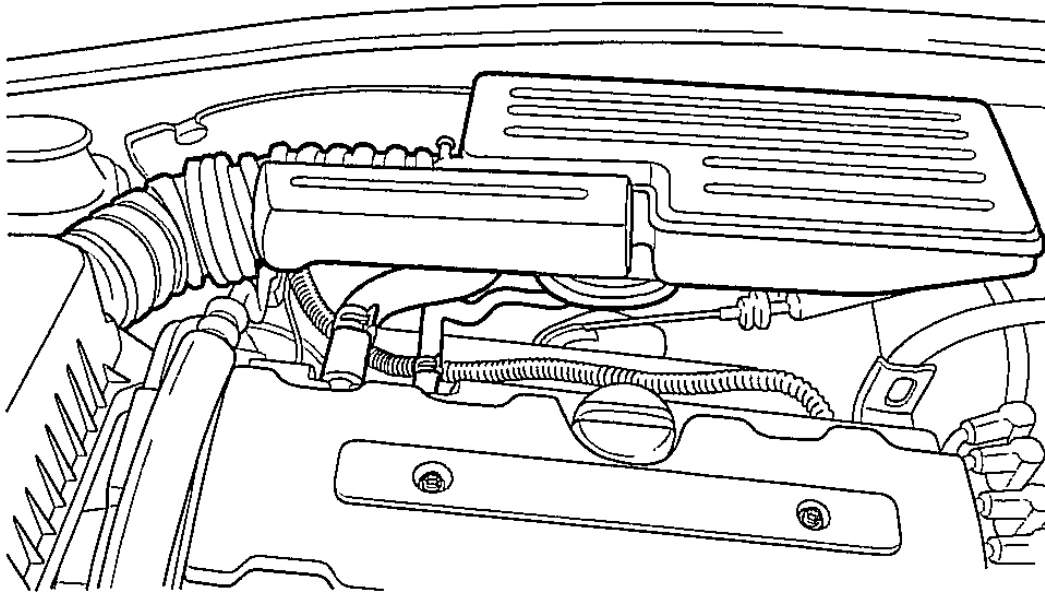
Fig. 49: Installing Right Engine Mount Bracket And Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

50. Install the engine assembly lift support J-28467-B.
51. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION**.
52. Connect the upper radiator hose to the thermostat housing.
53. Install the right front wheel well splash shield.
54. Install the right front wheel. Refer to Wheel Removal and Installation.
55. Install the air cleaner housing.
56. Install the air cleaner housing bolts.

Tighten

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

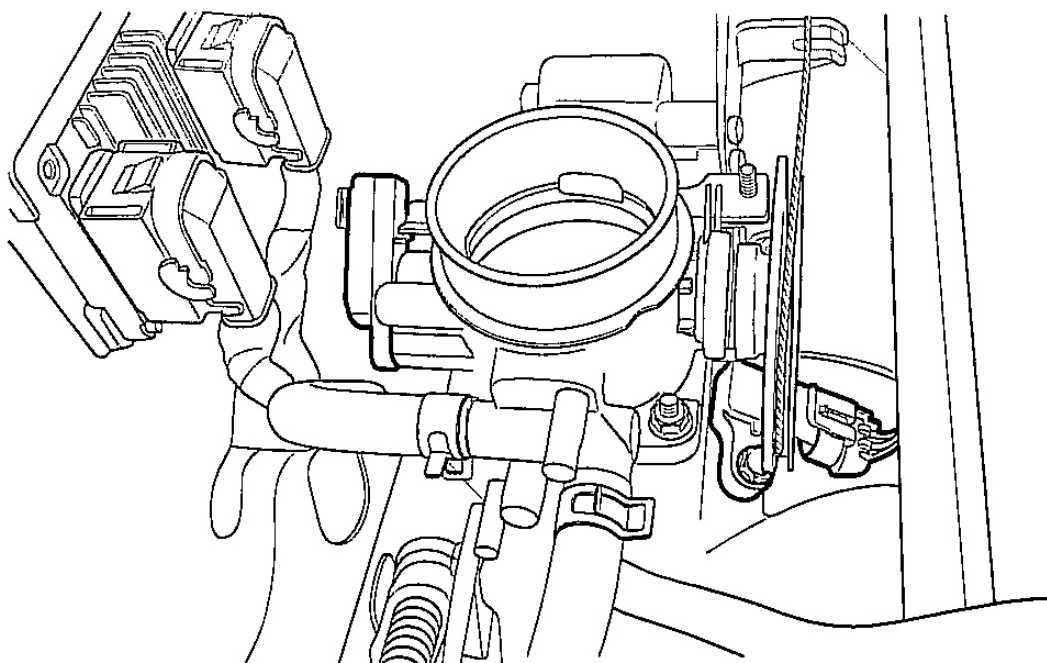
57. Connect the air cleaner outlet hose to the throttle body.



G00767258

Fig. 50: Installing Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

58. Connect the breather tube to the camshaft cover.
59. Connect the MAT sensor connector.
60. Connect the CTS connector.



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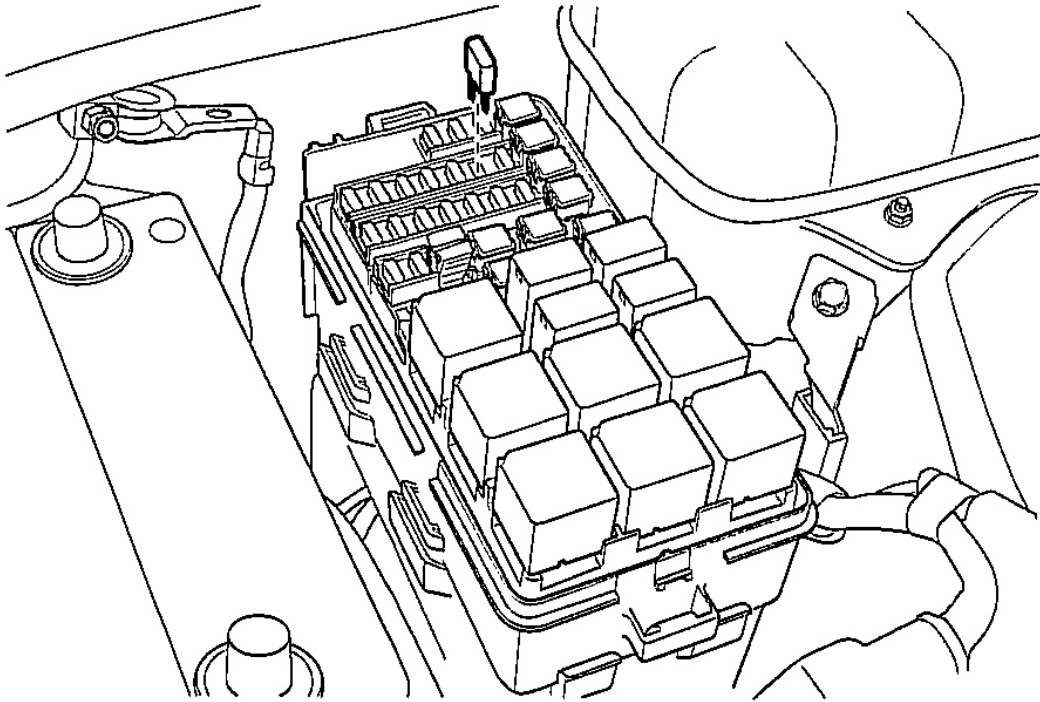
Fig. 51: Installing MAT Sensor And CTS Connectors
Courtesy of SUZUKI OF AMERICA CORP.

61. Connect the engine CTS connector.
62. Connect the IAC valve connector.
63. Connect the TPS connector.
64. Install the CCP and the EGR solenoid bracket bolt.

Tighten

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

65. Connect the DIS coil connector.
66. Connect the O2 sensor connector, if equipped.
67. Connect the ECM ground terminal.
68. Install the fuel pump fuse.



G00767260

Fig. 52: Installing The Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

69. Connect the negative battery ground cable.
70. Refill the engine cooling system. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM**.

Cylinder Head and Gasket Cleaning

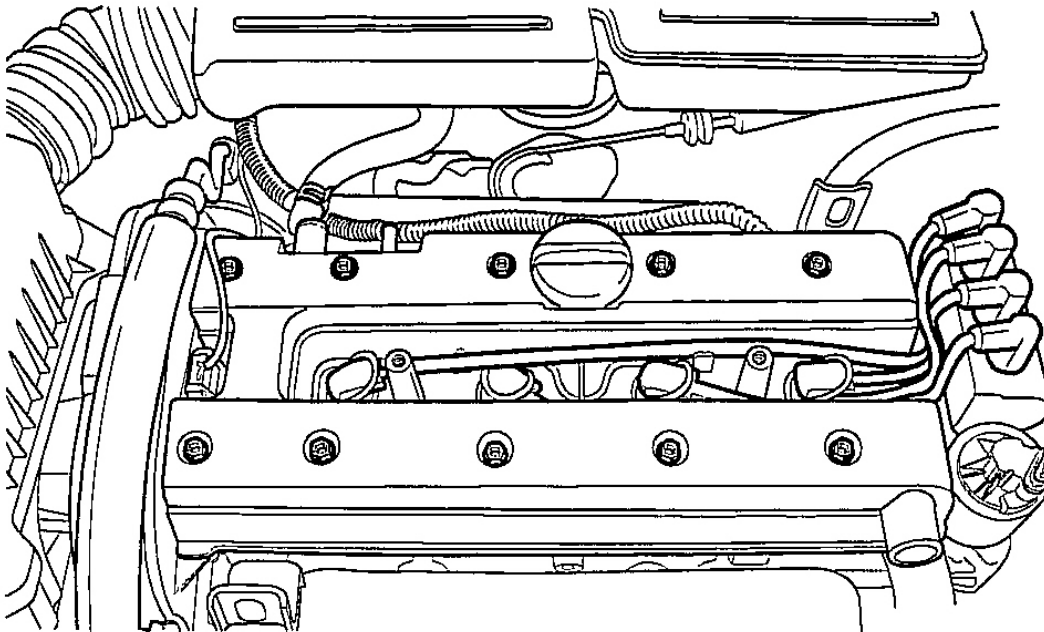
1. Clean the gasket surfaces of the cylinder head and the engine block.
2. Make sure the gasket surfaces of the cylinder head and the engine block are free of nicks and heavy scratches.
3. Clean the cylinder head bolts.
4. Inspect the cylinder head for warpage. Refer to **CYLINDER HEAD INSPECTION**.

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.

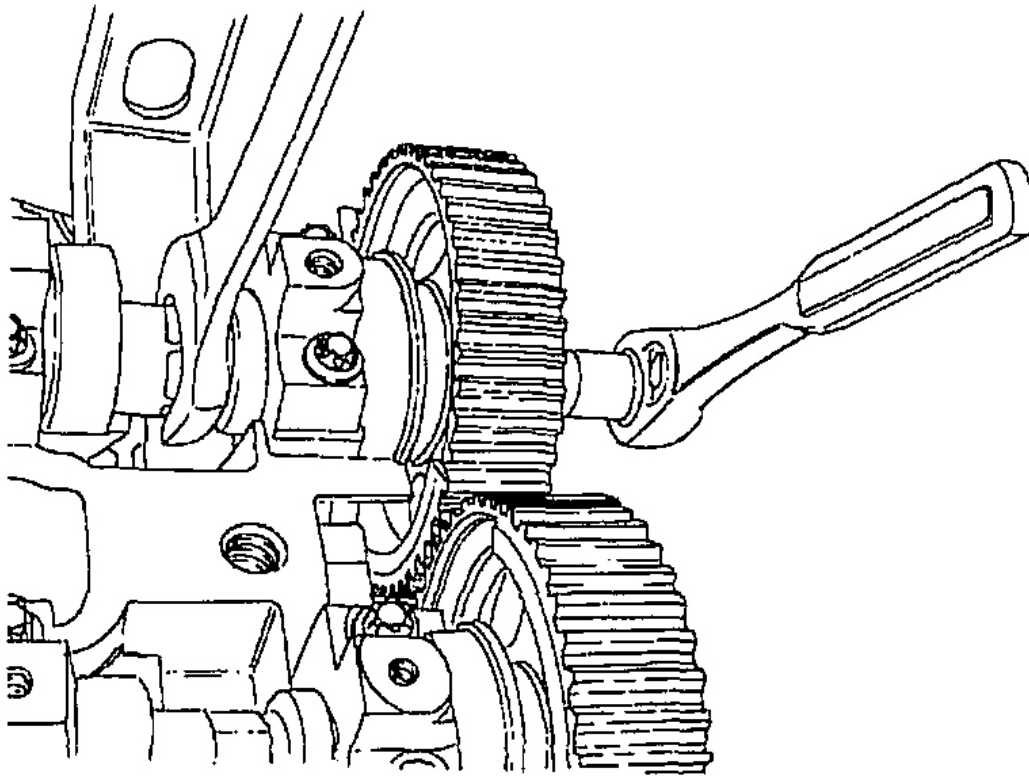


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Fig. 53: Removing The Camshaft Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

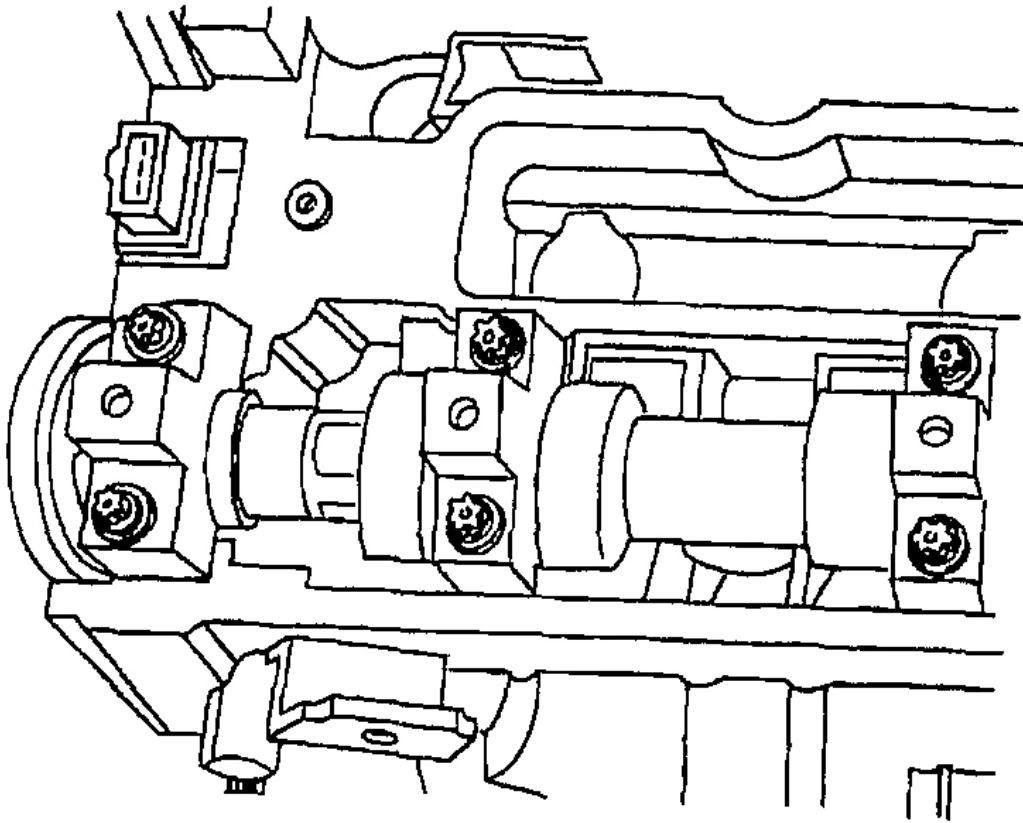
10. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
11. Remove the intake camshaft gear.
12. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
13. Remove the exhaust camshaft gear.



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Fig. 54: Removing Exhaust Camshaft Gear Bolt
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.



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Fig. 55: Removing Camshaft Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

16. Remove the camshafts.
17. Remove the seal ring from the camshafts.

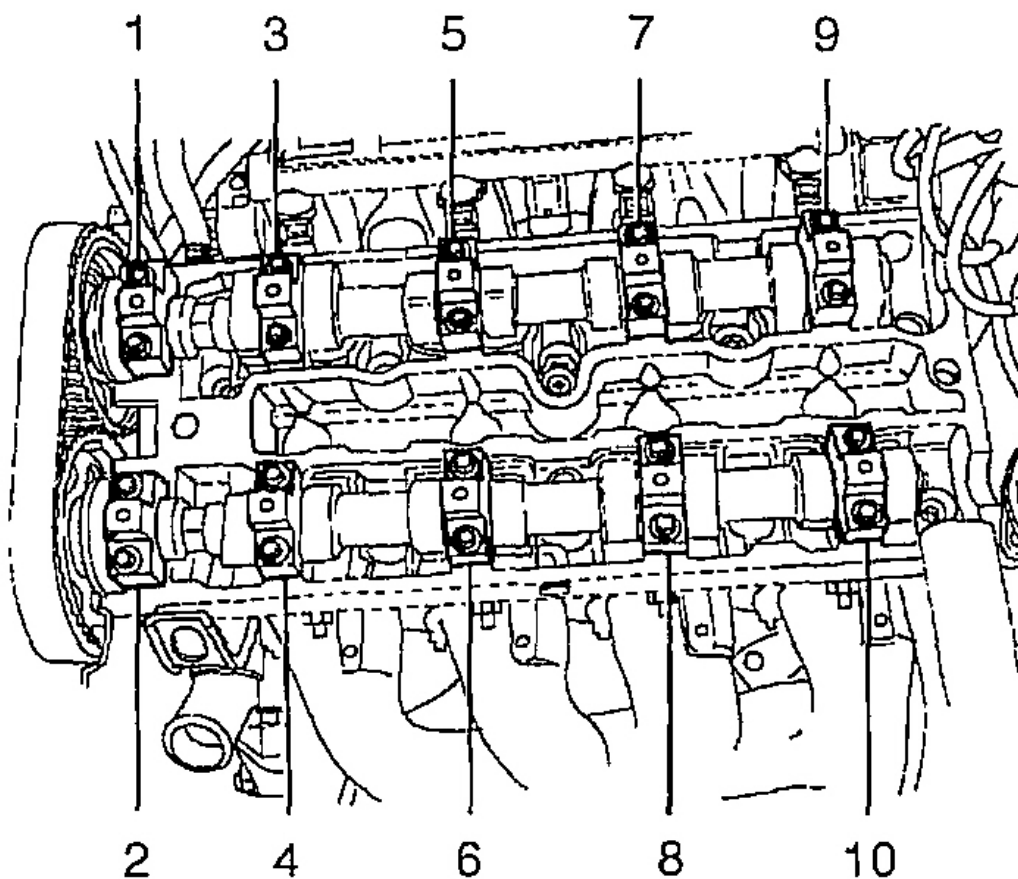
CAUTION: The camshaft must detach evenly from the bearing seats in the front guide bearing.

18. Check the camshaft and bearing seats for wear and replace them if necessary.

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.



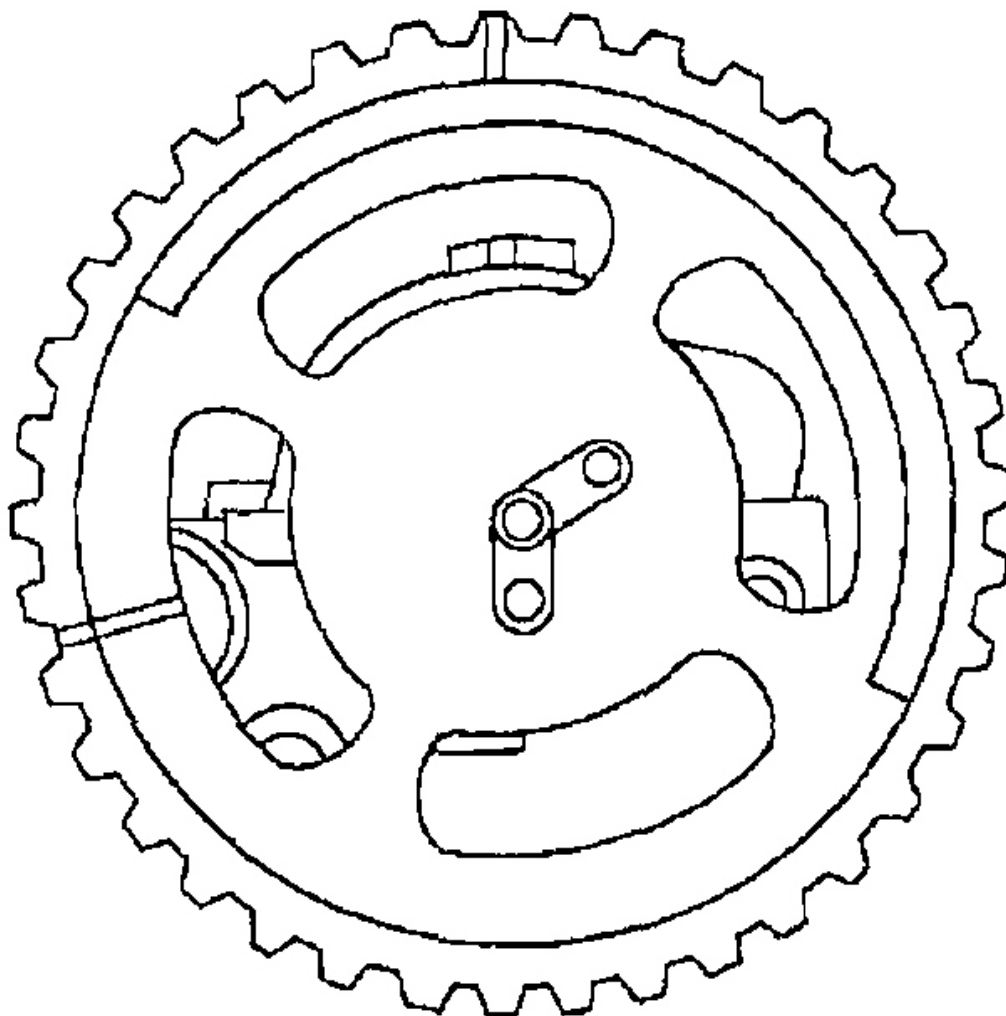
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Fig. 56: Tightening The Camshaft Cap Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

9. Measure the intake camshaft end play and the exhaust camshaft end play. Refer to **ENGINE SPECIFICATIONS**.
10. Install the intake camshaft gear.



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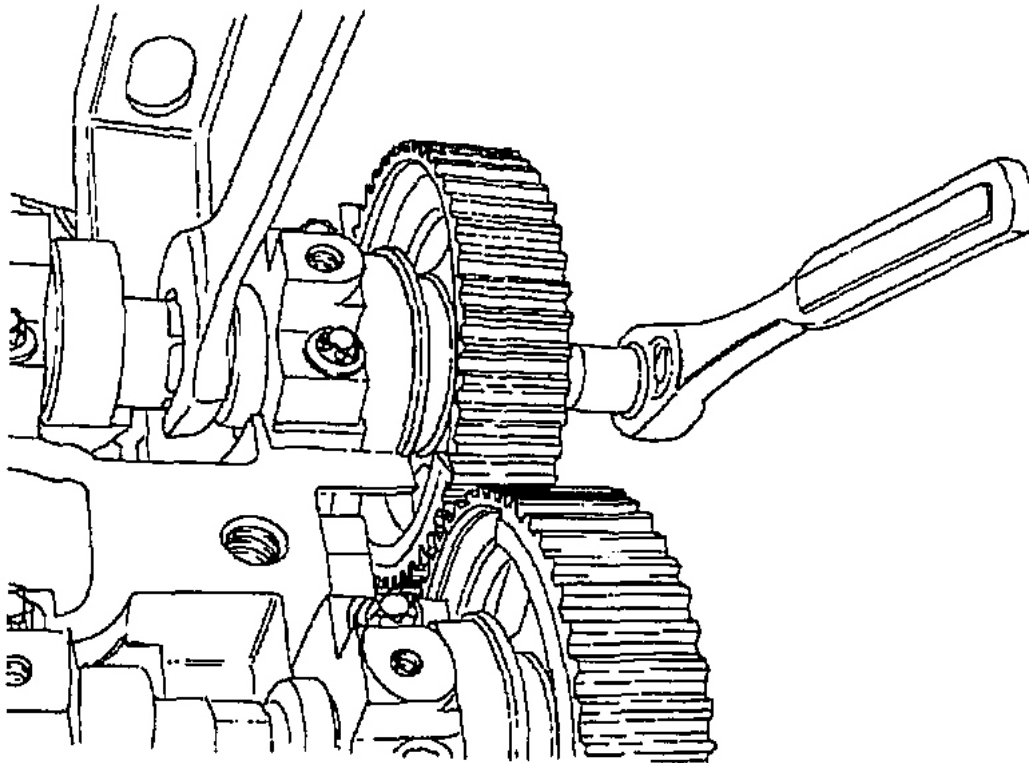
Fig. 57: Installing The Intake Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

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 degrees and 15 degrees using the angular torque gauge KM-470-B.

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



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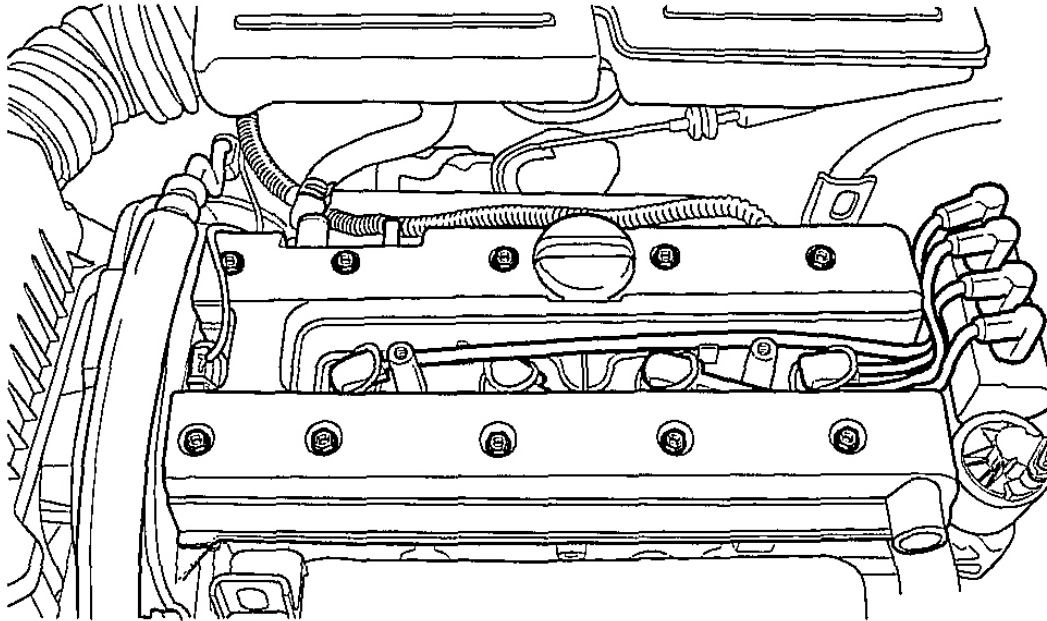
Fig. 58: Installing The Exhaust Camshaft Gear Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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

16. Install the camshaft cover bolts.



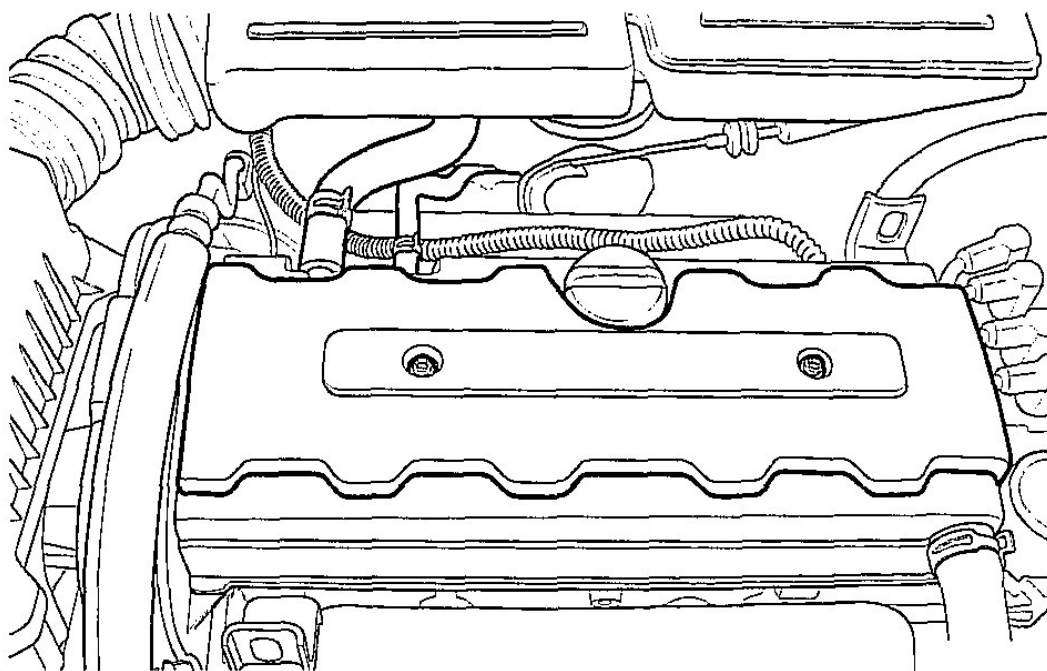
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Fig. 59: Installing The Camshaft Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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



G00767269

Fig. 60: Installing The Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the spark plug cover bolts.

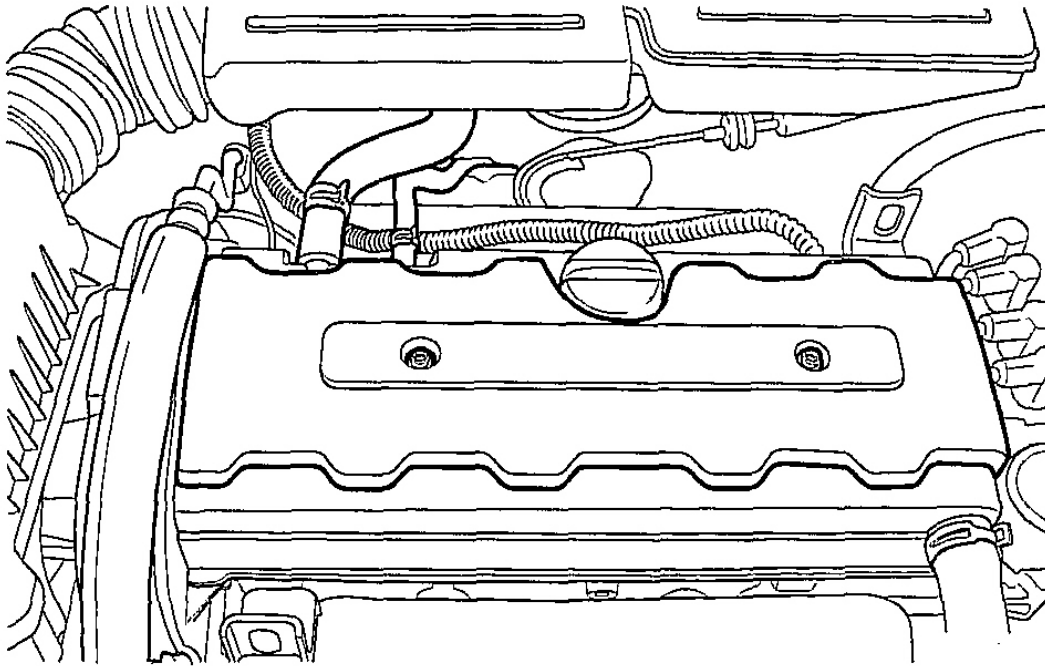
Tighten

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**.

Timing Belt Check and Adjust

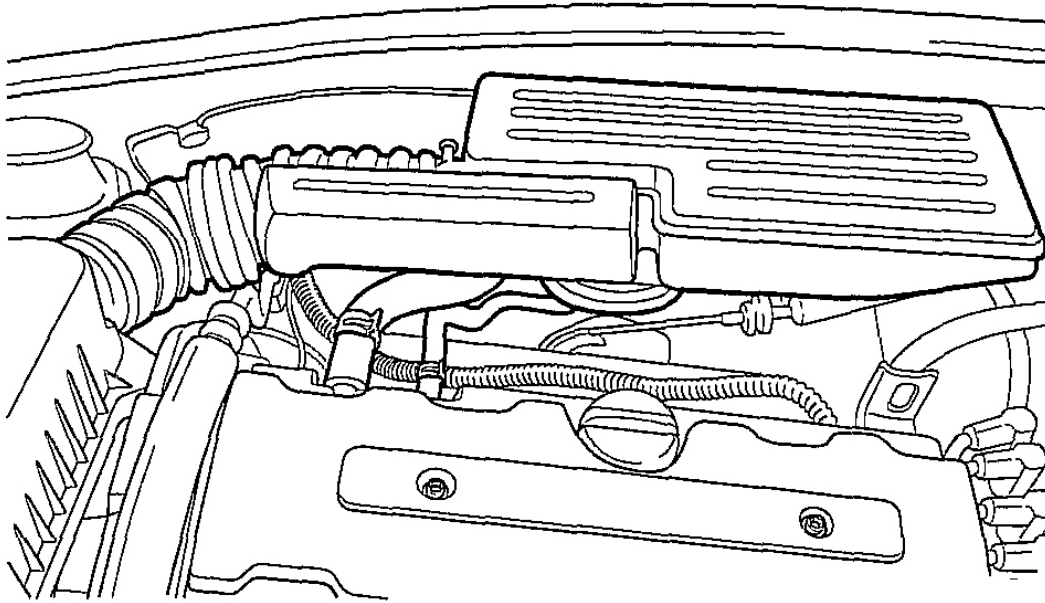
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sensor connector.
3. Remove the air cleaner outlet hose from the throttle body.
4. Remove the breather tube from the camshaft cover.



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Fig. 61: Removing The Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

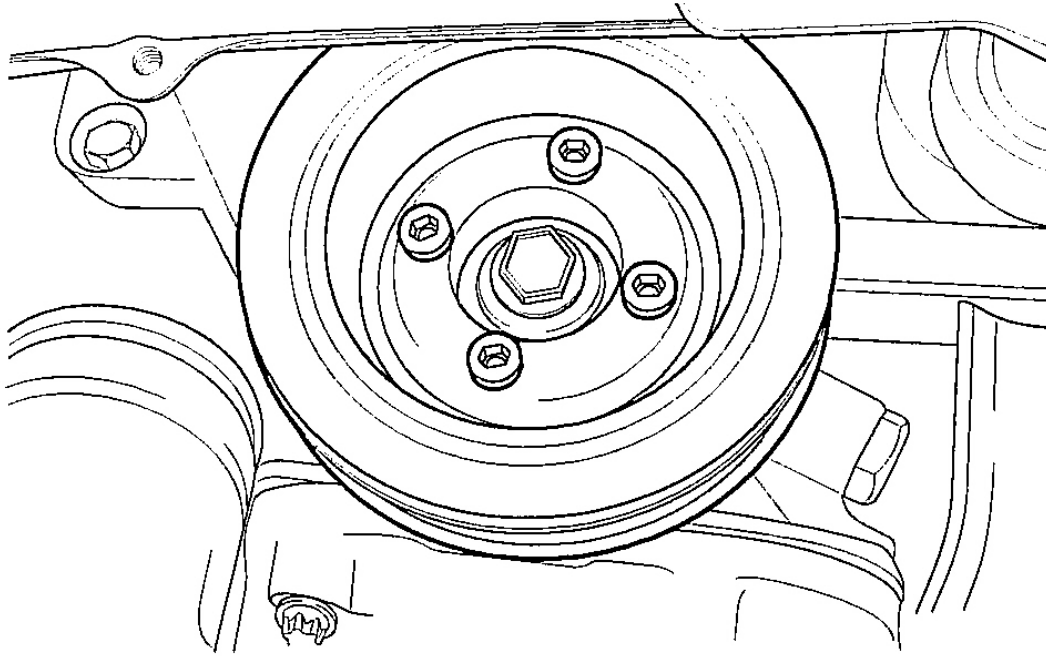
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.



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Fig. 62: Removing The Air Cleaner Housing
Courtesy of SUZUKI OF AMERICA CORP.

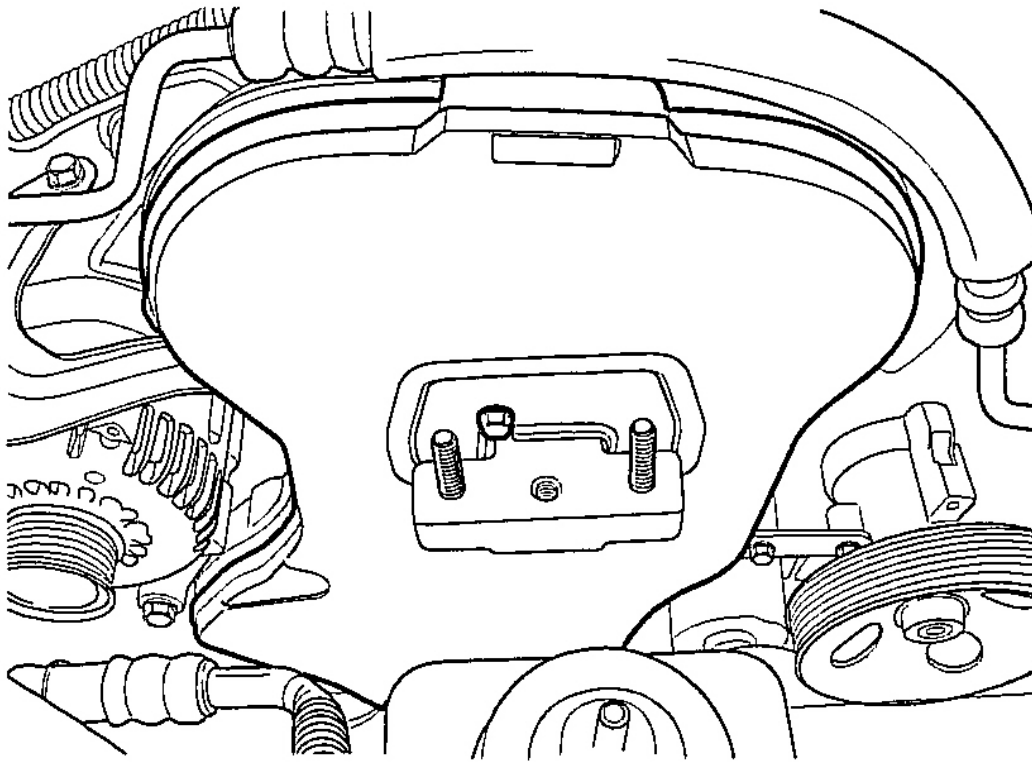
7. Remove the right front wheel. Refer to Wheel Removal and Installation .
8. Remove the right front wheel well splash shield.
9. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
10. Remove the crankshaft pulley bolts.



G00767272

Fig. 63: Removing The Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

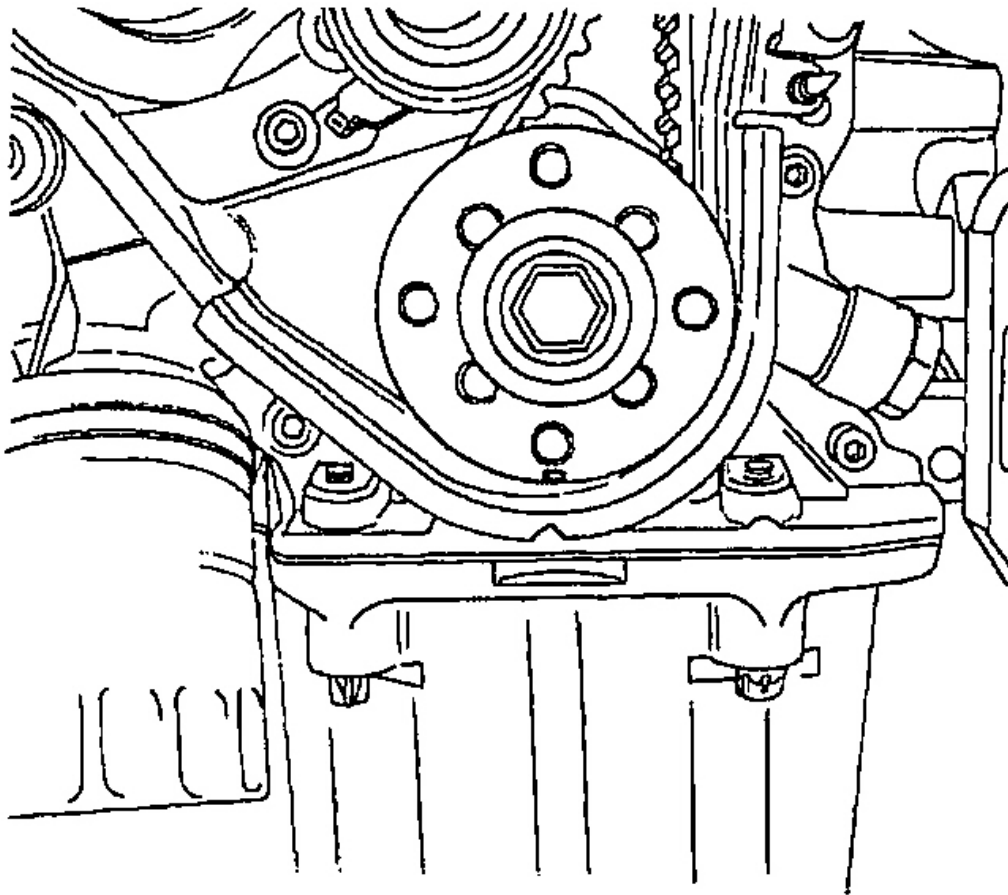
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to **ENGINE MOUNT REMOVAL AND INSTALLATION**.
13. Remove the front timing belt cover bolts.



G00767273

Fig. 64: Removing The Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

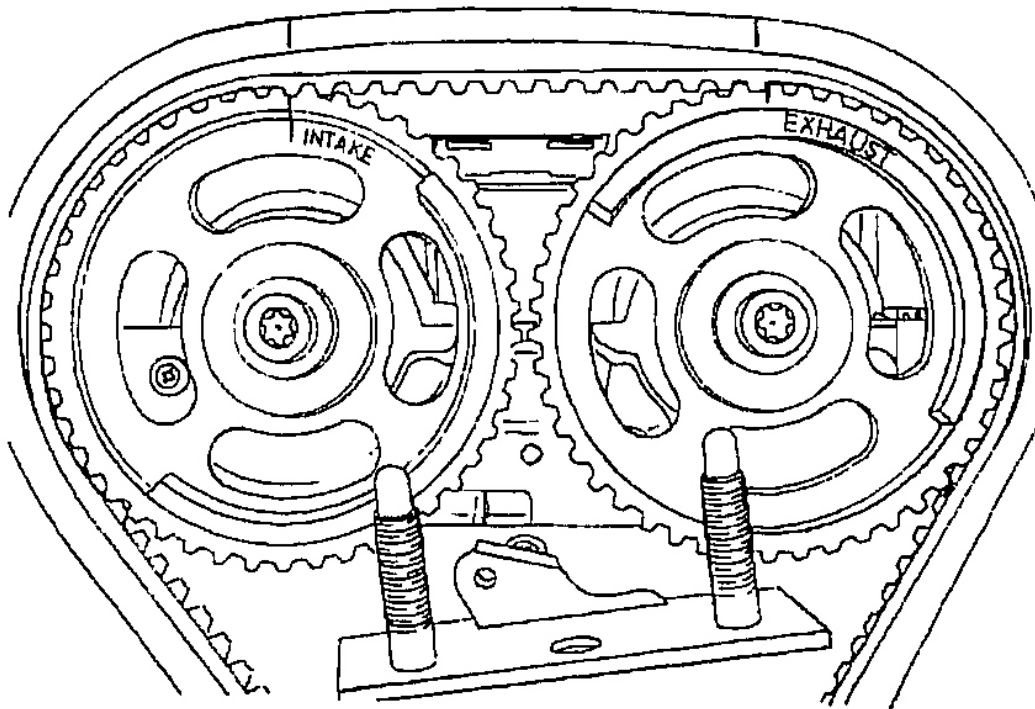
14. Remove the front timing belt cover.
15. Rotate the crankshaft at least one full turn clockwise using the crankshaft gear bolt.
16. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



G00767274

Fig. 65: Aligning The Mark On The Crankshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

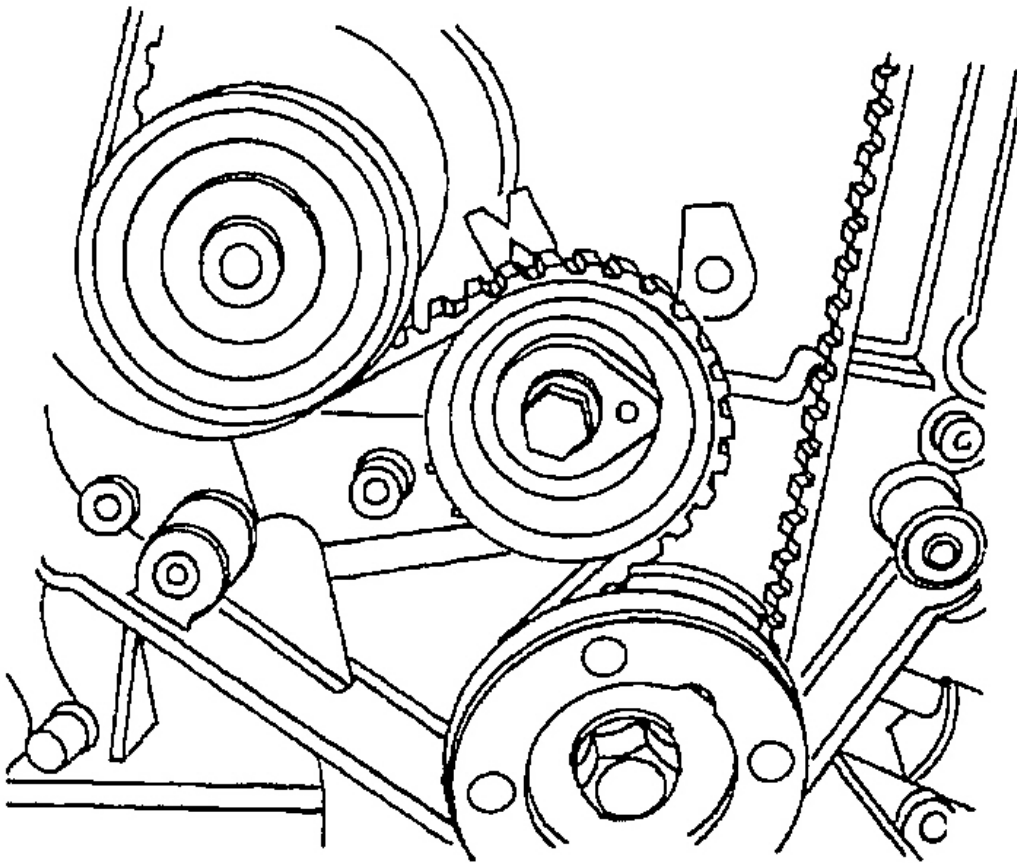
17. Align the camshaft gear timing marks. Use the exhaust gear mark for the exhaust gear and the intake gear mark for the intake gear, since the gears are interchangeable.



G00767275

Fig. 66: Aligning The Camshaft Gear Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

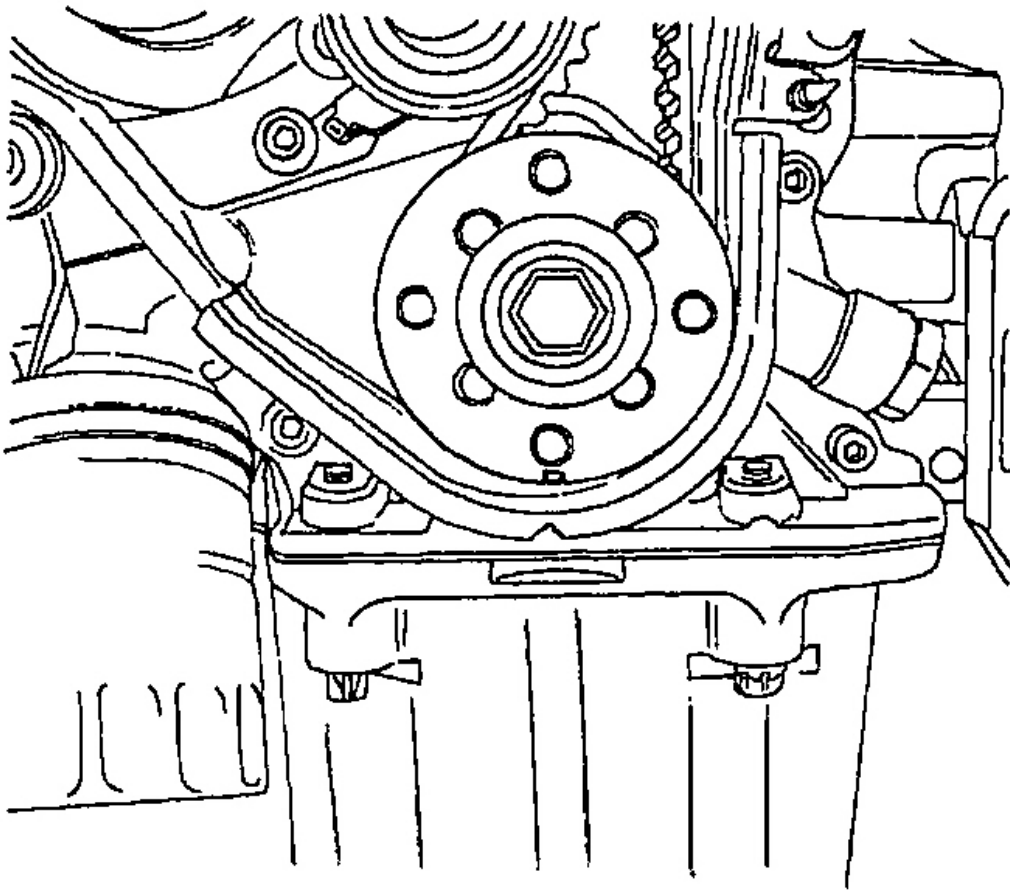
18. Loosen the automatic tensioner bolt. To relieve the belt tension, turn the hex-key tab counterclockwise.
19. Rotate the automatic tensioner hex-key tab clockwise until the adjust arm pointer of the timing belt automatic tensioner is aligned with the notch in the timing belt automatic tensioner bracket.



G00767276

Fig. 67: Aligning Arm Pointer Of The Timing Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

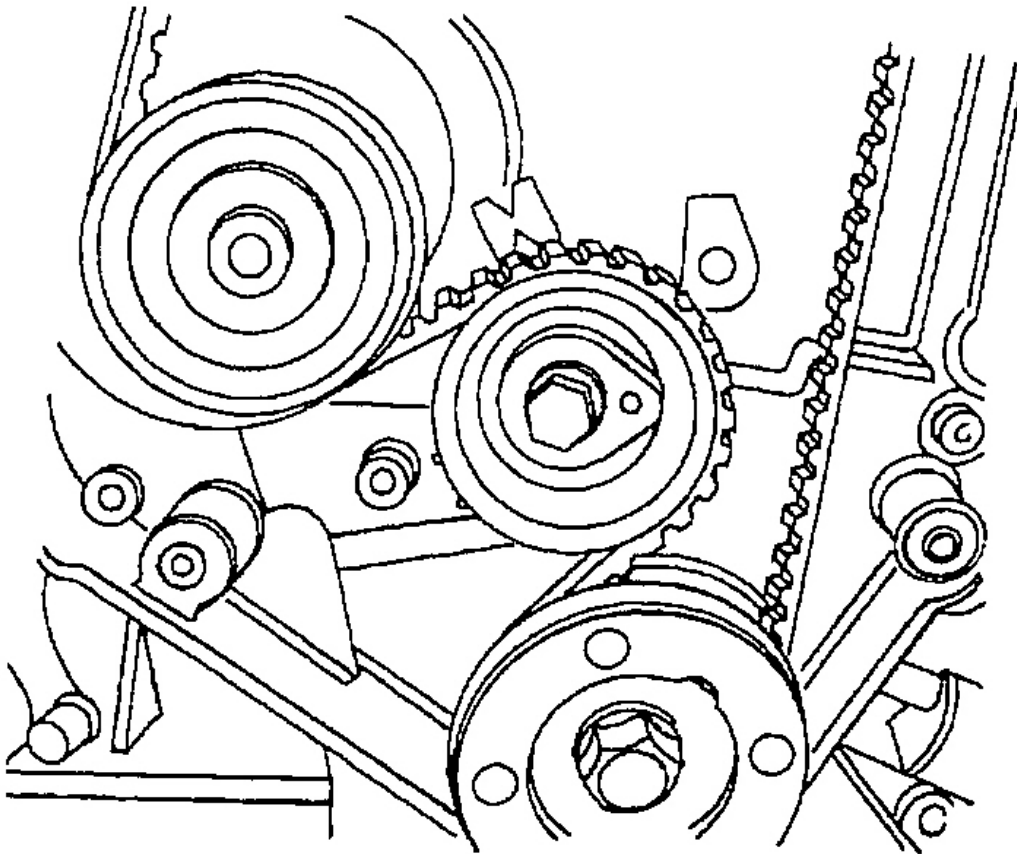
20. Tighten the automatic tensioner bolt.
21. Rotate the crankshaft two full turns clockwise using the crankshaft gear bolt.



G00767277

Fig. 68: Aligning The Camshaft Gear Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

22. Check the automatic tensioner pointer.
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.



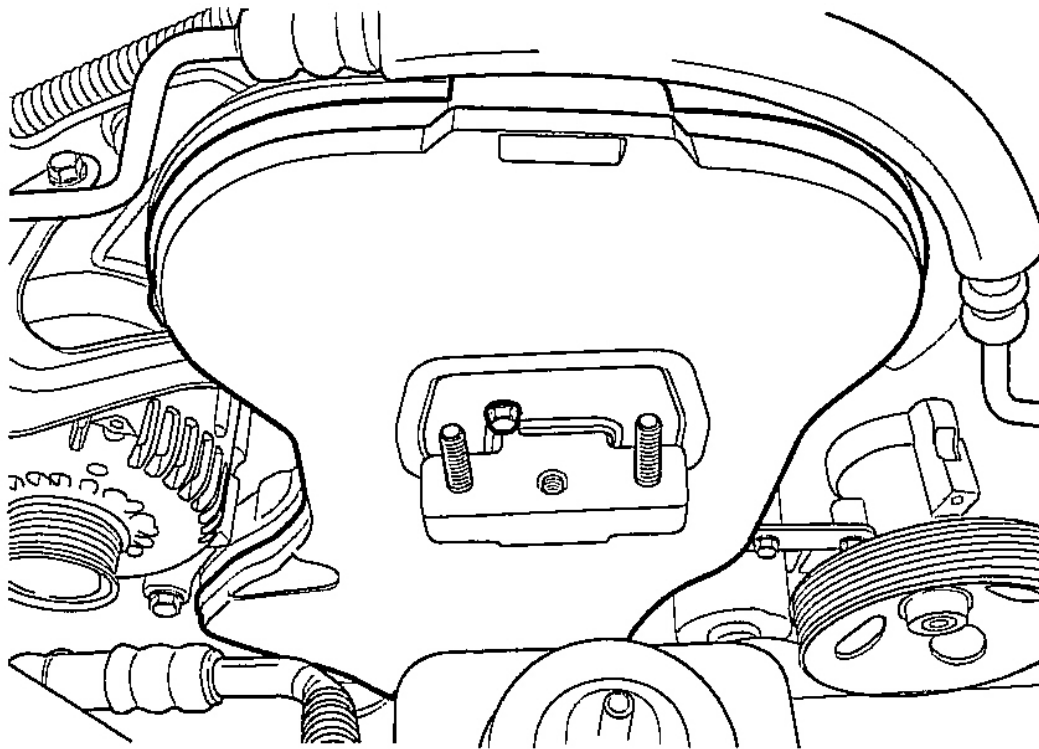
G00767278

Fig. 69: Checking Alignment Of Arm Pointer
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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



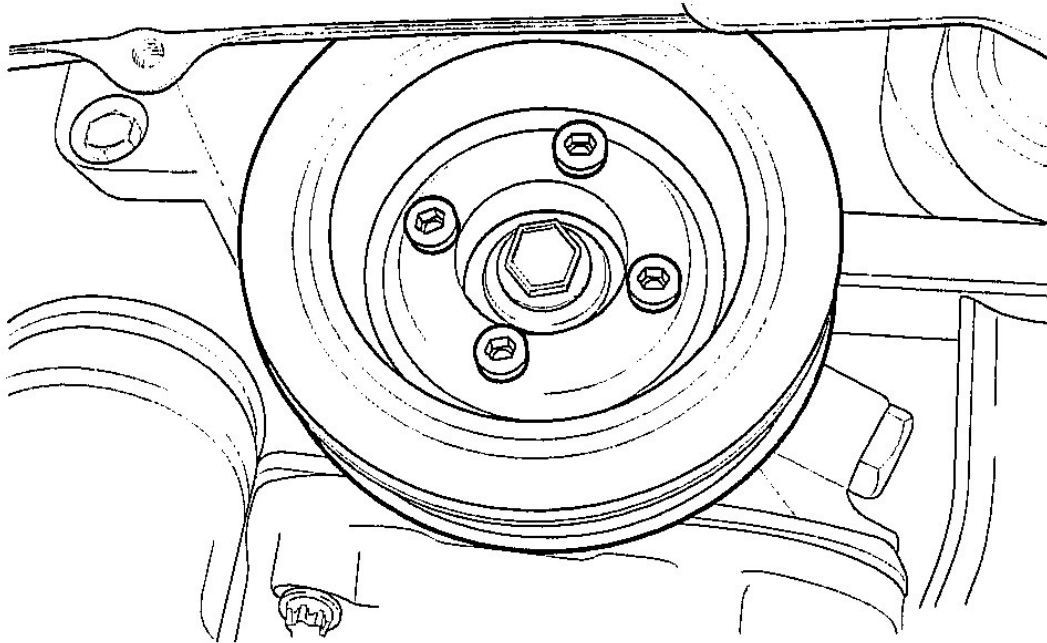
G00767279

Fig. 70: Installing The Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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



G00767280

Fig. 71: Installing The Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

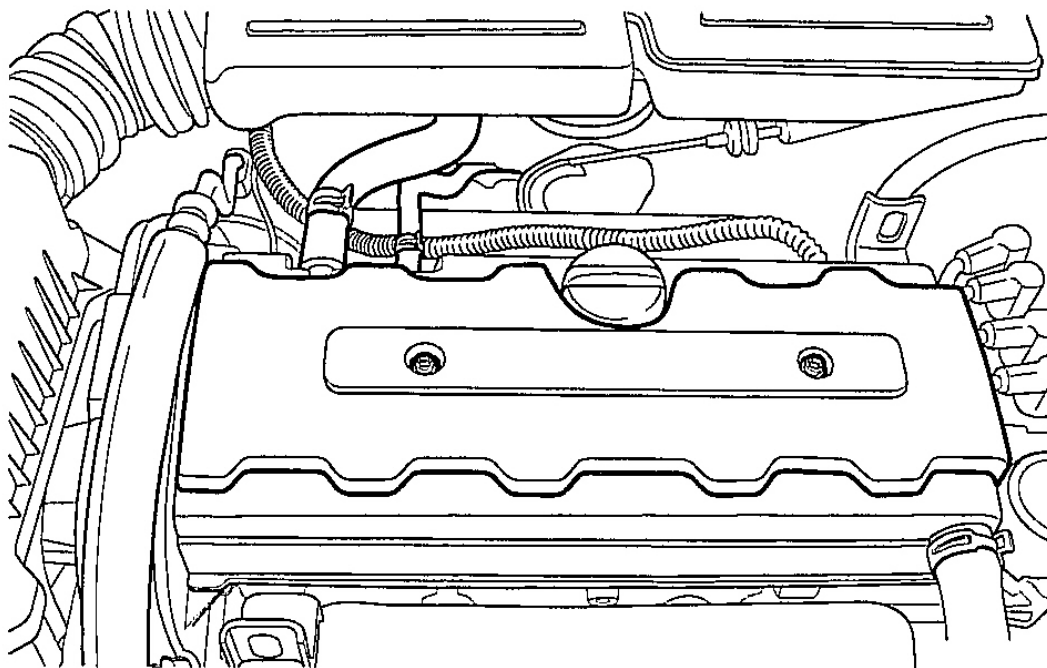
Tighten the crankshaft pulley bolt to 20 N.m (15 lb-ft).

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**.
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.
35. Connect the breather tube to the camshaft cover.



G00767281

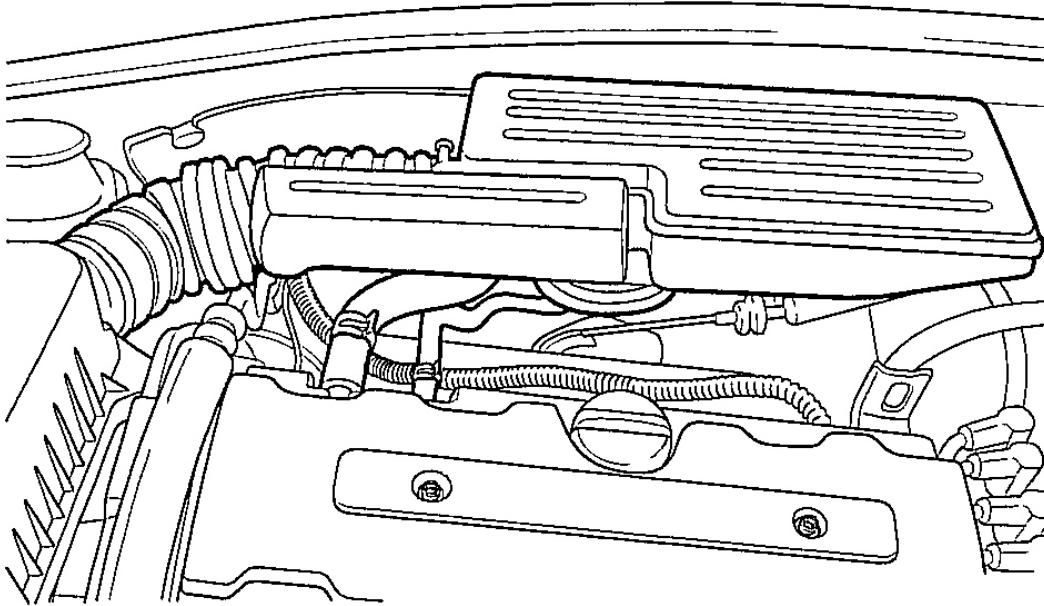
Fig. 72: Connecting The Breather Tube To The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

36. Connect the MAT sensor connector.
37. Connect the negative battery cable.

Timing Belt Removal and Installation

Removal

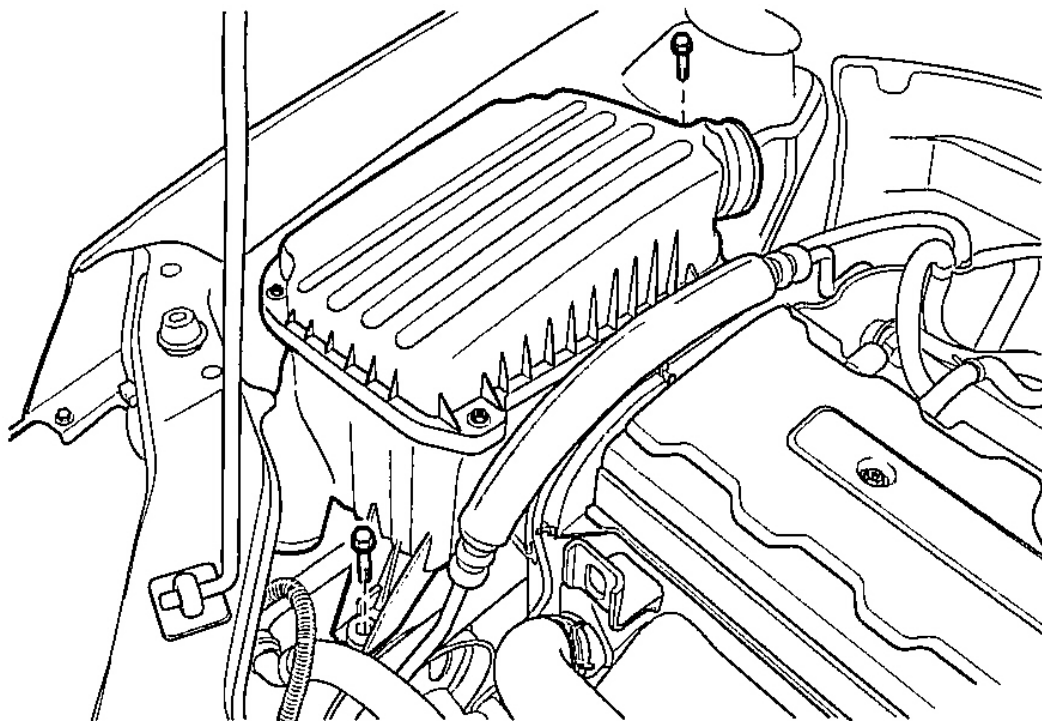
1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sensor connector.
3. Disconnect the air cleaner outlet hose from the throttle body.
4. Disconnect the breather tube from the camshaft cover.



G00767283

Fig. 73: Disconnecting The Breather Tube From The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

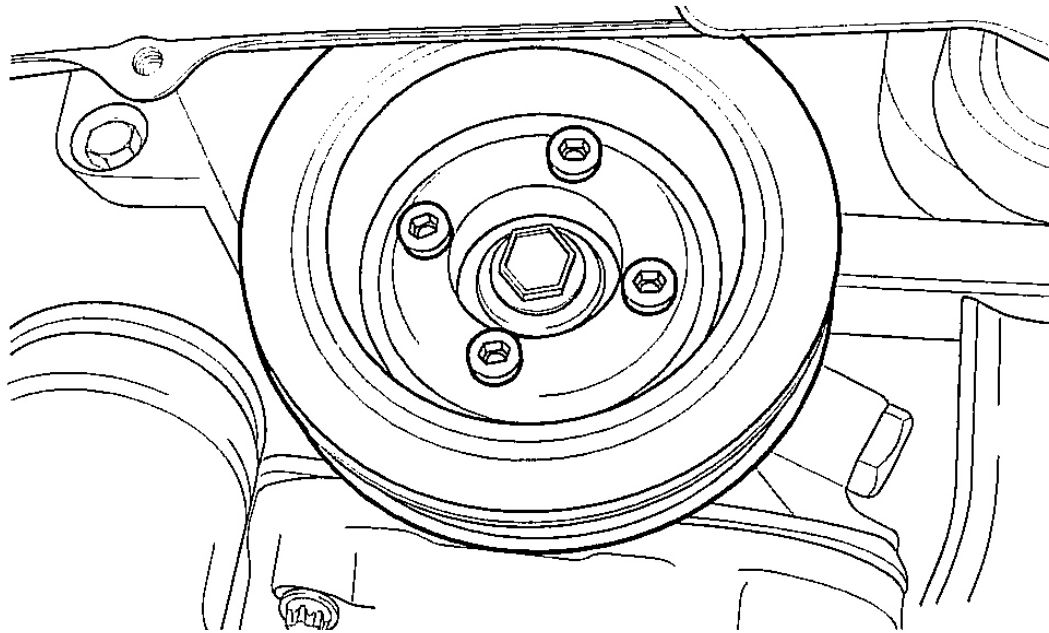
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.



G00767284

Fig. 74: Removing The Air Cleaner Housing
Courtesy of SUZUKI OF AMERICA CORP.

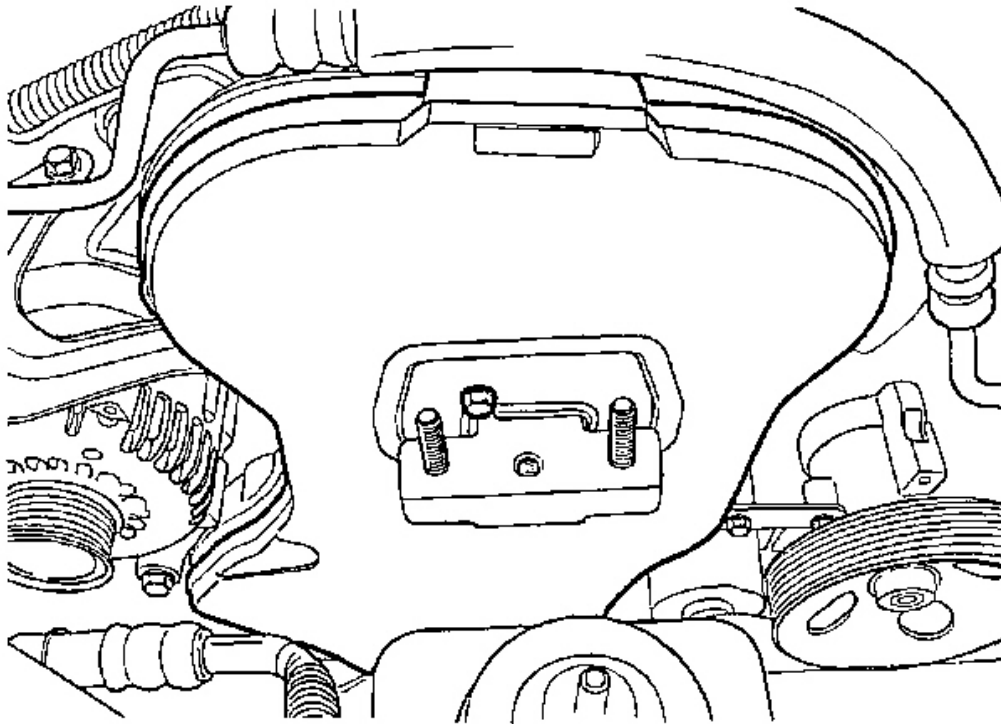
7. Remove the right front wheel. Refer to Wheel Removal and Installation .
8. Remove the right front wheel well splash shield.
9. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to **ENGINE MOUNT REMOVAL AND INSTALLATION**.



G00767285

Fig. 75: Removing The Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

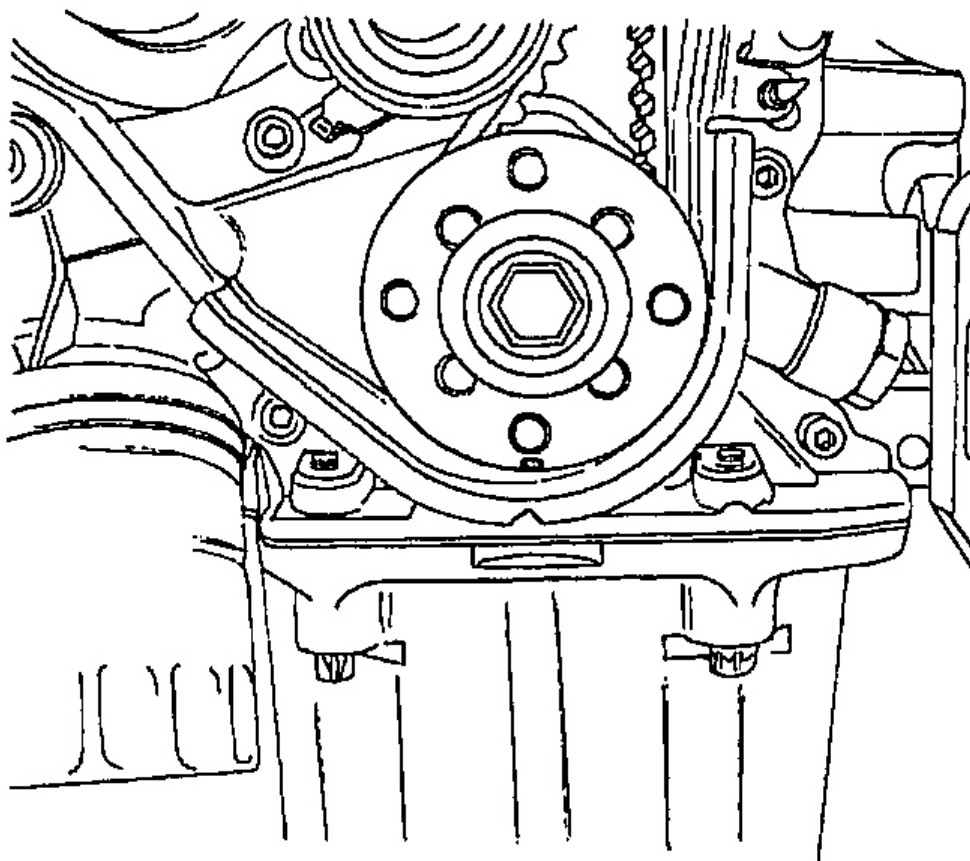
13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.



G00767286

Fig. 76: Removing The 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.



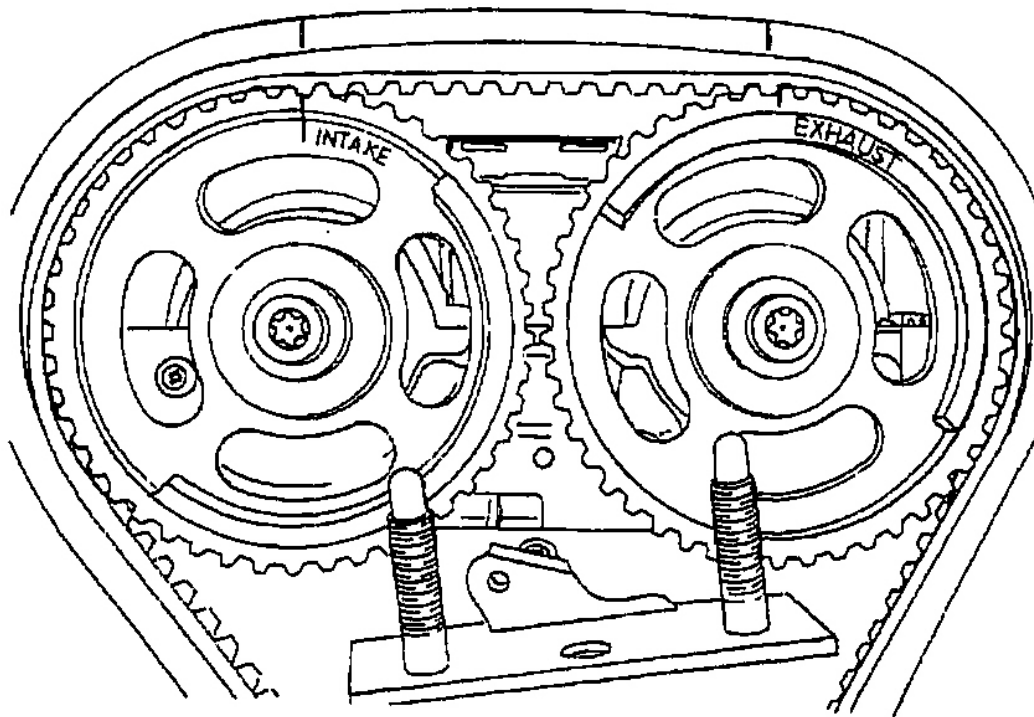
G00767287

Fig. 77: Aligning Timing Mark On The Crankshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

CAUTION: The camshaft gears must align with the notch on the camshaft cover or damage to the engine could result.

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

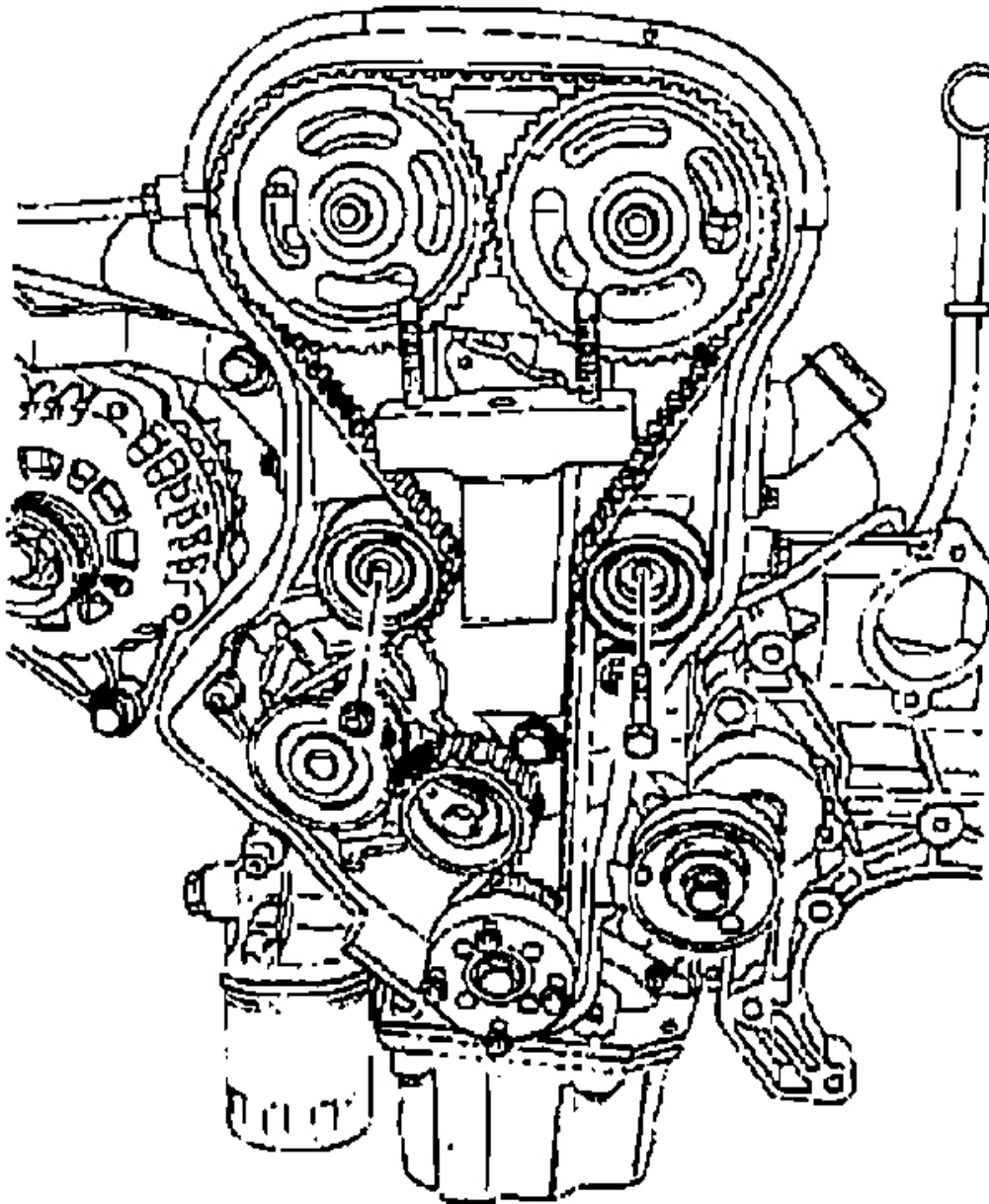
CAUTION: Use the intake gear mark for the intake camshaft gear and the exhaust gear mark for the exhaust camshaft gear since both gears are interchangeable.



G00767288

Fig. 78: Aligning The Camshaft Gears
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.

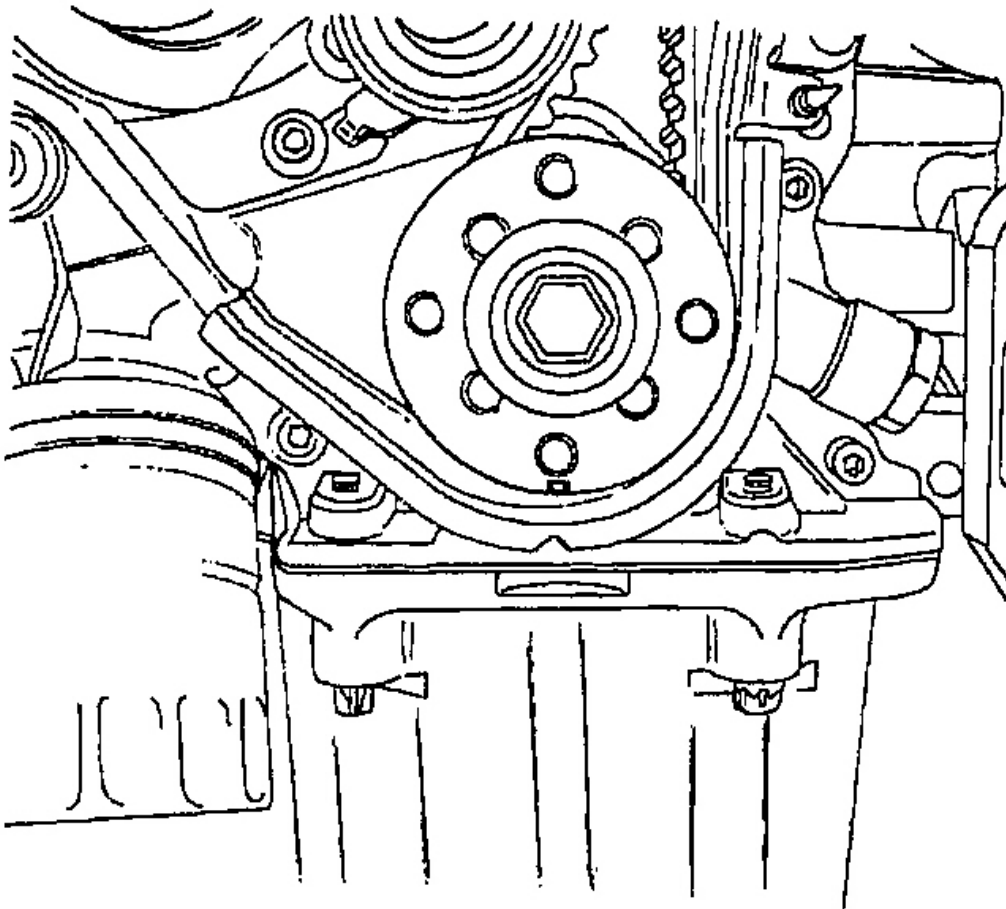


G00767289

Fig. 79: Loosening The Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Installation

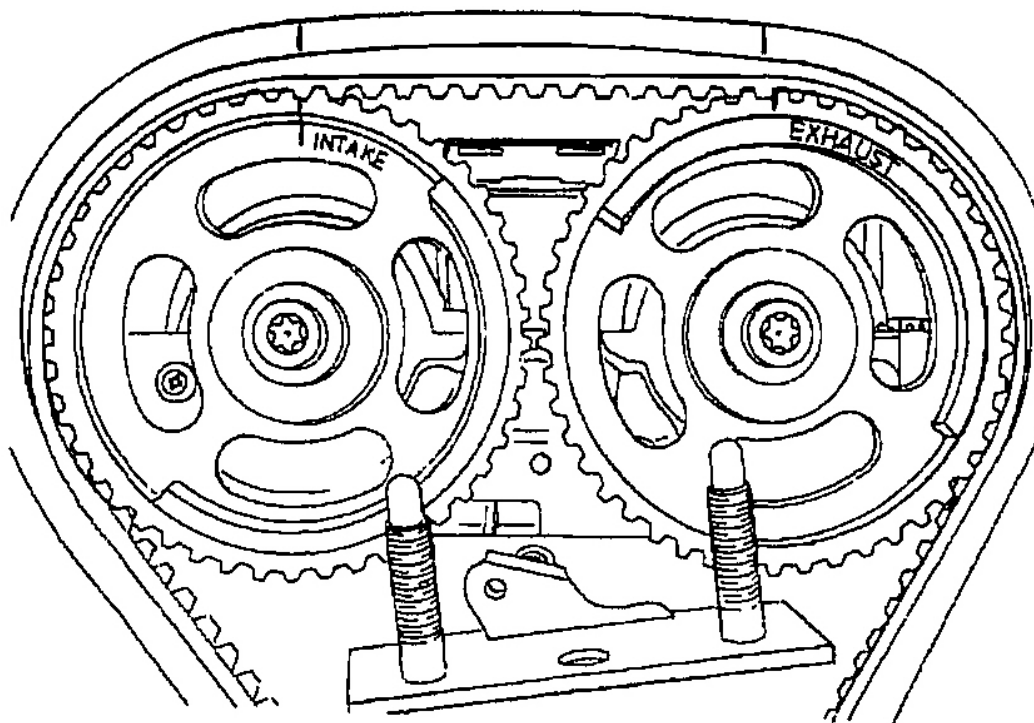
1. Align the timing mark on the crankshaft gear with the notch on the bottom of the rear timing belt cover.



G00767290

Fig. 80: Aligning Timing Mark On The Crankshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

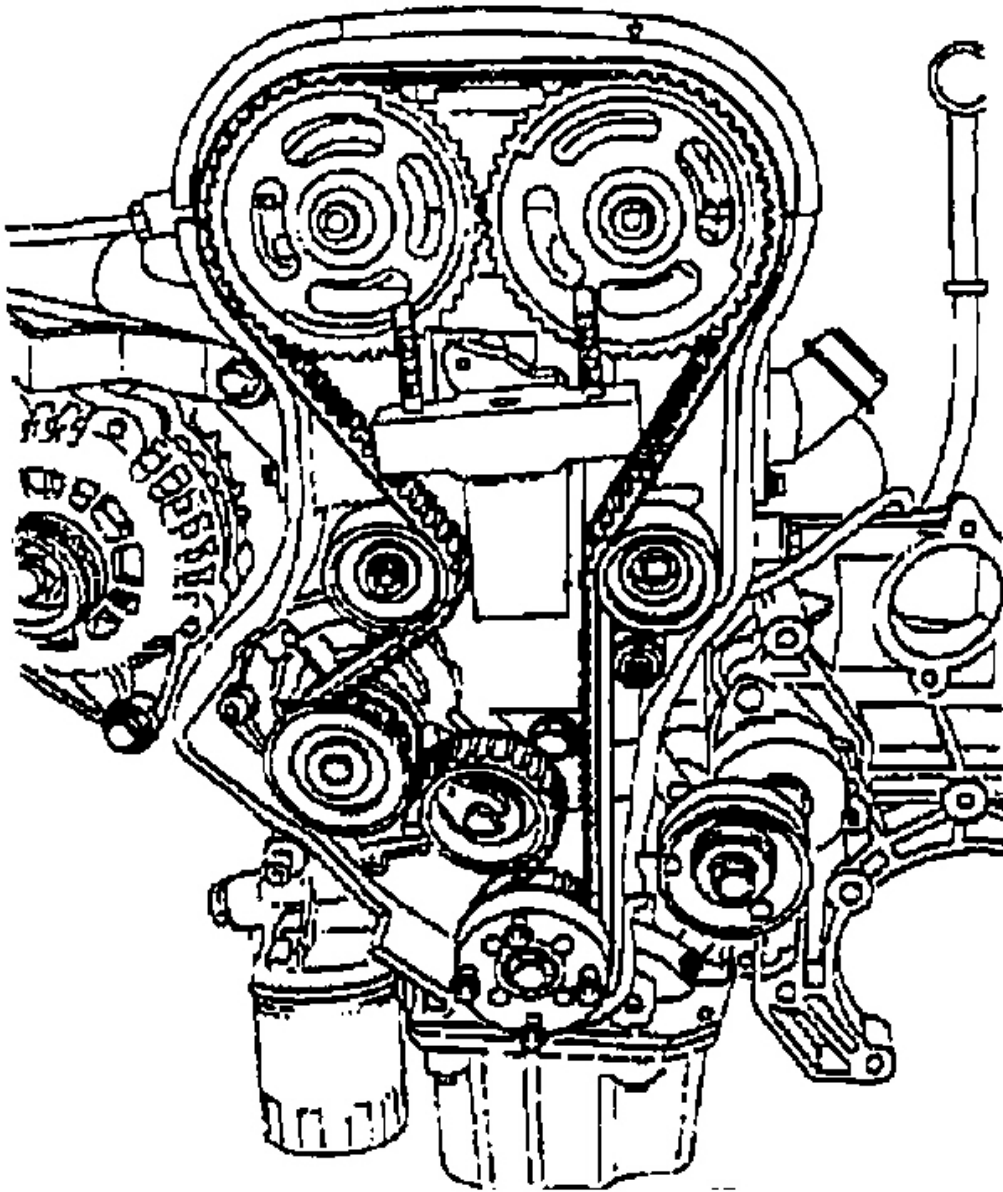
2. Align the timing marks on the camshaft gears, using the intake gear mark for the intake gear and the exhaust gear mark for the exhaust gear.



G00767291

Fig. 81: Aligning The Camshaft Gears
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the timing belt.



G00767292

Fig. 82: Installing The Timing Belt
Courtesy of SUZUKI OF AMERICA CORP.

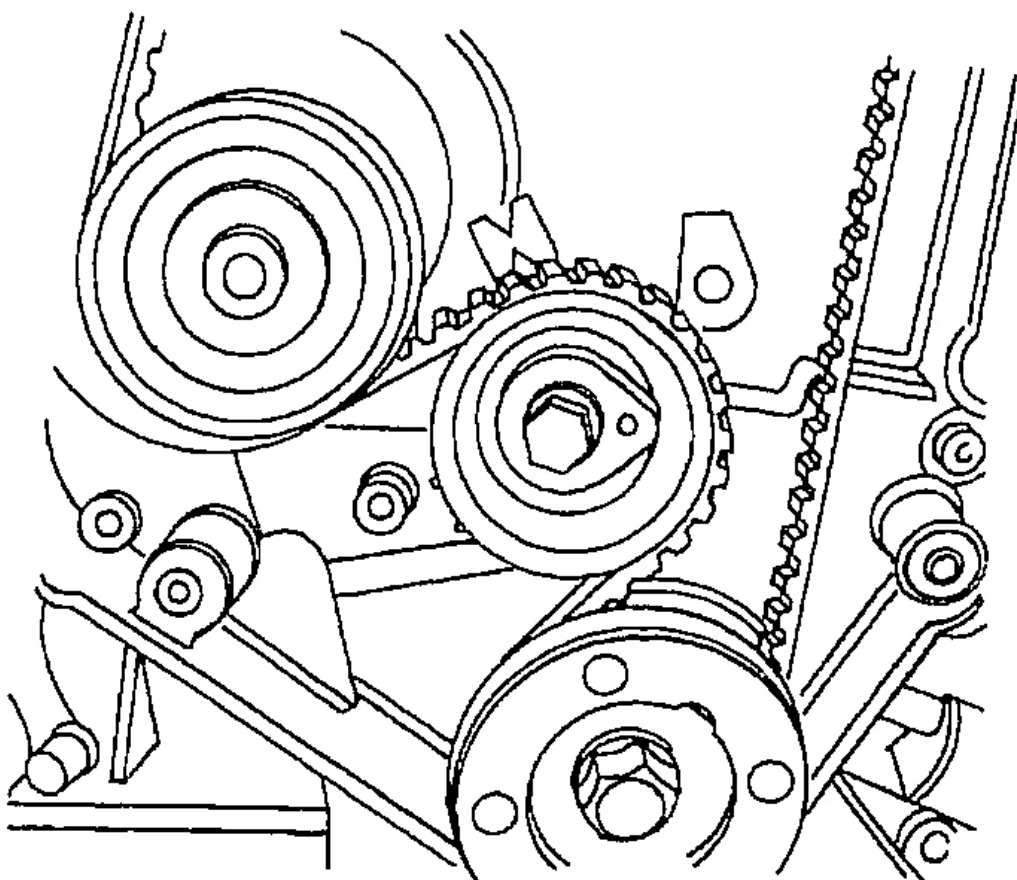
4. Turn the hex-key tab in a clockwise direction to tension the belt. Turn until the pointer aligns with the notch.

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.



G00767293

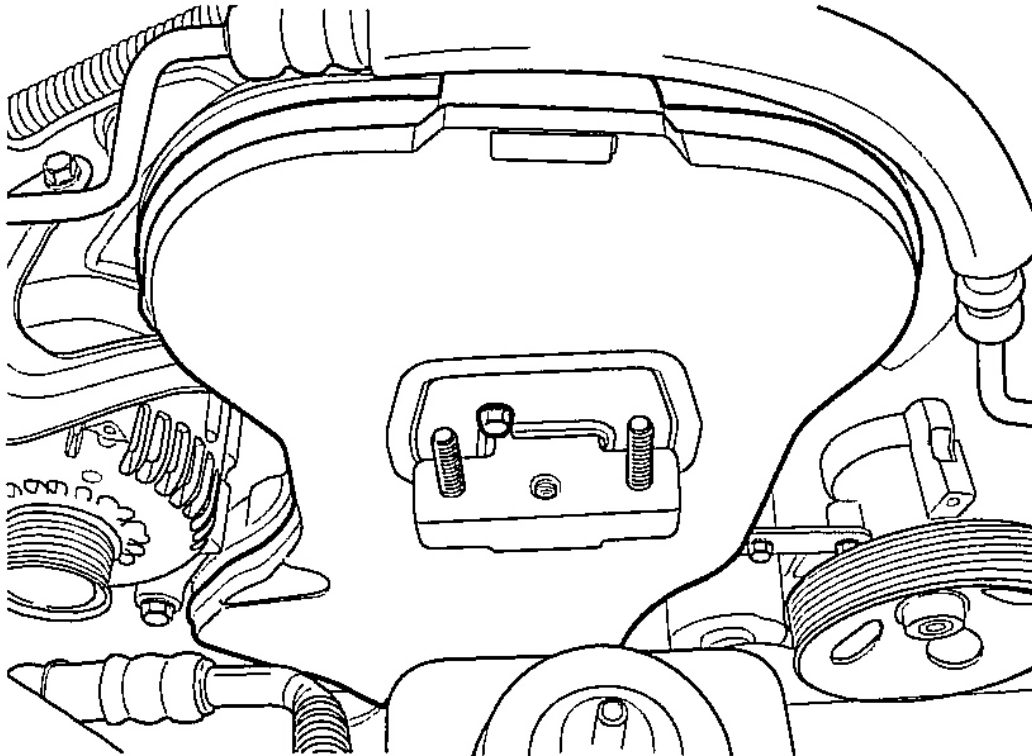
Fig. 83: Aligning Automatic Tensioner Pointer With Notch
Courtesy of SUZUKI OF AMERICA CORP.

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).

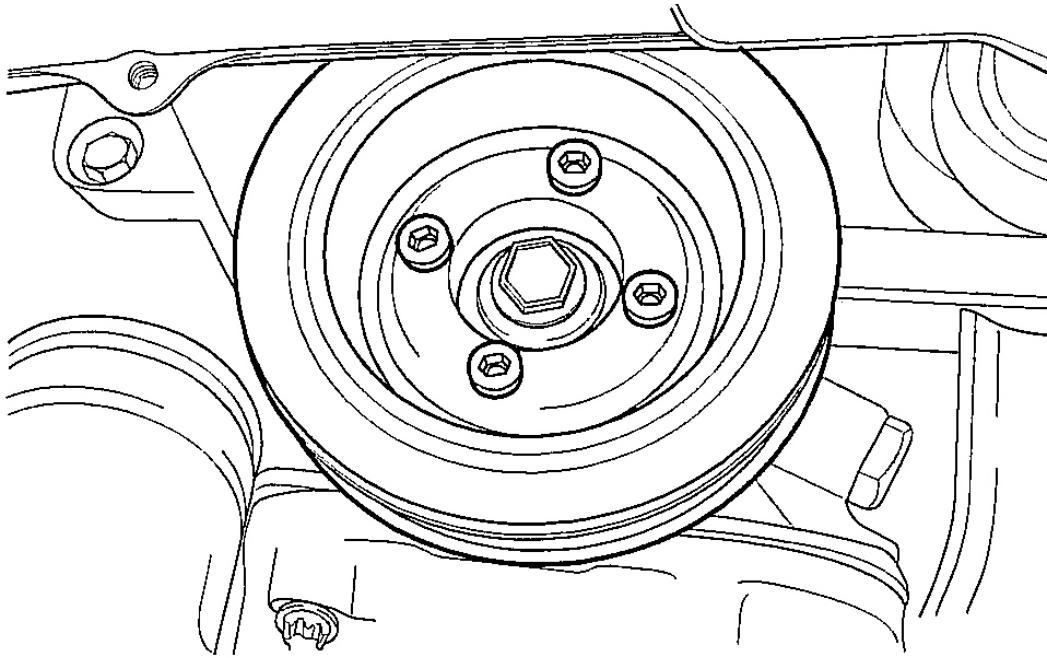
10. Install the right engine mount bracket.



G00767294

Fig. 84: Installing The Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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



G00767295

Fig. 85: Installing The Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

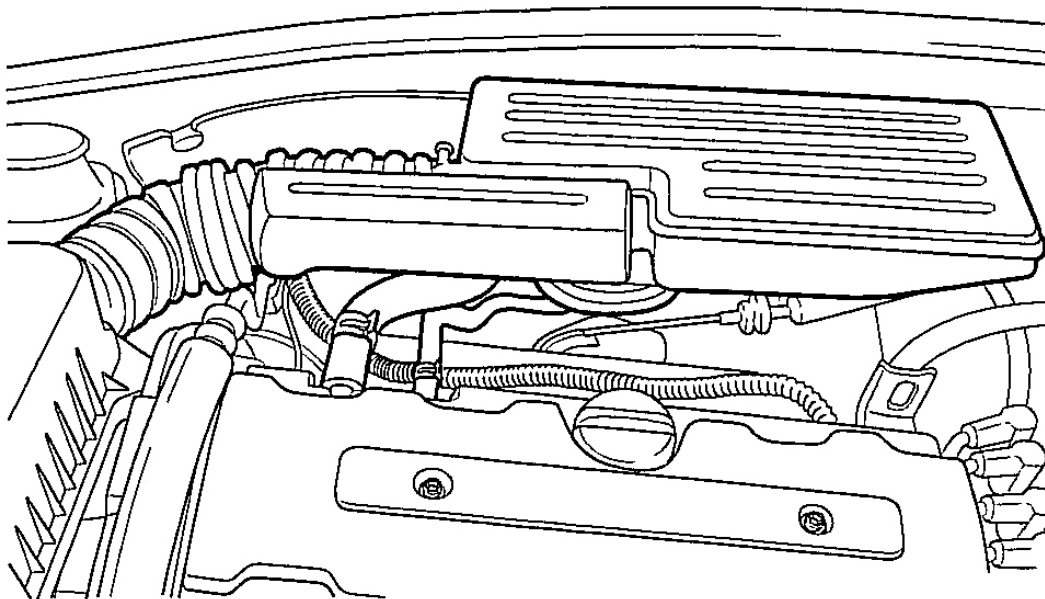
Tighten the crankshaft pulley bolts to 20 N.m (15 lb-ft).

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).

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



G00767296

Fig. 86: Installing The Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

19. Connect the breather tube to the camshaft cover.
20. Connect the MAT sensor connector.
21. Connect the negative battery cable.

Engine Mount Removal and Installation

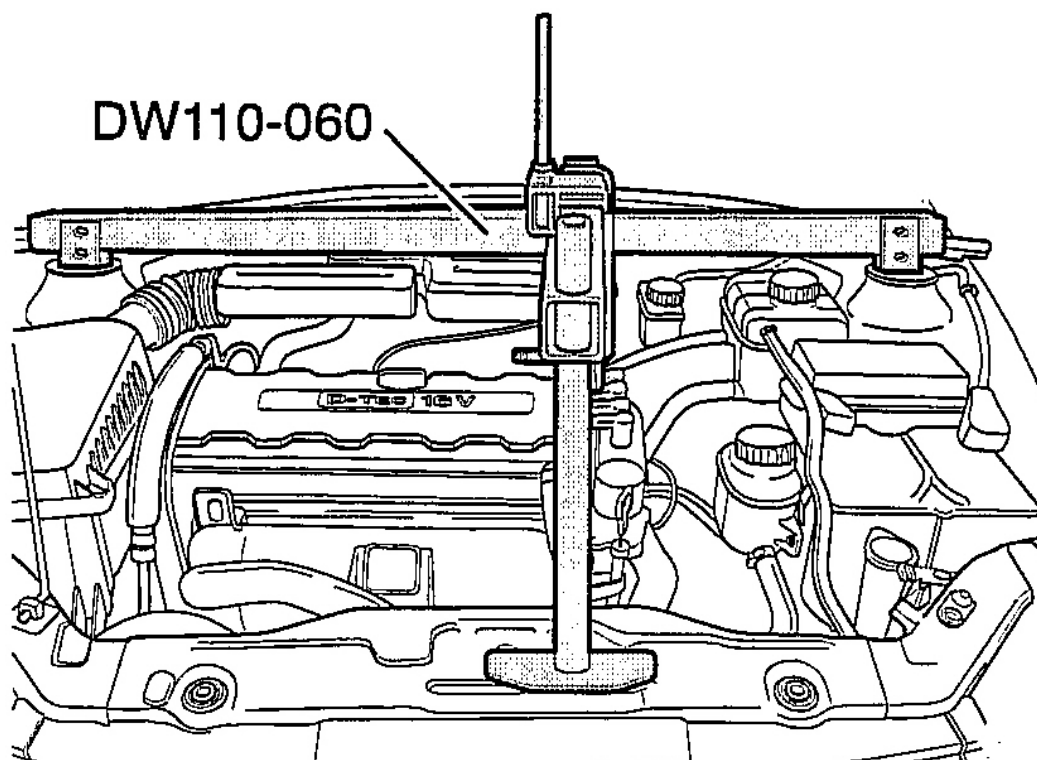
Tools Required

J-28467-B Engine Assembly Support Fixture

X-28467-560 Engine Assembly Support Channel

Removal

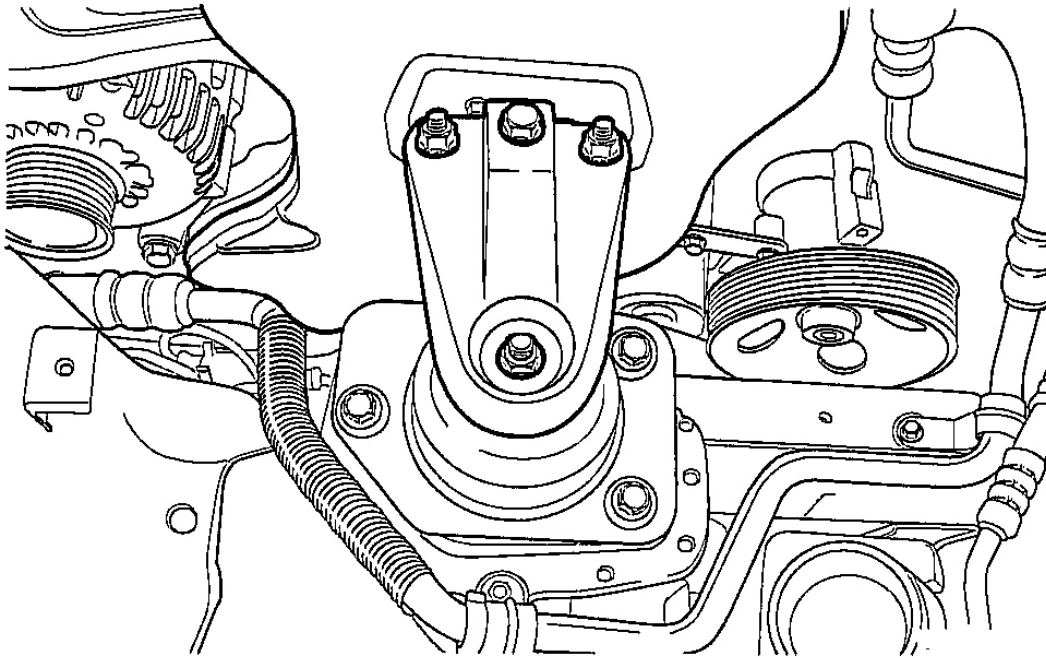
1. Disconnect the negative battery cable.
2. Support the engine assembly using the engine assembly support fixture J-28467-B, and the engine assembly support channel X-28467-560.



G00767297

Fig. 87: Supporting The Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

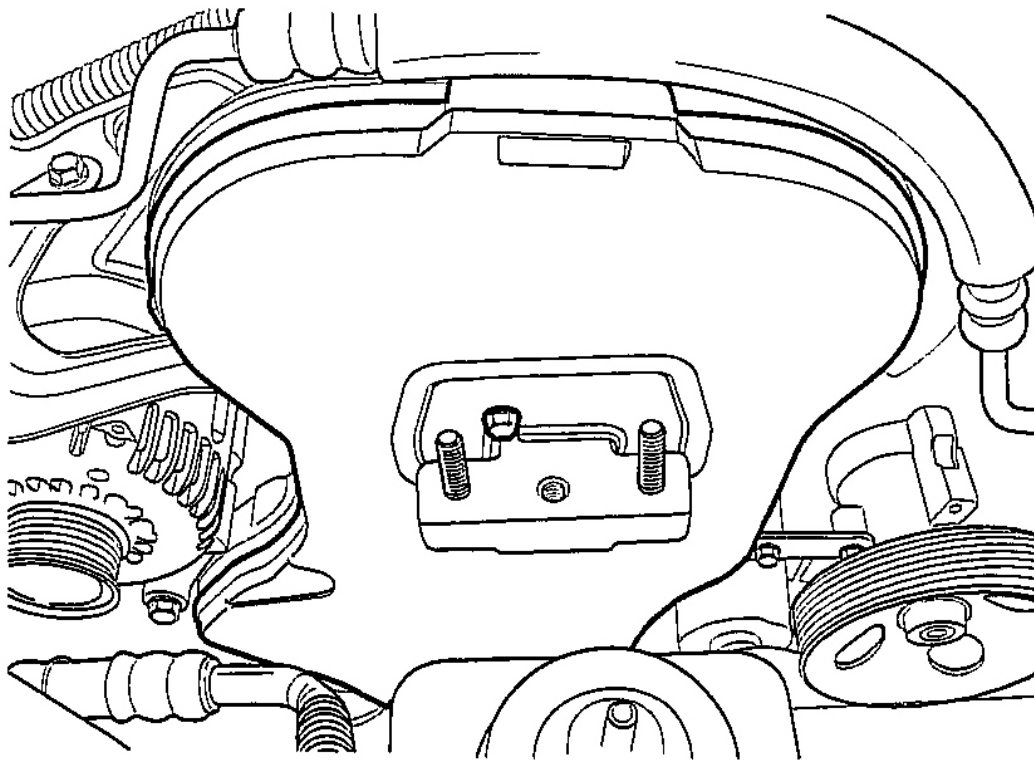
3. Disconnect the manifold air temperature (MAT) sensor connector.
4. Disconnect the air cleaner outlet hose from the throttle body.
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.
7. Remove the right front splash shield.
8. Remove the engine mount bracket retaining bolts.



G00767298

Fig. 88: Removing The Engine Mount Bracket Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the engine mount bracket.
10. Remove the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** .
11. Remove the front timing belt cover bolts.



G00767299

Fig. 89: Removing The Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

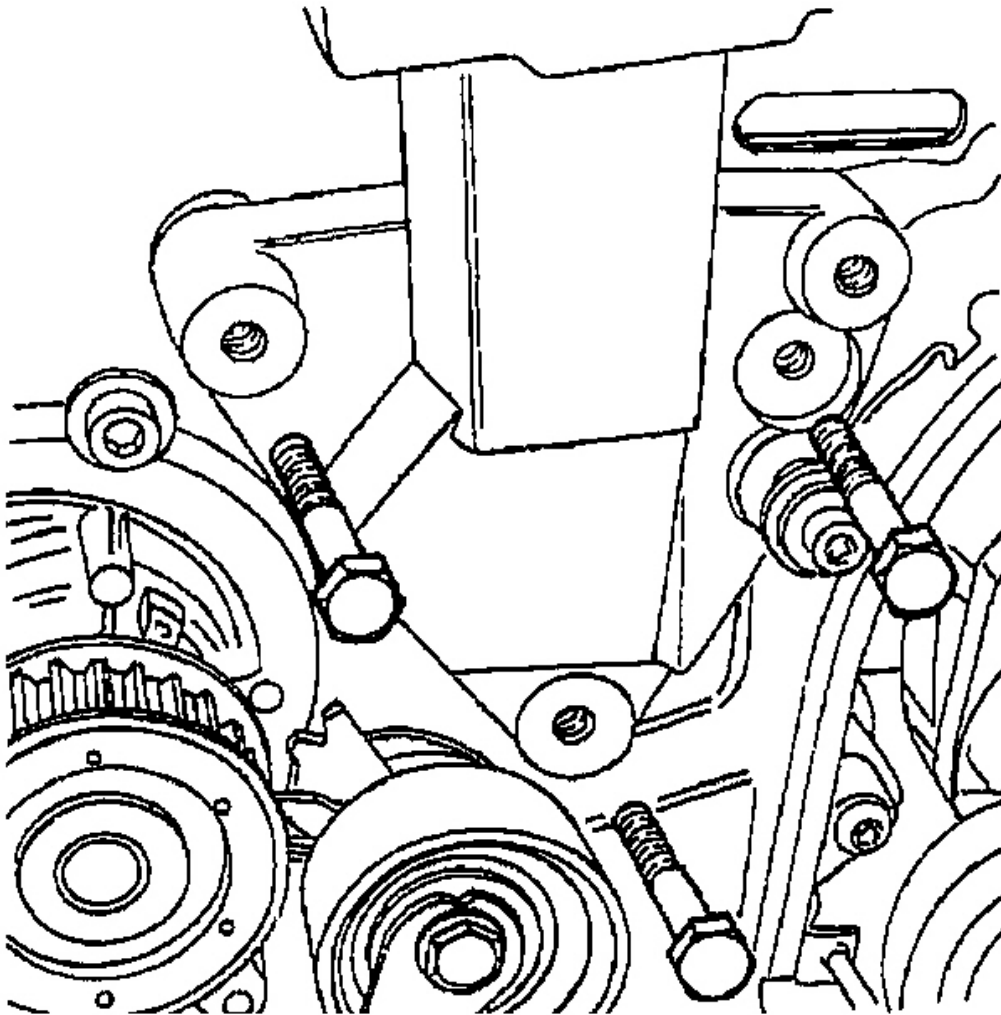
12. Align the crankshaft pulley timing mark with the pointer, and the camshaft gears with the timing marks on the rear cover, by turning the crankshaft gear bolt.
13. Loosen the timing belt automatic tensioner bolt.
14. Turn the hex-key tab to relieve belt tension.
15. Remove the timing belt idler pulley bolt and nut.
16. Remove the timing belt idler pulley.
17. Remove the engine mount retaining bolts. See **Fig. 90**.
18. Remove the engine mount.

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).



G00767300

Fig. 90: Removing/Installing 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.

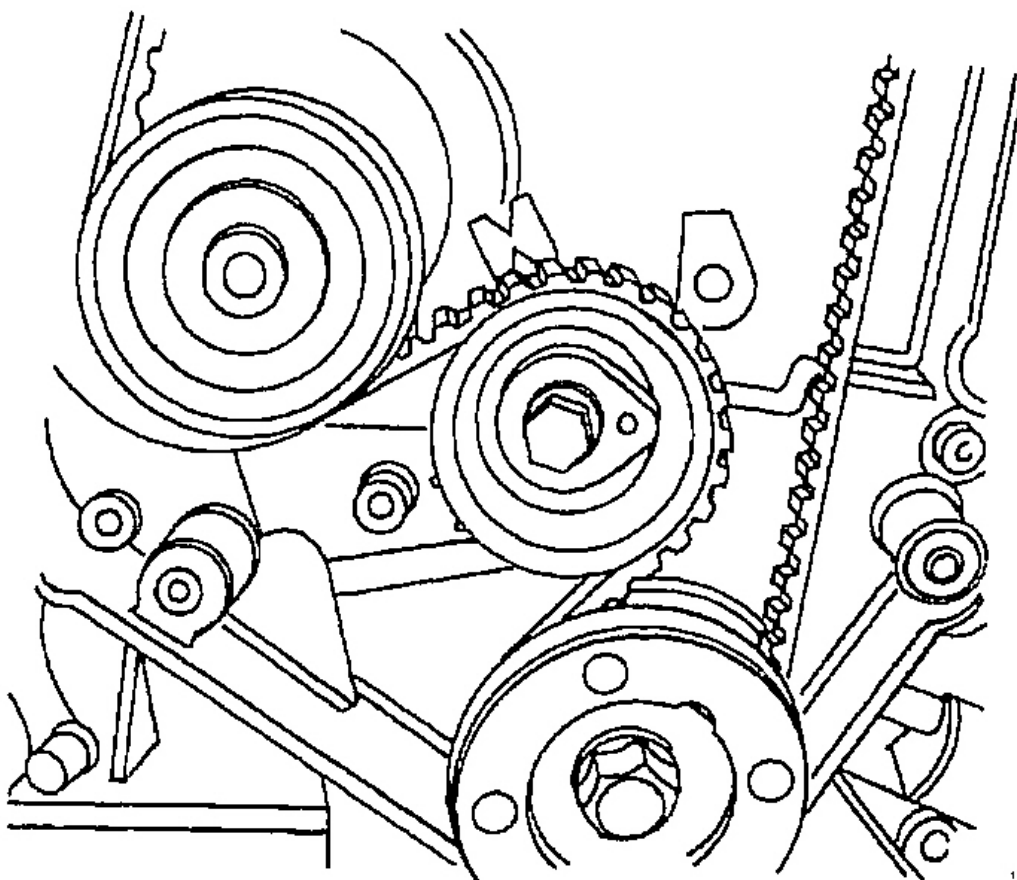
Tighten

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

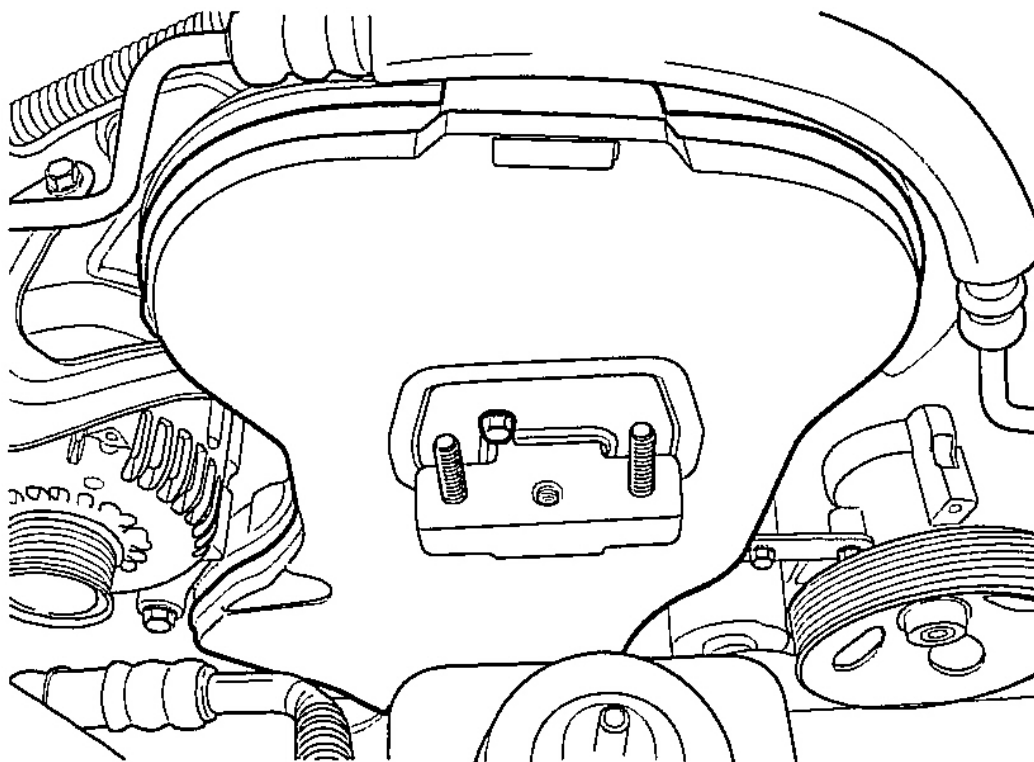
Tighten the timing belt automatic tensioner bolt to 25 N.m (18 lb-ft).



G00767301

Fig. 91: Aligning Timing Belt Automatic Tensioner Pointer
Courtesy of SUZUKI OF AMERICA CORP.

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



G00767302

Fig. 92: Installing The Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

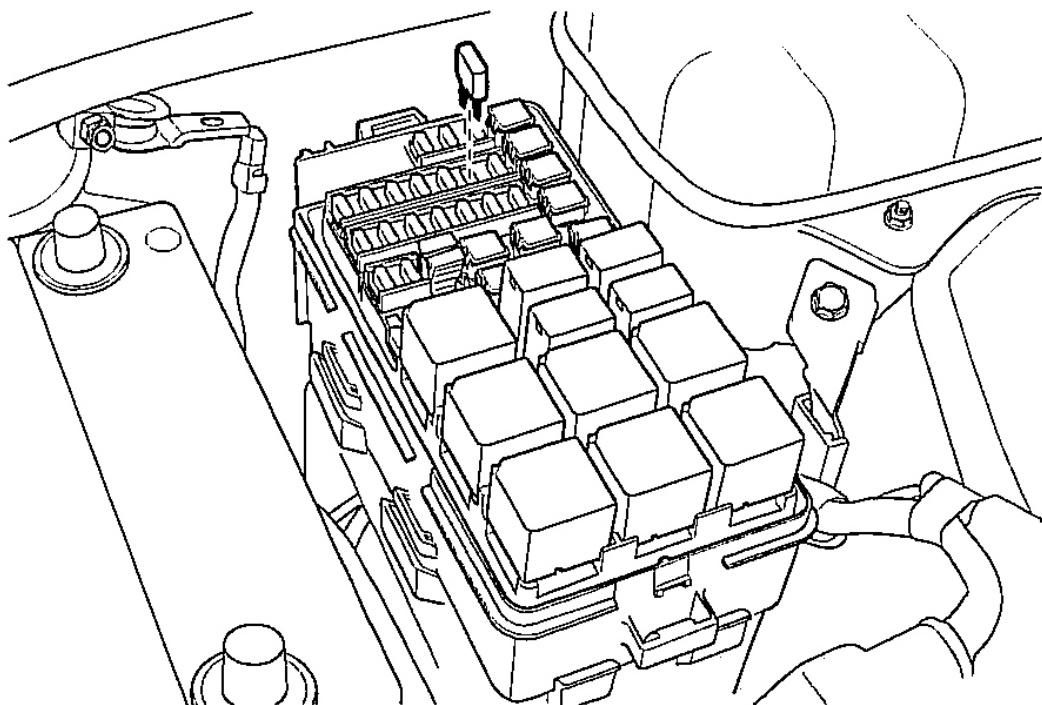
Tighten the engine mount bracket retaining bolts to 55 N.m (41 lb-ft).

9. Remove the engine assembly support fixture J-28467-B, and the channel X-28467-560.
10. Install the serpentine accessory drive belt. Refer to **SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION**.
11. Connect the negative battery cable.

Intake Manifold Removal and Installation

Removal

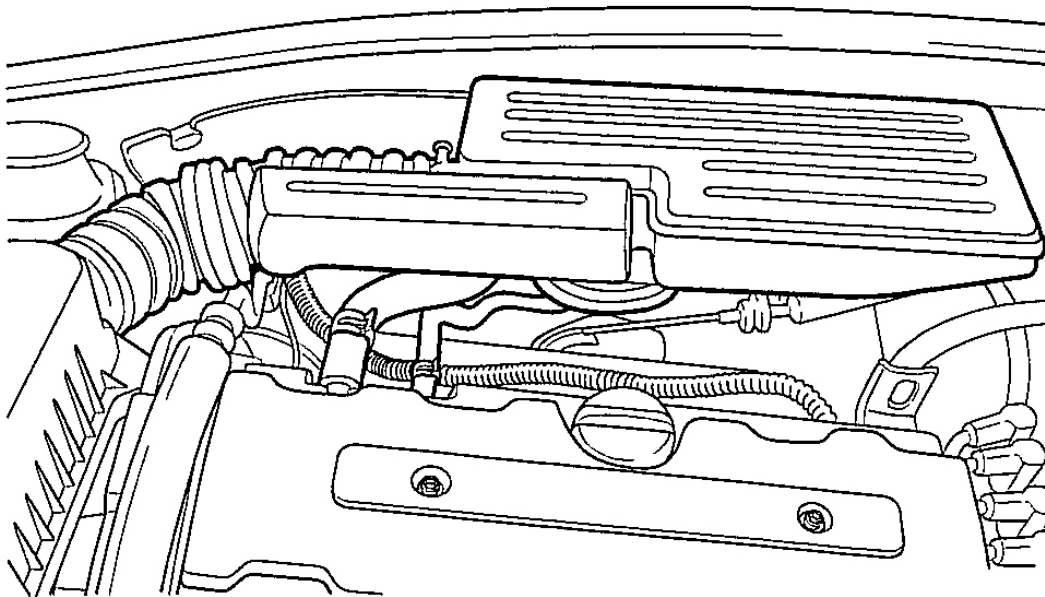
1. Remove the fuel pump fuse.



G00767303

Fig. 93: Removing The Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

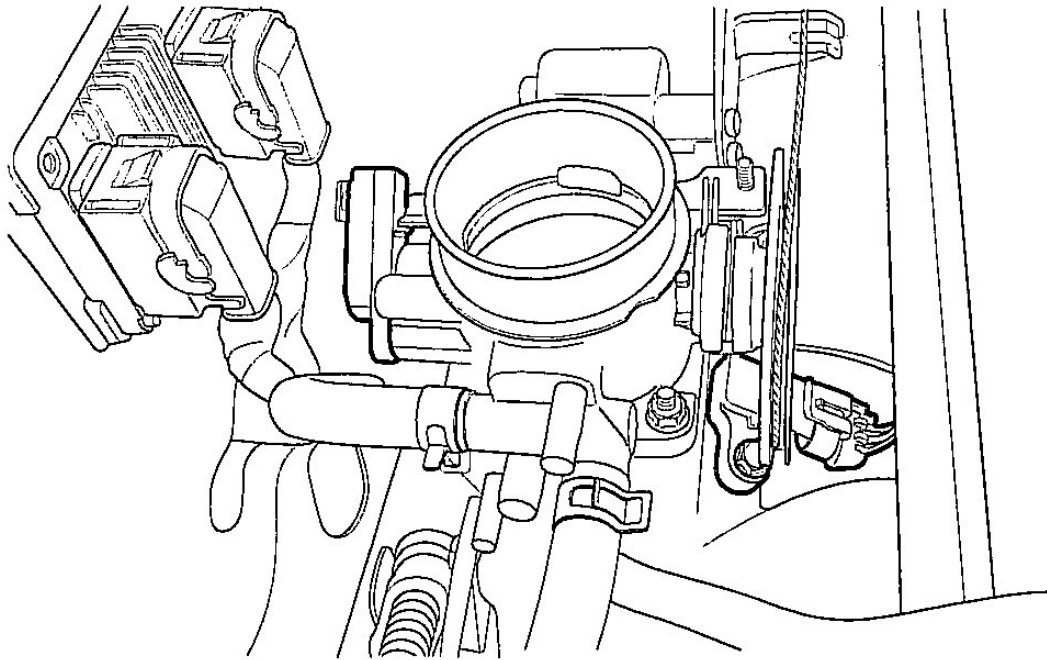
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the charcoal canister purge (CCP) and exhaust gas recirculation (EGR) solenoid from the intake manifold and loosen the bracket bolt.
5. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM**.
6. Disconnect the manifold air temperature sensor (MAT) connector.
7. Disconnect the air cleaner outlet hose from the throttle body.



G00767304

Fig. 94: Disconnecting The Air Cleaner Outlet Hose From The Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

8. Disconnect the idle air control (IAC) valve connector.
9. Disconnect the throttle position sensor (TPS) connector.
10. Disconnect the manifold absolute pressure (MAP) sensor connector.
11. Disconnect the coolant hoses at the throttle body.

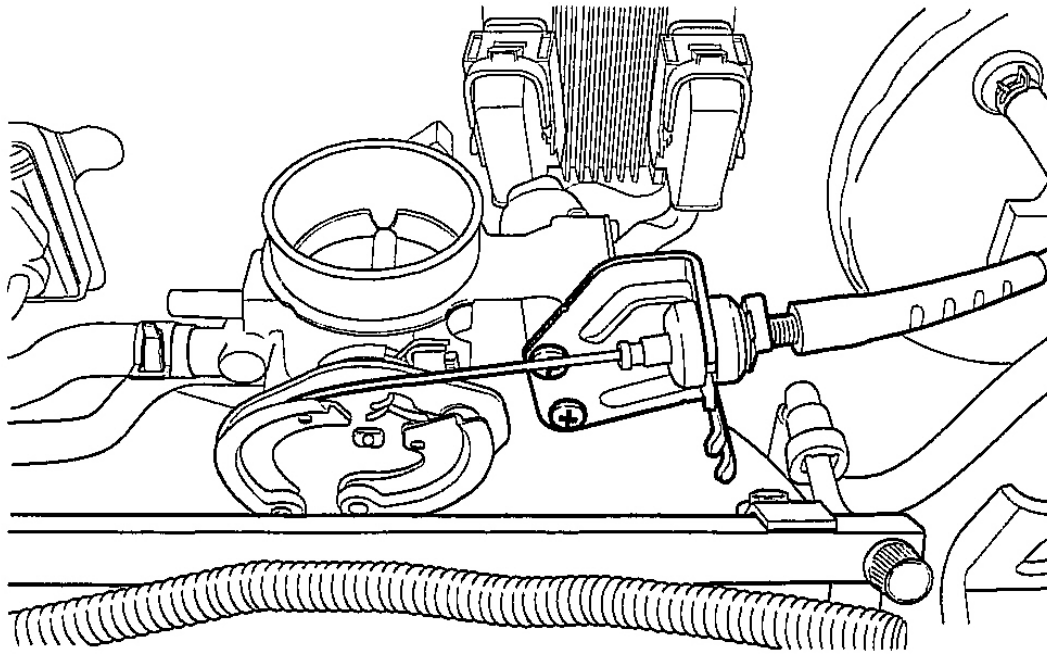


G00767305

Fig. 95: Disconnecting The Idle Air Control (IAC) Valve And Throttle Position Sensor (TPS) Connectors

Courtesy of SUZUKI OF AMERICA CORP.

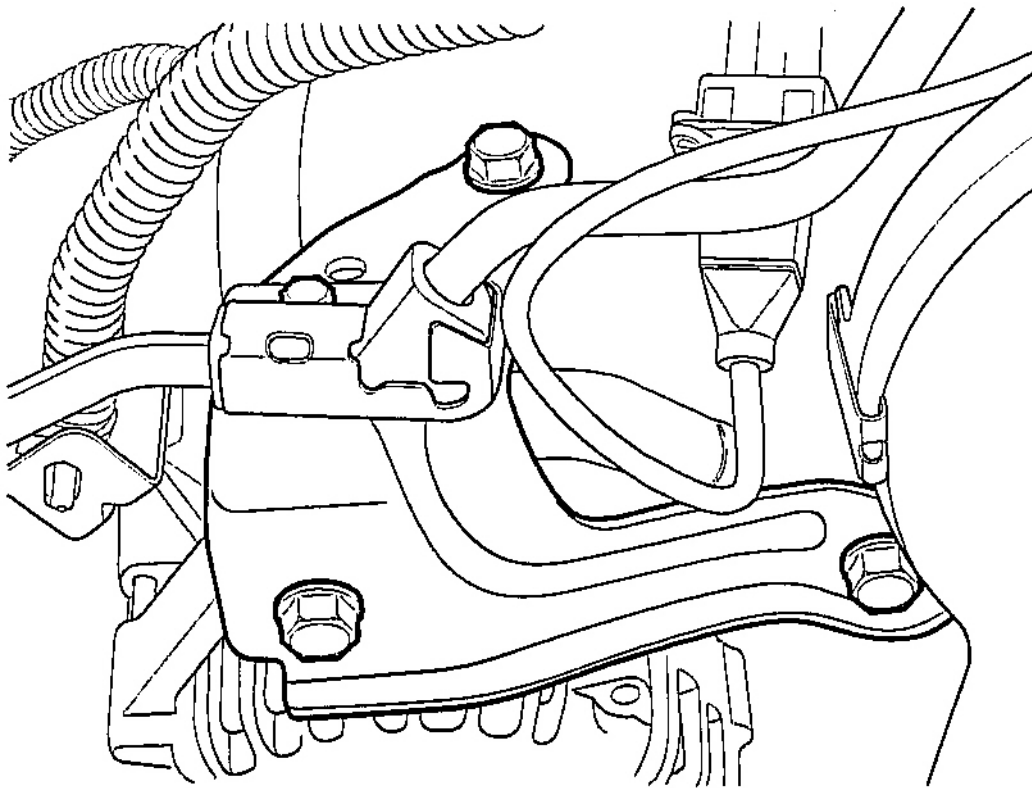
12. Disconnect all of the necessary vacuum hoses, including the vacuum hose at the fuel pressure regulator and the brake booster vacuum hose at the intake manifold.
13. Disconnect the throttle cable from the throttle body and the intake manifold.
14. Remove the throttle cable bracket bolts from the intake manifold.
15. Remove the throttle cable bracket.



G00767306

Fig. 96: Removing The Throttle Cable Bracket
Courtesy of SUZUKI OF AMERICA CORP.

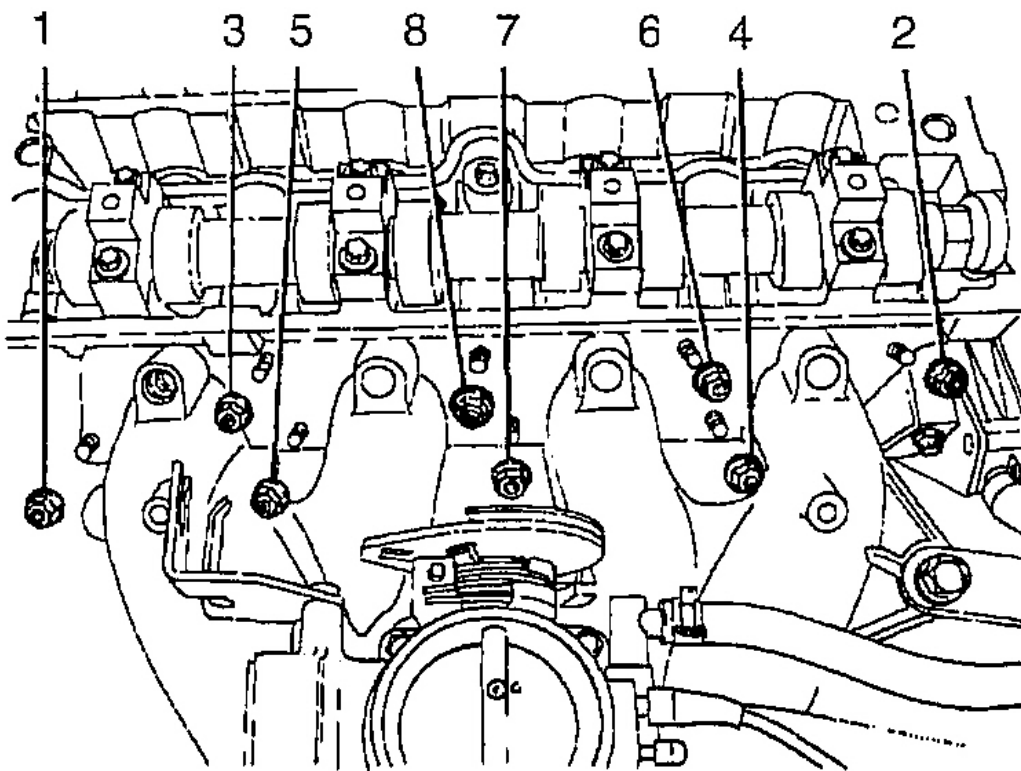
16. Remove the generator-to-intake manifold strap bracket bolts and strap.
17. Remove the fuel rail as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
18. Remove the generator-to-intake manifold support bracket bolts.
19. Remove the generator-to-intake manifold support bracket.



G00767307

Fig. 97: Removing The Generator-To-Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

20. Remove the intake manifold support bracket bolt at the engine block and the intake manifold.
21. Remove the intake manifold support bracket.
22. Remove the intake manifold retaining bolt and nuts in the sequence shown.



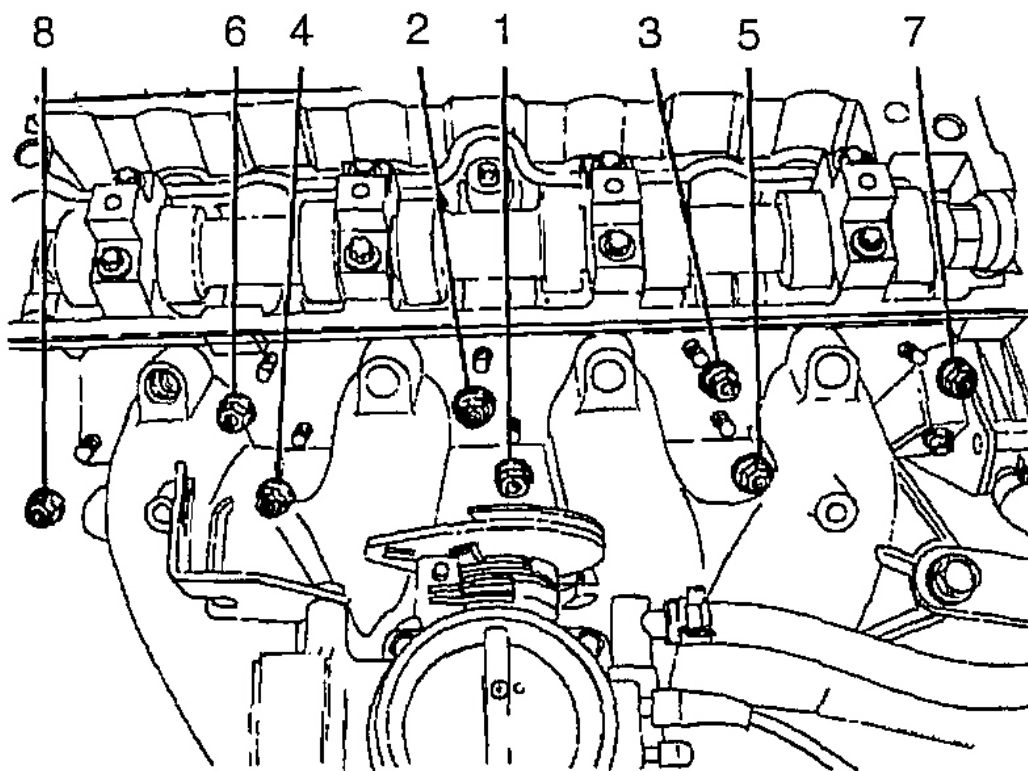
G00767308

Fig. 98: Removing The Intake Manifold Retaining Bolt And Nuts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

23. Remove the intake manifold.
24. Remove the intake manifold gasket.
25. Clean the sealing surfaces of the intake manifold and the cylinder head.

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.



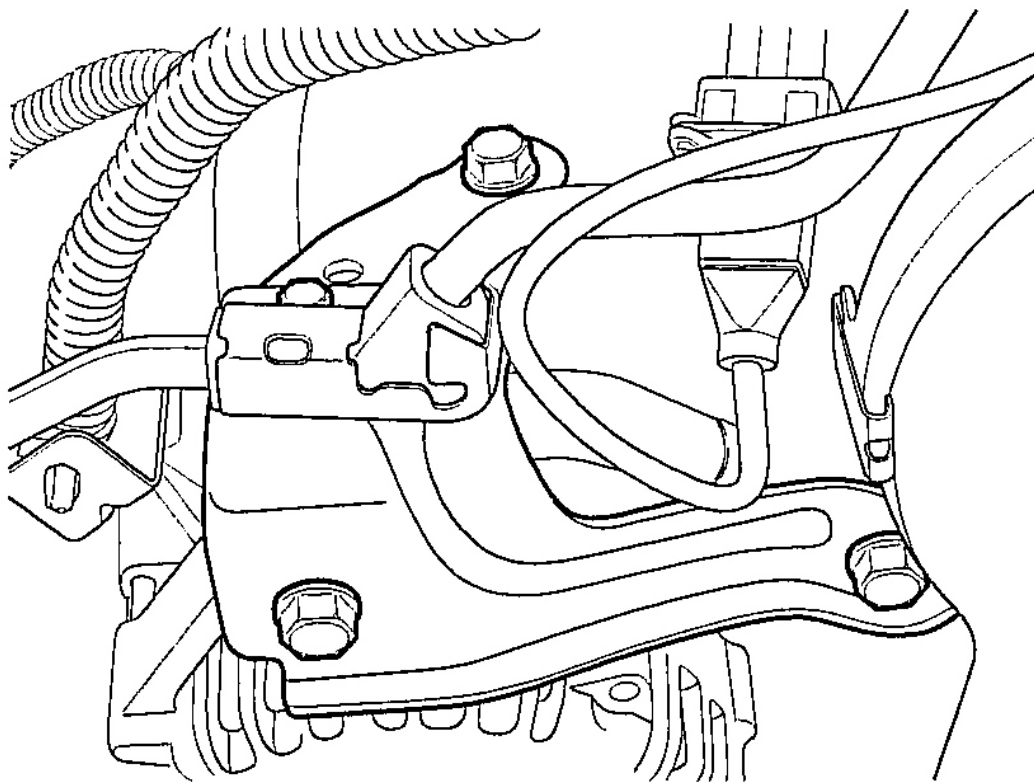
G00767377

Fig. 99: Installing The Intake Manifold Retaining Nuts And Bolt In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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.



G00767310

Fig. 100: Installing The Generator-To-Intake Manifold Strap Bracket
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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

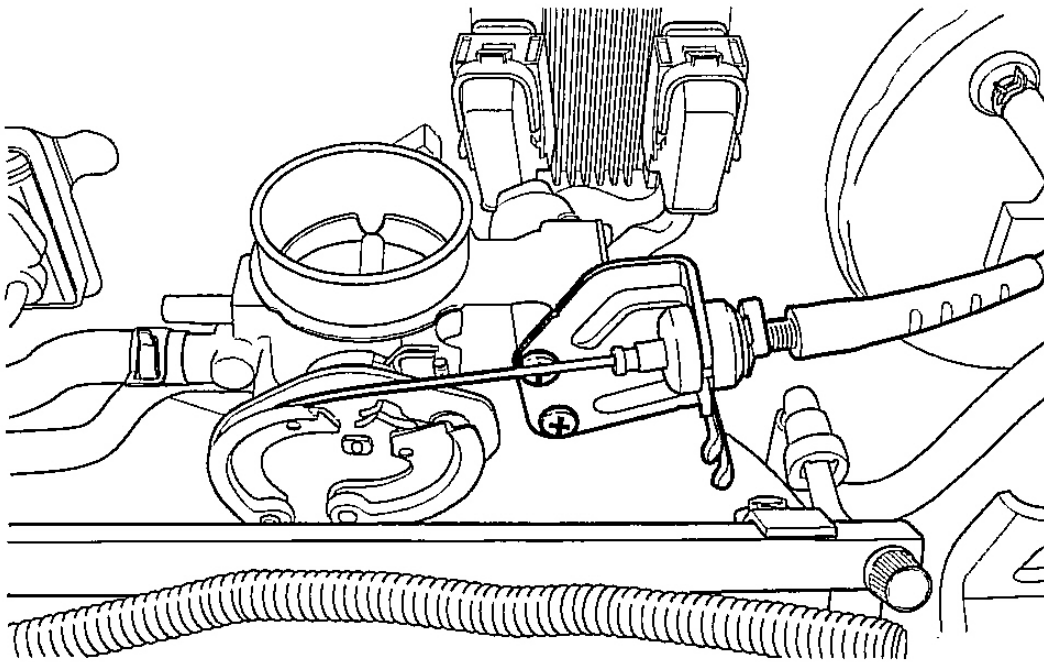
Tighten the intake manifold support bracket lower bolt to the engine block to 25 N.m (18 lb-ft).

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).

9. Install the fuel rail and injector cover as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
10. Install the throttle cable bracket.



G00767311

Fig. 101: Installing The Throttle Cable Bracket
Courtesy of SUZUKI OF AMERICA CORP.

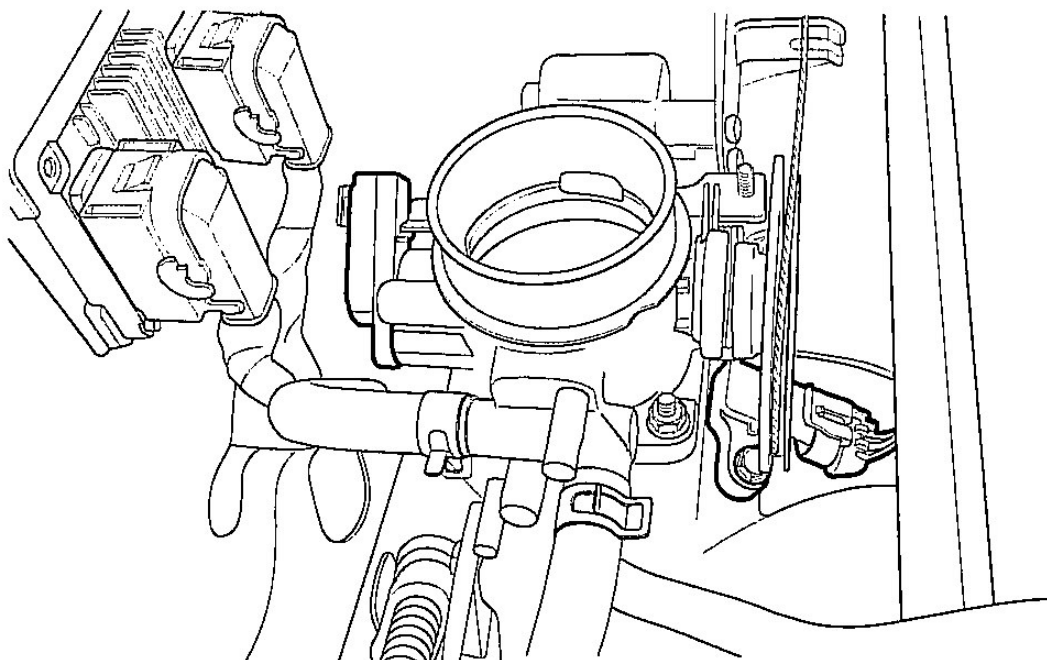
11. Install the throttle cable bracket bolts.

Tighten

Tighten the throttle cable bracket bolts to 8 N.m (71 lb-in).

12. Connect the throttle cable to the intake manifold and the throttle body.
13. Connect all of the necessary vacuum lines that were previously disconnected.
14. Connect the MAP sensor connector.

15. Connect the coolant hoses to the throttle body.
16. Connect the IAC valve connector.
17. Connect the TPS connector.



G00767312

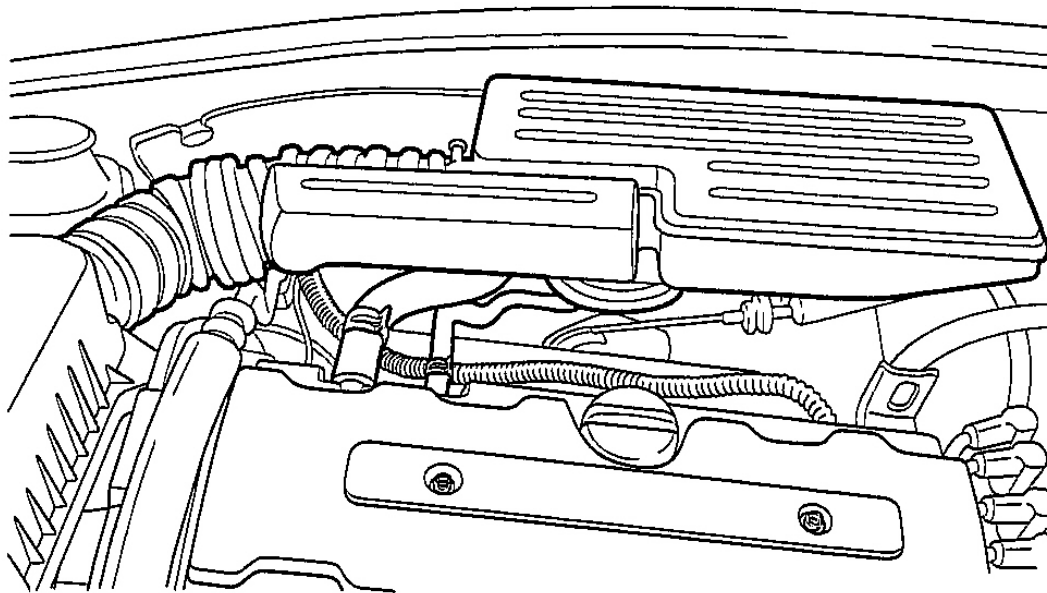
Fig. 102: Connecting The Idle Air Control (IAC) Valve And Throttle Position Sensor (TPS) Connectors
Courtesy of SUZUKI OF AMERICA CORP.

18. Connect the air cleaner outlet hose to the throttle body.
19. Connect the MAT sensor connector.
20. 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).

21. Install the fuel pump fuse.
22. Connect the negative battery cable.
23. Refill the engine cooling system. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .



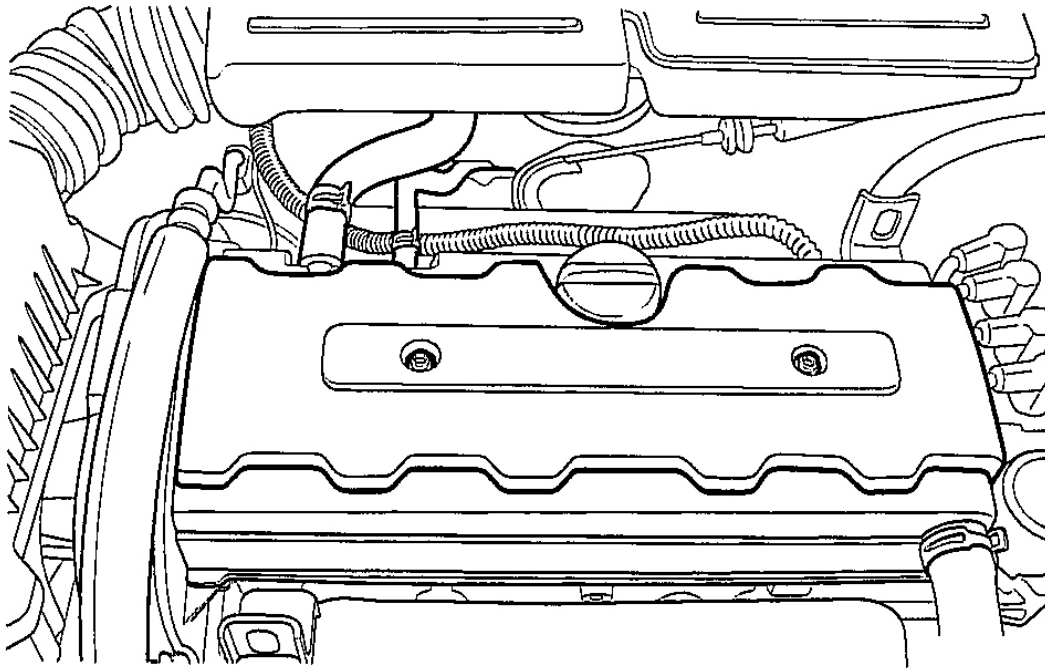
G00767313

Fig. 103: Connecting The Air Cleaner Outlet Hose From The Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

Camshaft Gears Removal and Installation

Removal

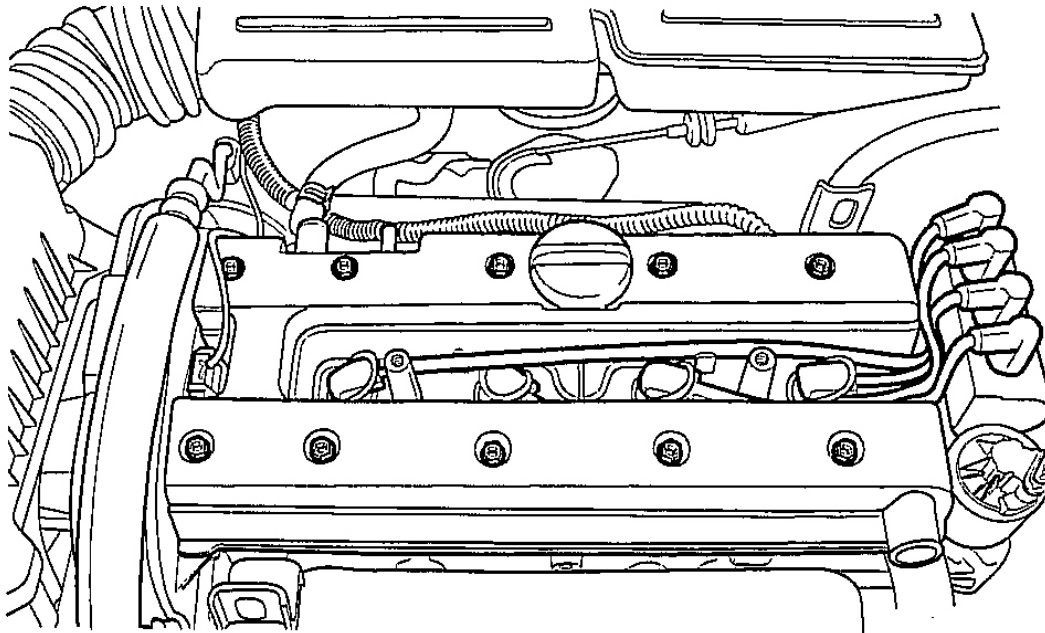
1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to **TIMING BELT REMOVAL AND INSTALLATION**.
3. Remove the spark plug cover bolts.
4. Remove the spark plug cover.



G00767315

Fig. 104: Removing The Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

5. Disconnect the ignition wires from the spark plugs.
6. Disconnect the breather tubes from the camshaft cover.
7. Remove the camshaft cover bolts.
8. Remove the camshaft cover washers.
9. Remove the camshaft cover and the camshaft cover gasket.

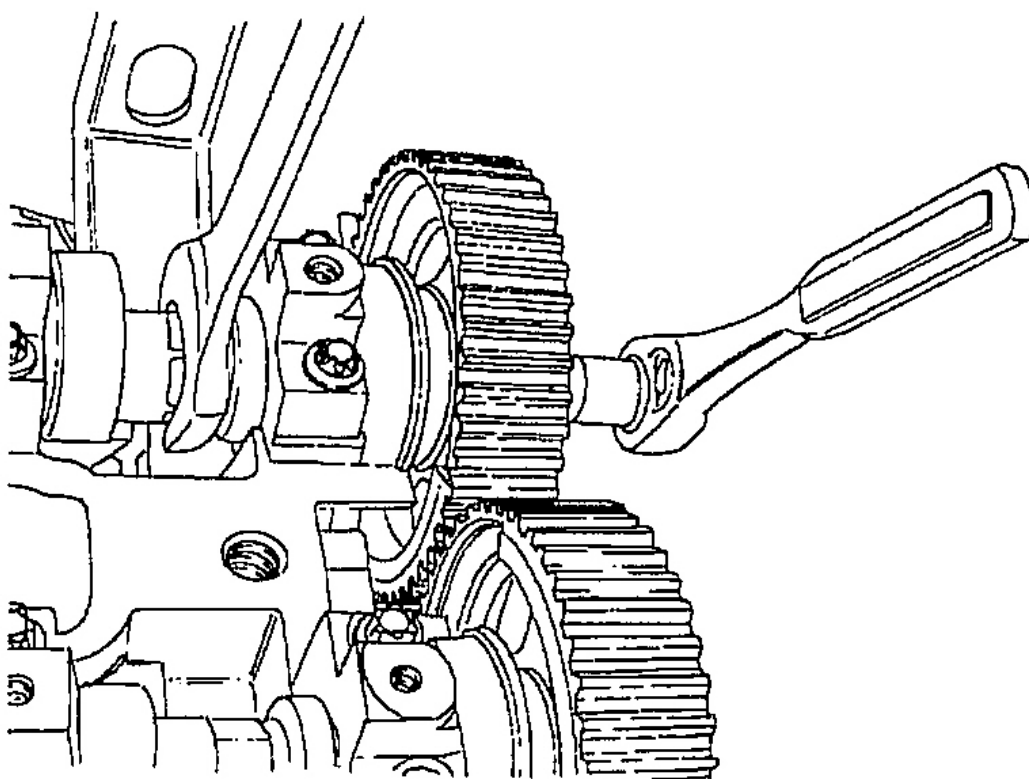


G00767314

Fig. 105: Removing The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

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



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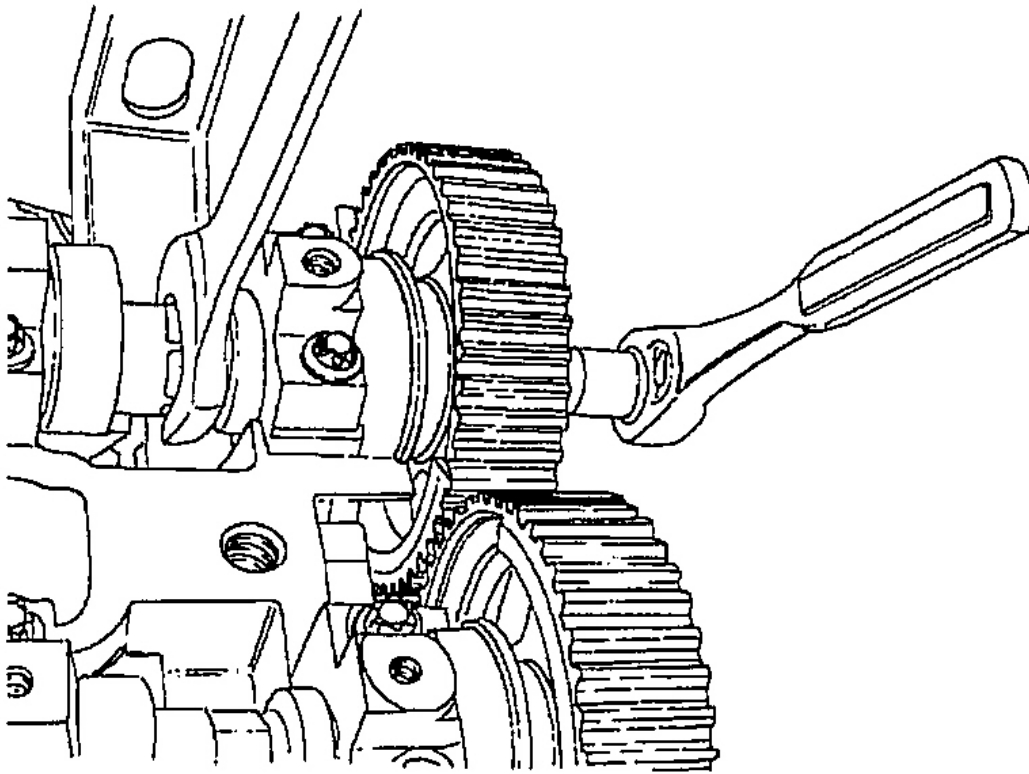
Fig. 106: Removing The Intake Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

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.

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.



G00767317

Fig. 107: Installing The Intake Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

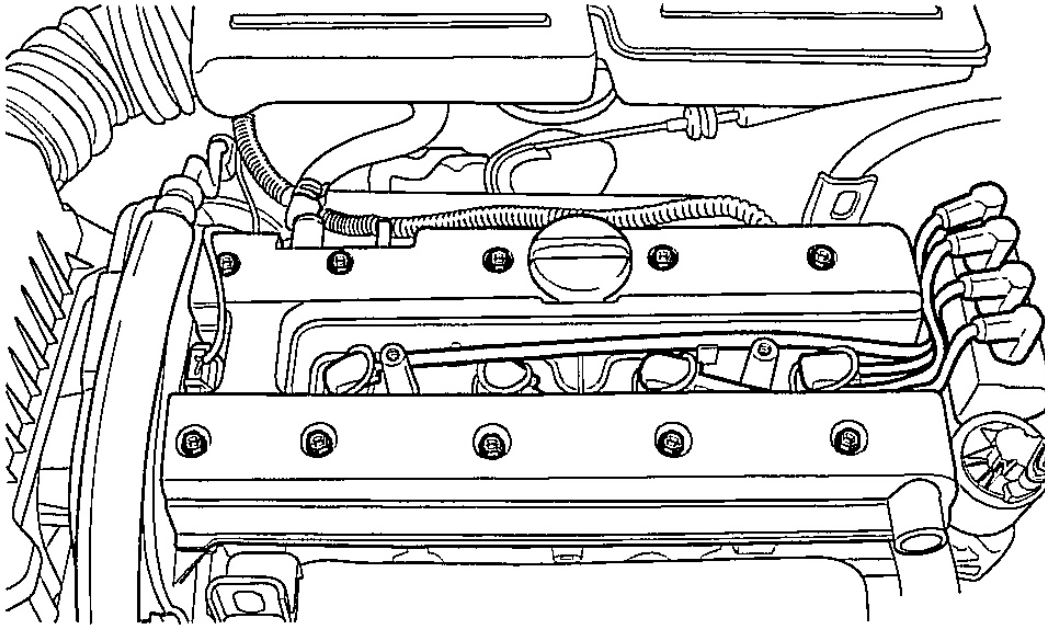
Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60 degrees and 15 degrees using the angular torque gauge KM-470-B.

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 degrees and 15 degrees 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.



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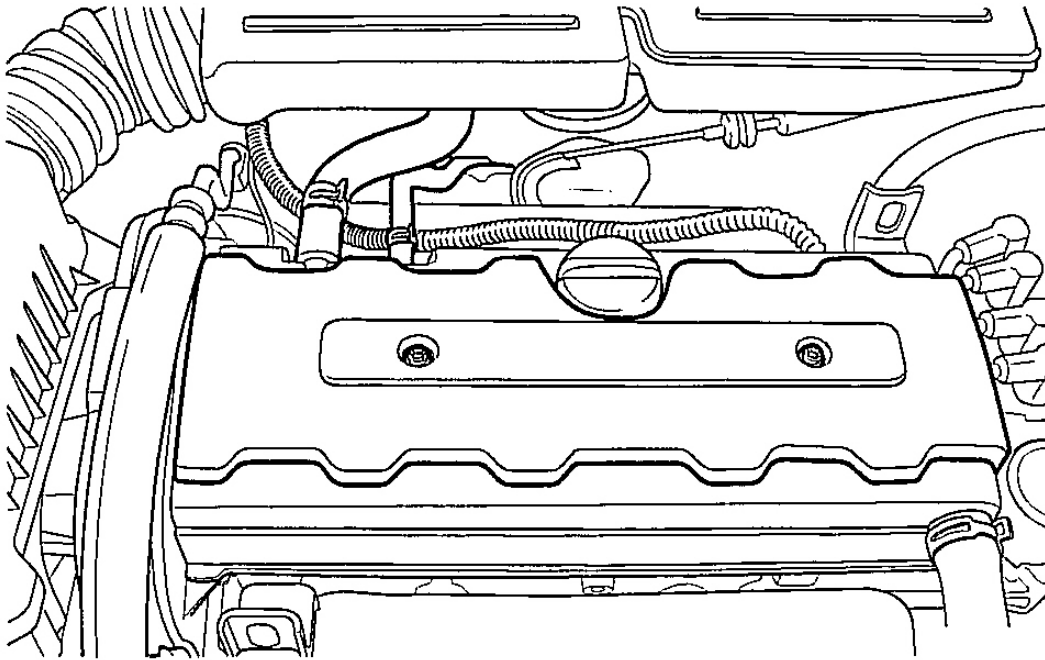
Fig. 108: Installing The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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).

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.



G00767319

Fig. 109: Installing The Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.

Rear Timing Belt Cover Removal and Installation

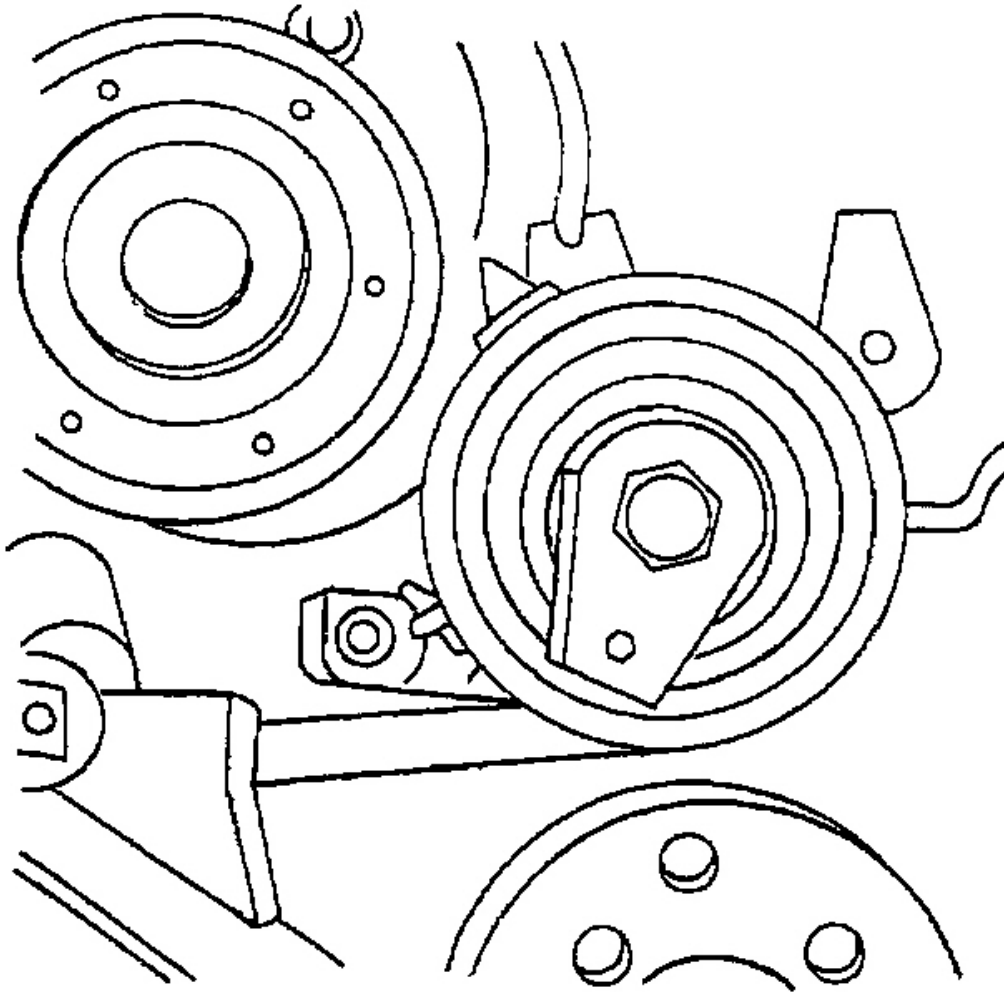
Tools Required

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**.

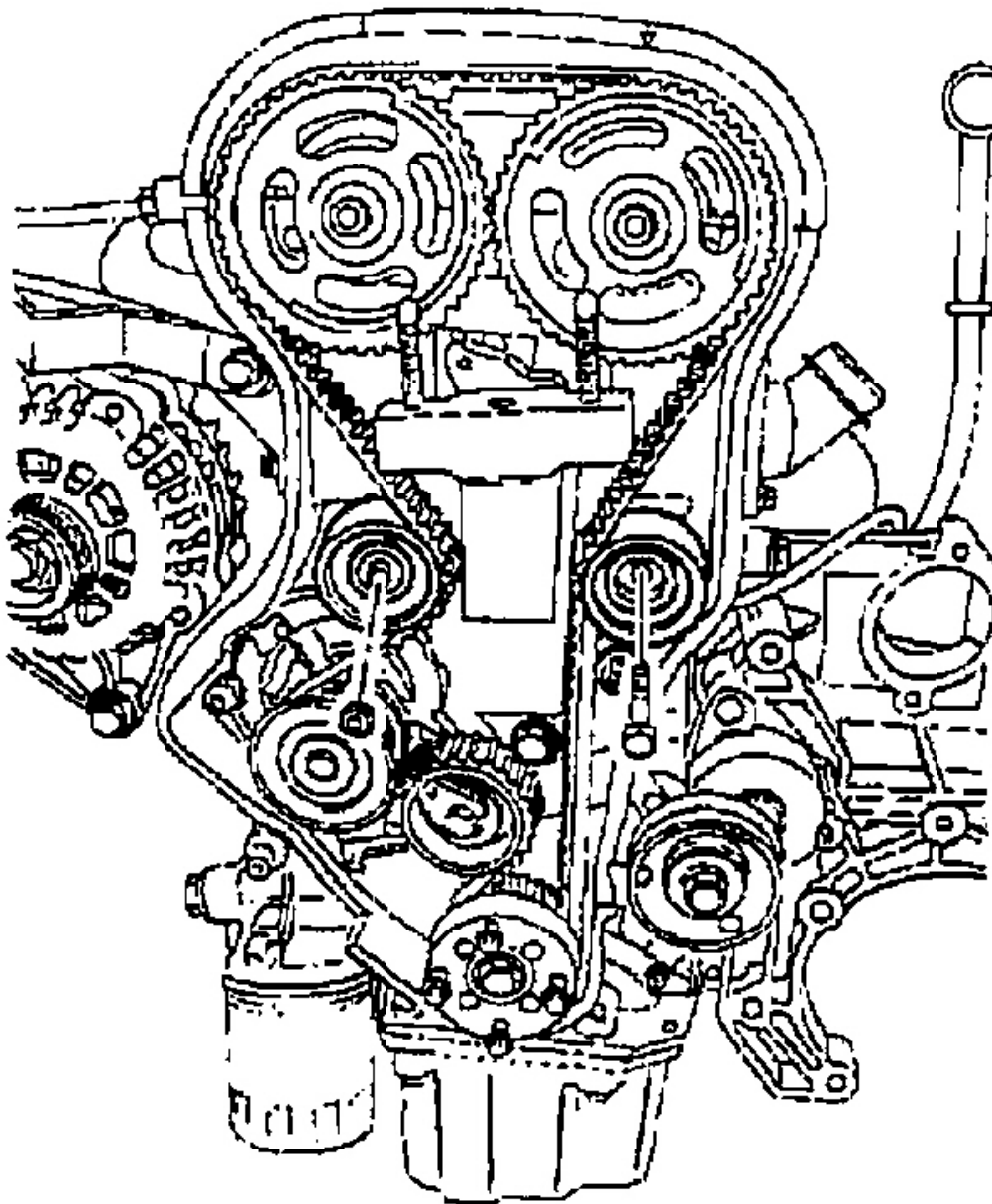
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.



G00767320

Fig. 110: Removing The 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.

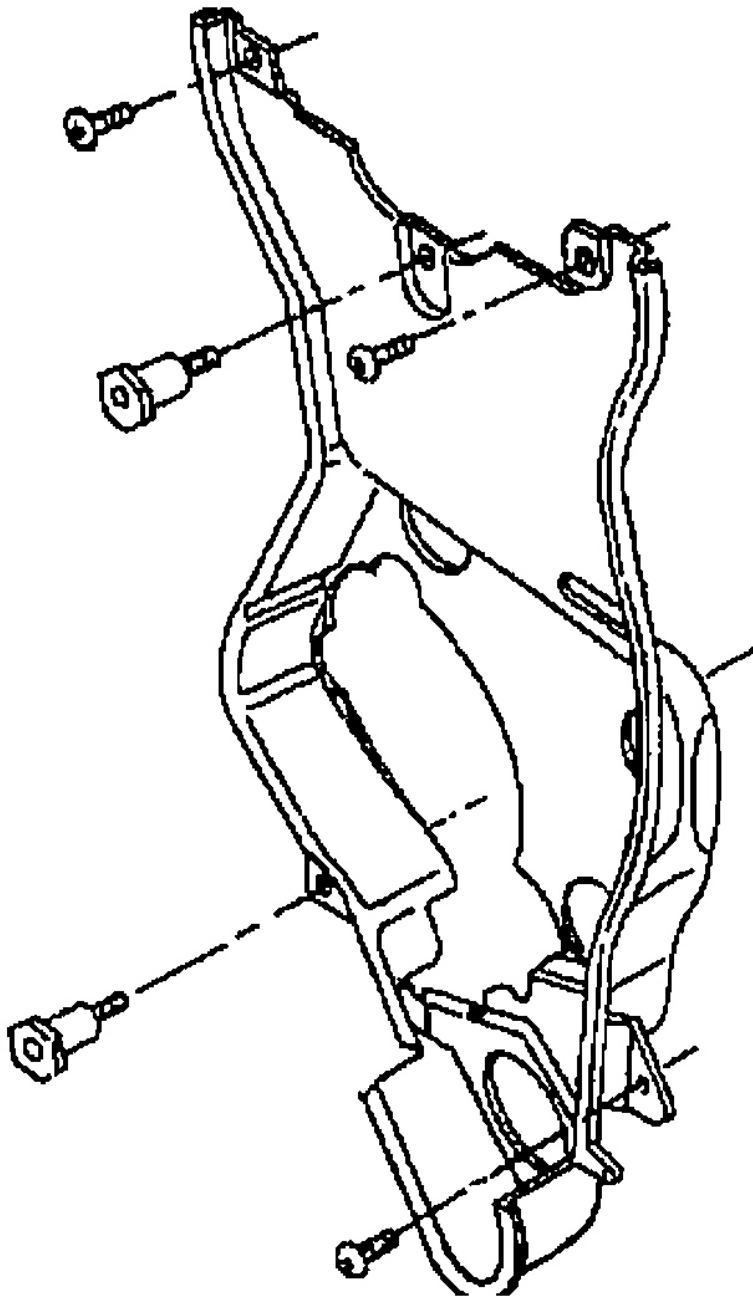


G00767321

Fig. 111: Removing The Timing Belt Idler Pulleys
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the engine mount retaining bolts.

9. Remove the engine mount.
10. Remove the crankshaft gear bolt.
11. Remove the crankshaft gear.
12. Remove the rear timing belt cover bolts.
13. Remove the rear timing belt cover.

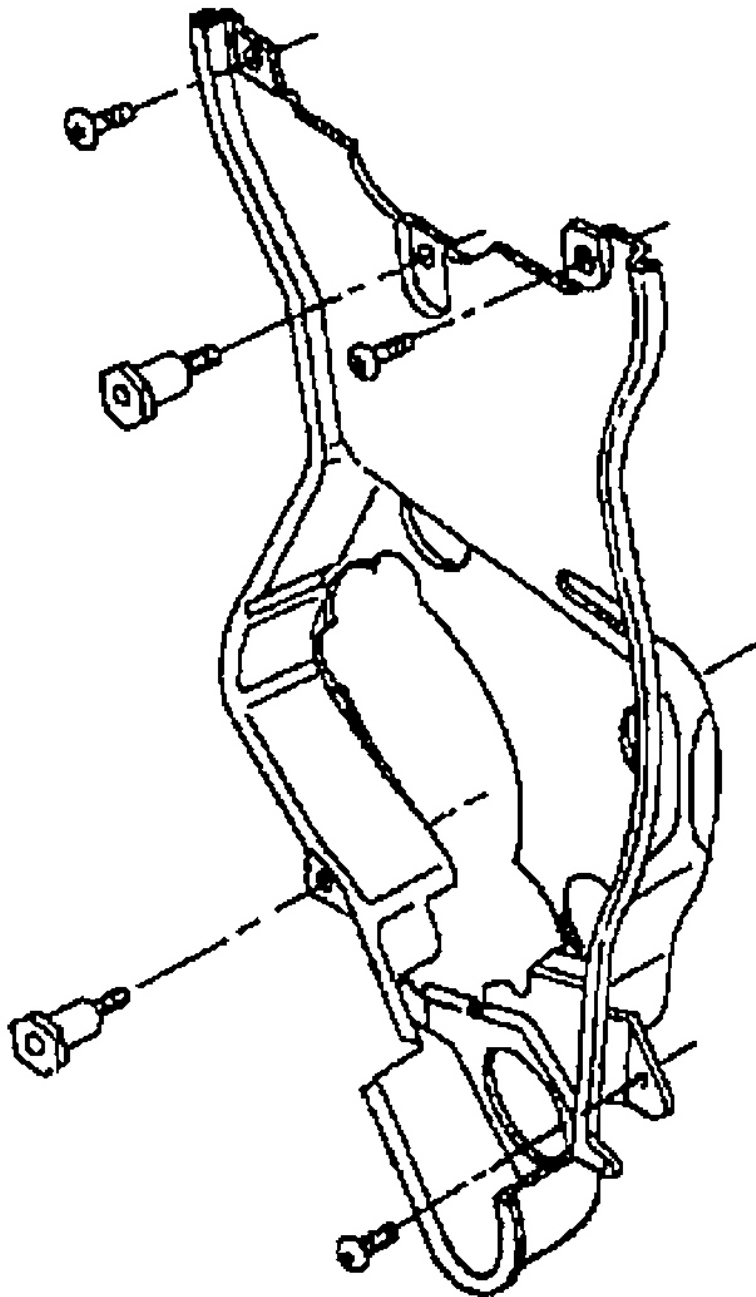


G00767322

Fig. 112: Removing The Rear Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Install the rear timing belt cover.



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Fig. 113: Installing The Rear Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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).

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 degrees and plus 15 degrees using the angular torque gauge KM-470-B.

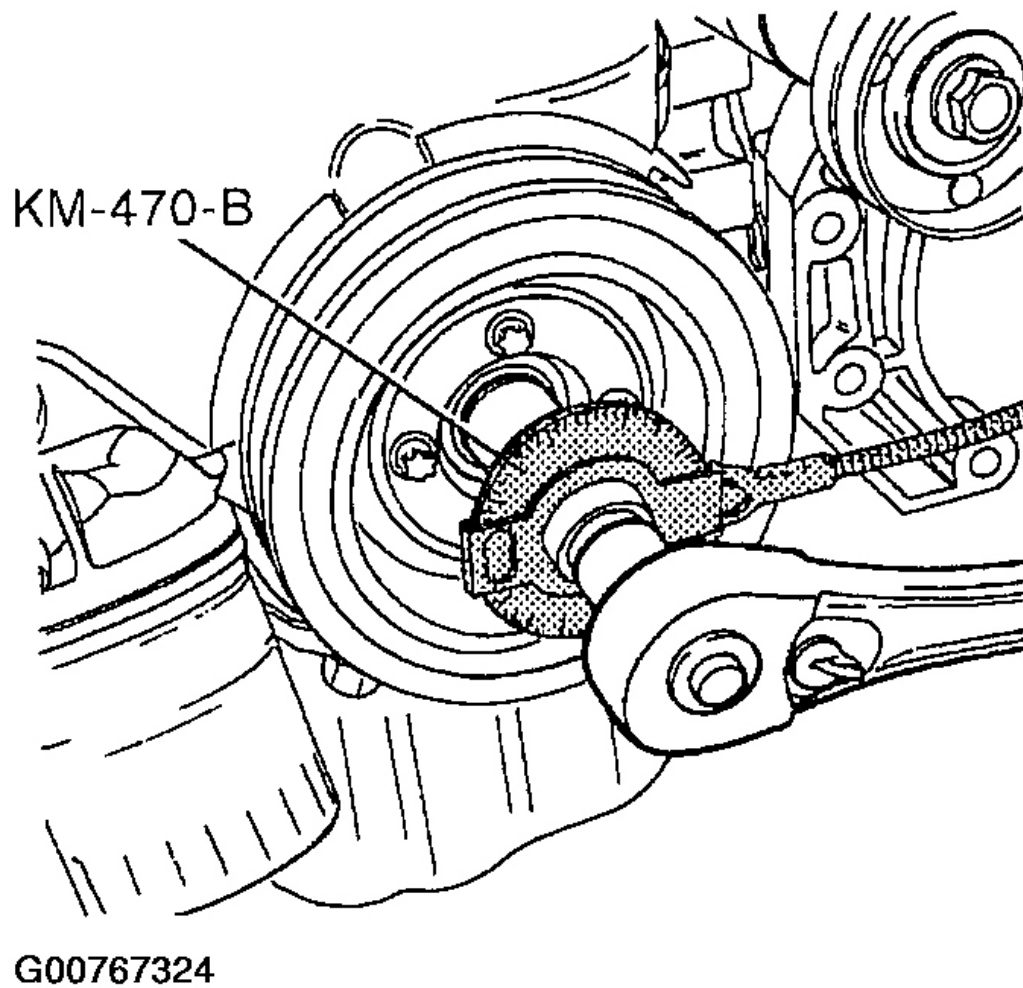
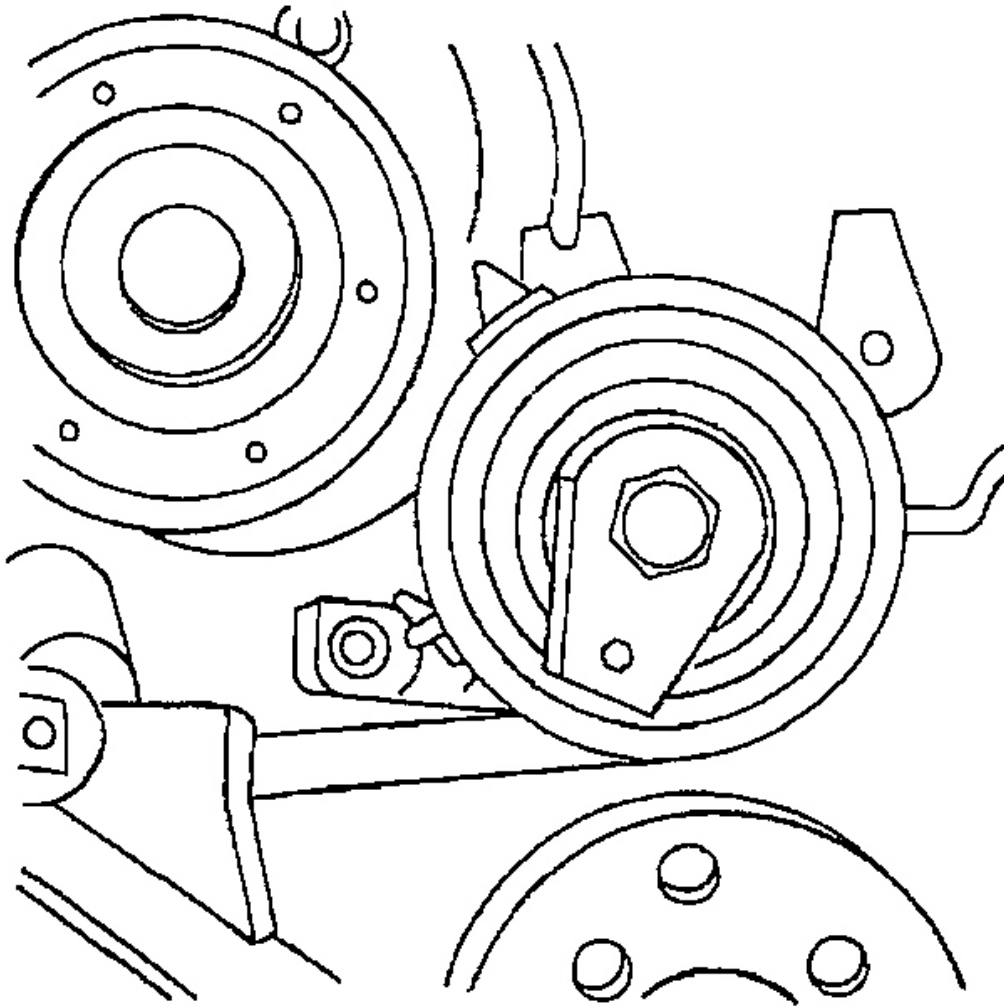


Fig. 114: Tightening The Crankshaft Gear Bolt Using The Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the timing belt automatic tensioner and bolt.



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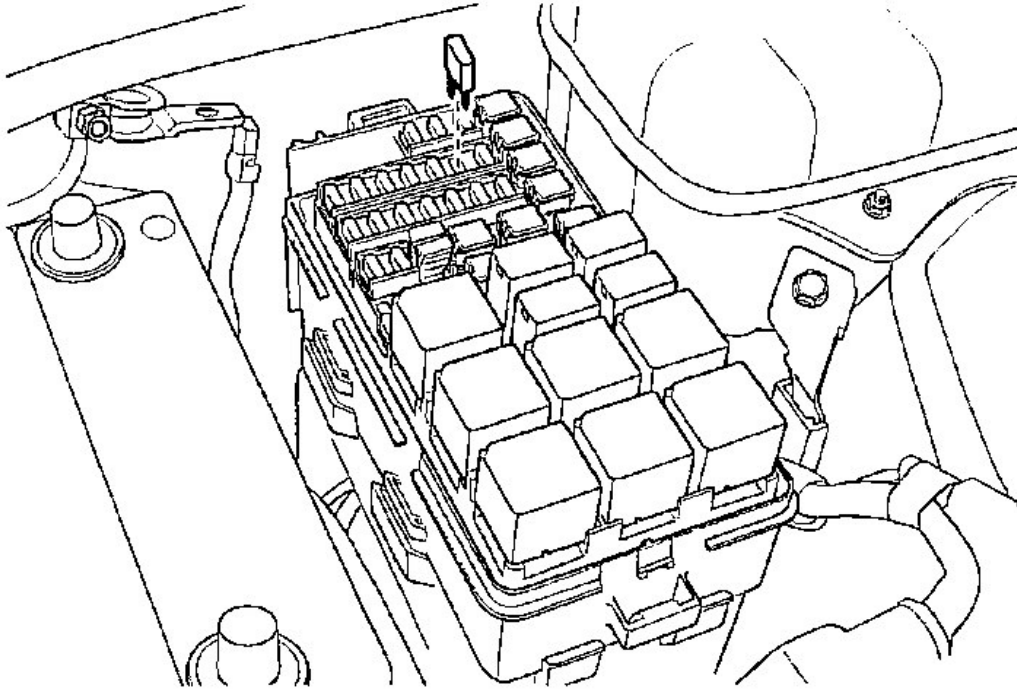
Fig. 115: Installing The Timing Belt Automatic Tensioner And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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.

Engine Removal and Installation

Removal

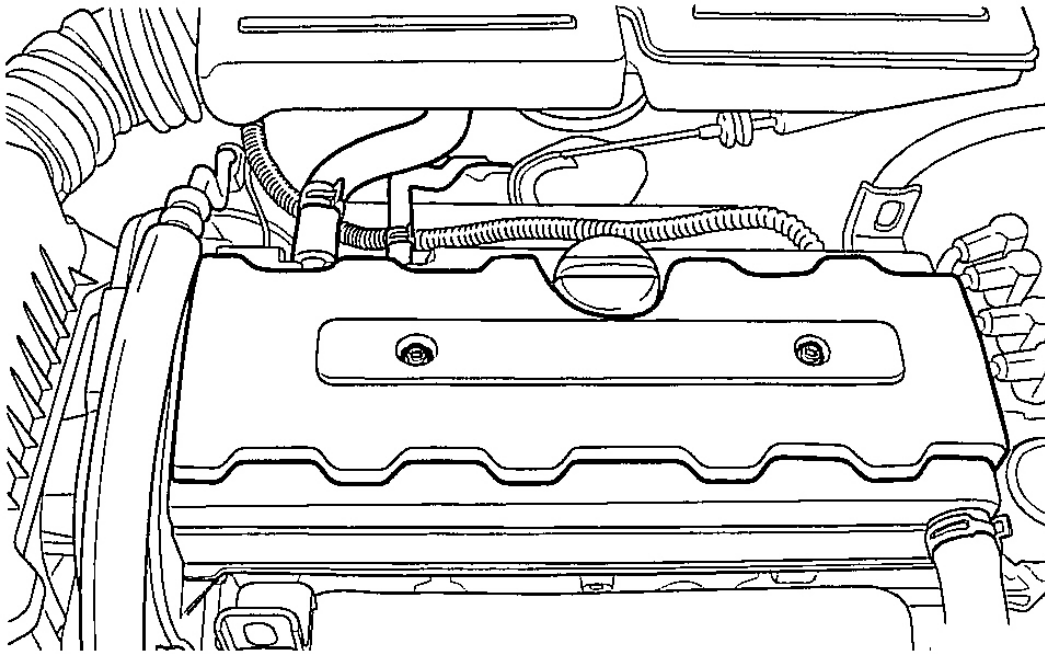
1. Remove the fuel pump fuse.



G00767326

Fig. 116: Removing The Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

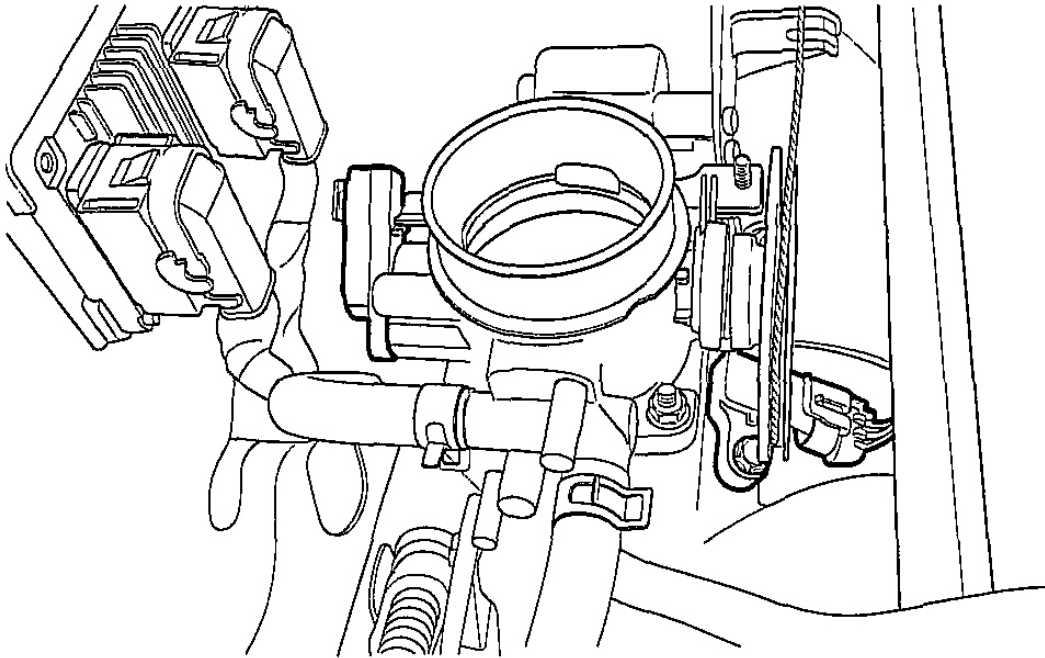
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Remove the hood.
4. Drain the engine oil.
5. Disconnect the negative battery cable.
6. Discharge the air conditioning (A/C) system, if equipped. Refer to **DISCHARGING, ADDING OIL, EVACUATING, 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.



G00767327

Fig. 117: Disconnecting The Breather Tubes From The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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** .
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 electronic control module (ECM) ground terminal and at the starter motor.
19. Disconnect the oxygen (O₂) sensor connector, if equipped.
20. Disconnect the idle air control (IAC) valve connector.
21. Disconnect the throttle position sensor (TPS) connector.

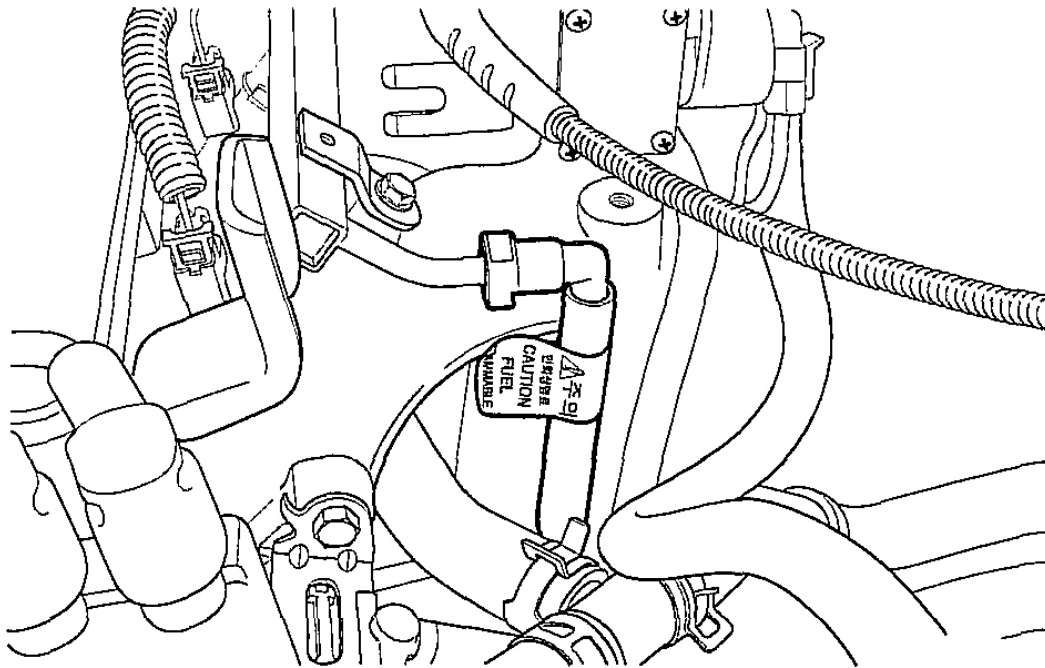


G00767329

Fig. 118: Disconnecting The Idle Air Control (IAC) Valve And Throttle Position Sensor (TPS) Connectors

Courtesy of SUZUKI OF AMERICA CORP.

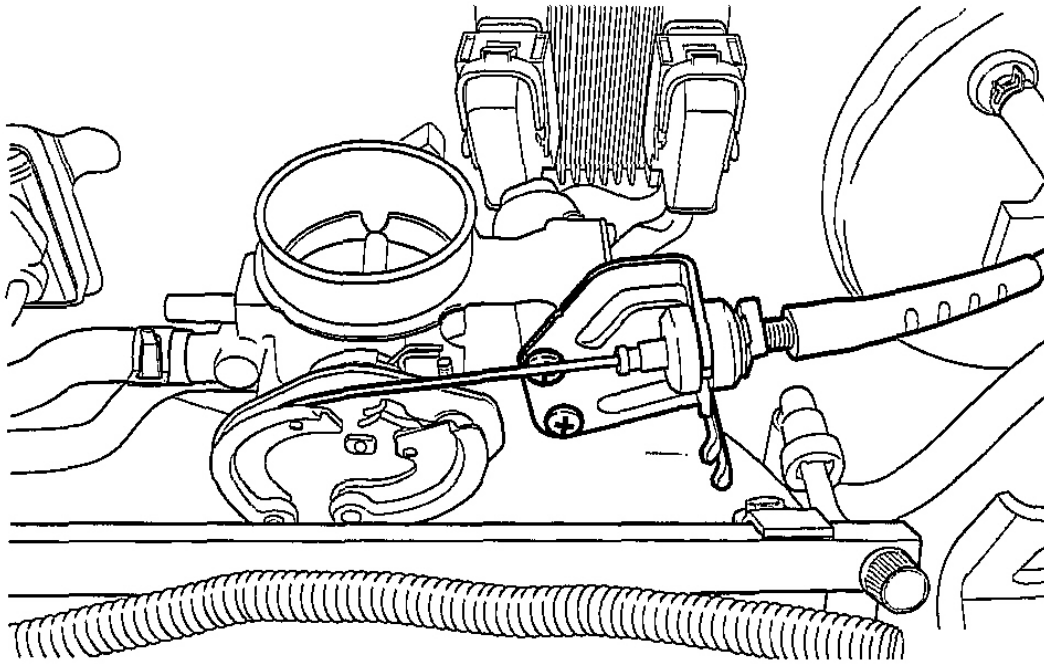
22. Disconnect the engine coolant temperature sensor (CTS) connector.
23. Disconnect the generator voltage regulator connector and power lead.
24. Disconnect all of the necessary vacuum lines, including the brake booster vacuum hose.
25. Disconnect the fuel return line at the fuel rail.
26. Disconnect the fuel feed line at the fuel rail.



G00767330

Fig. 119: Disconnecting The Fuel Feed Line
Courtesy of SUZUKI OF AMERICA CORP.

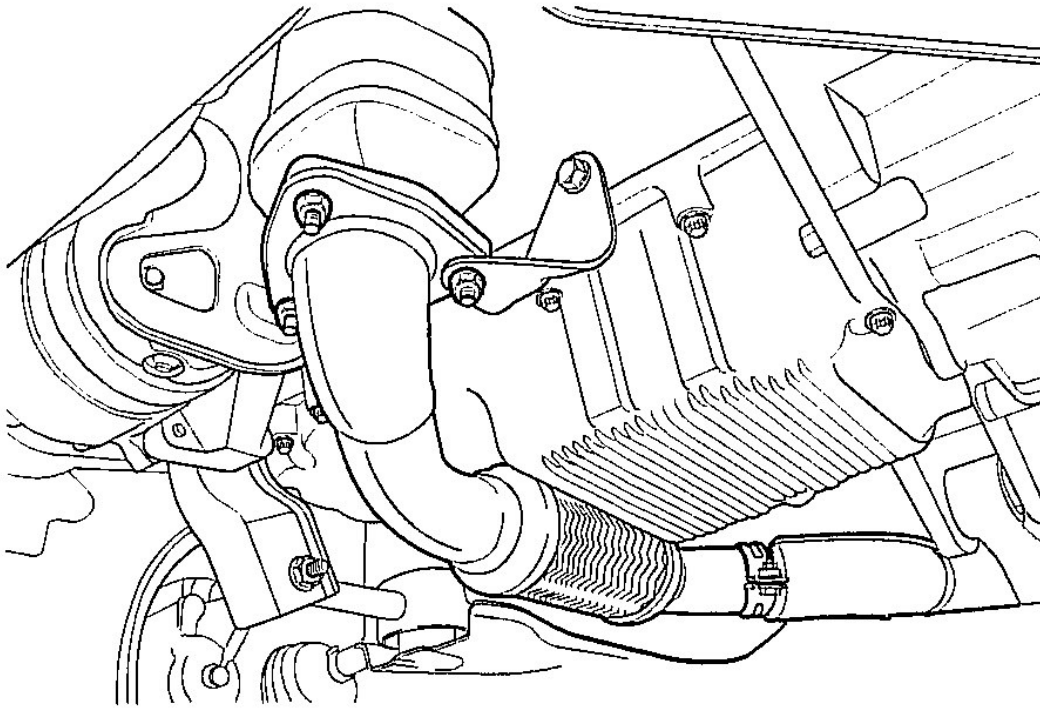
27. Remove the fuel rail and injector channel cover as an assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION** .
28. Disconnect the throttle cable from the throttle body and the intake manifold bracket.



G00767331

Fig. 120: Disconnecting The Throttle Cable From The Throttle Body
 Courtesy of SUZUKI OF AMERICA CORP.

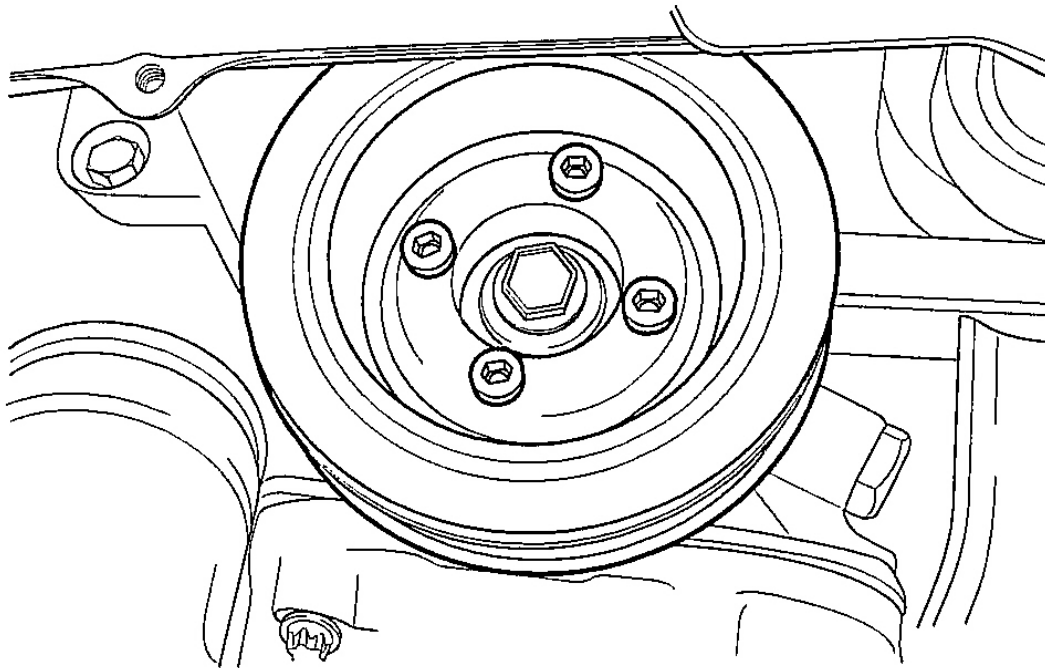
29. Disconnect the coolant hose at the throttle body.
30. Disconnect the heater outlet hose at the coolant pipe.
31. Disconnect the coolant bypass hose from the cylinder head.
32. Disconnect the surge tank coolant hose from the coolant pipe.
33. Disconnect the lower radiator hose from the coolant pipe.
34. Disconnect the starter solenoid "S" terminal wire and power lead.
35. Remove the A/C compressor. Refer to **COMPRESSOR REMOVAL AND INSTALLATION** .
36. Remove the exhaust flex pipe retaining nuts from the exhaust manifold studs.
37. Remove the exhaust flex pipe retaining nuts from the catalytic converter or the connecting pipe.
38. Remove the exhaust flex pipe.



G00767332

Fig. 121: Removing The Exhaust Flex Pipe
Courtesy of SUZUKI OF AMERICA CORP.

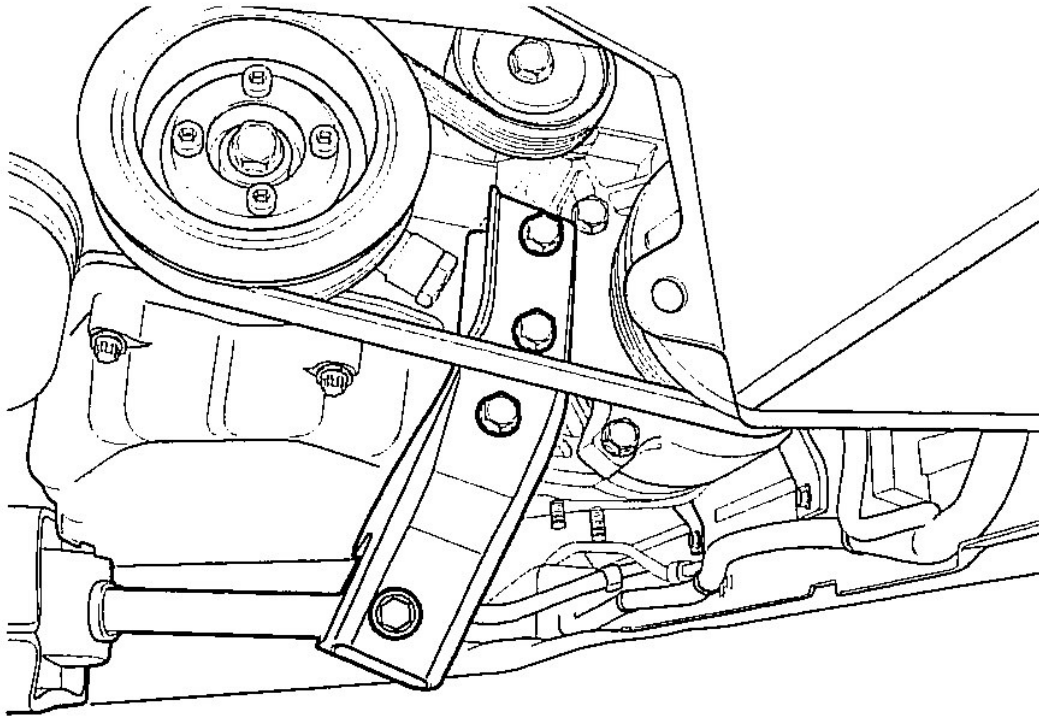
39. Remove the crankshaft pulley bolts.



G00767333

Fig. 122: Removing The Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

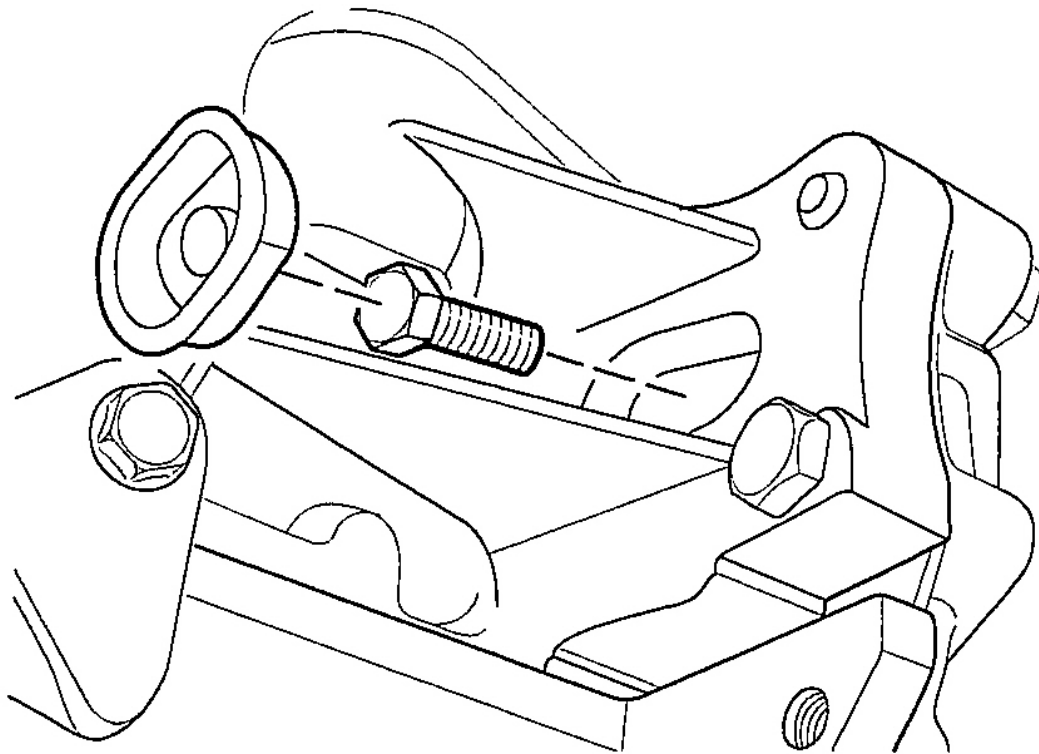
40. Remove the crankshaft pulley.
41. Disconnect the vacuum lines at the charcoal canister purge solenoid.
42. Disconnect the electrical connector at the charcoal canister purge (CCP) and the exhaust gas recirculation (EGR) solenoid.
43. Disconnect the electrical connector at the oil pressure switch.
44. Disconnect the crankshaft position sensor (CPS) connector.
45. Disconnect the knock sensor connector.
46. Remove the lower reaction rod bracket bolts.
47. Remove the lower reaction rod bracket.
48. Remove the lower reaction rod mount bolt.
49. Remove the lower reaction rod mount.



G00767334

Fig. 123: Removing The Lower Reaction Rod Mount
Courtesy of SUZUKI OF AMERICA CORP.

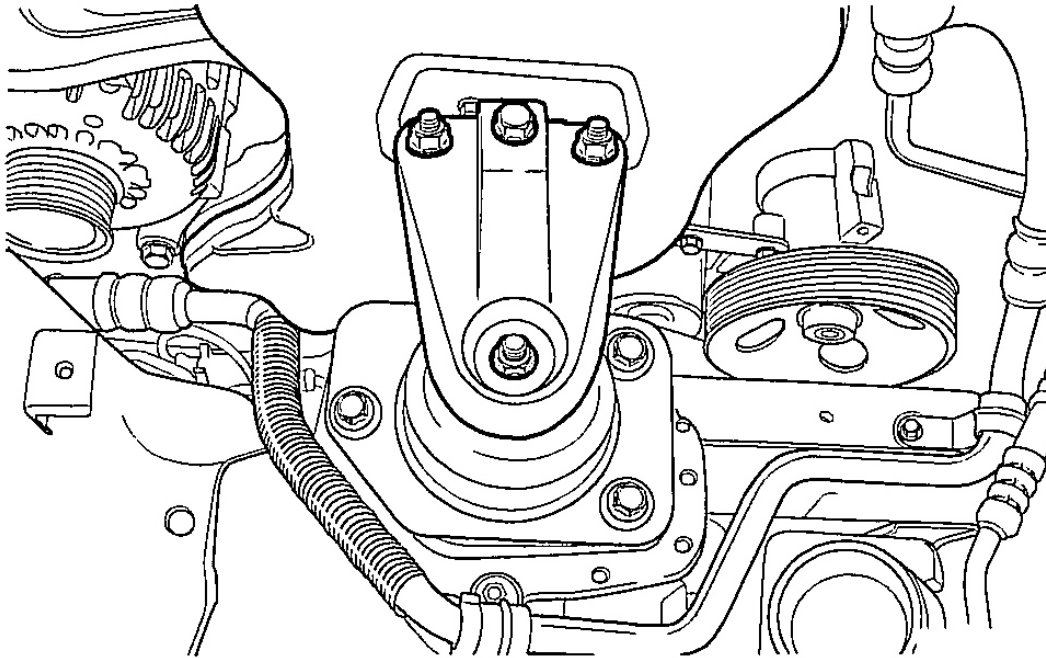
50. Remove the rubber cover as a service hole.



G00767335

Fig. 124: Removing The Rubber Cover
Courtesy of SUZUKI OF AMERICA CORP.

51. Remove the transaxle torque converter bolts through the service hole, if automatic transaxle equipped.
52. Remove the transaxle bell housing bolts and the oil pan flange bolts.
53. Support the transaxle with a floor jack.
54. Install the engine lifting device.
55. Disconnect the right engine mount bracket from the engine mount by removing the retaining bolt.
56. Remove the right engine mount bracket from the engine block and frame mount.



G00767336

Fig. 125: Removing The Right Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

57. Separate the engine block from the transaxle. Remove the engine.

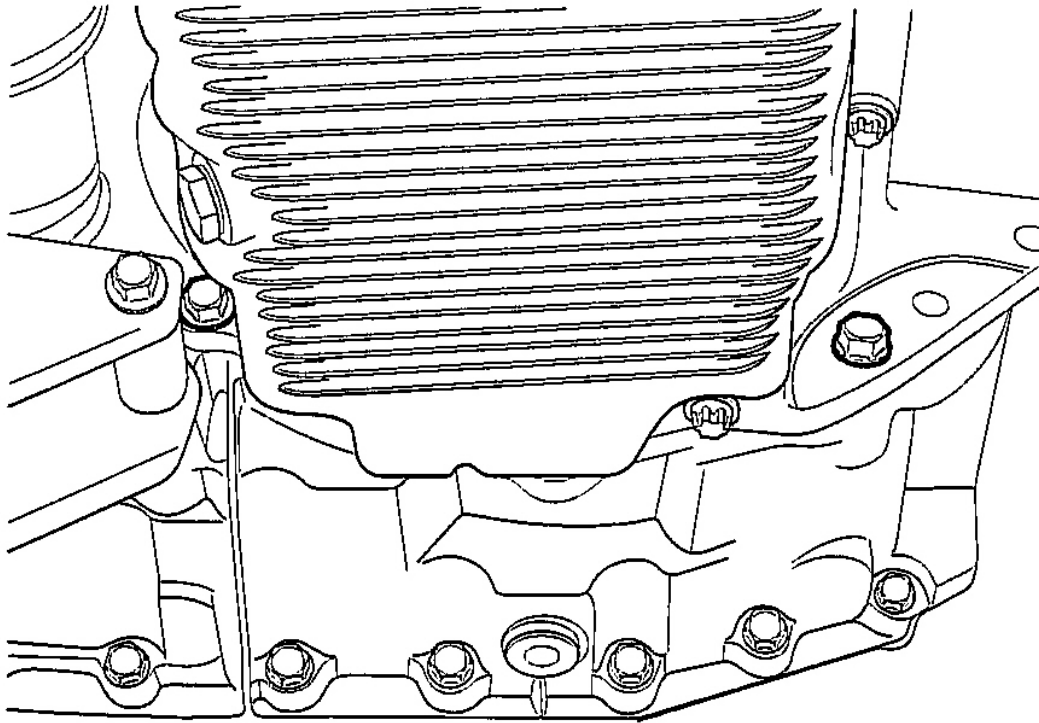
Installation

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.



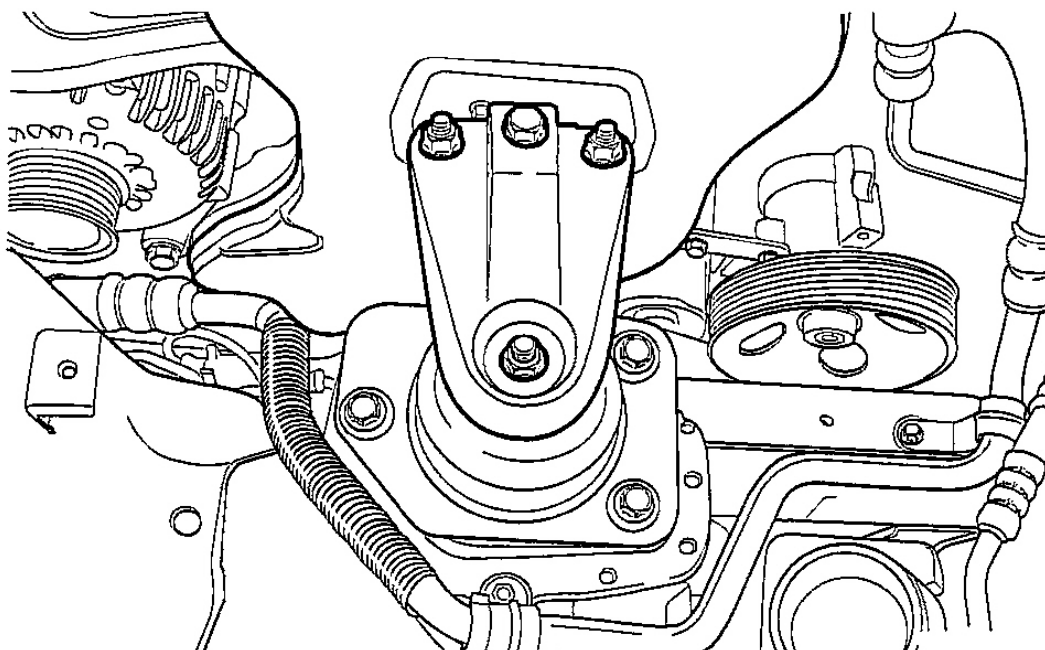
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Fig. 126: Installing The Oil Pan Flange-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

5. Install the right engine mount to the engine block mount and the frame mount.



G00767338

Fig. 127: Installing The Right Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the right engine mount bracket retaining bolts and nuts.

Tighten

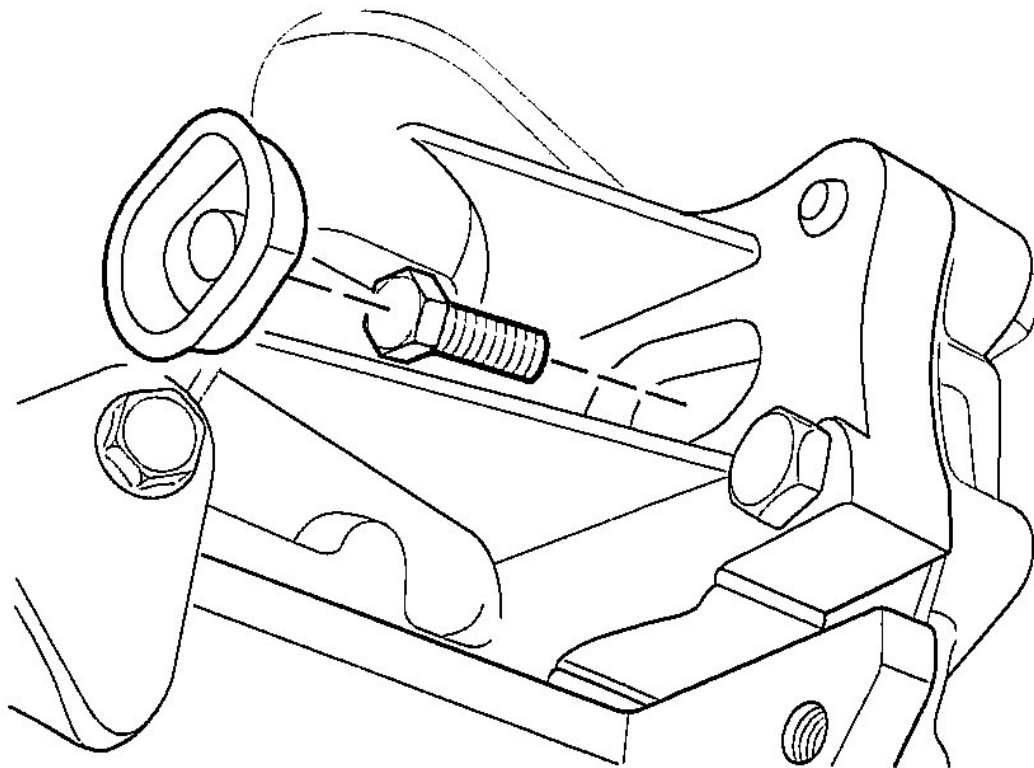
Tighten the engine mount bracket retaining bolts and nuts to 55 N.m (41 lb-ft).

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.



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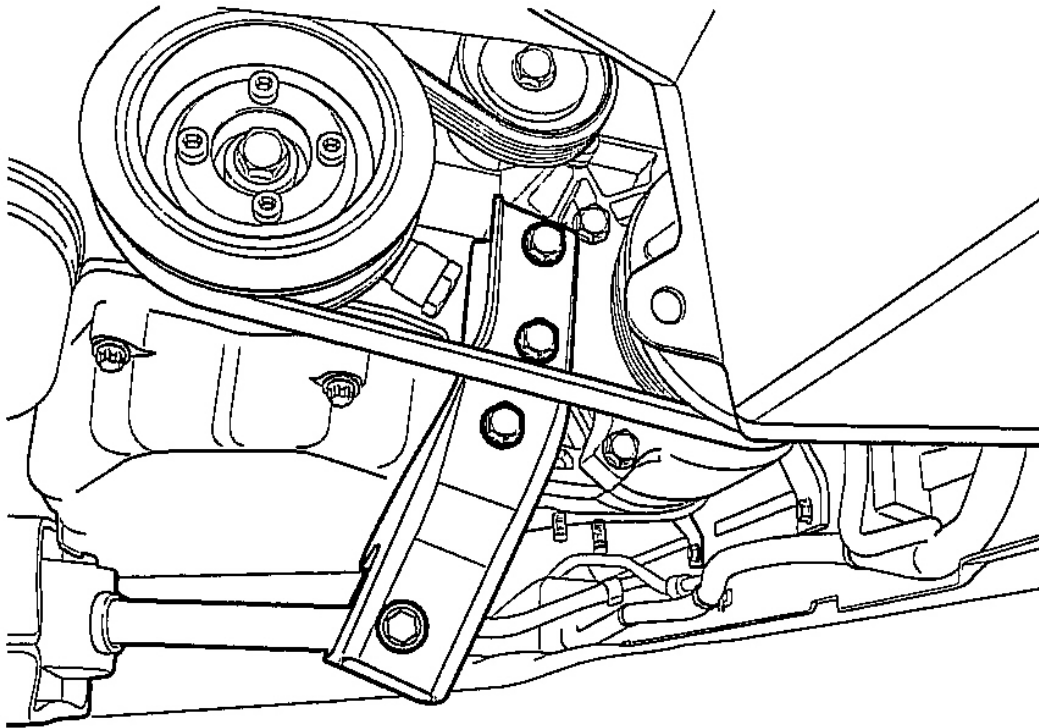
Fig. 128: Installing The Rubber Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.



G00767340

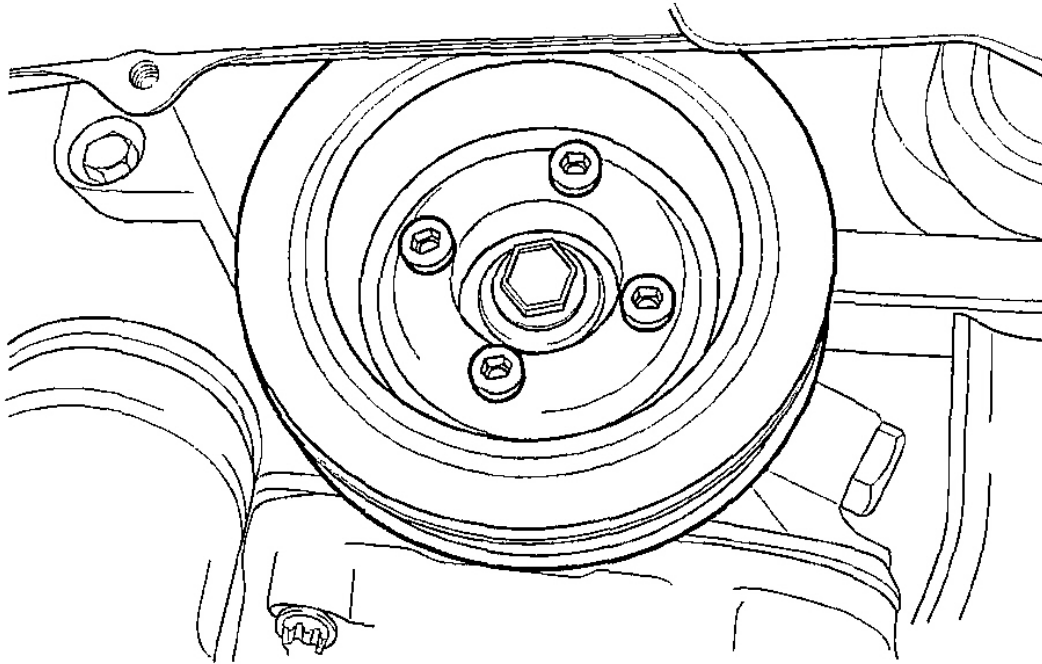
Fig. 129: Installing The Lower Reaction Rod Bracket
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the lower reaction rod bracket bolts.

Tighten

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

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.



G00767341

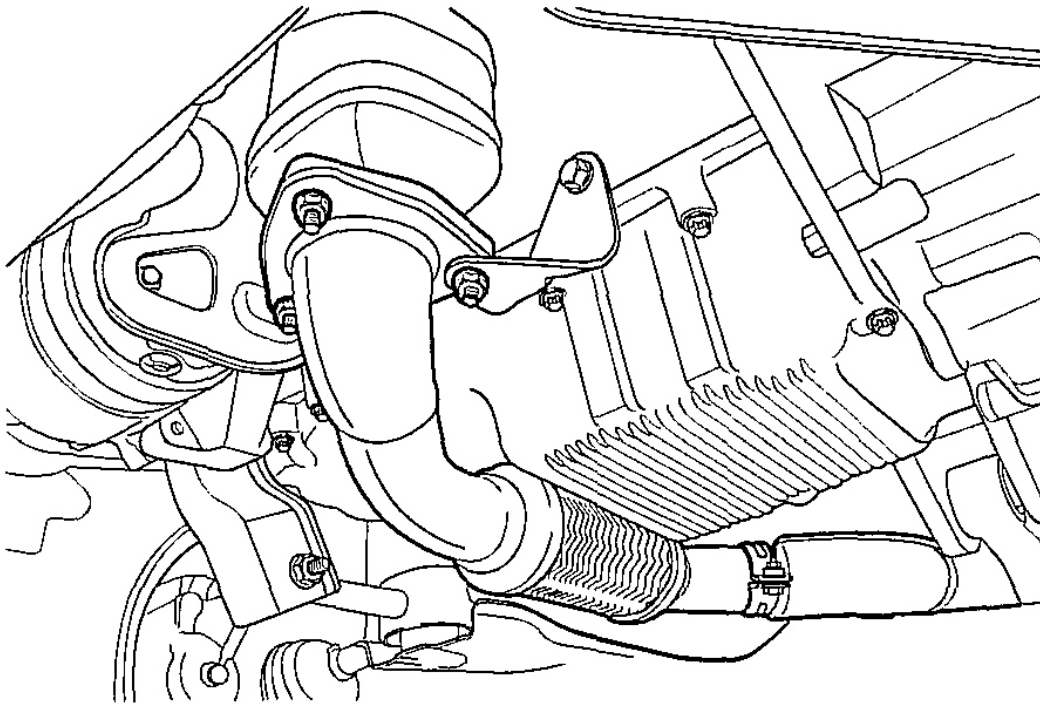
Fig. 130: Installing The Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the crankshaft pulley bolts.

Tighten

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

20. Connect the CPS connector.
21. Install the exhaust flex pipe.



G00767342

Fig. 131: Installing The Exhaust Flex Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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).

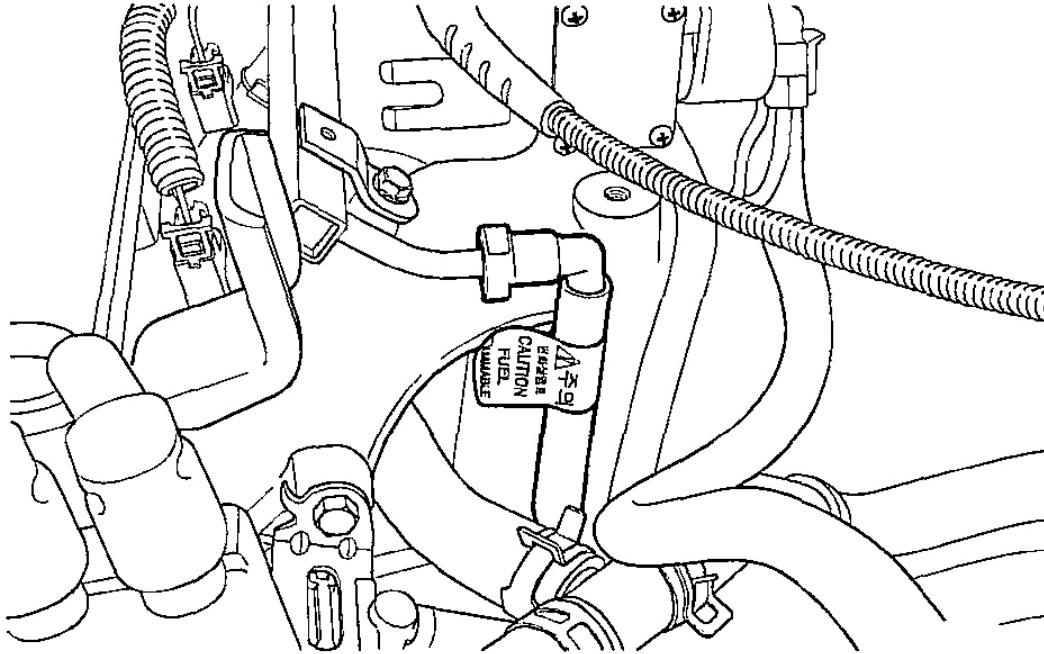
23. Install the exhaust flex pipe retaining nuts to the catalytic converter or the connecting pipe.

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**.
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.



G00767344

Fig. 132: Connecting The Fuel Feed Line
 Courtesy of SUZUKI OF AMERICA CORP.

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** .
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 TPS connector.

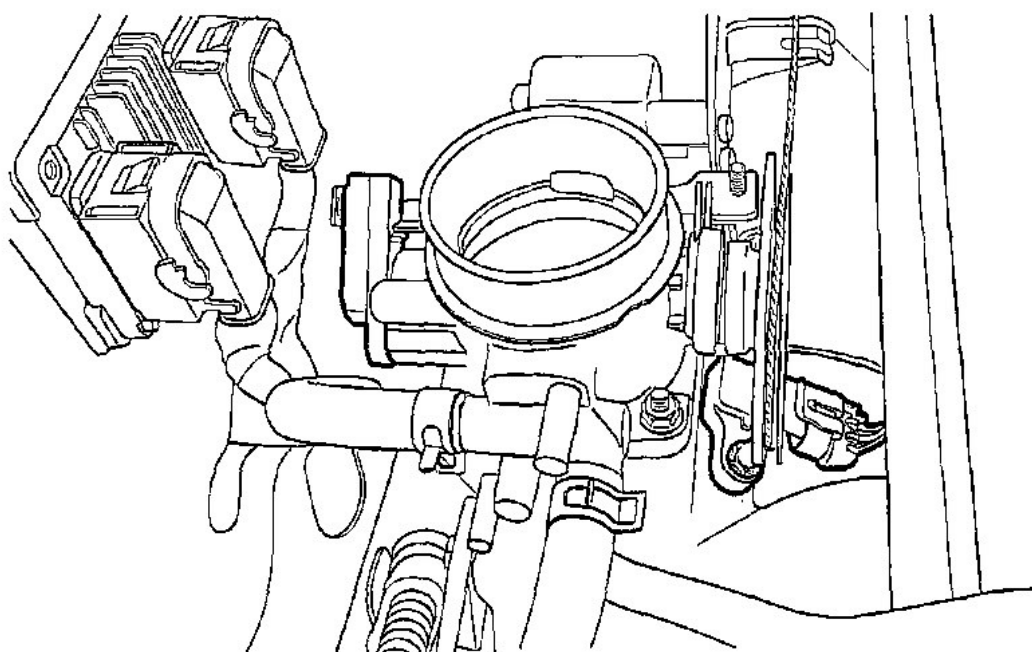
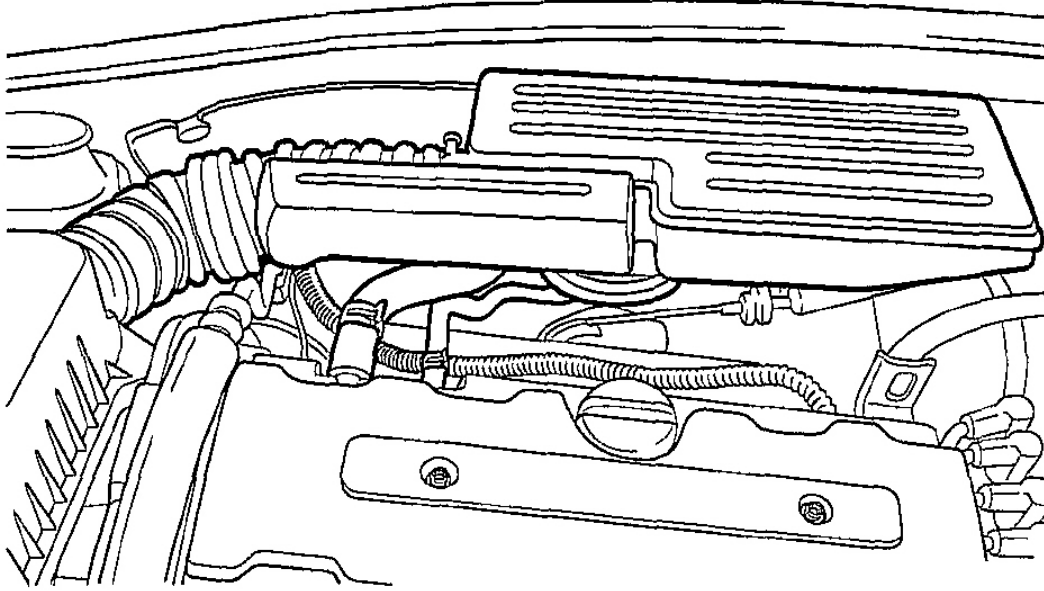
**G00767345**

Fig. 133: Connecting The TPS And IAC Valve Connectors
Courtesy of SUZUKI OF AMERICA CORP.

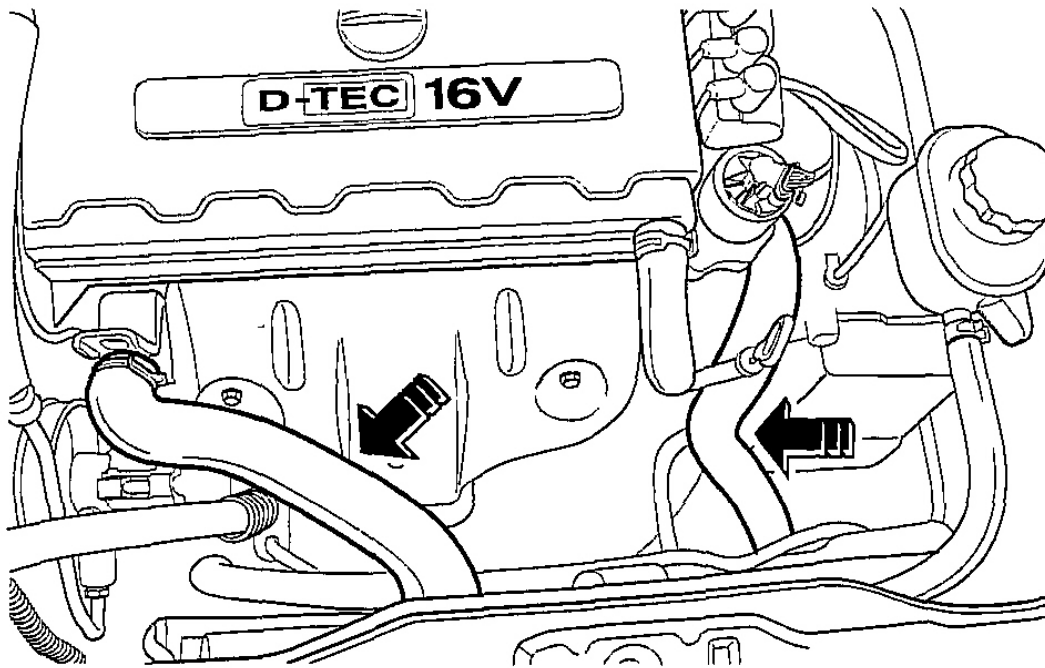
40. Connect the IAC valve connector.
41. Connect the MAP sensor connector.
42. Connect the knock sensor, if necessary.
43. Connect the electrical connector at the DIS ignition coil and the ECM ground terminal and at the starter motor.
44. Install the air cleaner outlet hose between the throttle body and the air cleaner housing.



G00767346

Fig. 134: Installing The Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

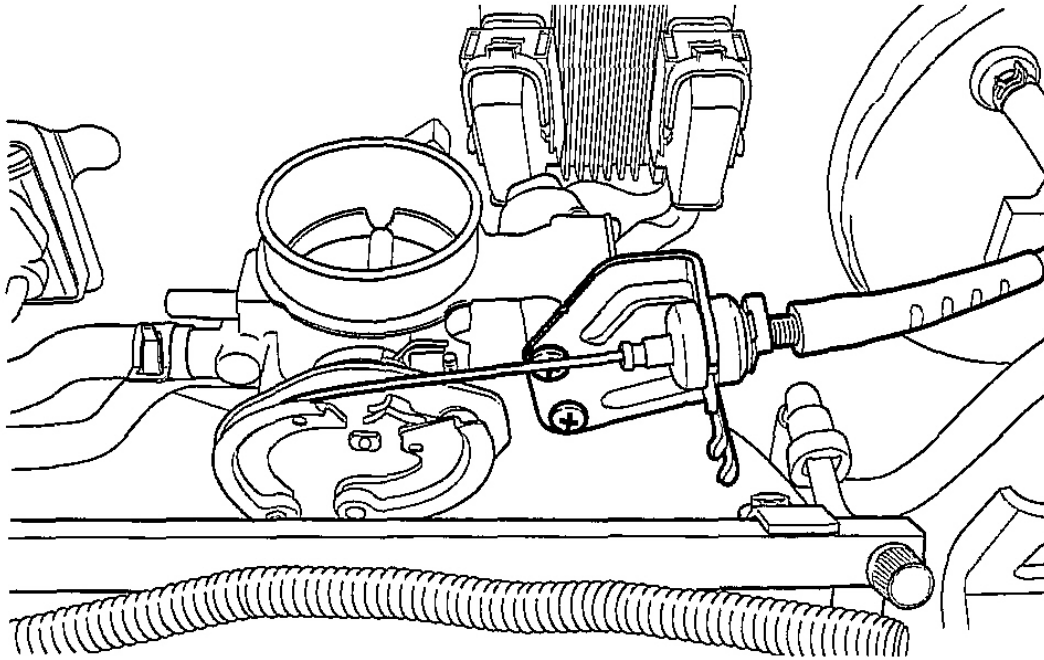
45. Connect the breather tubes to the camshaft cover.
46. Connect the MAT sensor connector.
47. Install the cooling system radiator and the engine cooling fans. Refer to **RADIATOR REMOVAL AND INSTALLATION**.
48. Connect the lower radiator hose to the coolant pipe.



G00767347

Fig. 135: Connecting The Radiator Hoses
Courtesy of SUZUKI OF AMERICA CORP.

49. Connect the upper radiator hose to the thermostat housing.
50. Connect the heater inlet hose to the cylinder head.
51. Connect the heater outlet hose to the coolant pipe.
52. Connect the coolant surge tank hose to the coolant pipe.
53. Connect the coolant hose to the throttle body.
54. Connect the throttle cable to the throttle body and the intake manifold bracket.



G00767348

Fig. 136: Connecting The Throttle Cable
Courtesy of SUZUKI OF AMERICA CORP.

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

Pistons and Rods Removal and Installation

Tools Required

J-8037 Universal Piston Ring Compressor

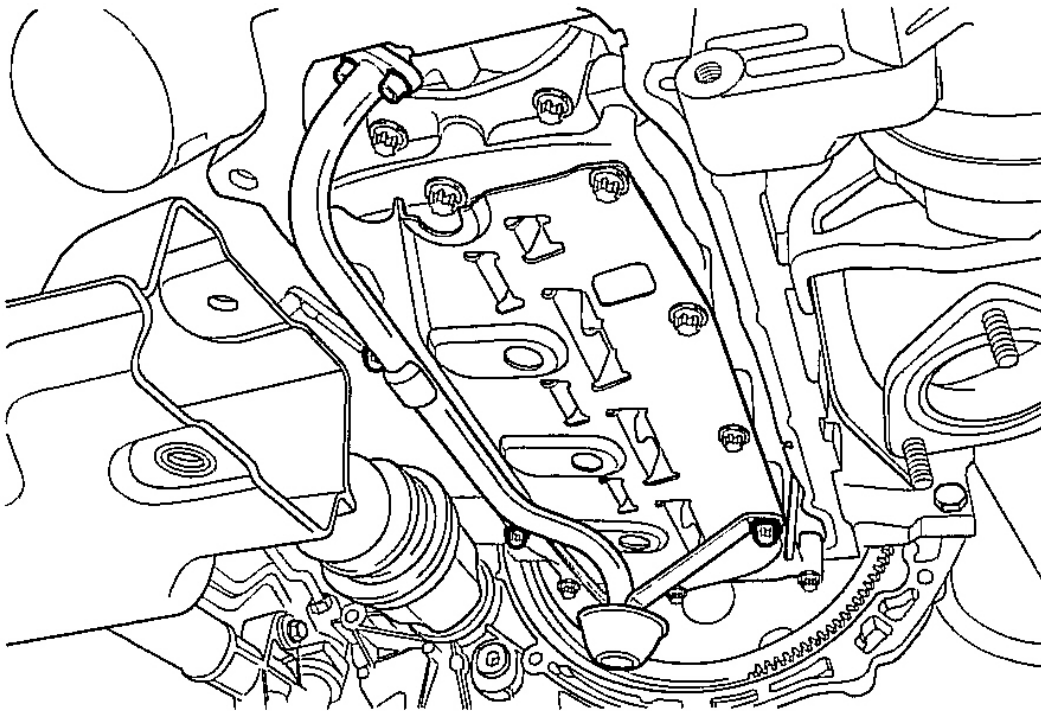
J-8087 Cylinder Bore Check Gauge

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.

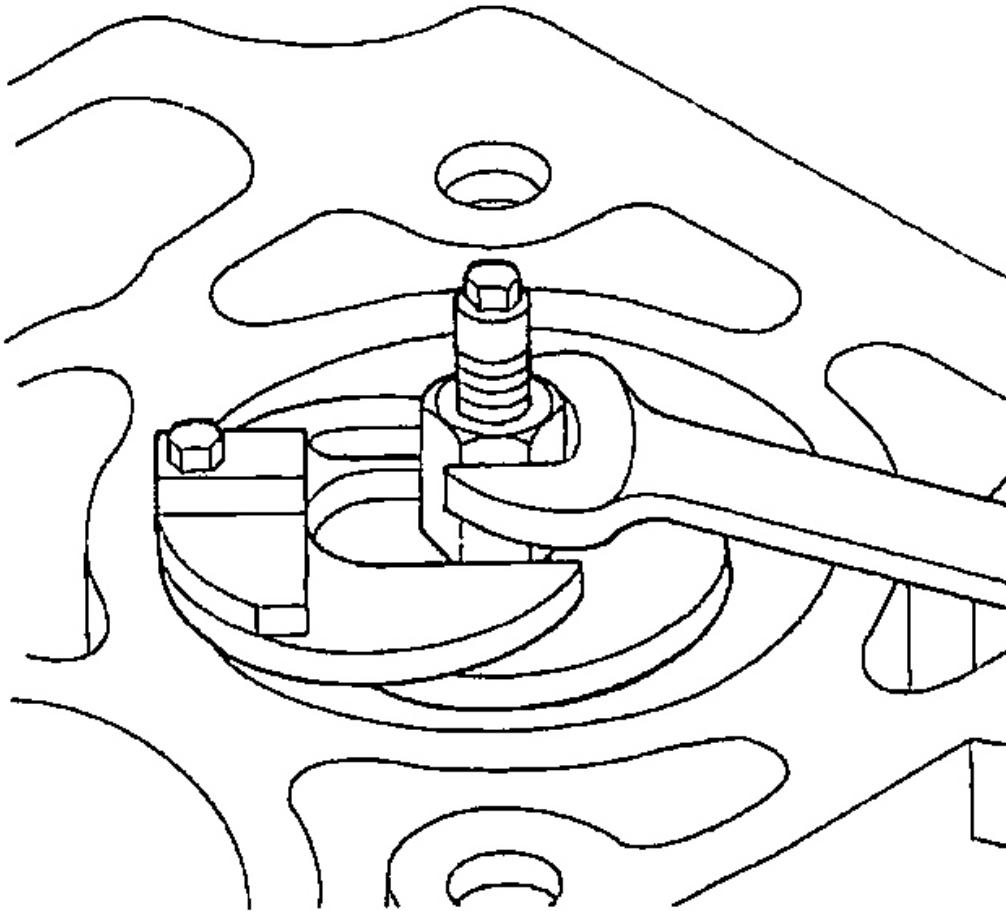


G00767349

Fig. 137: Removing The Oil Suction Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.

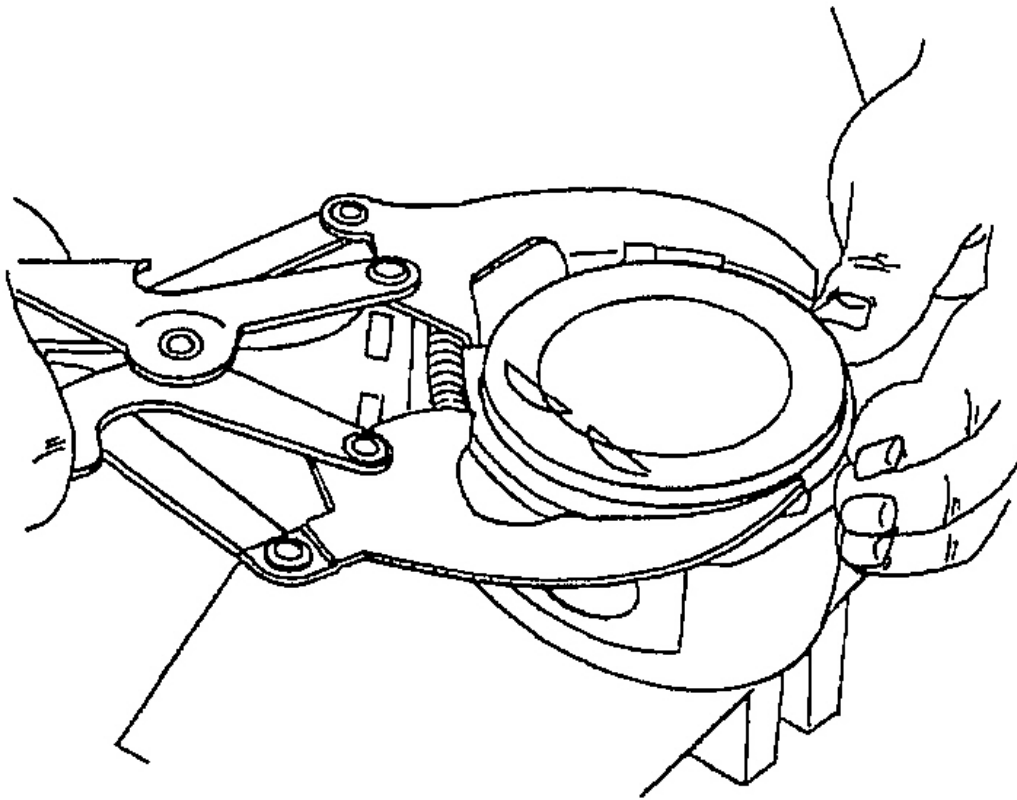


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Fig. 138: Ridge Reaming The Cylinder Wall
Courtesy of SUZUKI OF AMERICA CORP.

WARNING: Use care when handling the piston. Worn piston rings are sharp and may cause injury.

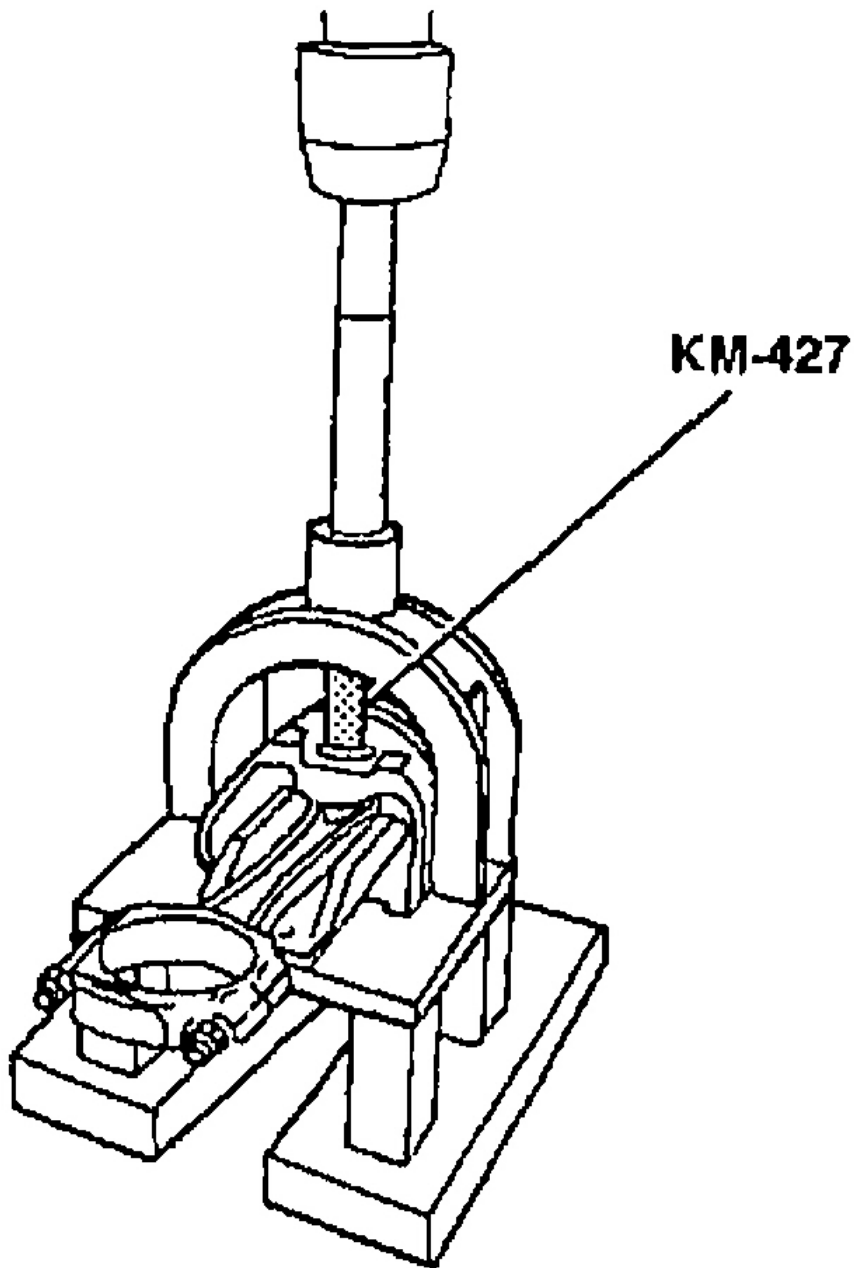
13. Remove the piston.
14. Use a piston ring expander tool to expand the piston rings.



G00767351

Fig. 139: Using A Piston Ring Expander Tool
Courtesy of SUZUKI OF AMERICA CORP.

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



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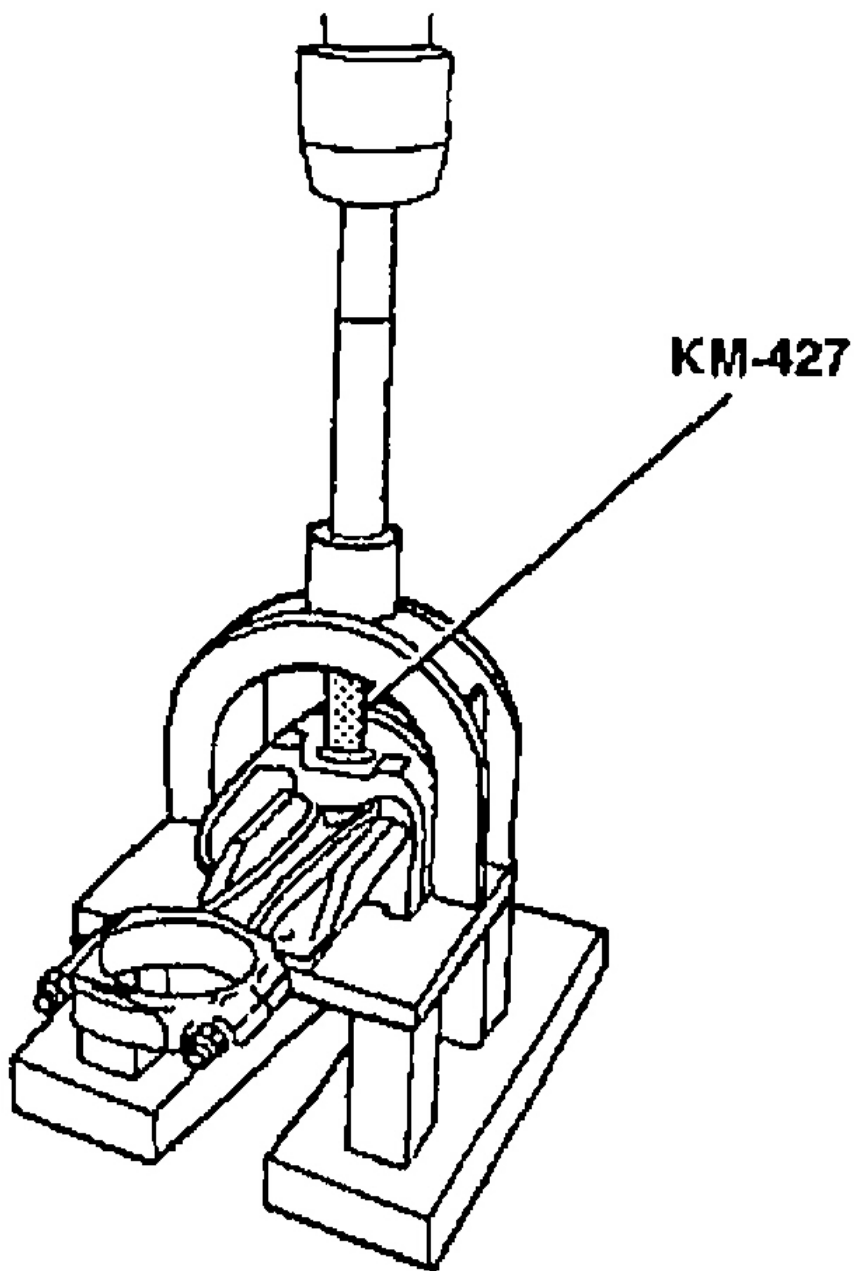
Fig. 140: Removing The Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

17. Separate the piston from the connecting rod.

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.

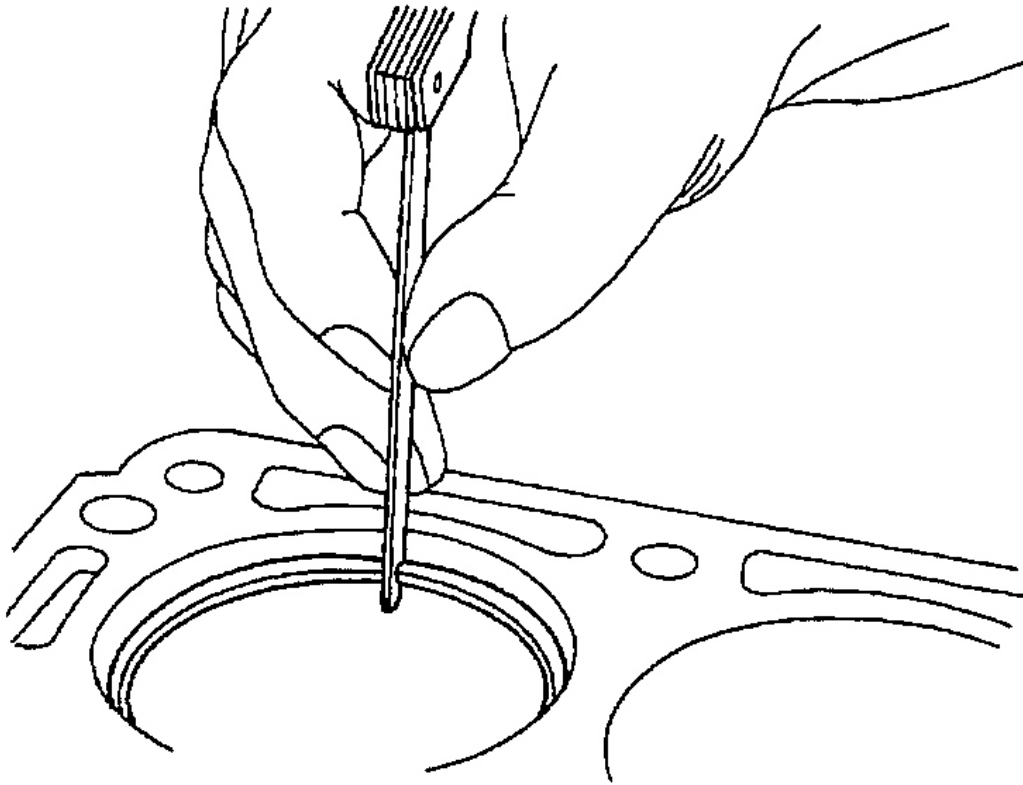


G00767353

Fig. 141: Installing The Piston Pin
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.

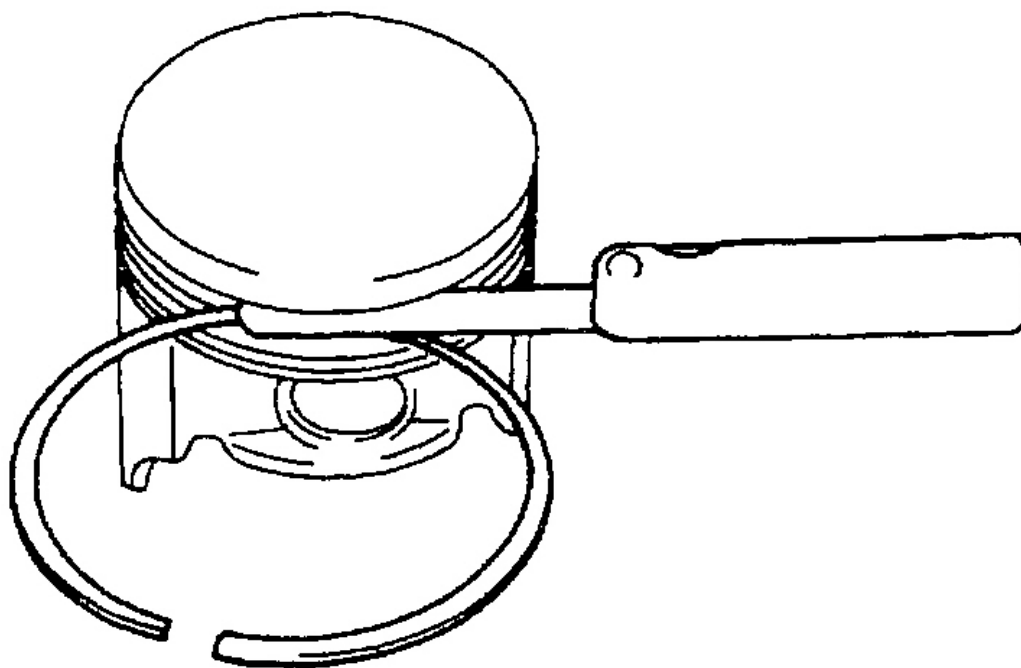
6. Select a set of new piston rings.
7. Measure the piston ring gap using a feeler gauge. Refer to **ENGINE SPECIFICATIONS**.



G00767354

Fig. 142: Measuring The Piston Ring Gap
Courtesy of SUZUKI OF AMERICA CORP.

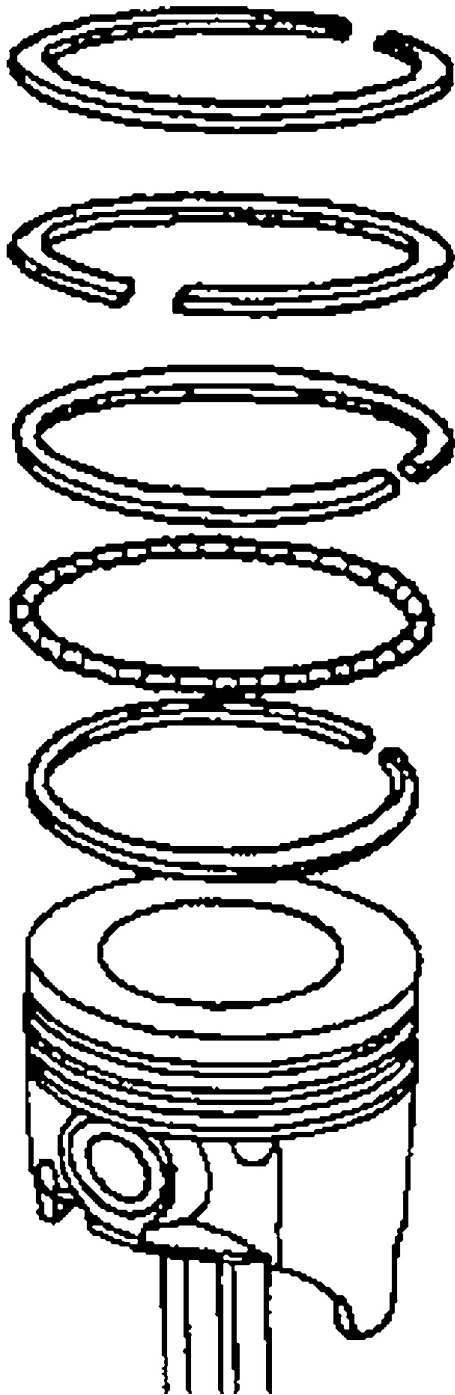
8. Increase the piston ring gap by carefully filing off excess material if the piston ring gap is below specifications.
9. Measure the piston ring side clearance using a feeler gauge. Refer to **ENGINE SPECIFICATIONS**.



G00767355

Fig. 143: Measuring The Piston Ring Side Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.

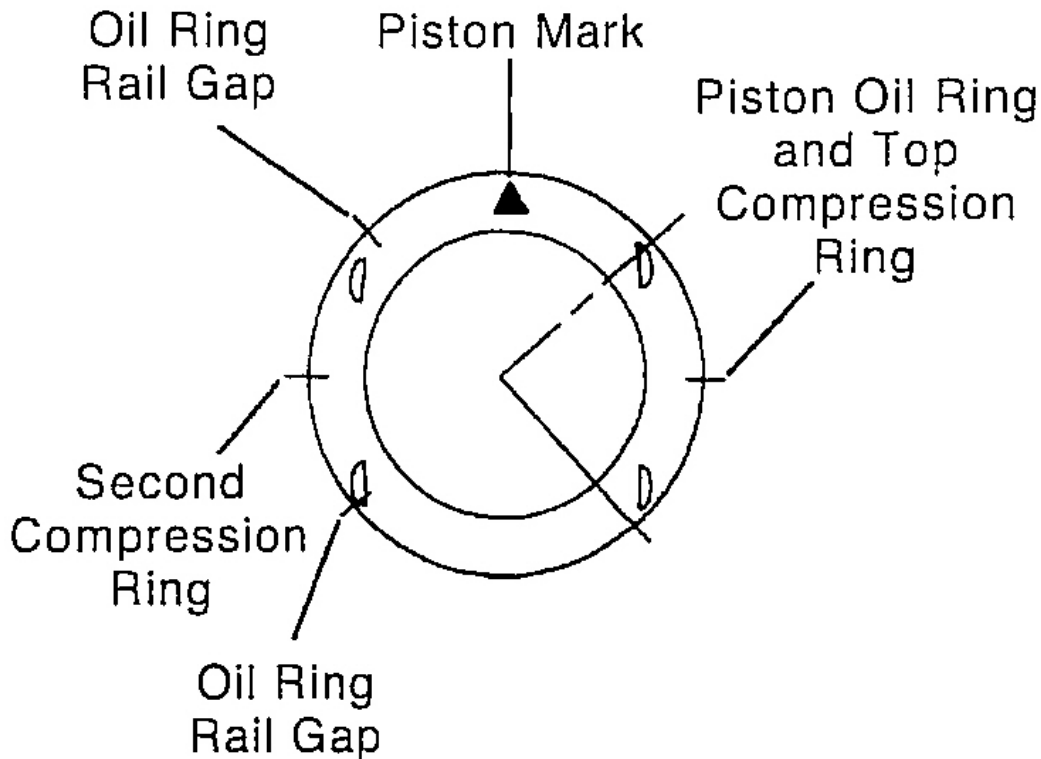


G00767356

Fig. 144: Exploded View Of Piston Rings
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.

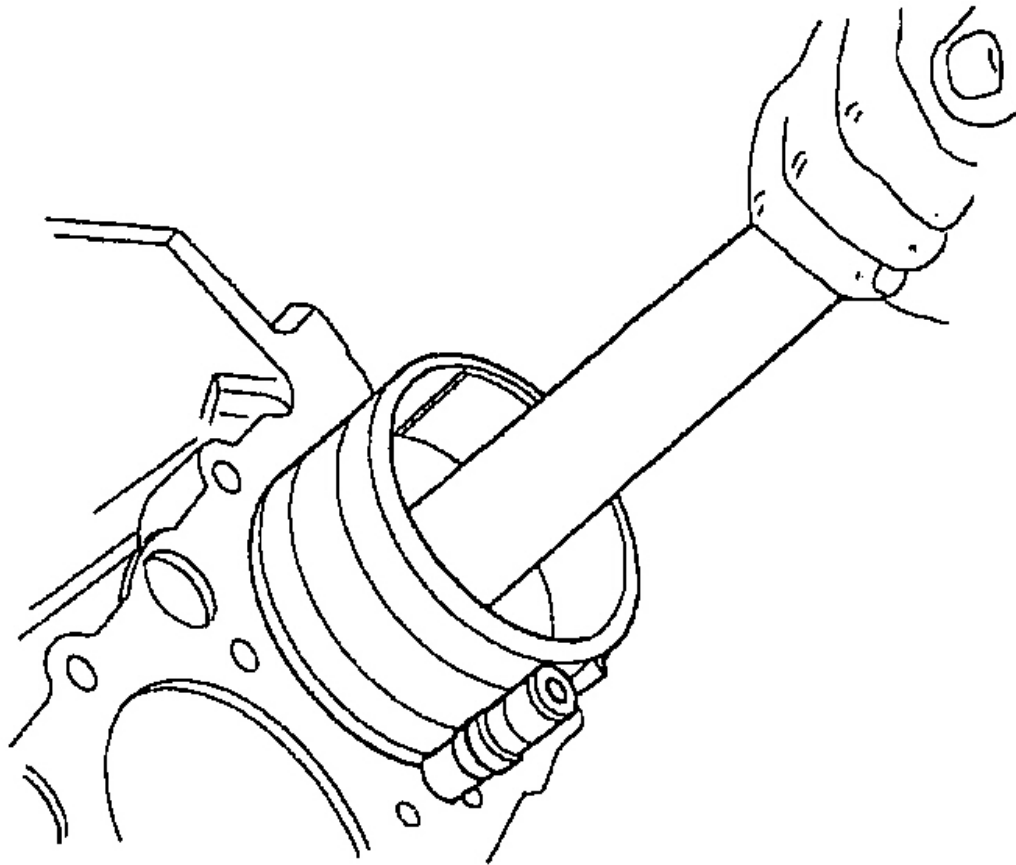
16. Stagger the piston oil rings, the oil ring rail gaps, the second compression ring, and the top compression ring in relation to the notch on the top of the piston.



G00767357

Fig. 145: Identifying Piston Ring Orientation
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**.



G00767358

Fig. 146: Installing The Piston

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 KM-470-B, tighten the bolts one turn of 45 degrees plus one turn of 15 degrees.

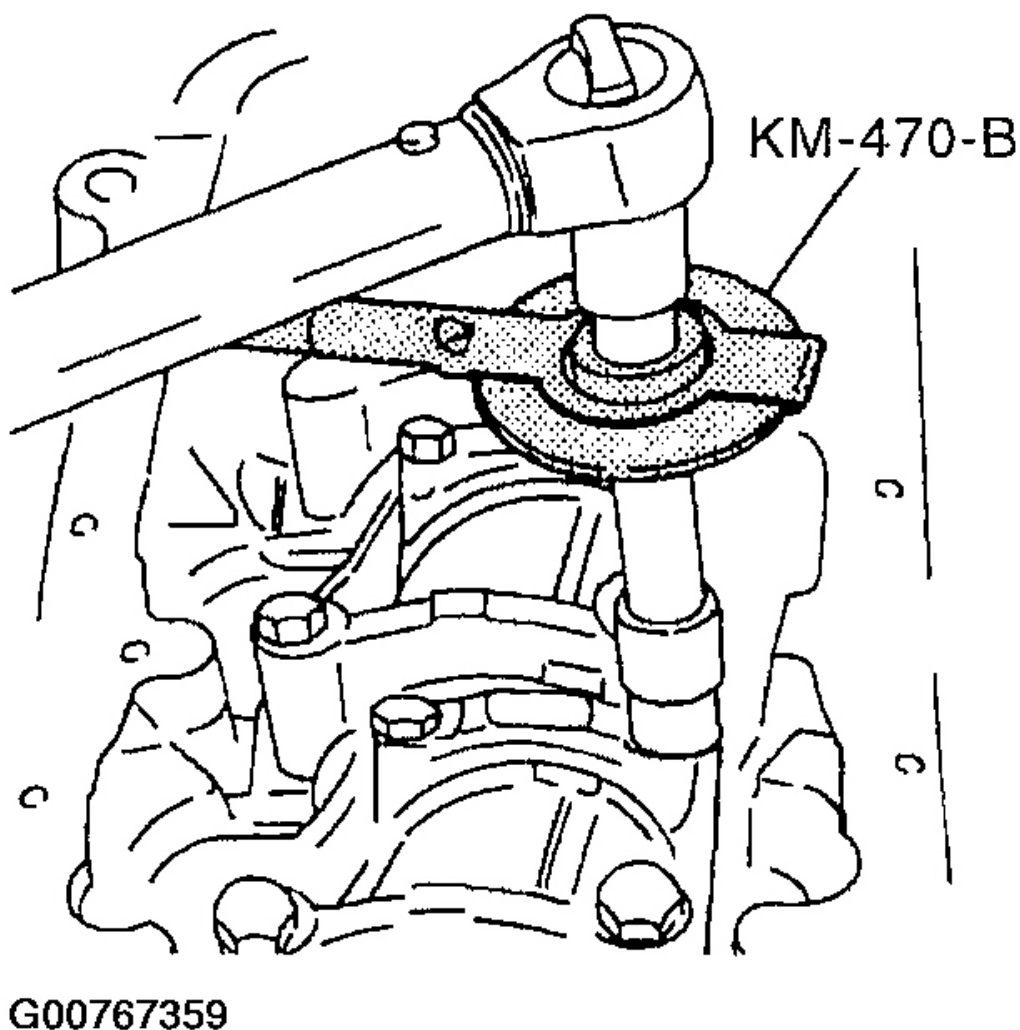


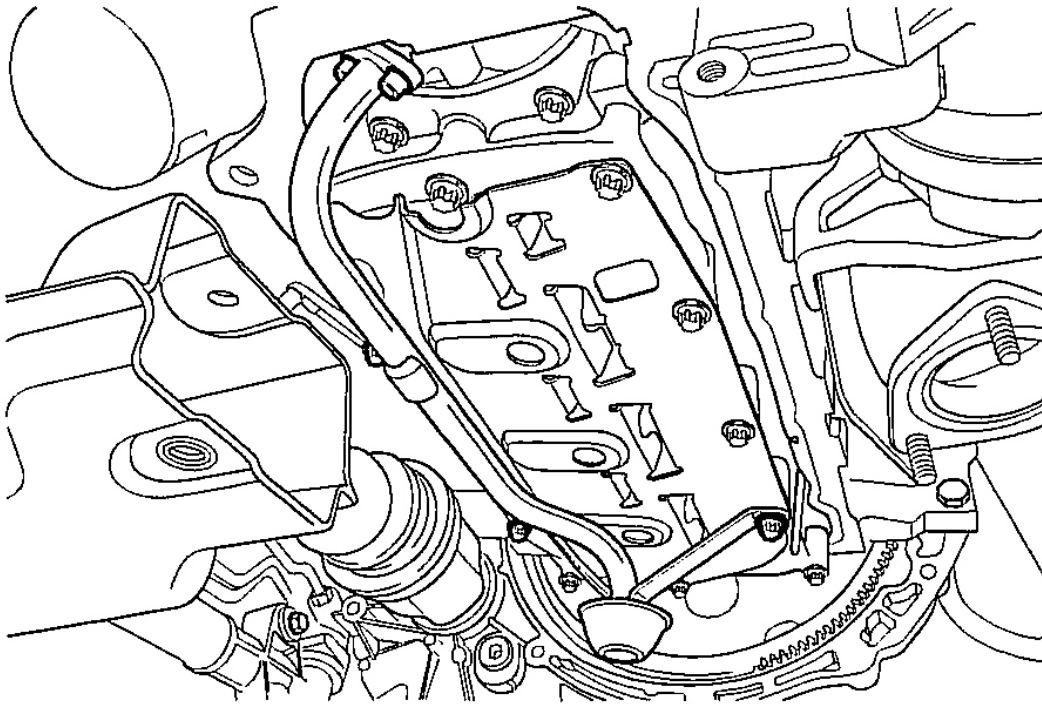
Fig. 147: Tightening The Connecting Rod Cap Bolts Using The Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

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 degrees using the angular torque gauge KM-470-B.

22. Install the oil suction pipe.



G00767360

Fig. 148: Installing The Oil Suction Pipe
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the oil suction pipe bolts.

Tighten

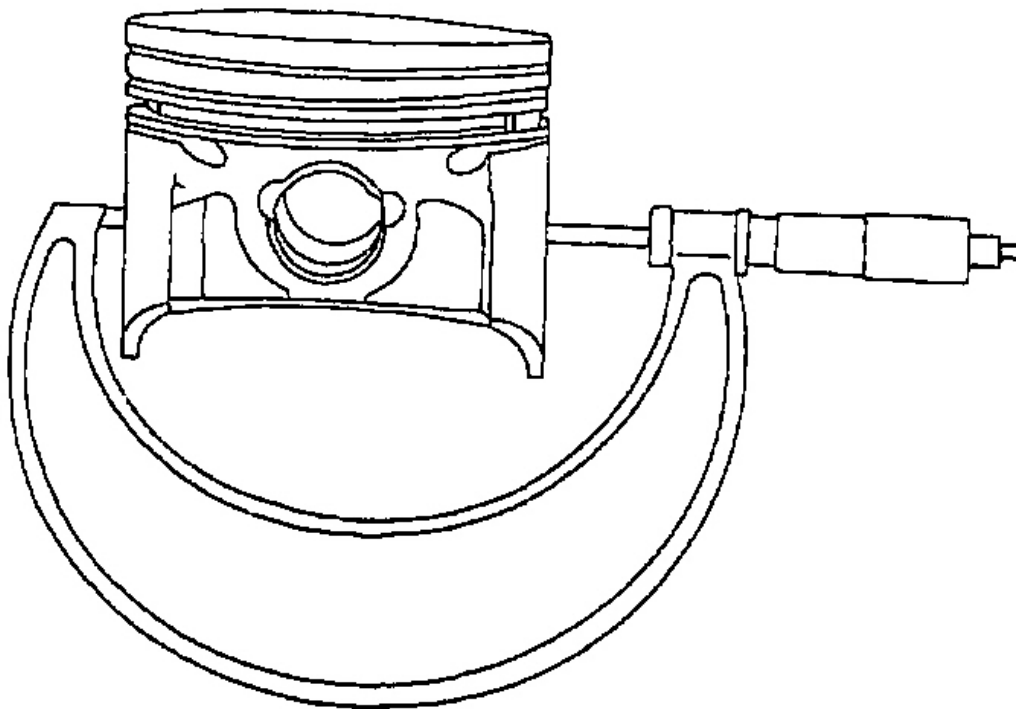
Tighten the oil suction pipe bolts to 8 N.m (71 lb-in) and the oil suction pipe bracket bolt to 6 N.m (53 lb-in).

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**.

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.

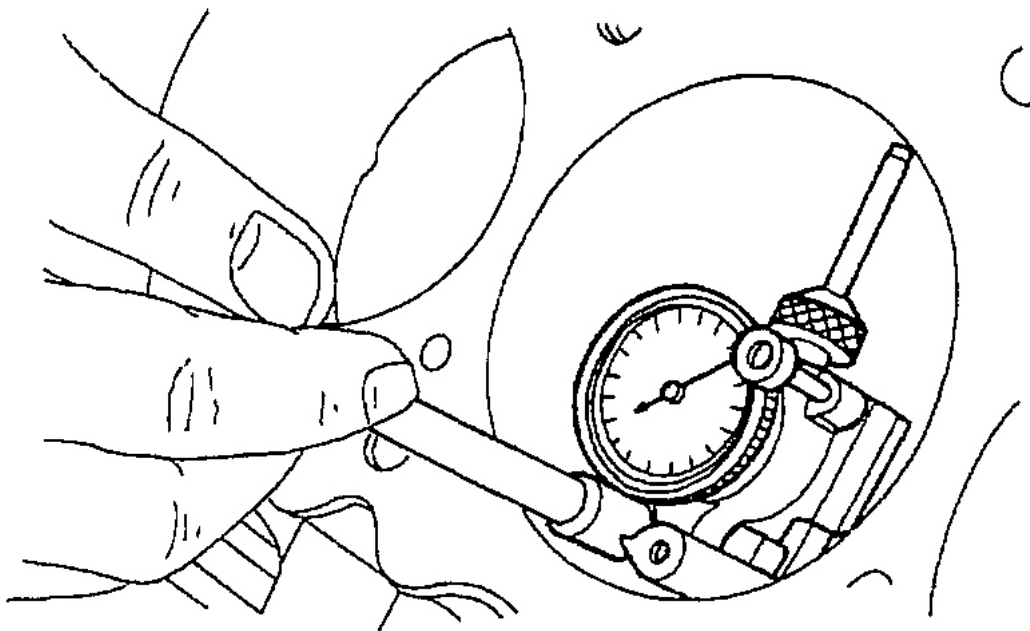
5. Inspect the crankshaft rod bearing journal for wear. Refer to **ENGINE SPECIFICATIONS**.
6. Inspect the piston for scoring, cracks, and wear.
7. Inspect the piston for taper using a micrometer.



G00767361

Fig. 149: Measuring Piston For Taper
Courtesy of SUZUKI OF AMERICA CORP.

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



G00767363

Fig. 150: Inspecting The Engine Block Cylinder Bore
Courtesy of SUZUKI OF AMERICA CORP.

12. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.

Cylinder Head and Valve Train Components Disassembly and Assembly

Tools Required

MKM-571-B Gauge

KM-340-0 Cutter Set

KM-340-7 Guide Drift

KM-340-13 Cutters

KM-340-26 Cutters

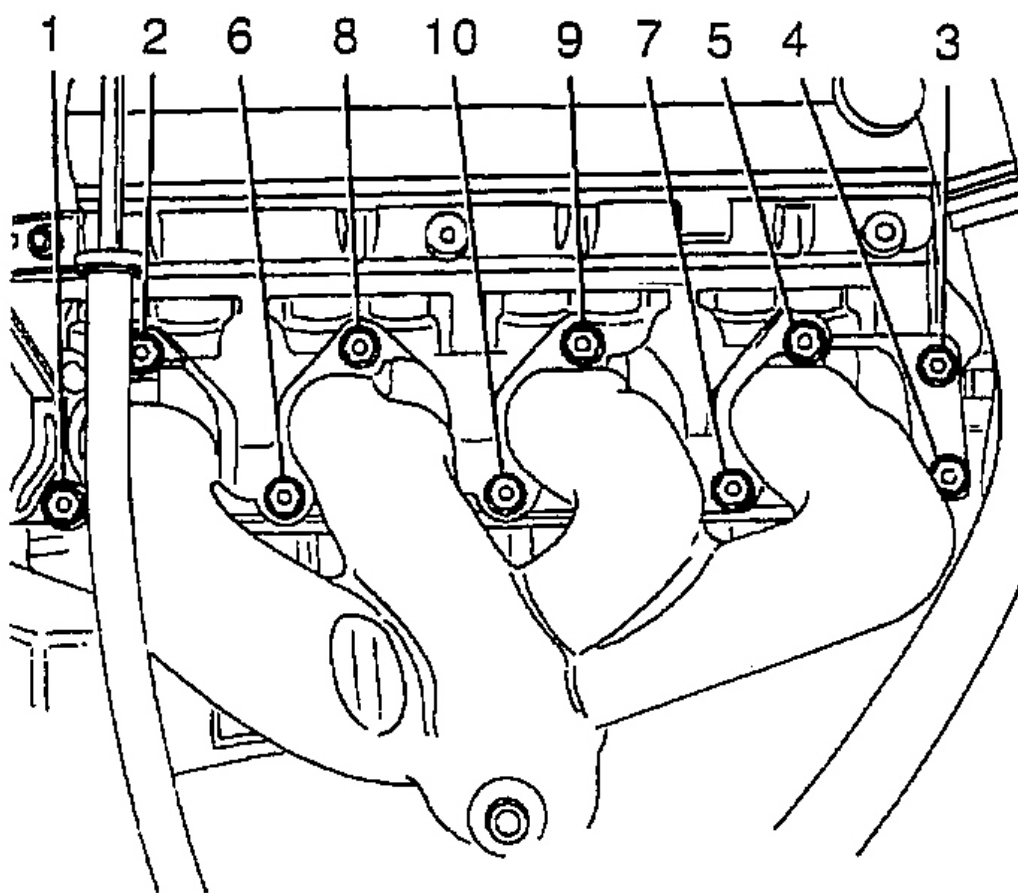
KM-348 Valve Spring Compressor

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.

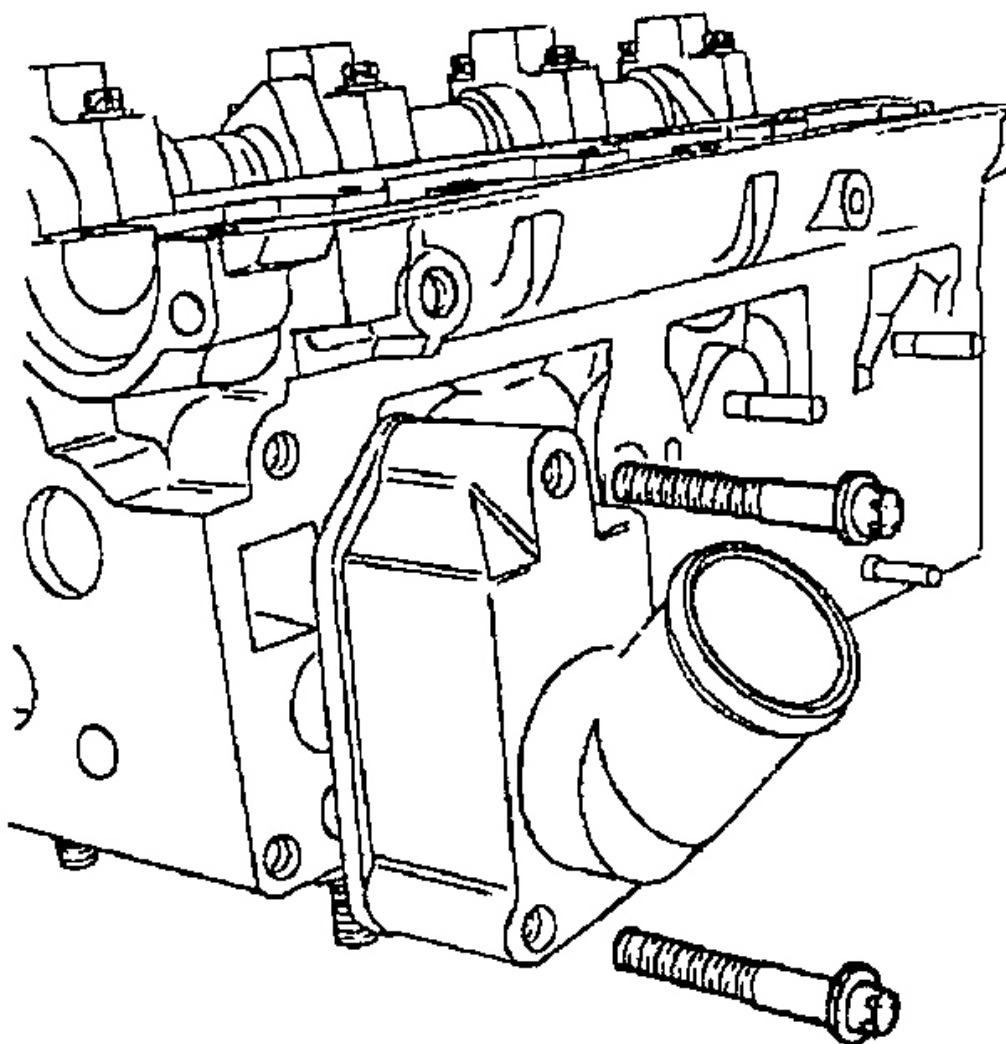


G00767364

Fig. 151: Removing The Exhaust Manifold Retaining Nuts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove the exhaust manifold.

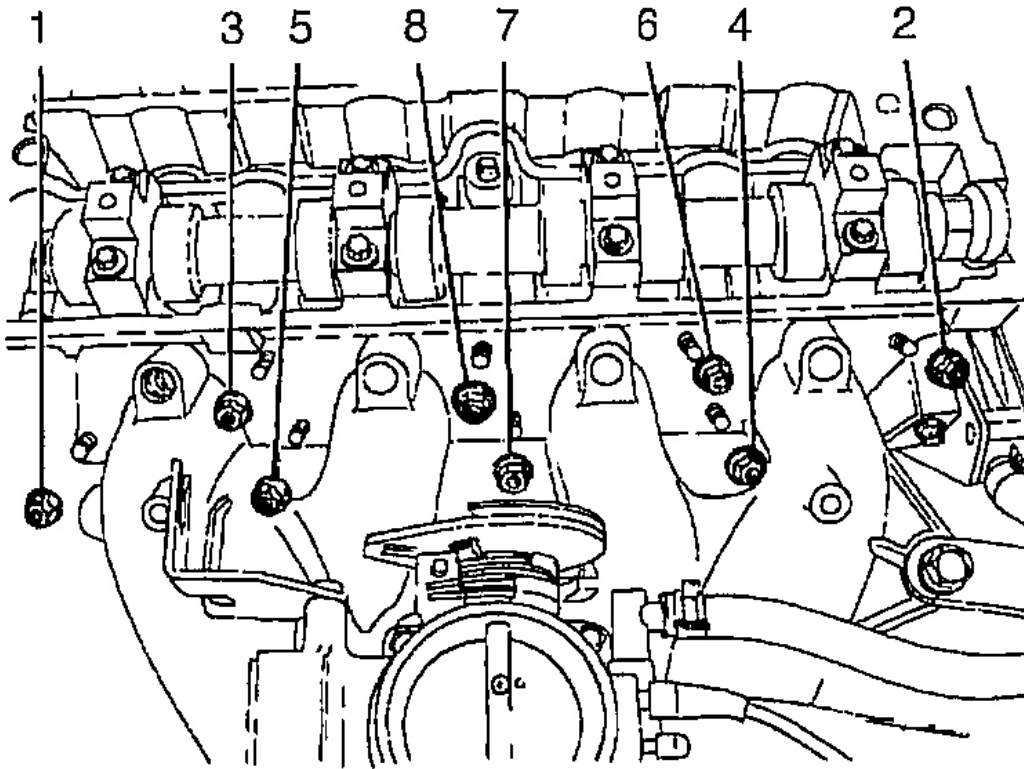
6. Remove the exhaust manifold gasket.
7. Remove the exhaust manifold studs.
8. Remove the thermostat housing mounting bolts.
9. Remove the thermostat housing assembly.
10. Remove the fuel rail assembly. Refer to **FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION**.
11. Remove the coolant bypass housing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



G00767365

Fig. 152: Removing The Coolant Bypass Housing
Courtesy of SUZUKI OF AMERICA CORP.

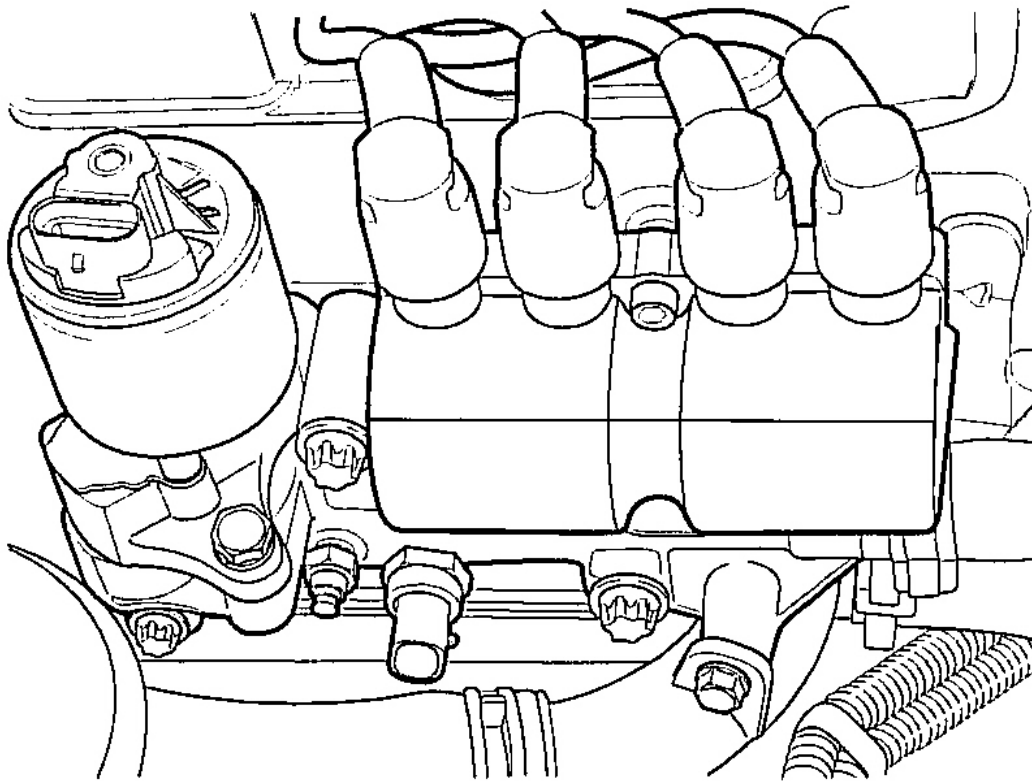
12. Remove the intake manifold retaining nuts and retaining bolt in the sequence shown.



G00767366

Fig. 153: Removing The Intake Manifold Retaining Nuts And Bolt In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

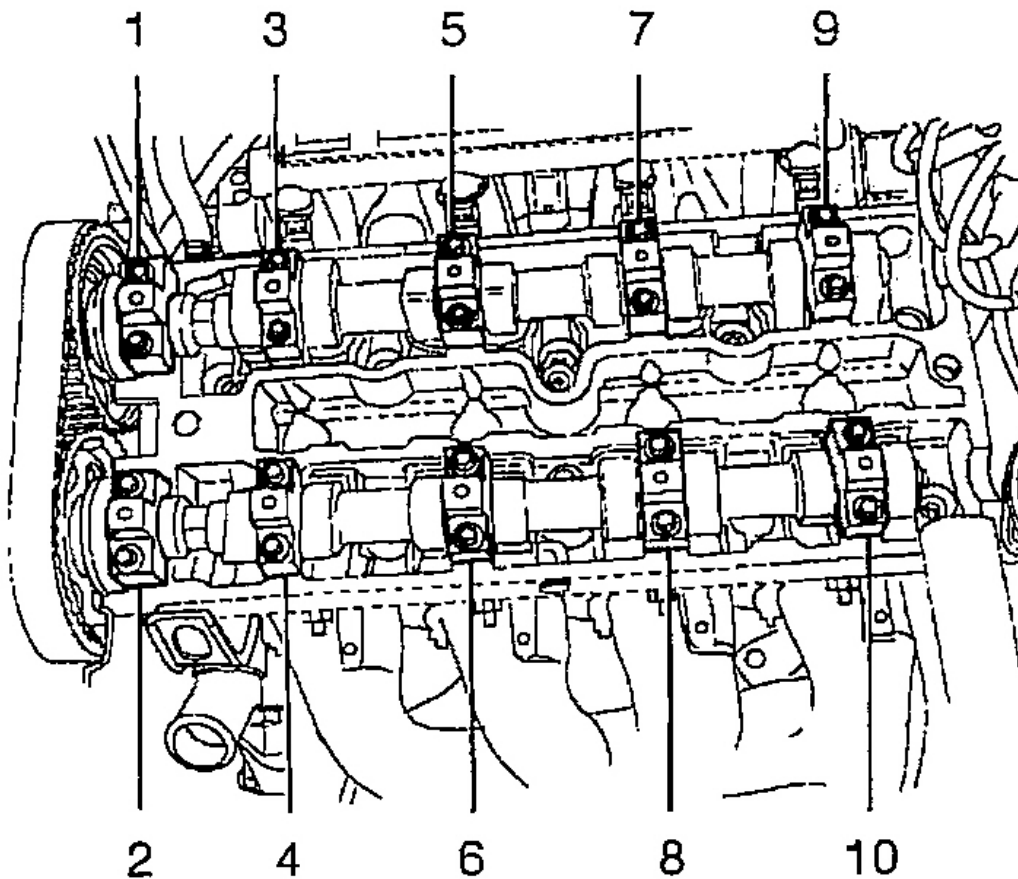
13. Remove the intake manifold.
14. Remove the intake manifold gasket.
15. Remove the direct ignition system (DIS) coil and the exhaust gas recirculation (EGR) mounting bracket bolts.
16. Remove the DIS ignition coil and the EGR mounting bracket and ignition wires.



G00767367

Fig. 154: Removing The DIS Ignition Coil
Courtesy of SUZUKI OF AMERICA CORP.

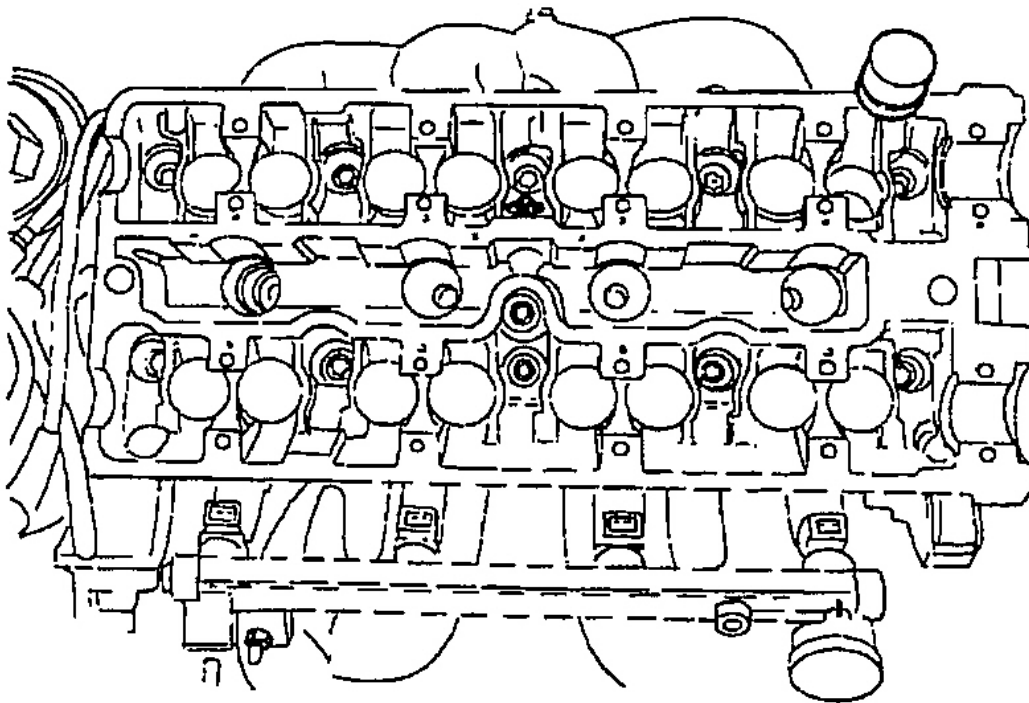
17. Remove the intake manifold studs.
18. Remove the spark plugs.
19. Remove the camshaft bearing cap bolts gradually and in the sequence shown for each camshaft cap.



G00767368

Fig. 155: Removing The Camshaft Bearing Cap Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

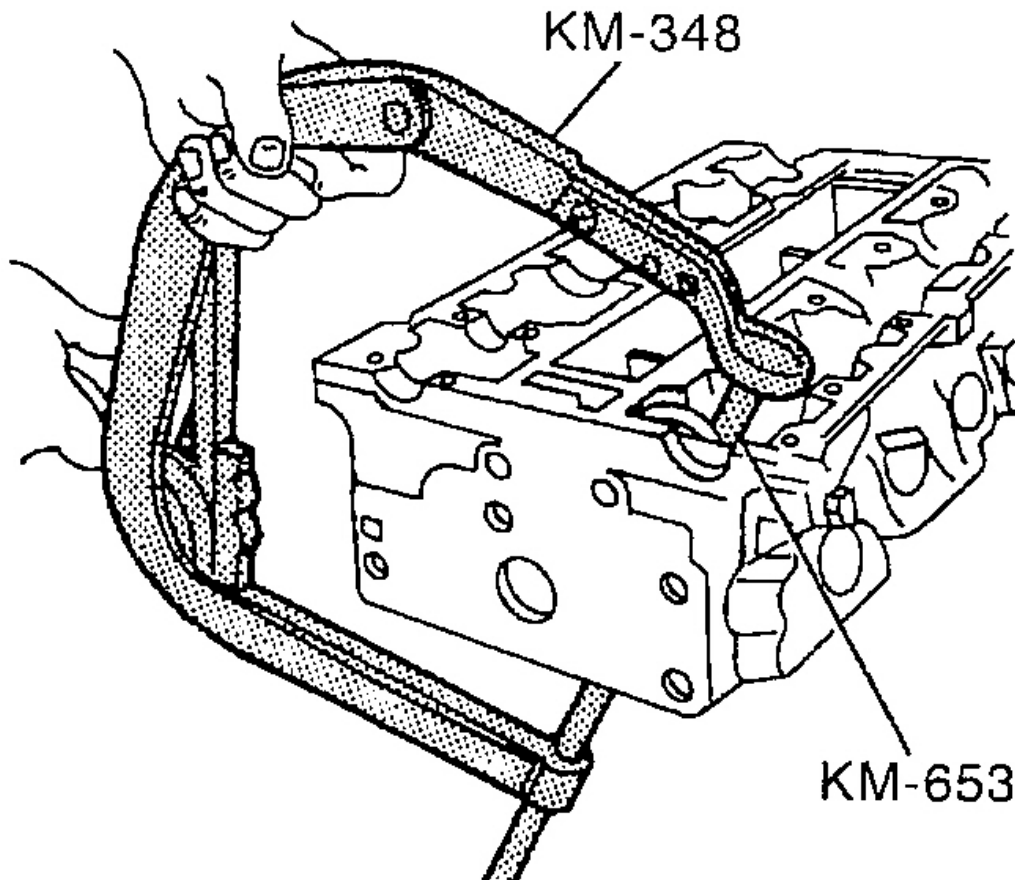
20. Remove the intake camshaft caps. Maintain the correct positions for installation.
21. Remove the intake camshaft.
22. Remove the intake valve tappet adjusters.
23. Remove the exhaust camshaft caps. Maintain the correct positions for installation.
24. Remove the exhaust camshaft.
25. Remove the exhaust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



G00767369

Fig. 156: Removing The Exhaust Valve Tappet Adjusters
Courtesy of SUZUKI OF AMERICA CORP.

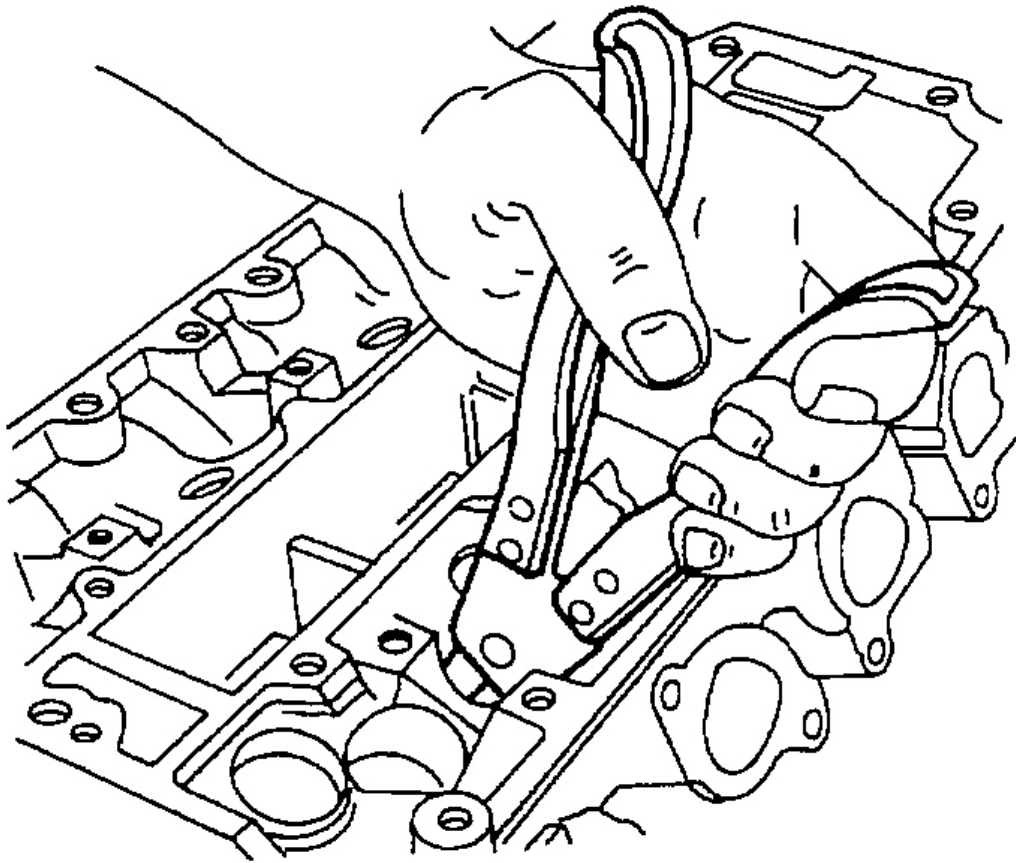
26. Compress the valve springs with the valve spring compressor KM-348 and the adapter KM-653.



G00767370

Fig. 157: Compressing The Valve Springs
 Courtesy of SUZUKI OF AMERICA CORP.

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

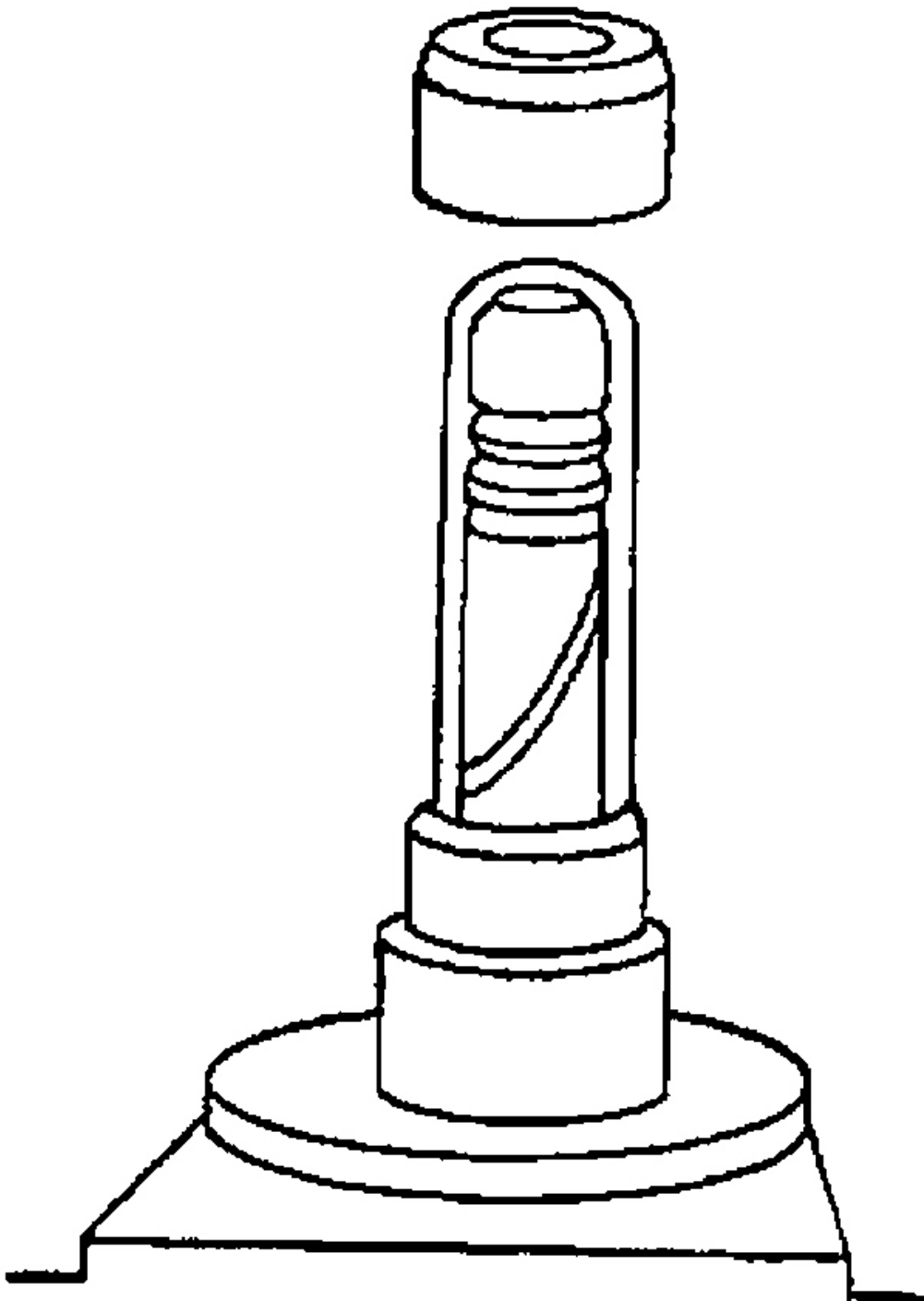


G00767371

Fig. 158: Removing The Valve Stem Seals
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

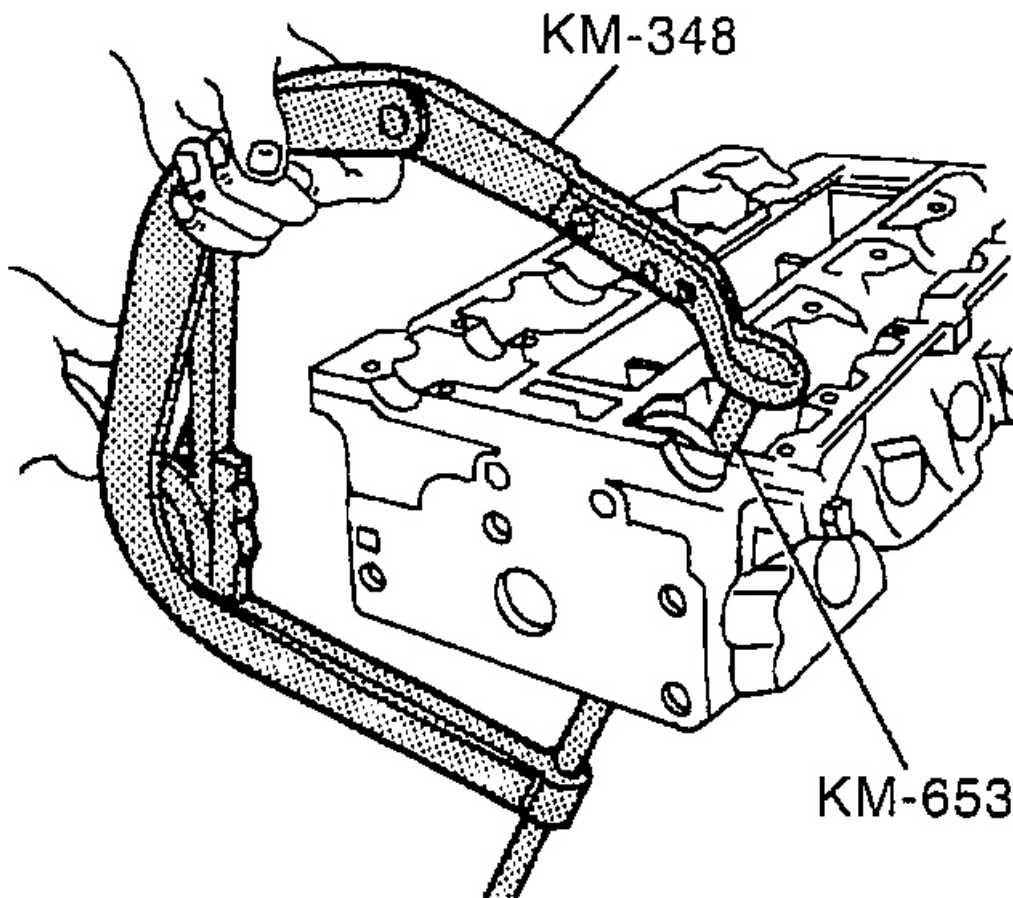
1. Coat the valve stems with engine oil.
2. Insert the valves in the cylinder head in their original positions.
3. Insert the valve spring seats.
4. Push the accompanying assembly sleeve onto the valve stem.



G00767372

Fig. 159: Installing The Valve Stem Seal
Courtesy of SUZUKI OF AMERICA CORP.

5. Insert the new valve stem seal.
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.
9. Compress the valve springs with the valve spring compressor KM-348 and adapter KM-653.

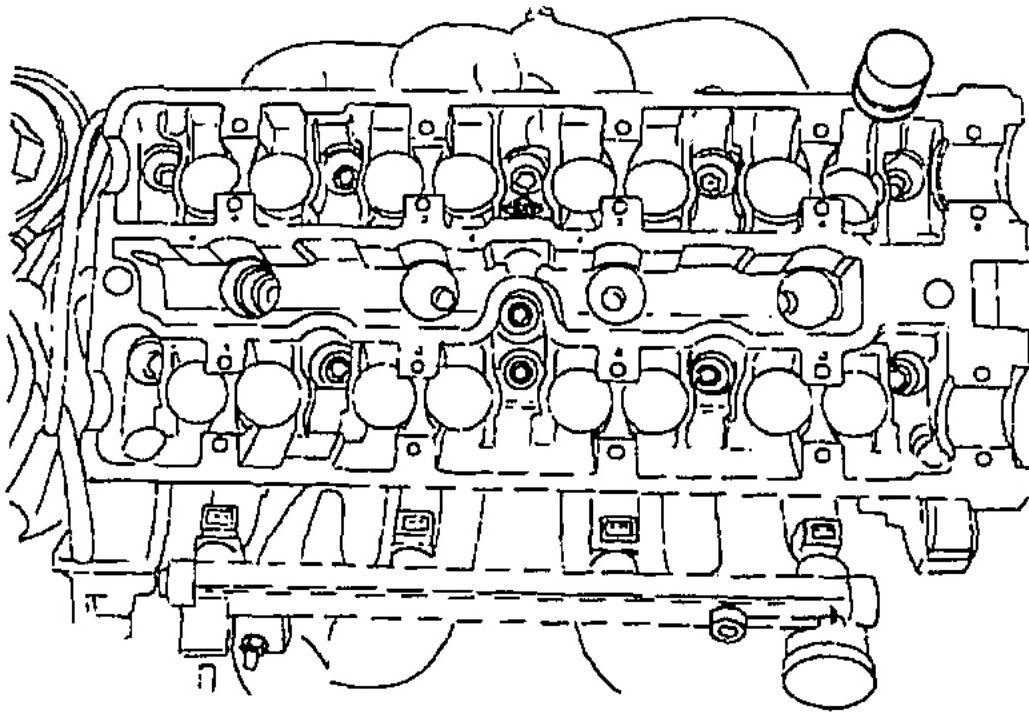


G00767373

Fig. 160: Compressing The Valve Springs
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the valve keys.

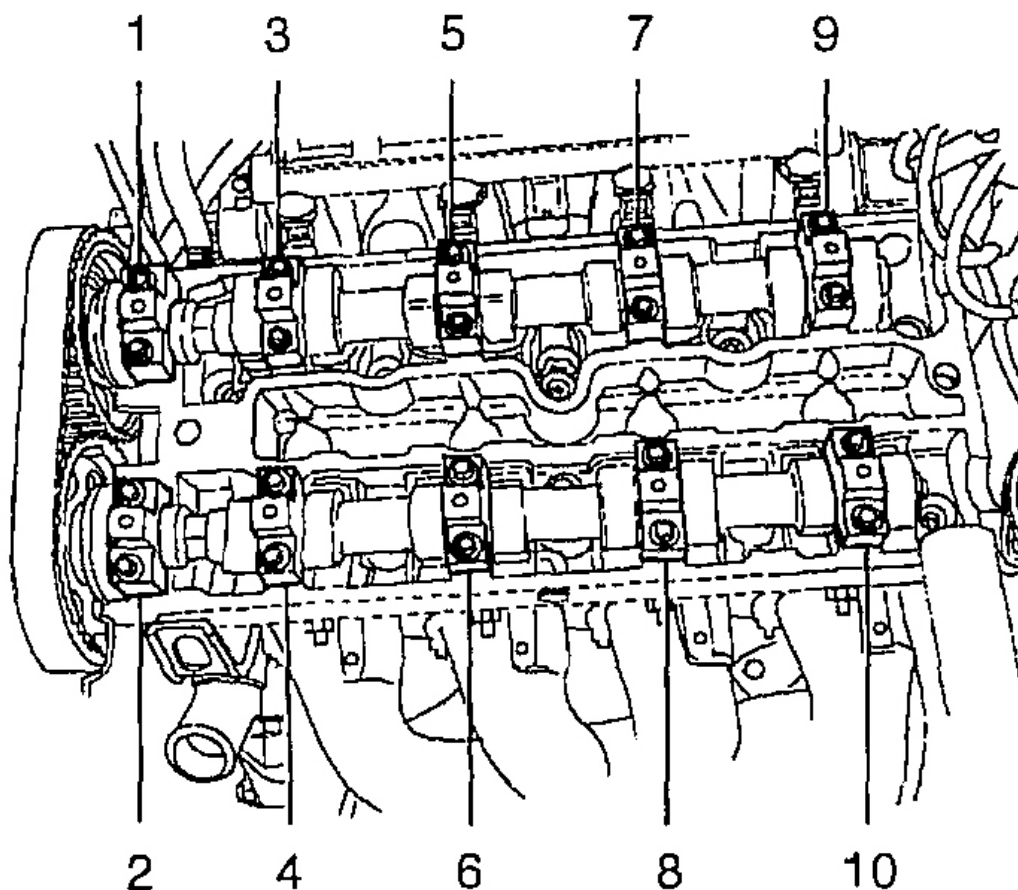
11. Remove the valve spring compressor KM-348 and adapter KM-653.
12. Lubricate the valve tappet adjusters with engine oil.
13. Install the valve tappet adjusters.



G00767374

Fig. 161: Installing The 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.



G00767375

Fig. 162: Tightening The Camshaft Bearing Cap Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

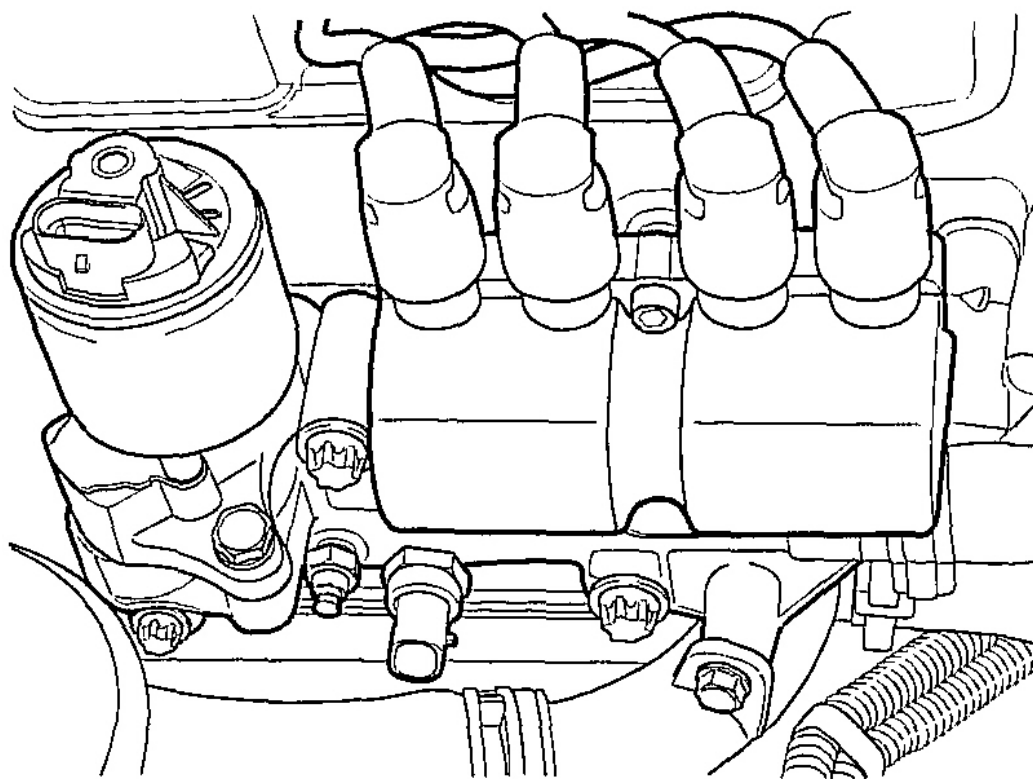
Tighten the camshaft bearing cap bolts to 8 N.m (71 lb-in).

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.



G00767376

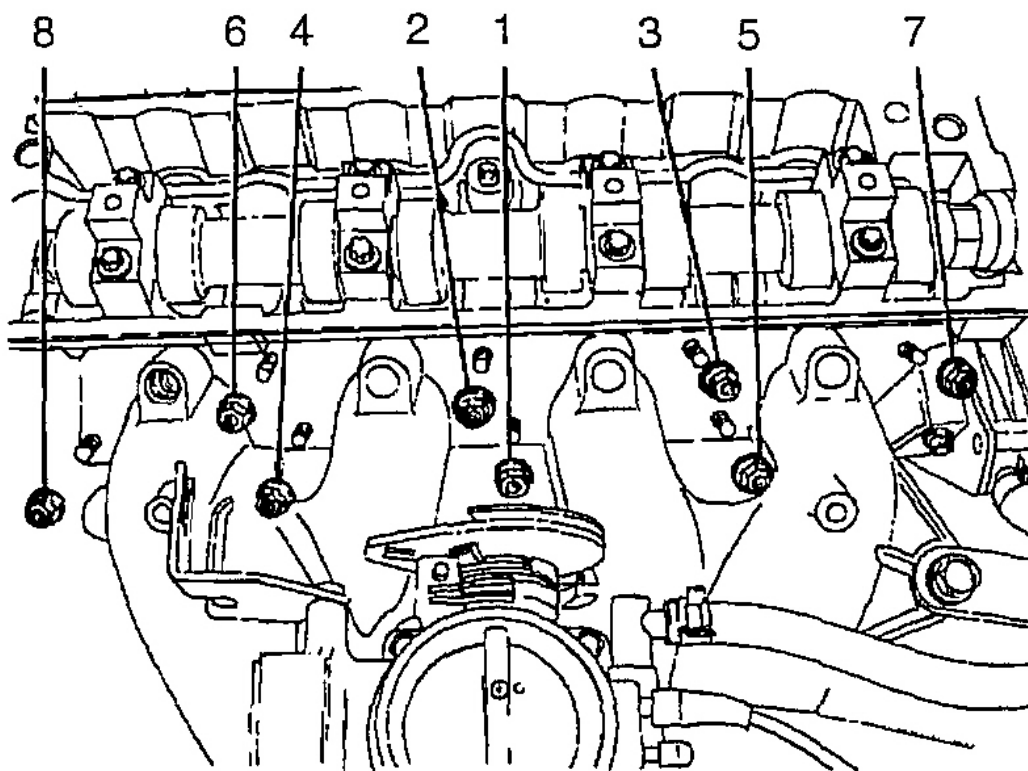
Fig. 163: Installing The DIS Coil And EGR Mounting Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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).

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.



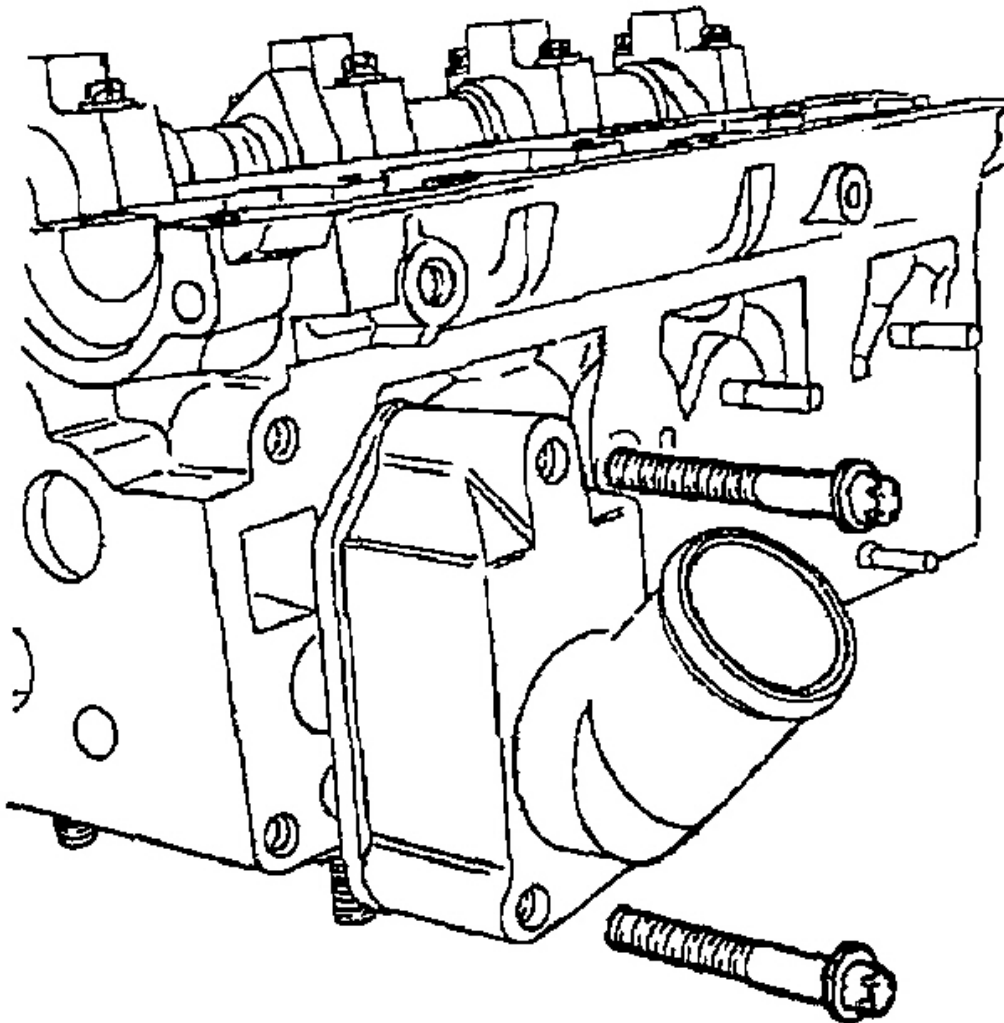
G00767377

Fig. 164: Installing The Intake Manifold Retaining Nuts And Bolt In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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



G00767378

Fig. 165: Installing The Thermostat Housing
Courtesy of SUZUKI OF AMERICA CORP.

29. Install the thermostat housing mounting bolts.

Tighten

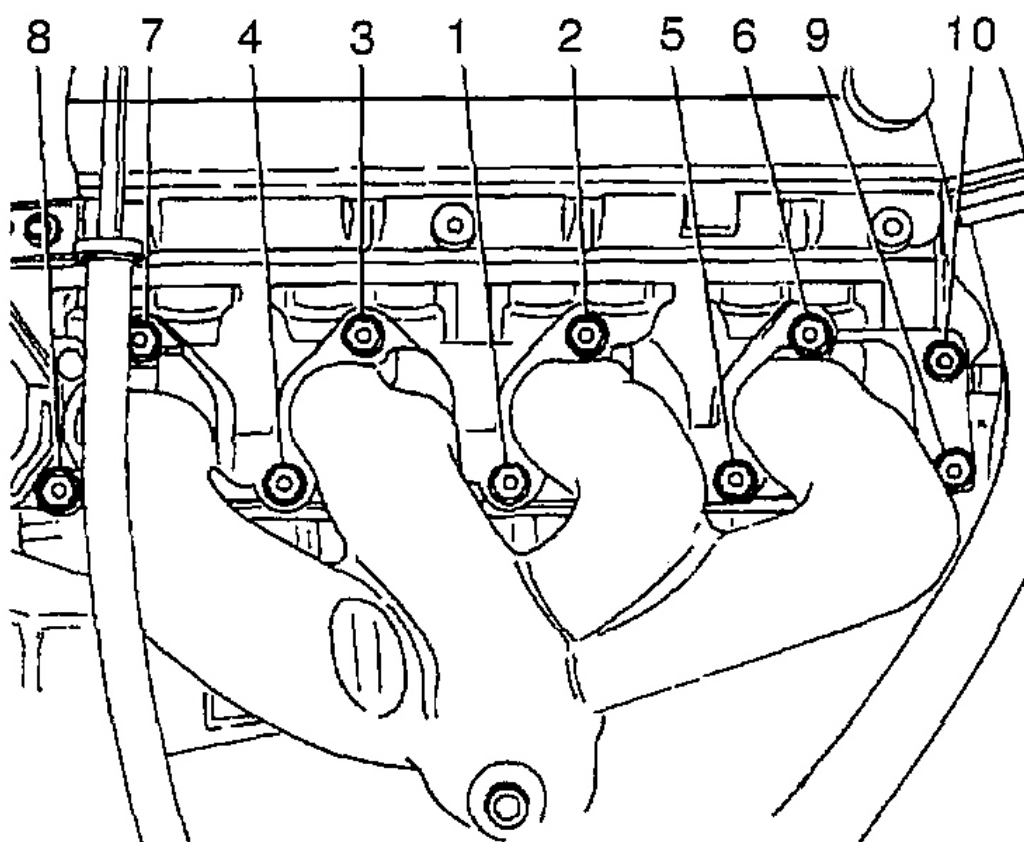
Tighten the thermostat housing mounting bolts to 15 N.m (11 lb-ft).

30. Install the coolant bypass housing and mounting bolts.

Tighten

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

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.



G00767379

Fig. 166: Installing The Exhaust Manifold Retaining Nuts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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.

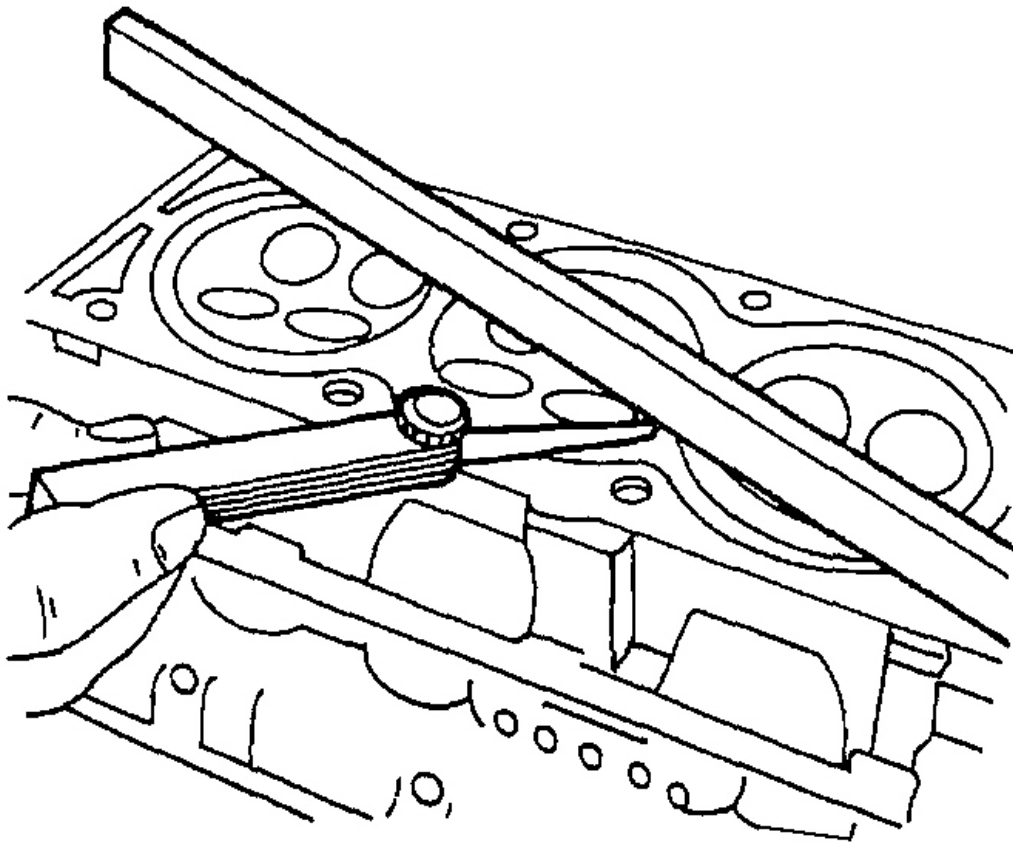
Tighten

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**.

Cylinder Head Inspection

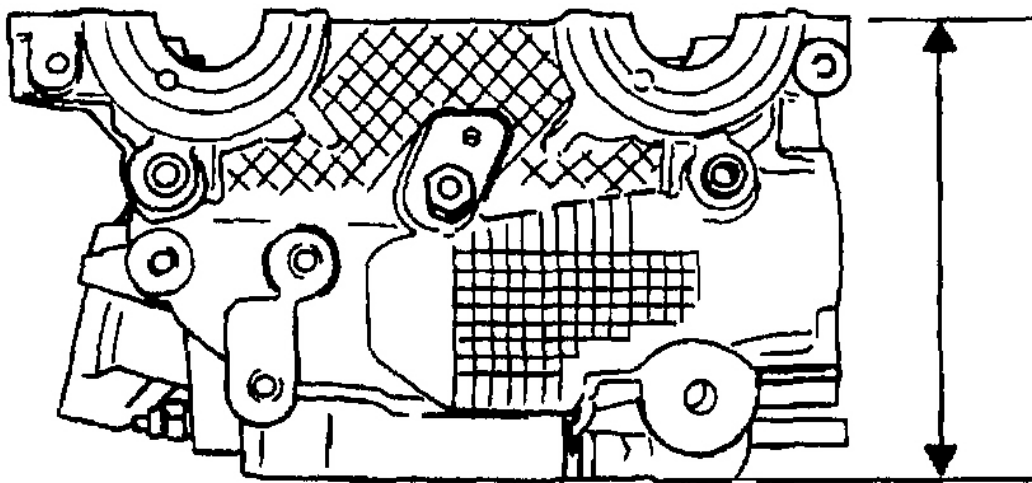
1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation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



G00767380

Fig. 167: Inspecting Cylinder Head Sealing Surface**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 to 134.025 mm (5.274 to 5.276 inches). If the cylinder head height is less than 133.9 mm (5.271 inches), replace the cylinder head.



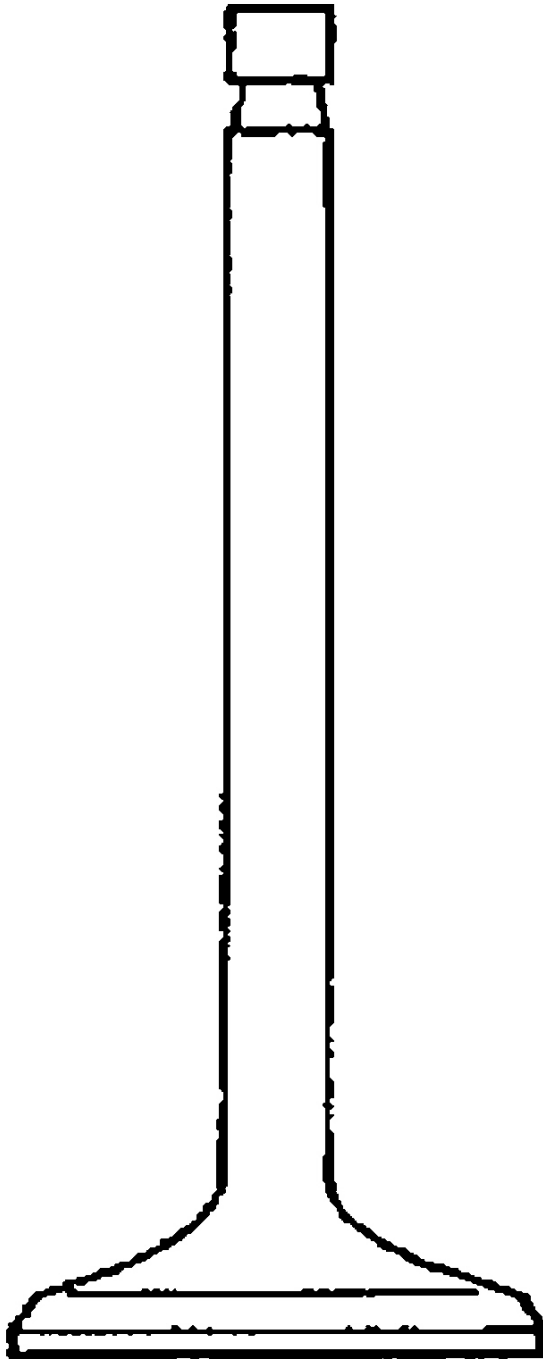
G00767381

Fig. 168: Measuring The Height Of The Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

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

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.



G00767382

Fig. 169: Identifying Valve

Courtesy of SUZUKI OF AMERICA CORP.

8. Inspect the valve spring seating surface of the valve rotators for wear or gouges. Replace as required.

Cylinder Head and Valve Train Components Cleaning

1. Clean the cylinder head.

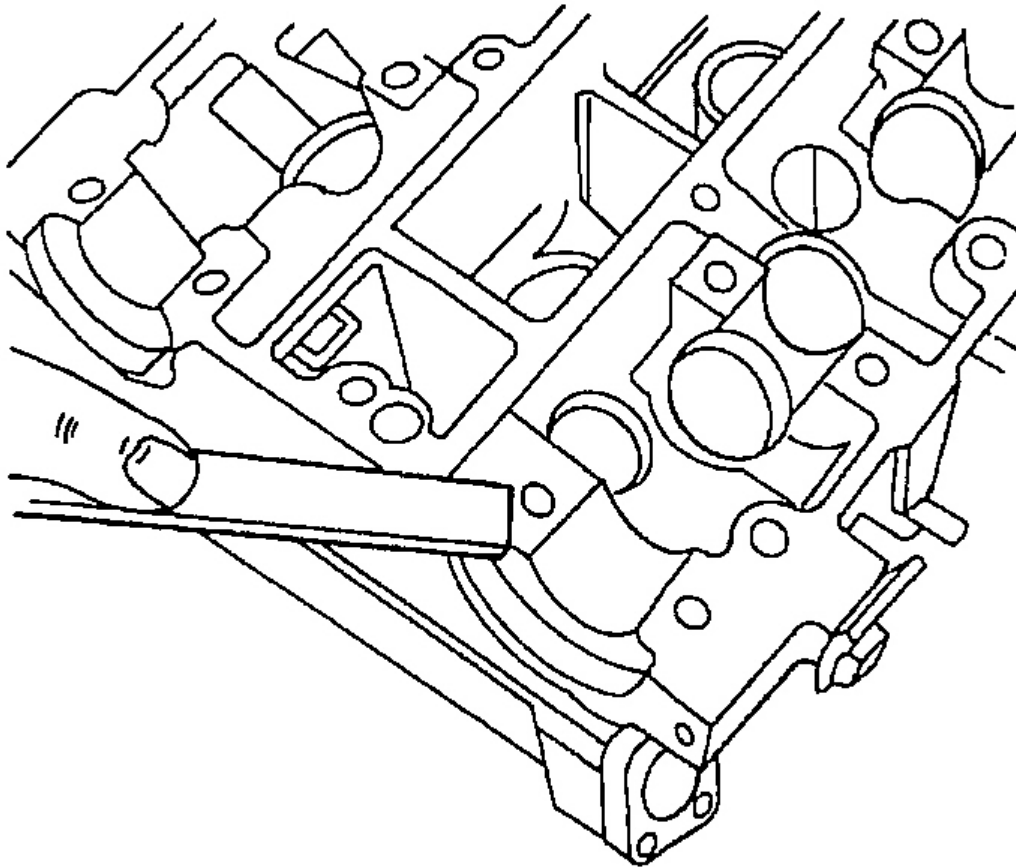
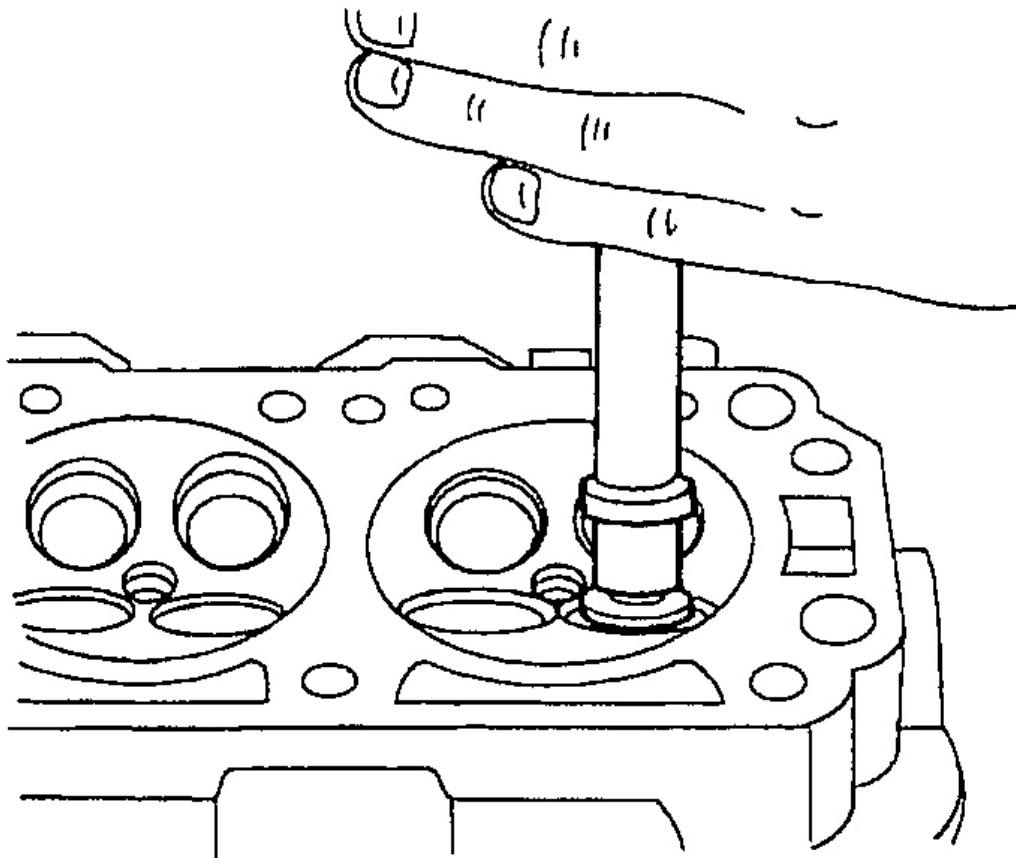
**G00767383**

Fig. 170: Cleaning Head Surface
Courtesy of SUZUKI OF AMERICA CORP.

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

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.

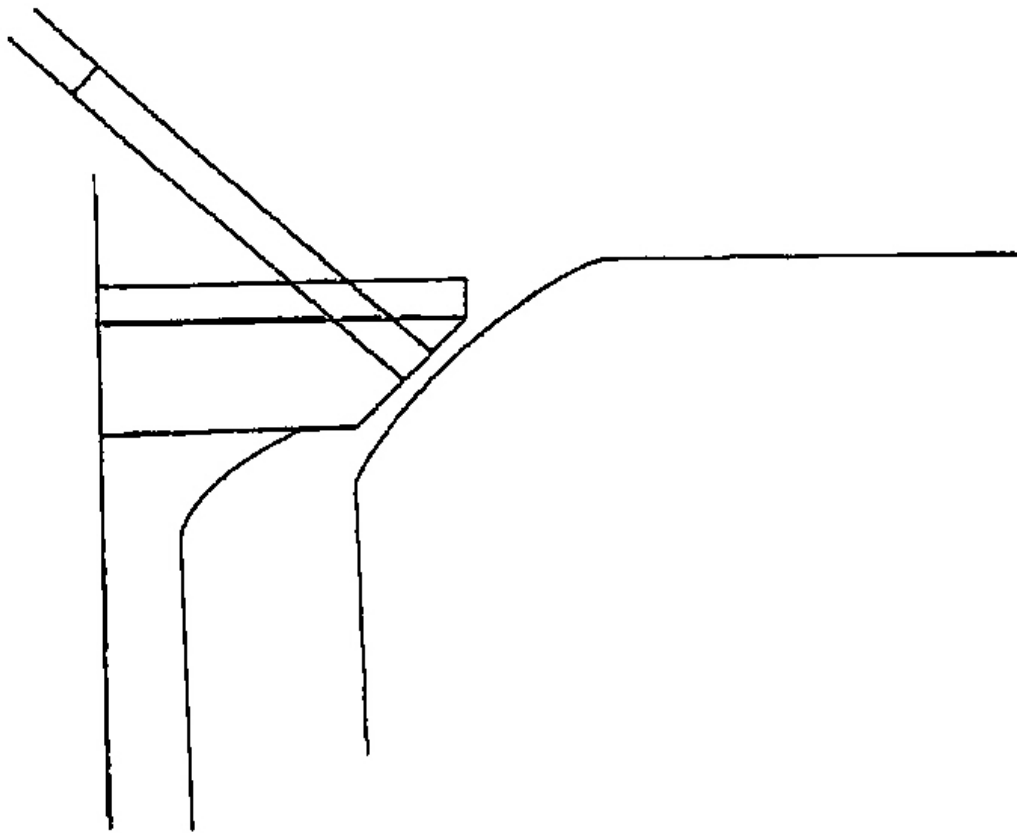


G00767384

Fig. 171: Lapping Valve

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.

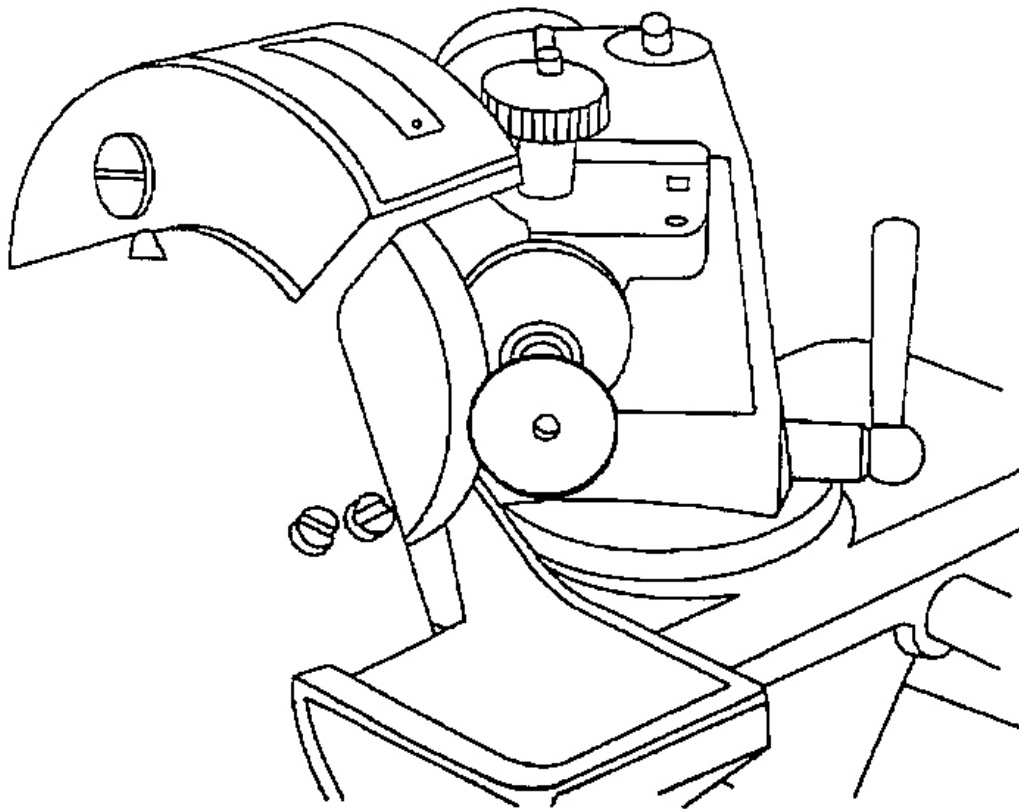


G00767385

Fig. 172: Inspecting Valve Contact Pattern
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 degrees.
4. Inspect the assembly height of the intake valves and the exhaust valves.



G00767386

Fig. 173: Grinding Valve Face
Courtesy of SUZUKI OF AMERICA CORP.

Valve Guide - Ream

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

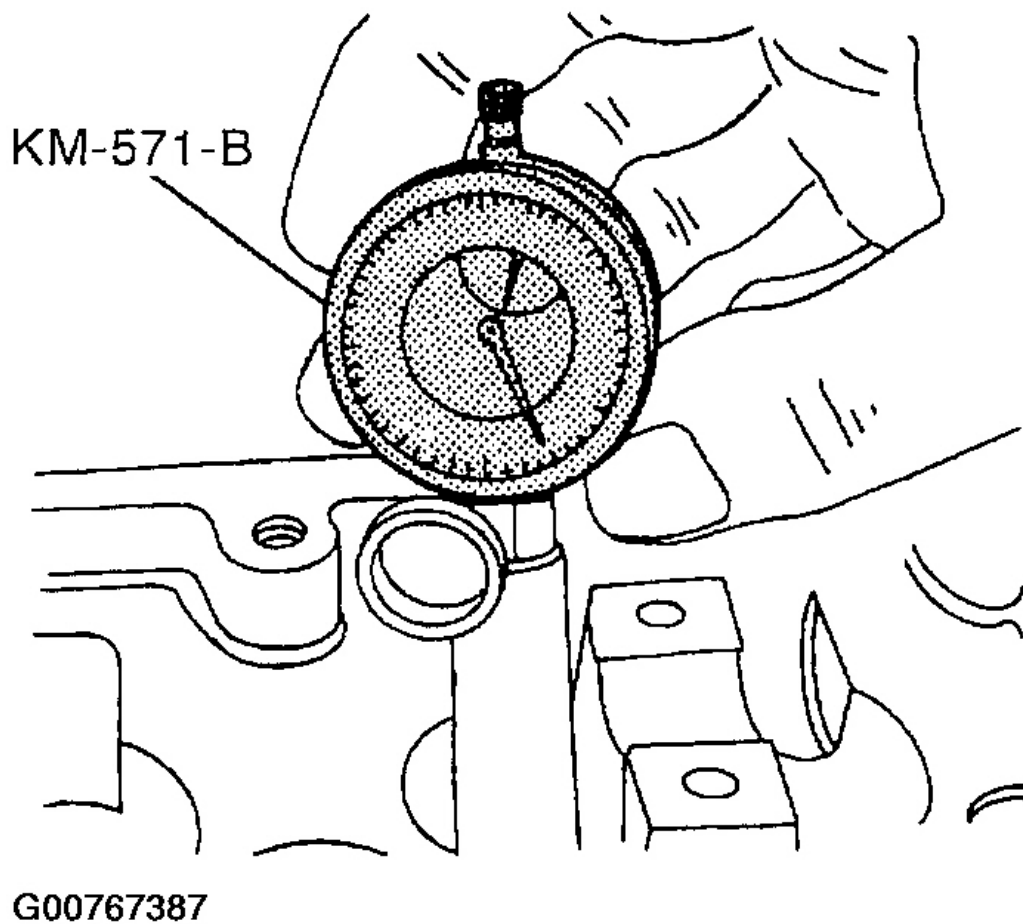


Fig. 174: Measuring The Diameter Of The Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Valve oversizes may already have been fitted in production.

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.

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

G00767388

Fig. 175: Valve Guide Size Chart**Courtesy of SUZUKI OF AMERICA CORP.**

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.

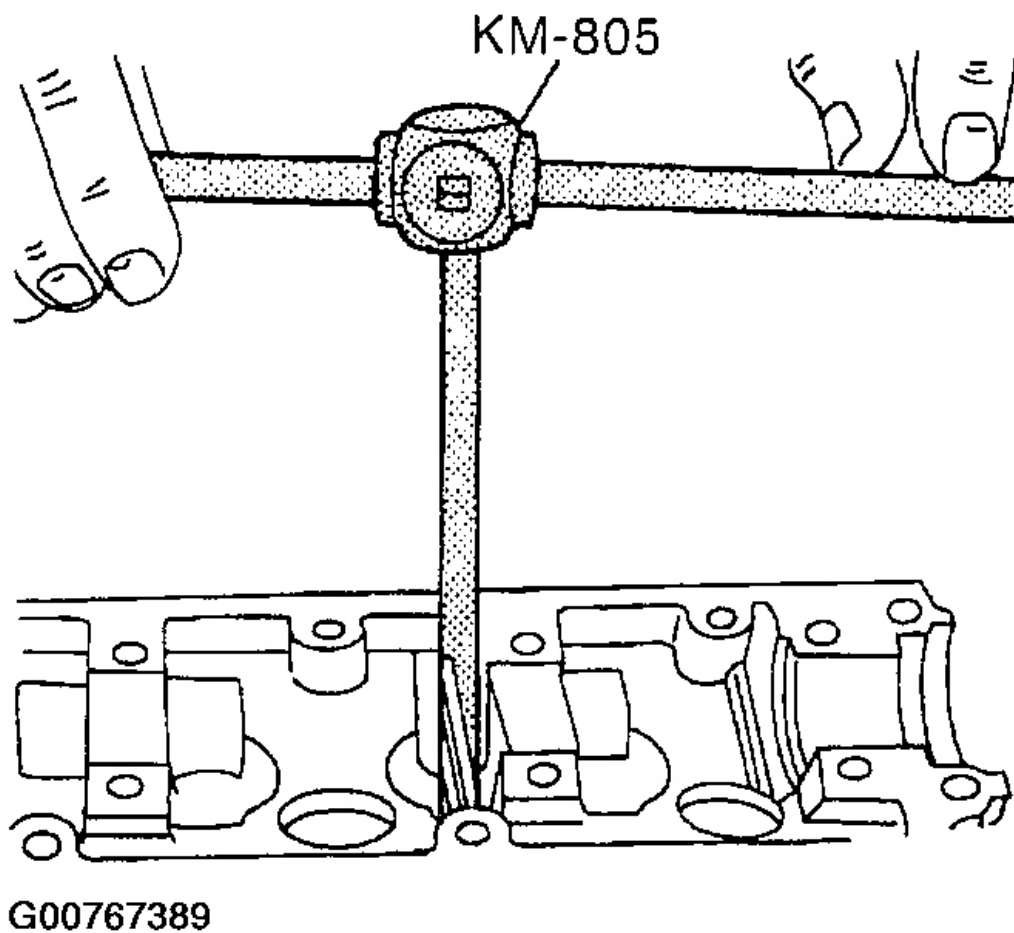
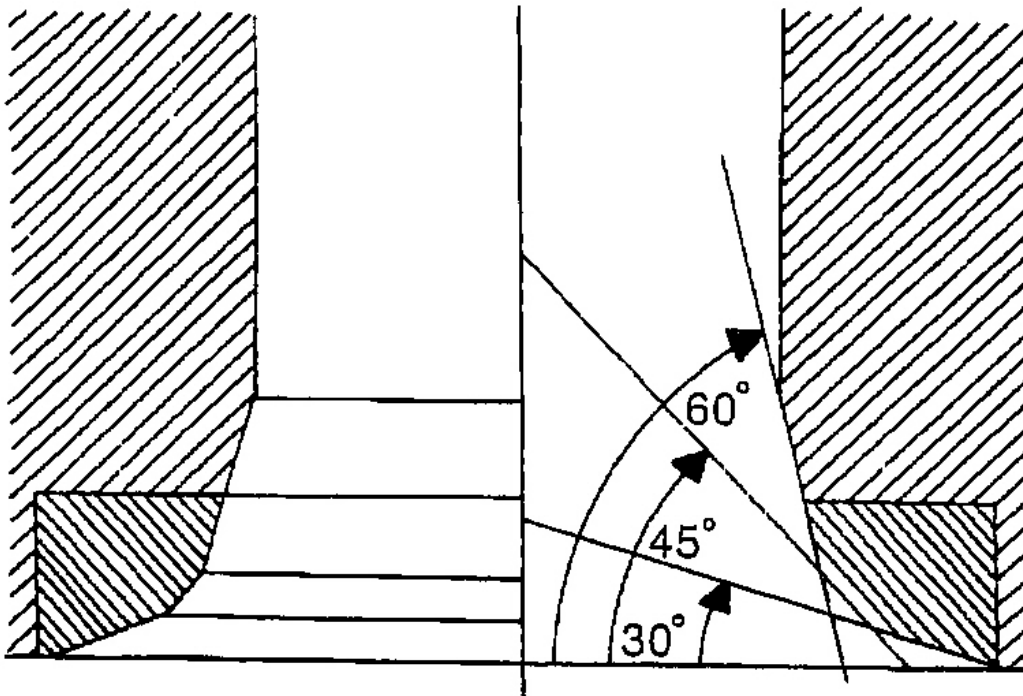


Fig. 176: Reaming The Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

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-degree surface using the cutter KM-340-13.
 - Upper correction angle - A 30-degree surface using the cutter KM-340-13.
 - Lower correction angle - A 60-degree surface using the cutter KM-340-26.



G00767390

Fig. 177: Identifying Valve Seat Angles
Courtesy of SUZUKI OF AMERICA CORP.

3. Clean the chippings from the cylinder head.
4. Inspect the dimension for the valve seat width.
 - Intake: 1.2 to 1.4 mm (0.047 to 0.055 inch).
 - Exhaust: 1.4 to 1.8 mm (0.055 to 0.070 inch).
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

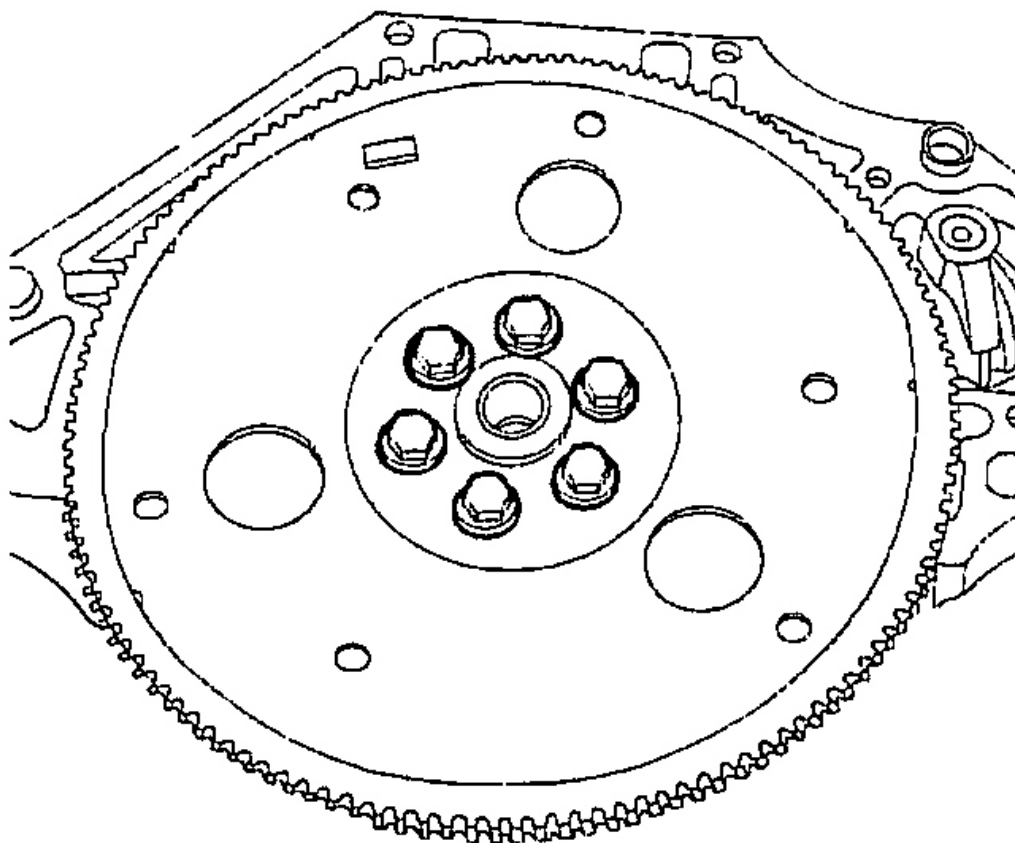
KM-412 Engine Overhaul Stand

KM-470-B Angular Torque Gauge

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

Disassembly

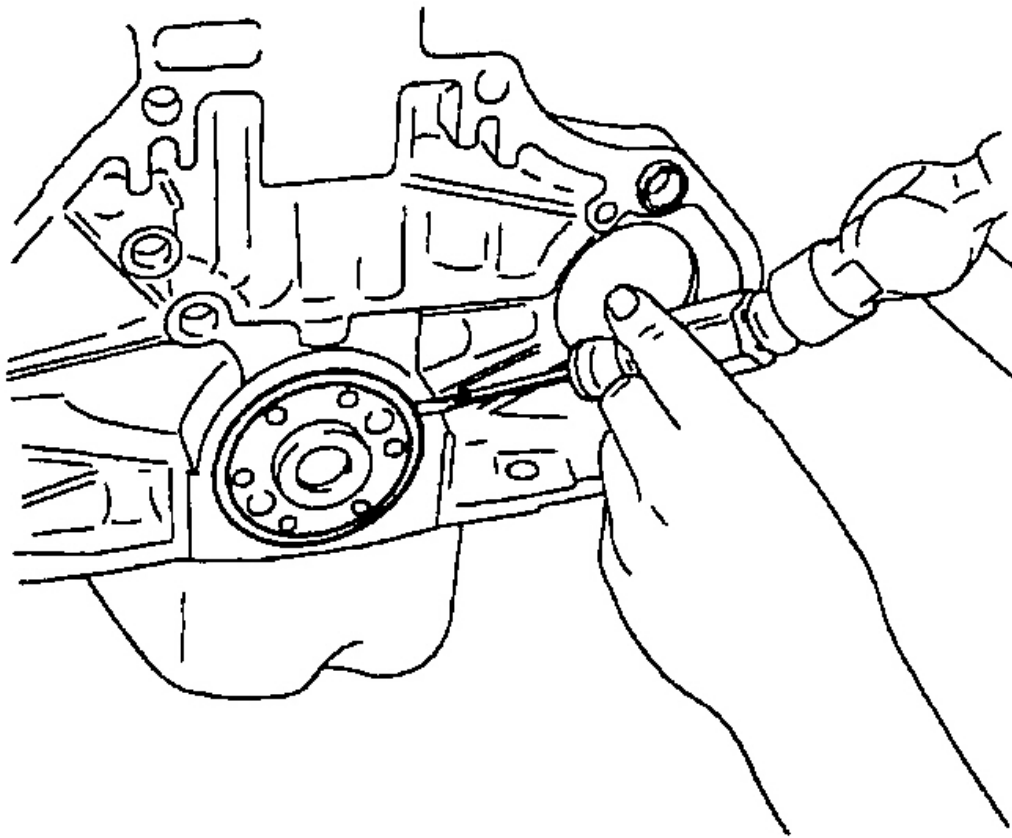
1. Remove the engine. Refer to **ENGINE REMOVAL AND INSTALLATION**.
2. Remove the flywheel or flexible plate bolts.
3. Remove the flywheel or the flexible plate.



G00767391

Fig. 178: Removing The Flywheel Or Flexible Plate
Courtesy of SUZUKI OF AMERICA CORP.

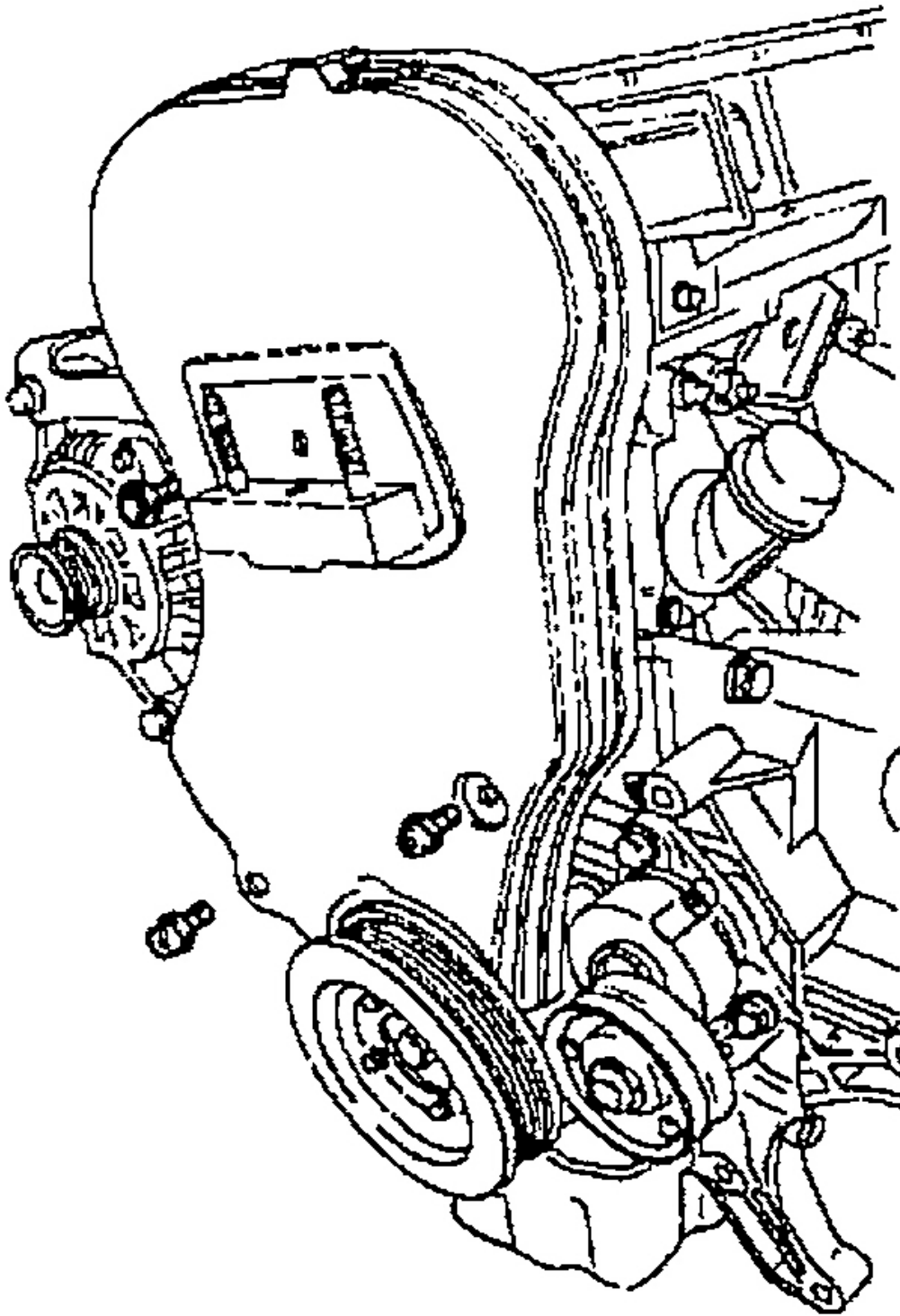
4. Remove the crankshaft rear oil seal.



G00767392

Fig. 179: Removing The Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

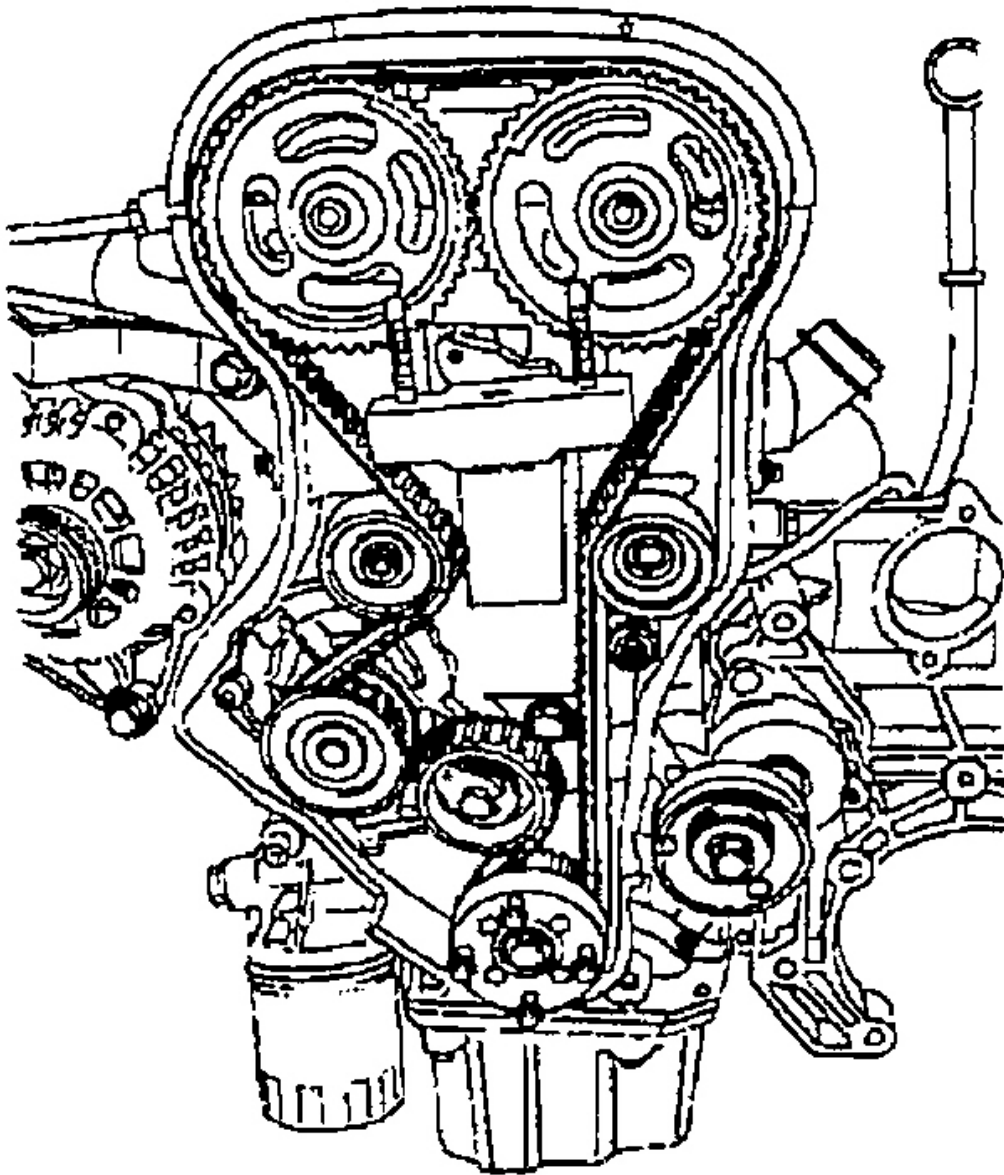
5. Mount the engine assembly on the engine overhaul stand KM-412.
6. Remove the front timing belt cover bolts.



G00767393

Fig. 180: Removing The Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove the front timing belt cover.
8. Remove the crankshaft pulley bolts.
9. Remove the crankshaft pulley.
10. Loosen the timing belt automatic tensioner bolt.

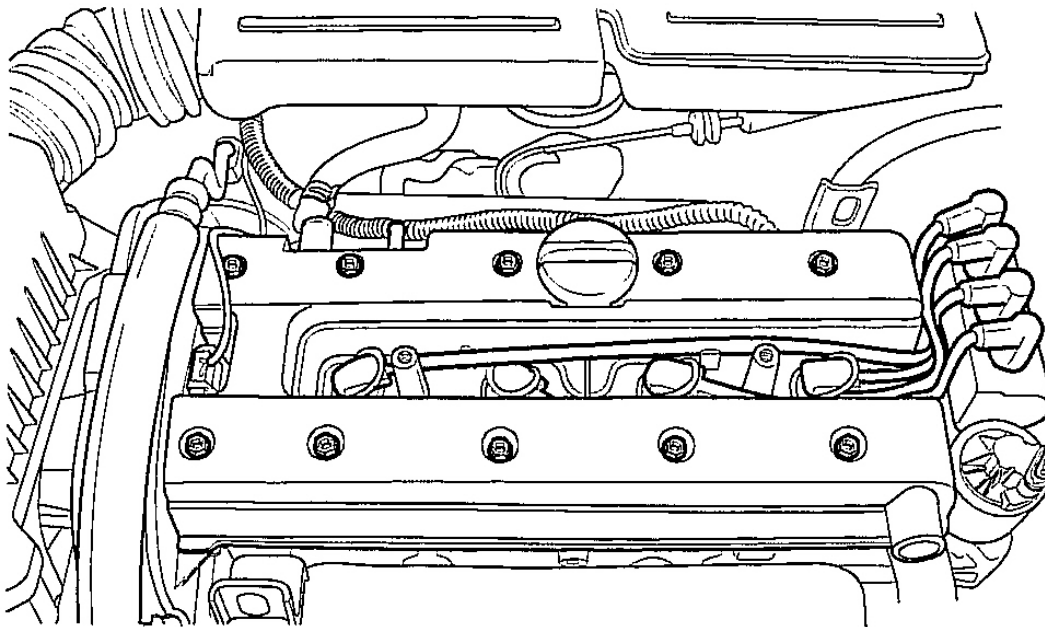


G00767394

Fig. 181: Locating Timing Belt Components
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.



G00767395

Fig. 182: Removing The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.

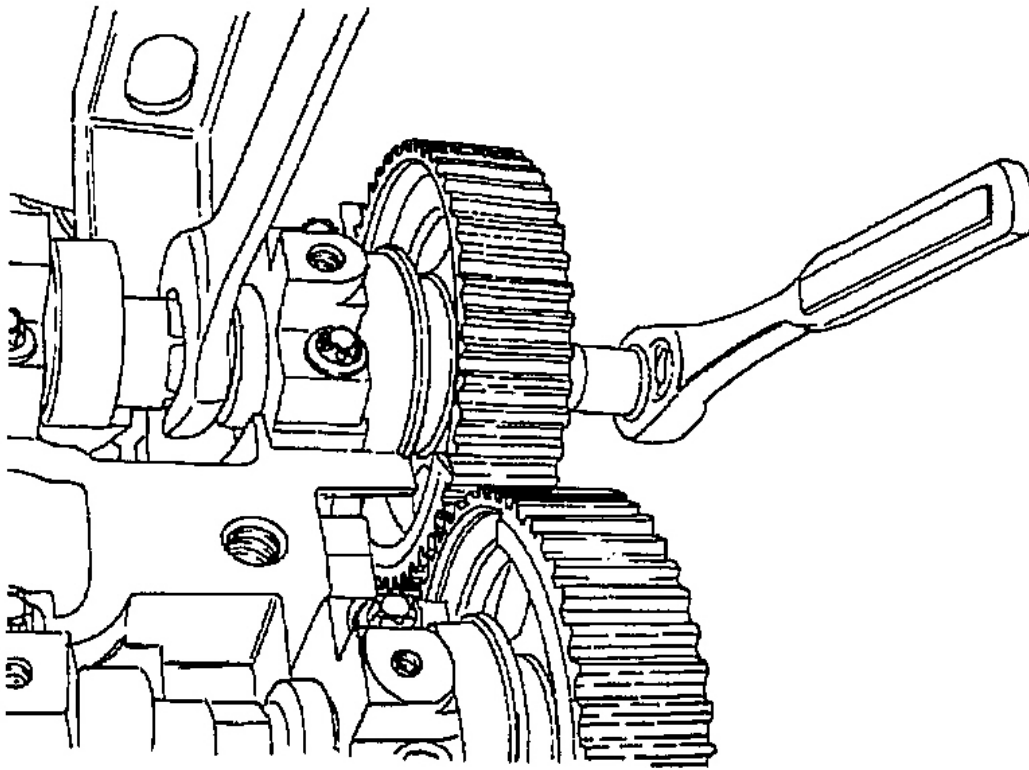
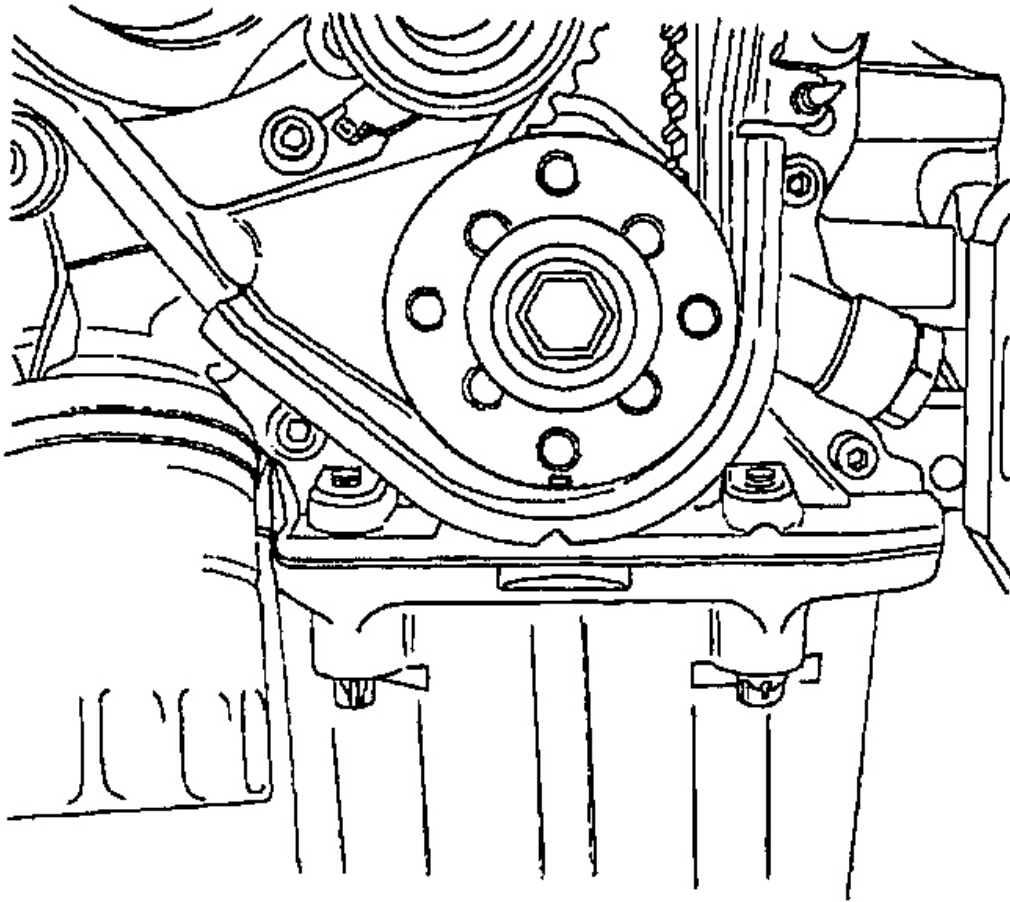
**G00767396**

Fig. 183: Removing The Intake Camshaft Bolt
Courtesy of SUZUKI OF AMERICA CORP.

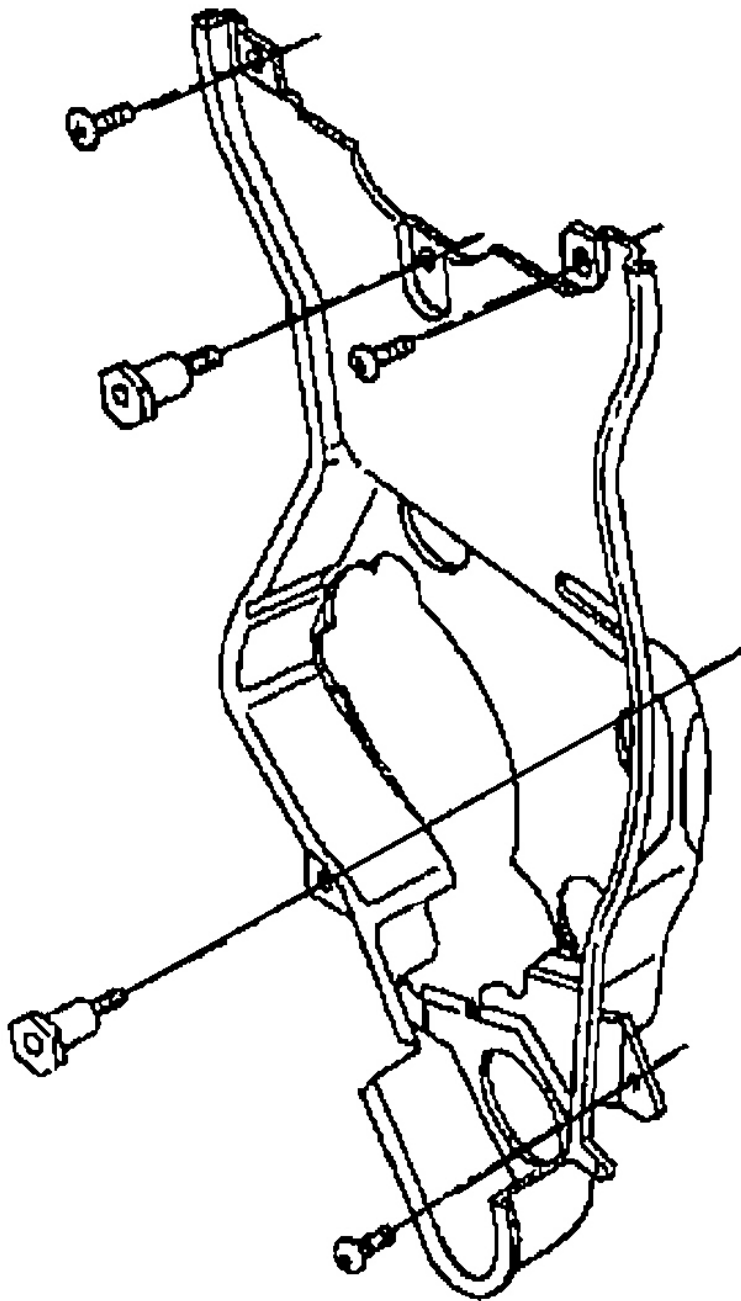
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.
28. Remove the crankshaft timing belt gear.



G00767397

Fig. 184: Removing The Crankshaft Timing Belt Gear
Courtesy of SUZUKI OF AMERICA CORP.

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



G00767398

Fig. 185: Removing The Rear Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

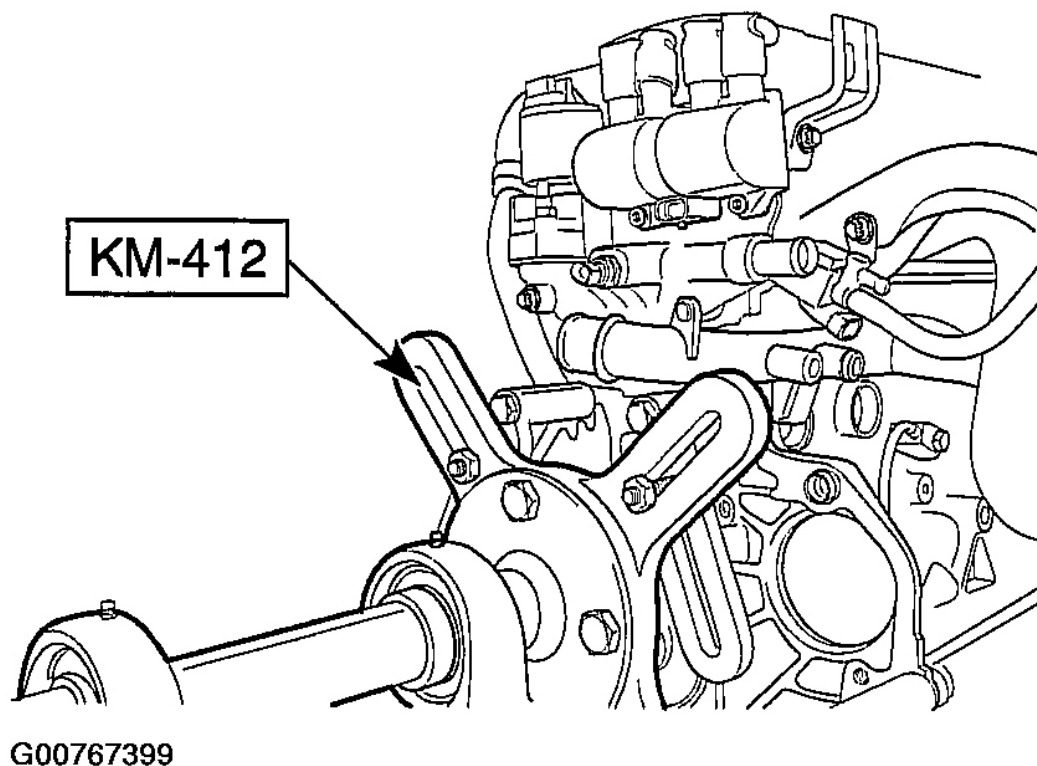
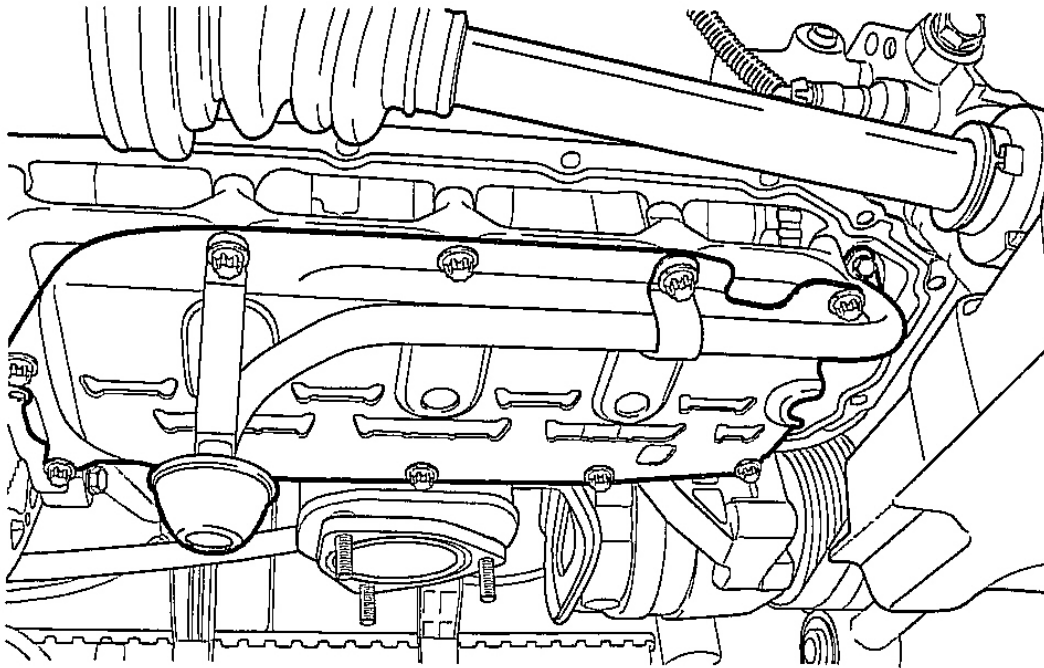


Fig. 186: Rotating Engine On The Engine Overhaul Stand
Courtesy of SUZUKI OF AMERICA CORP.

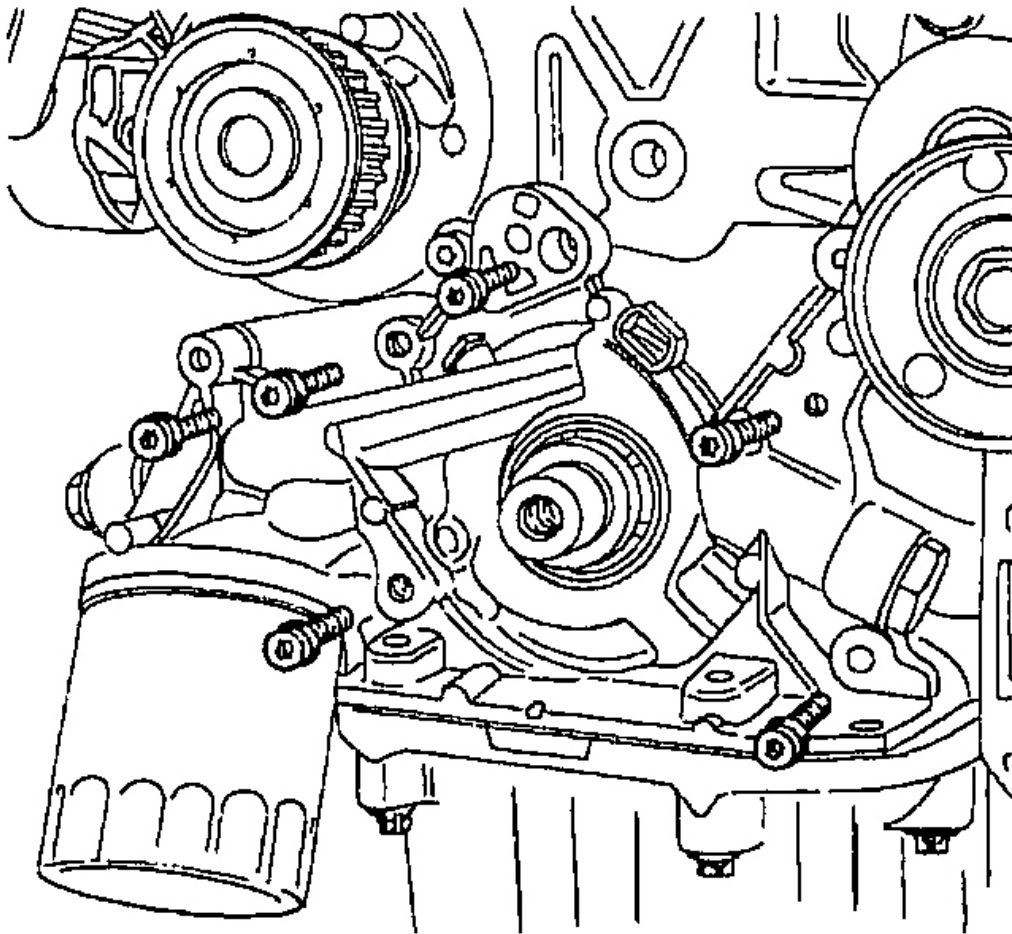
31. Remove the oil pan retaining bolts.
32. Remove the oil pan.
33. Remove the oil suction pipe and support bracket bolts.
34. Remove the oil suction pipe.
35. Remove the crankshaft bearing bridge and oil pan scraper bolts.
36. Remove the oil pan scraper.
37. Remove the crankshaft bearing bridge bolts.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



G00767400

Fig. 187: Identifying Crankshaft Bearing Bridge
Courtesy of SUZUKI OF AMERICA CORP.

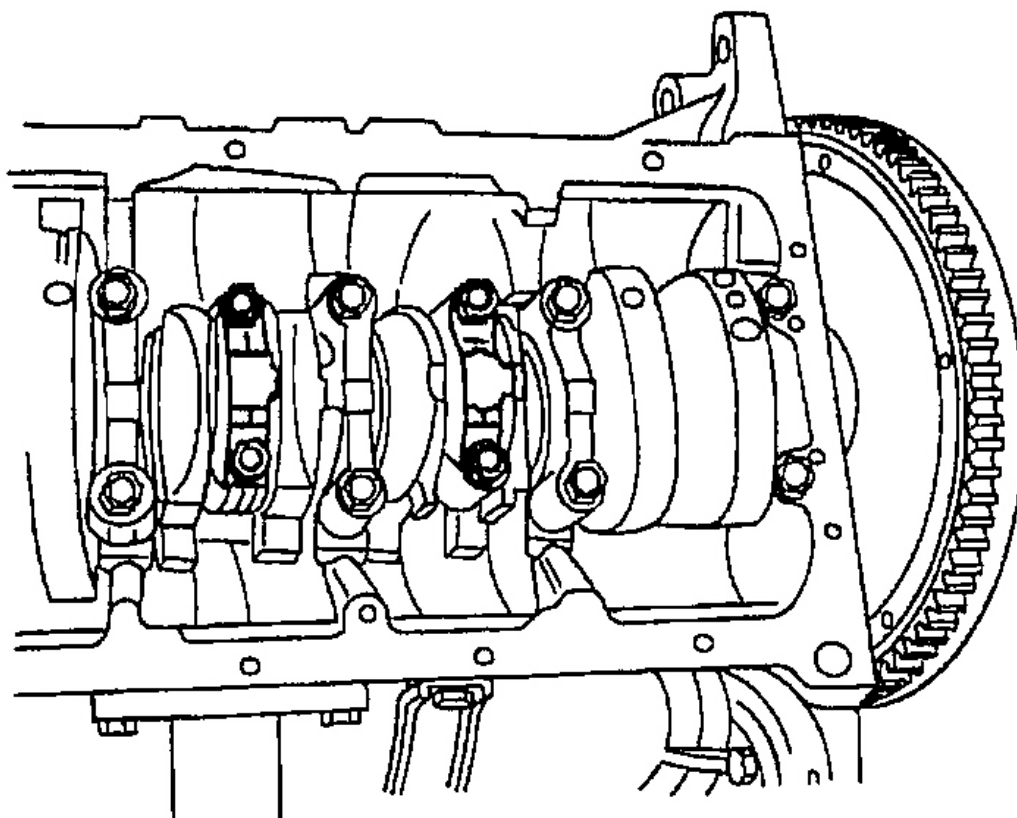
39. Remove the oil pump retaining bolts.
40. Remove the oil pump.



G00767401

Fig. 188: Removing The Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

41. Mark the order of the connecting rod bearing caps.



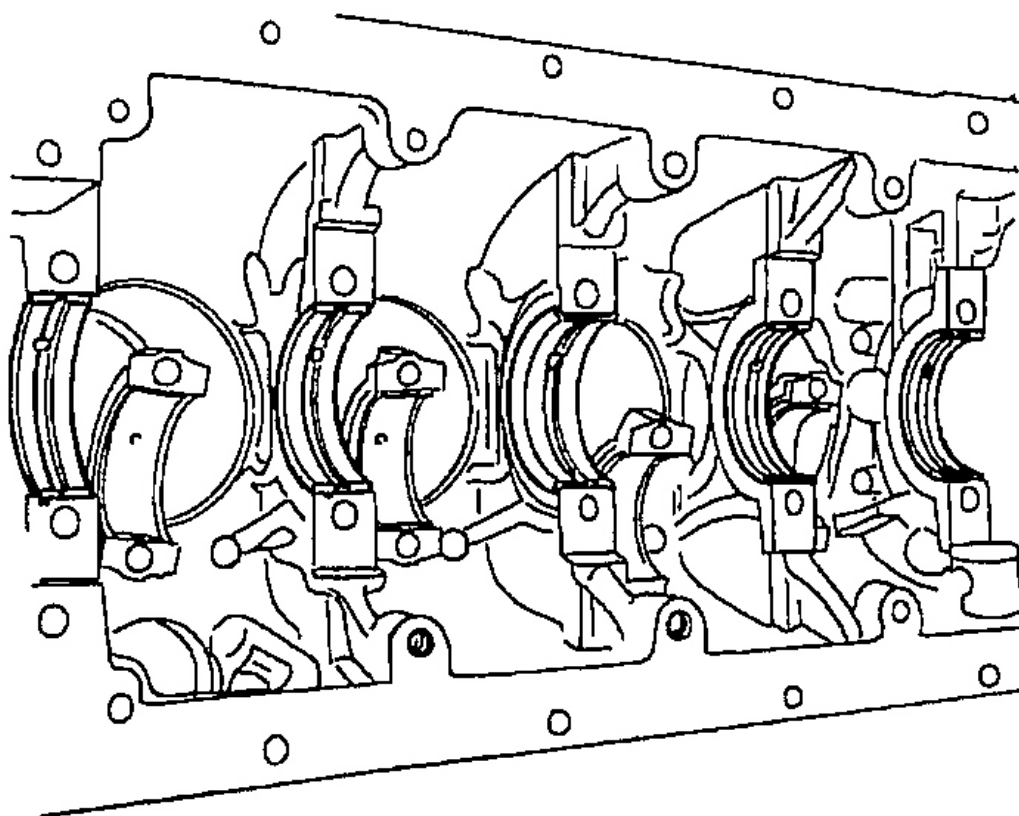
G00767402

Fig. 189: Locating Connecting Rod Bearing Caps
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.

Assembly

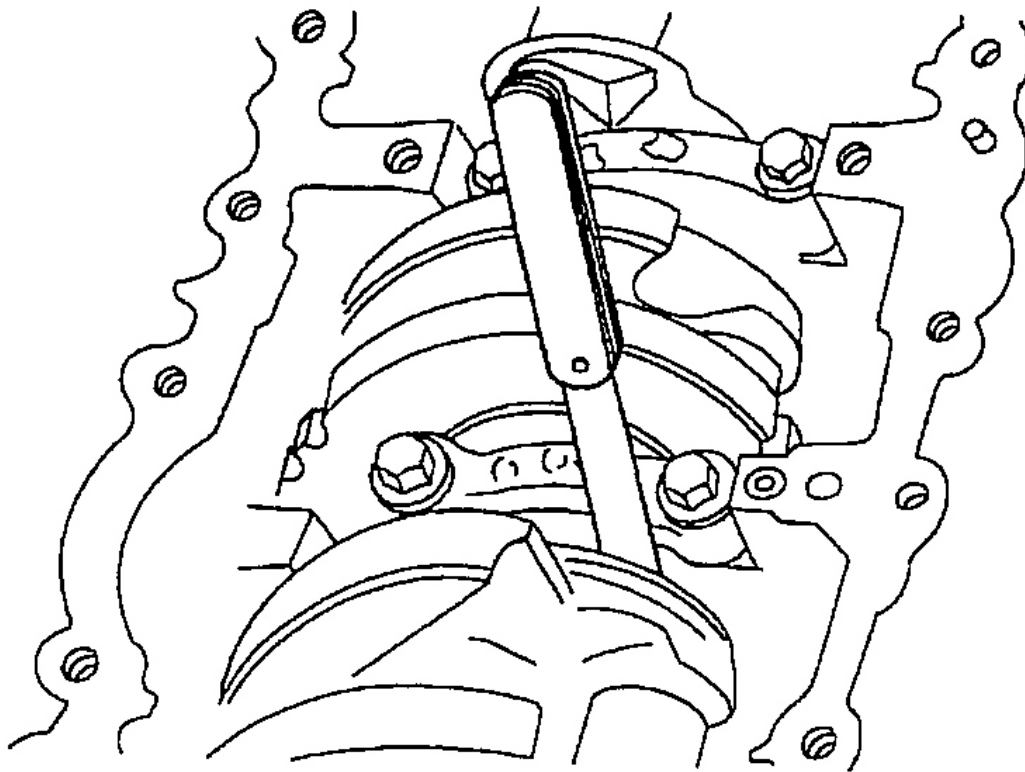
1. Coat the crankshaft bearings with engine oil.



G00767404

Fig. 190: Locating Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

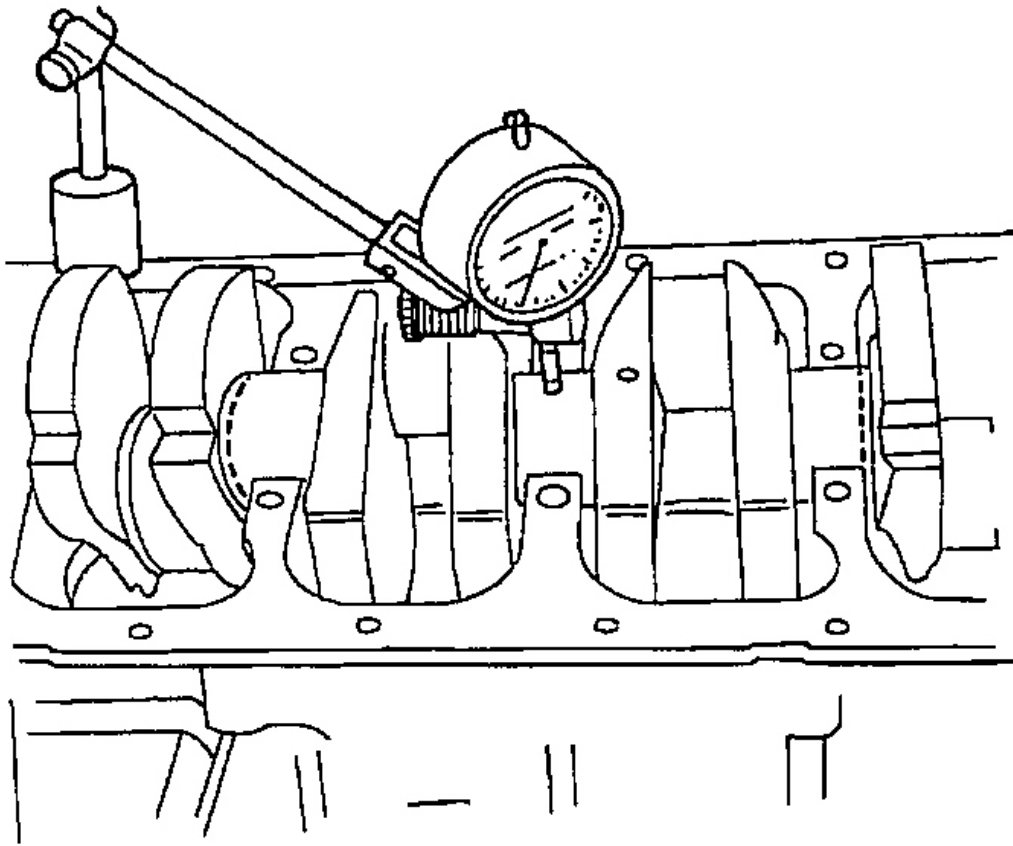
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.
3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to **ENGINE SPECIFICATIONS**.



G00767405

Fig. 191: Checking 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**.



G00767406

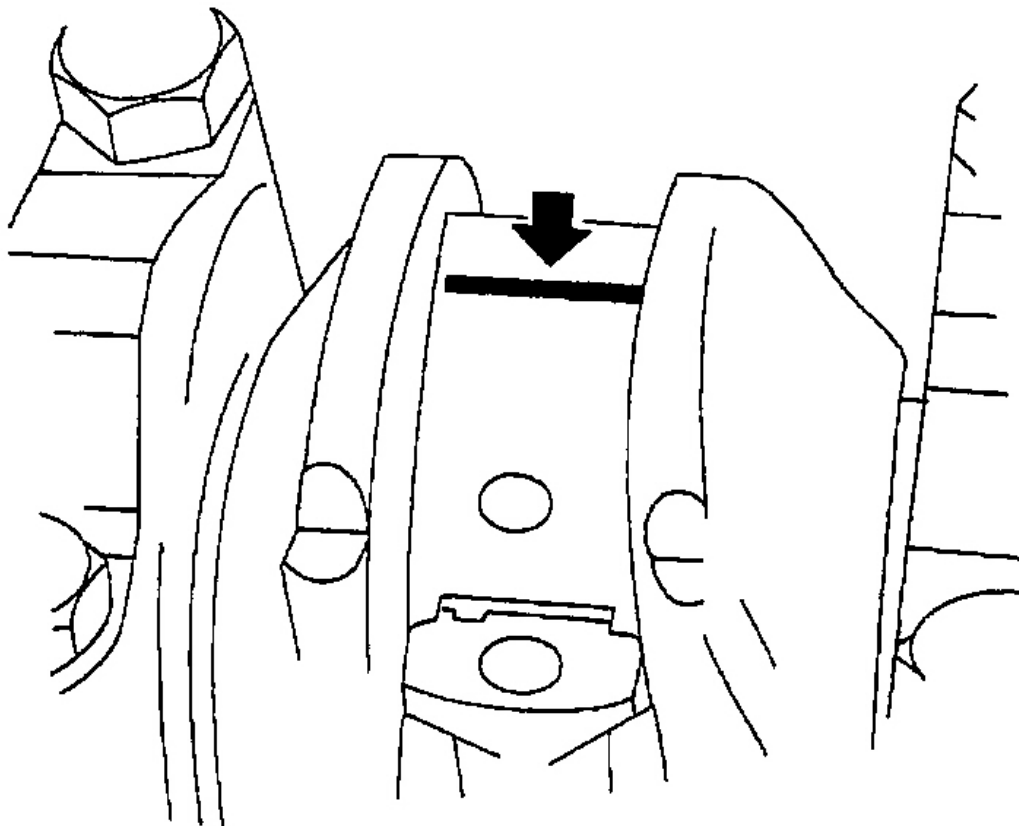
Fig. 192: Checking The Middle Crankshaft Journal Runout
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

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

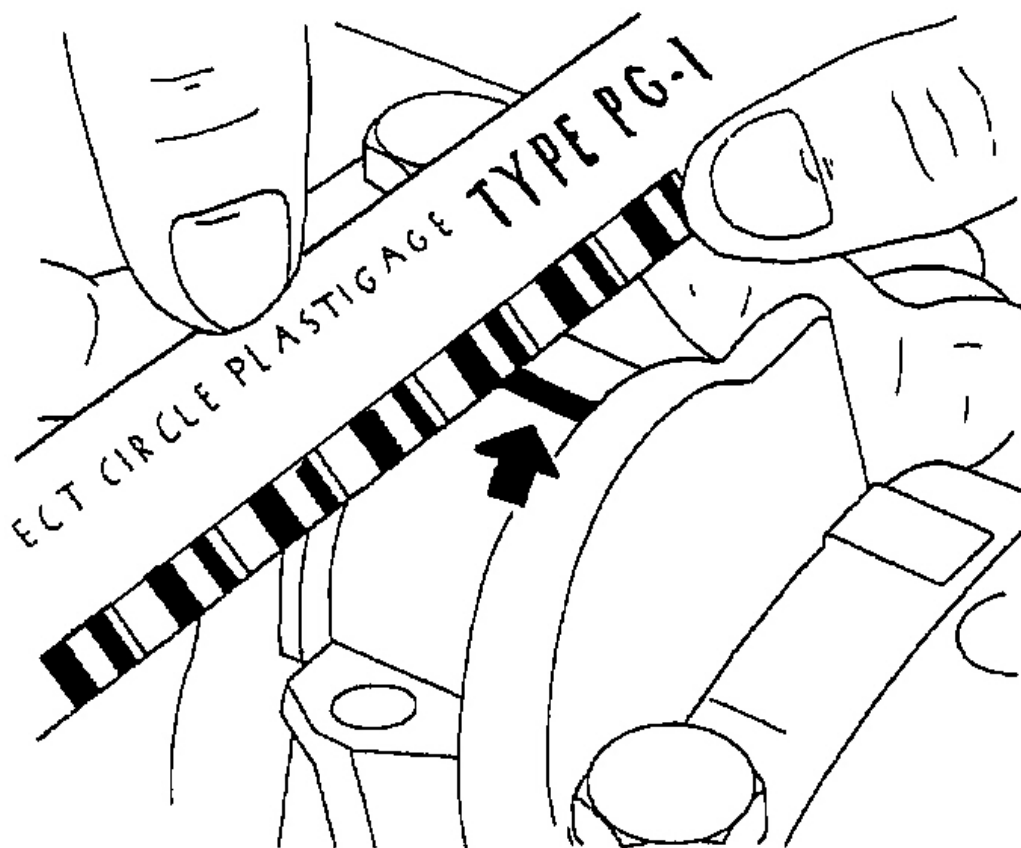
Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft) plus 45 degrees and 15 degrees.



G00767407

Fig. 193: Applying Plastic Gauging
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**.



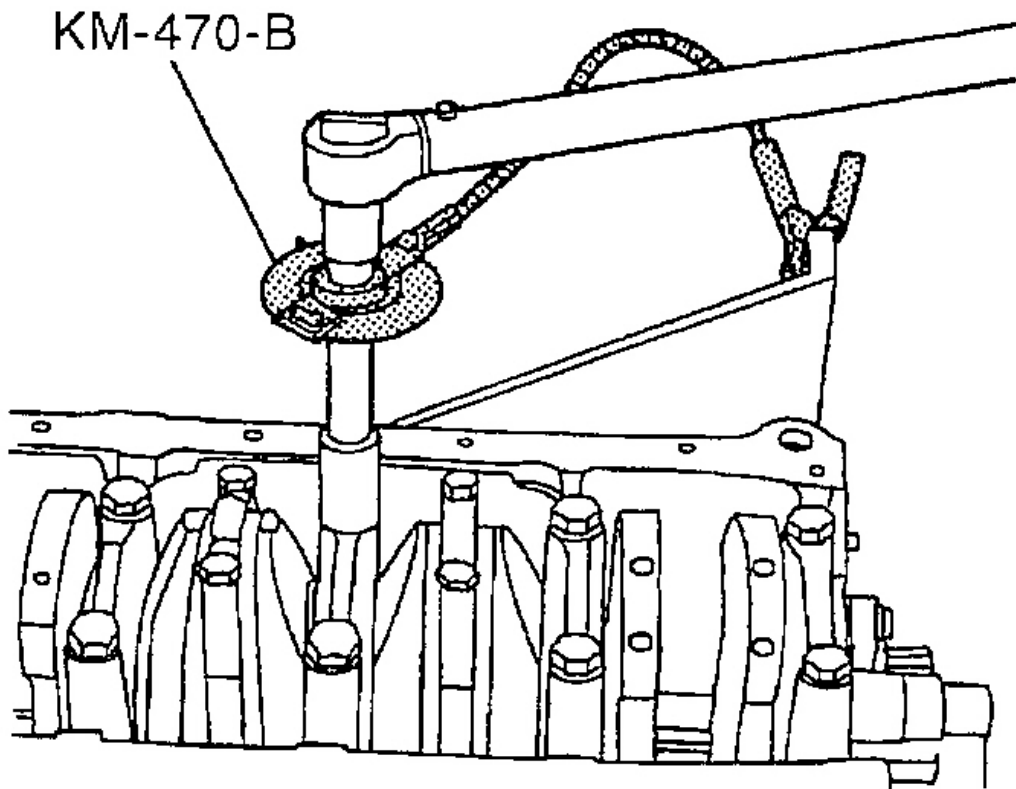
G00767408

Fig. 194: Measuring Width Of The Plastic Gauging
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 degrees and 15 degrees.



G00767409

Fig. 195: Tightening The Crankshaft Bearing Cap Bolts Using Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

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 degrees plus 15

degrees.

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

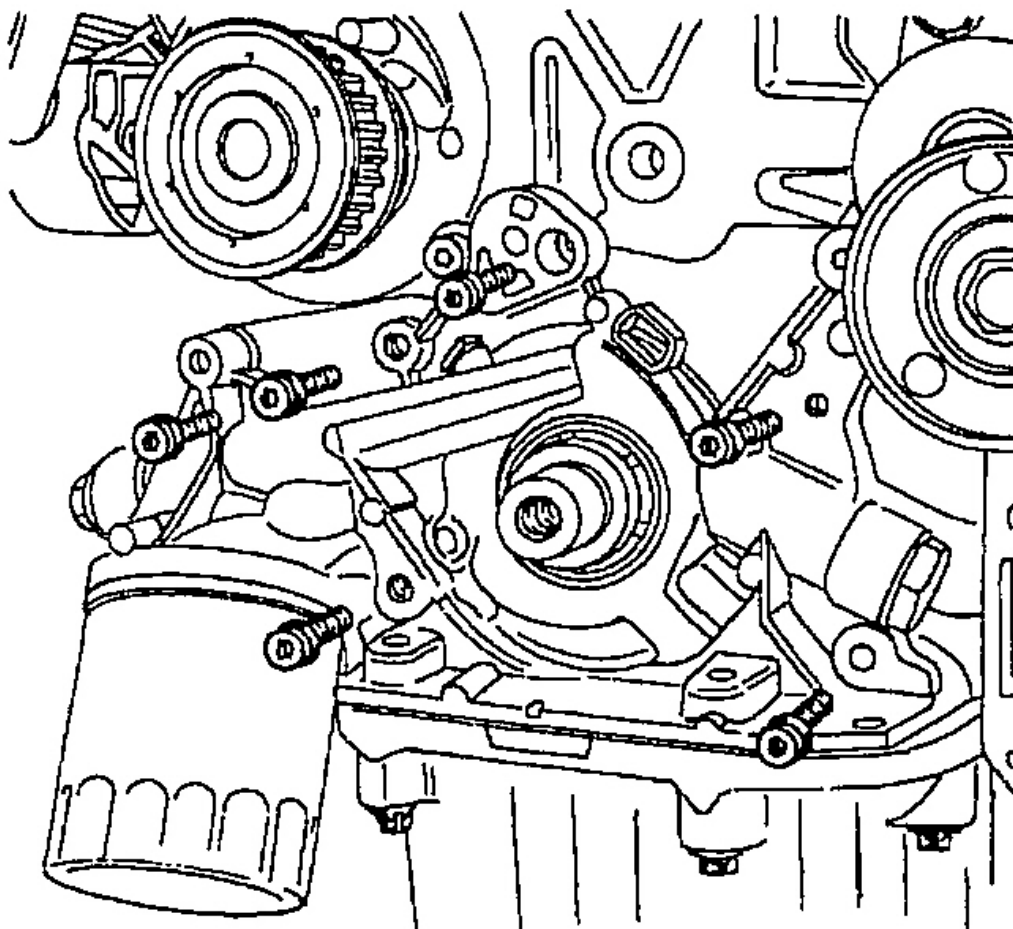
Tighten

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 degrees plus 15 degrees.

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).



G00767413

Fig. 196: Installing The Oil Pump
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 degrees using the angular torque gauge KM-470-B.

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

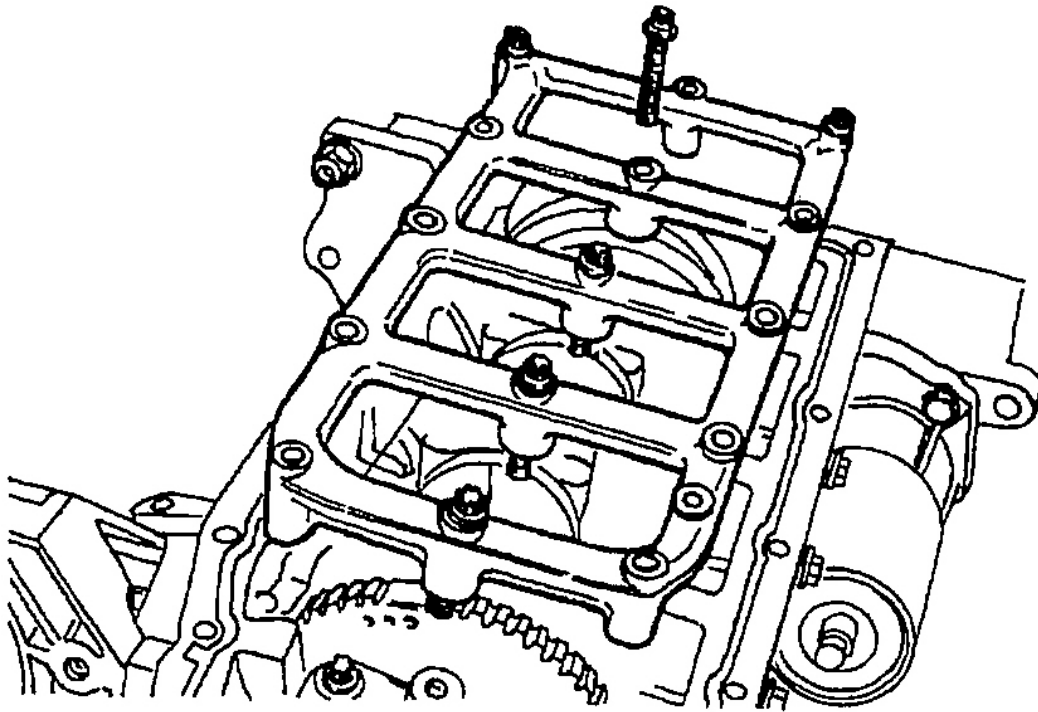
Tighten

Tighten the crankshaft bearing bridge and oil scraper bolts to 20 N.m (15 lb-ft) plus 45 degrees 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).



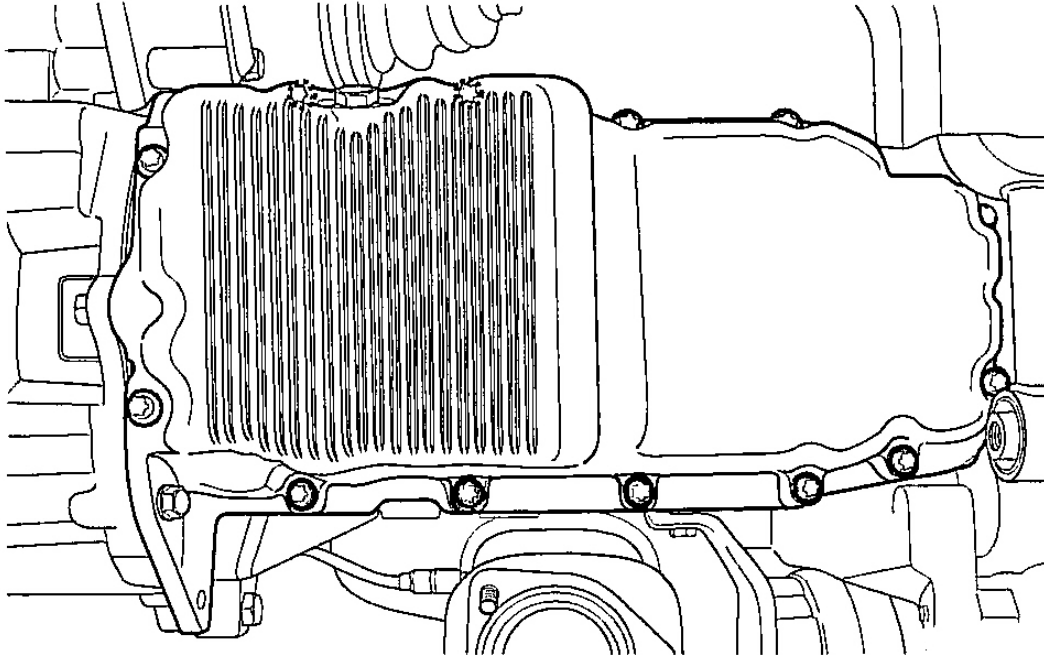
G00767414

Fig. 197: Installing The Crankshaft Bearing Bridge
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).



G00767415

Fig. 198: Installing The Oil Pan
Courtesy of SUZUKI OF AMERICA CORP.

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

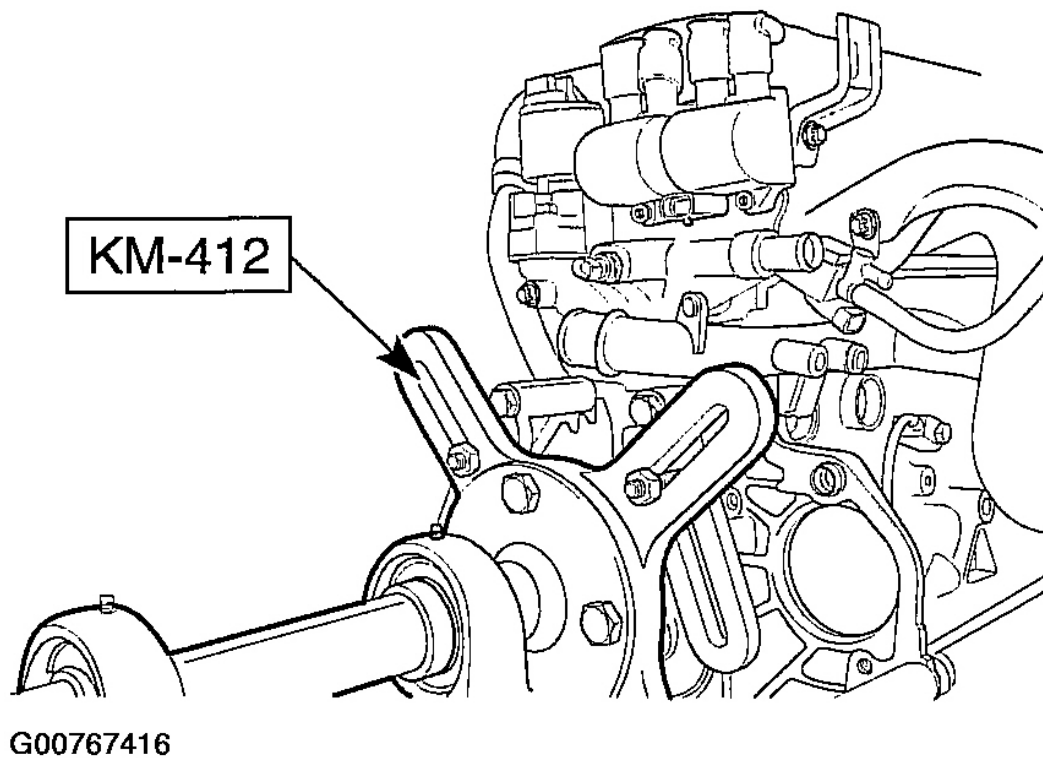


Fig. 199: Rotating The Engine On The Engine Overhaul Stand
Courtesy of SUZUKI OF AMERICA CORP.

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

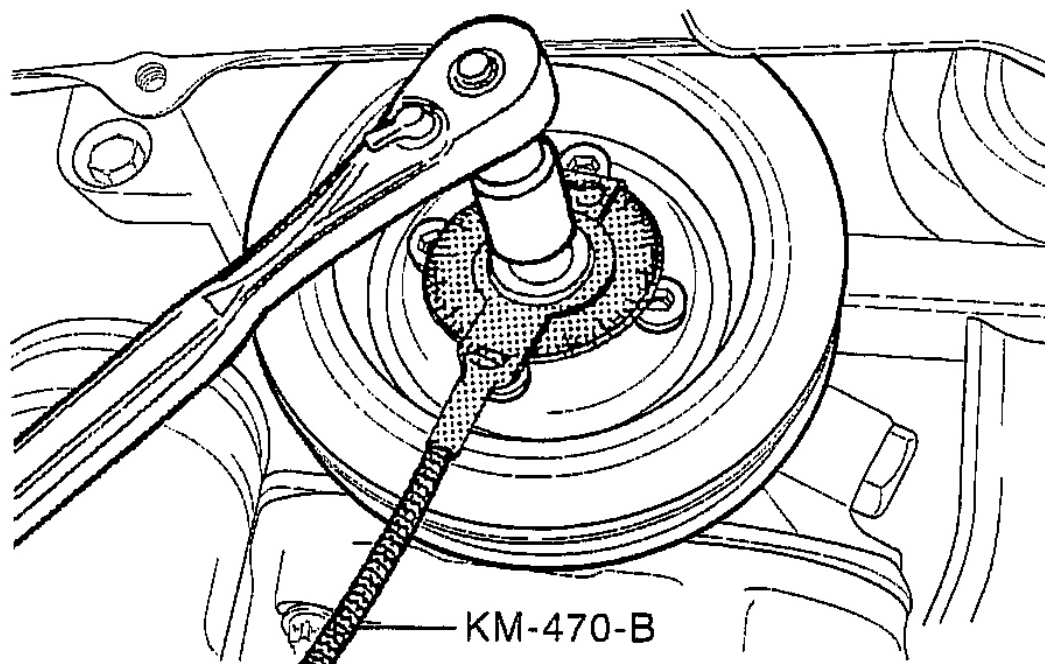
Tighten

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 degrees plus 15 degrees using the angular torque gauge KM-470-B.



G00767417

Fig. 200: Tightening The Crankshaft Gear Bolt Using The Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

39. Install the engine mount and retaining bolts.

Tighten

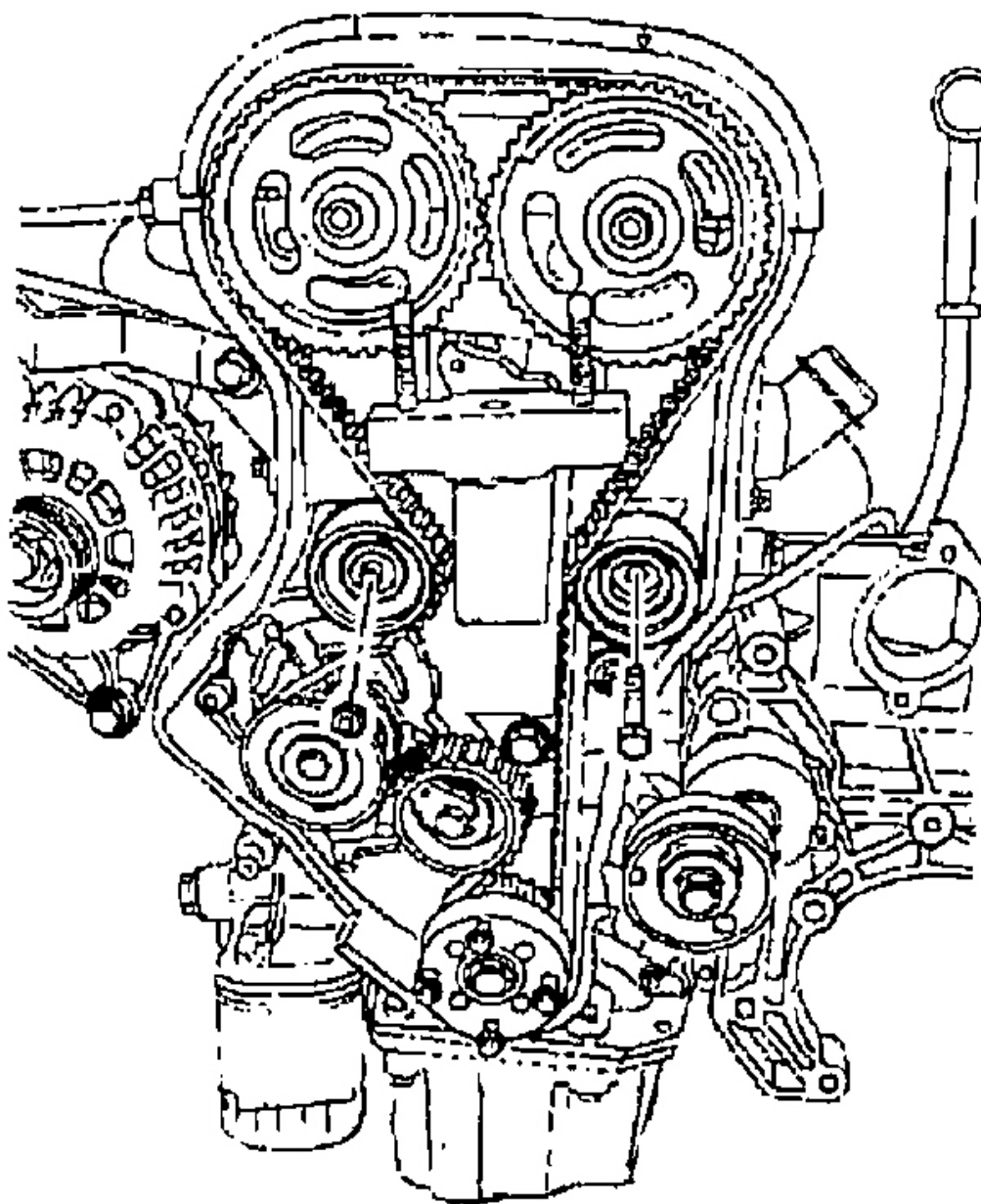
Tighten the engine mount retaining bolts to 45 N.m (33 lb-ft).

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.



G00767418

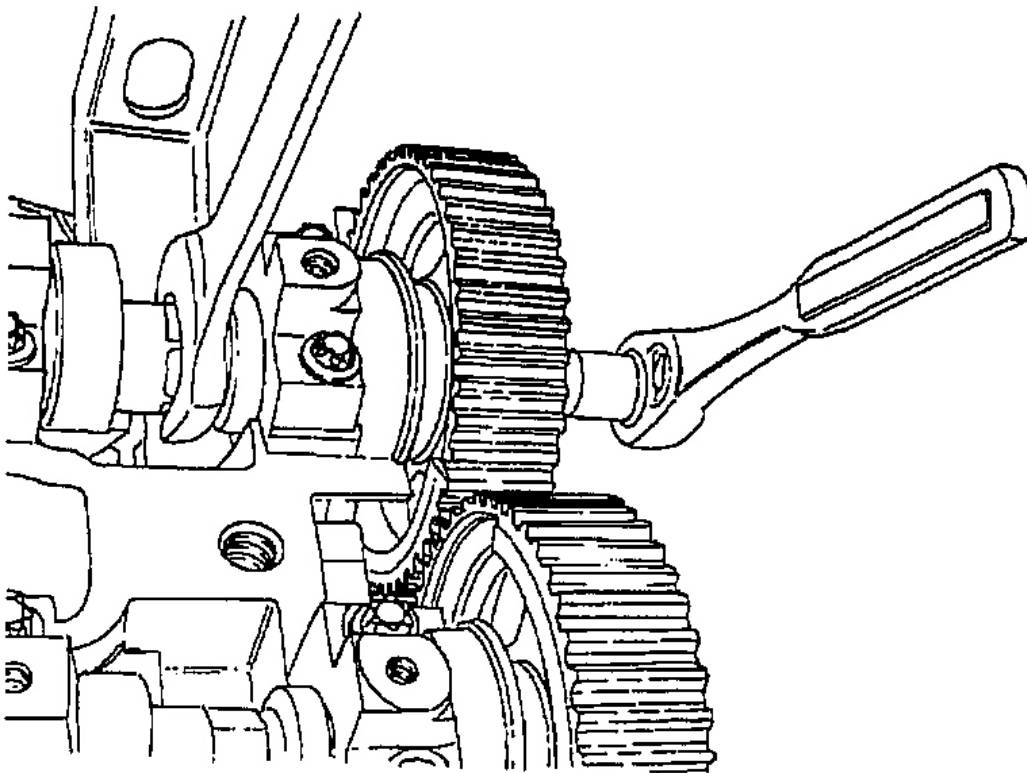
Fig. 201: Locating Timing Belt Components
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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

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



G00767419

Fig. 202: Installing The Intake Camshaft Gear Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60 degrees and 15 degrees 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.

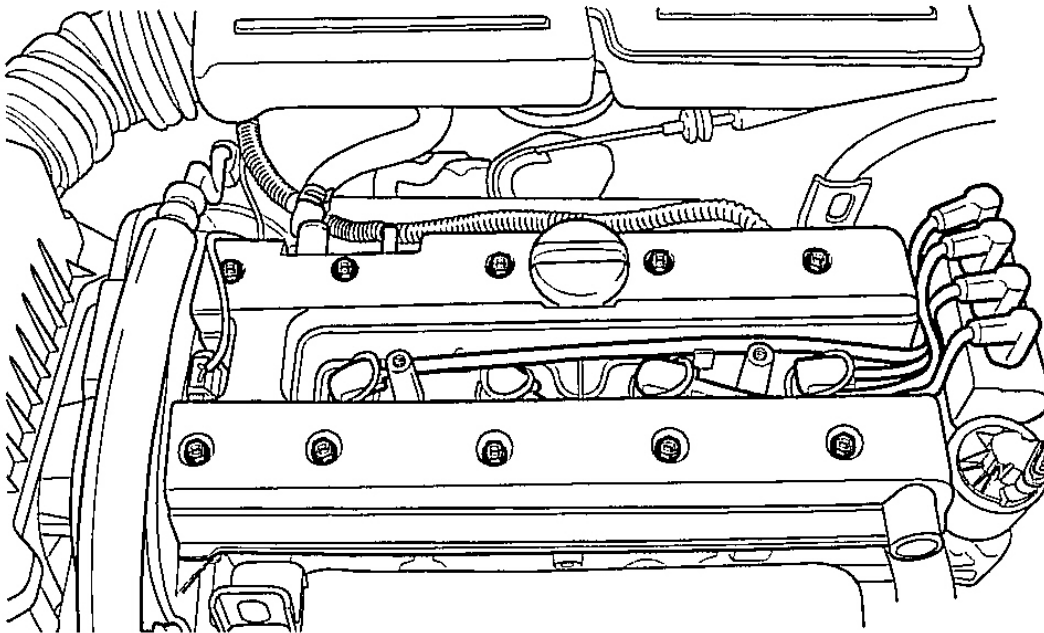
Tighten

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

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).



G00767420

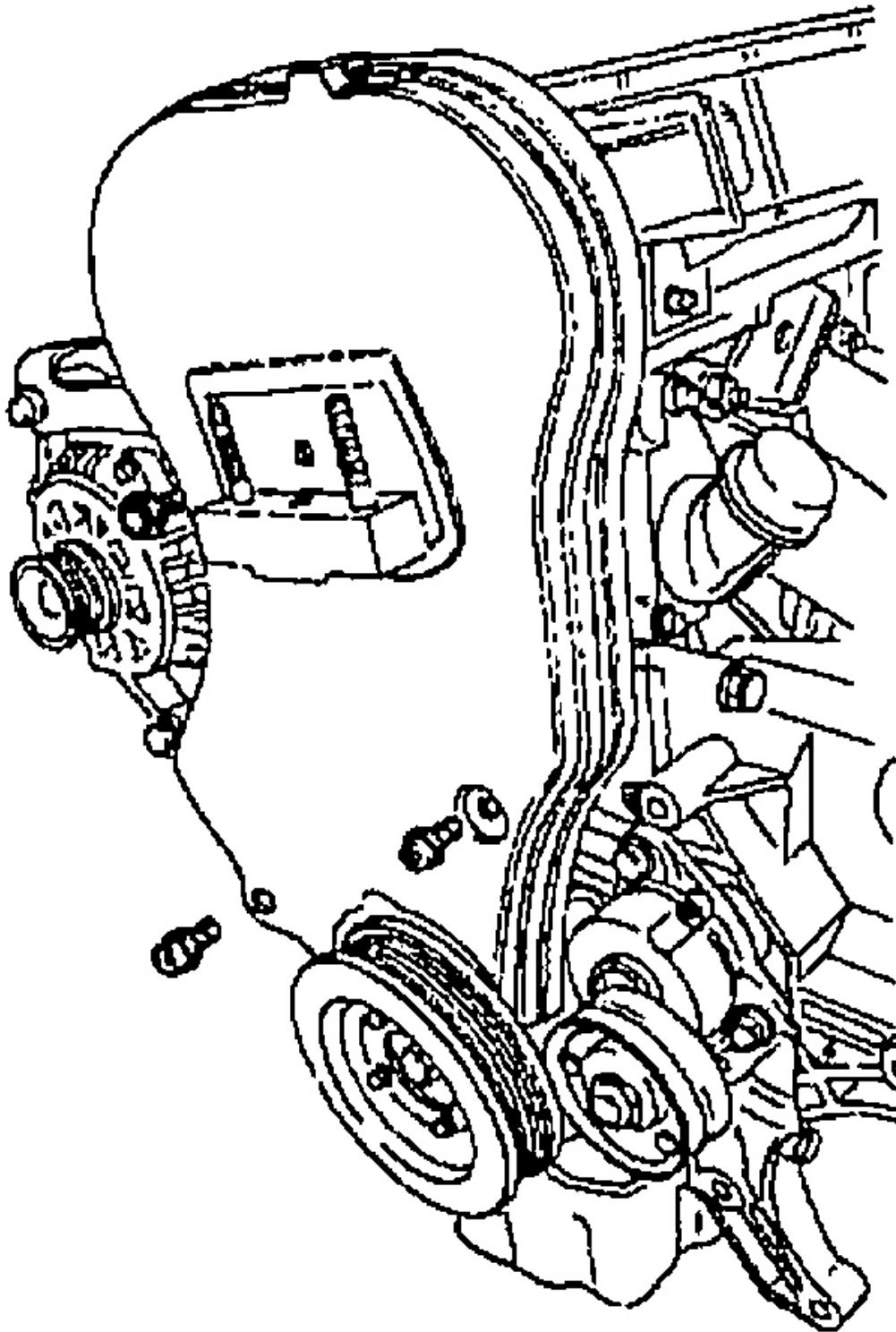
Fig. 203: Installing The Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

- 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.



G00767421

Fig. 204: Installing The Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.
62. Install a new crankshaft rear oil seal using installer J-36792 or KM-635.

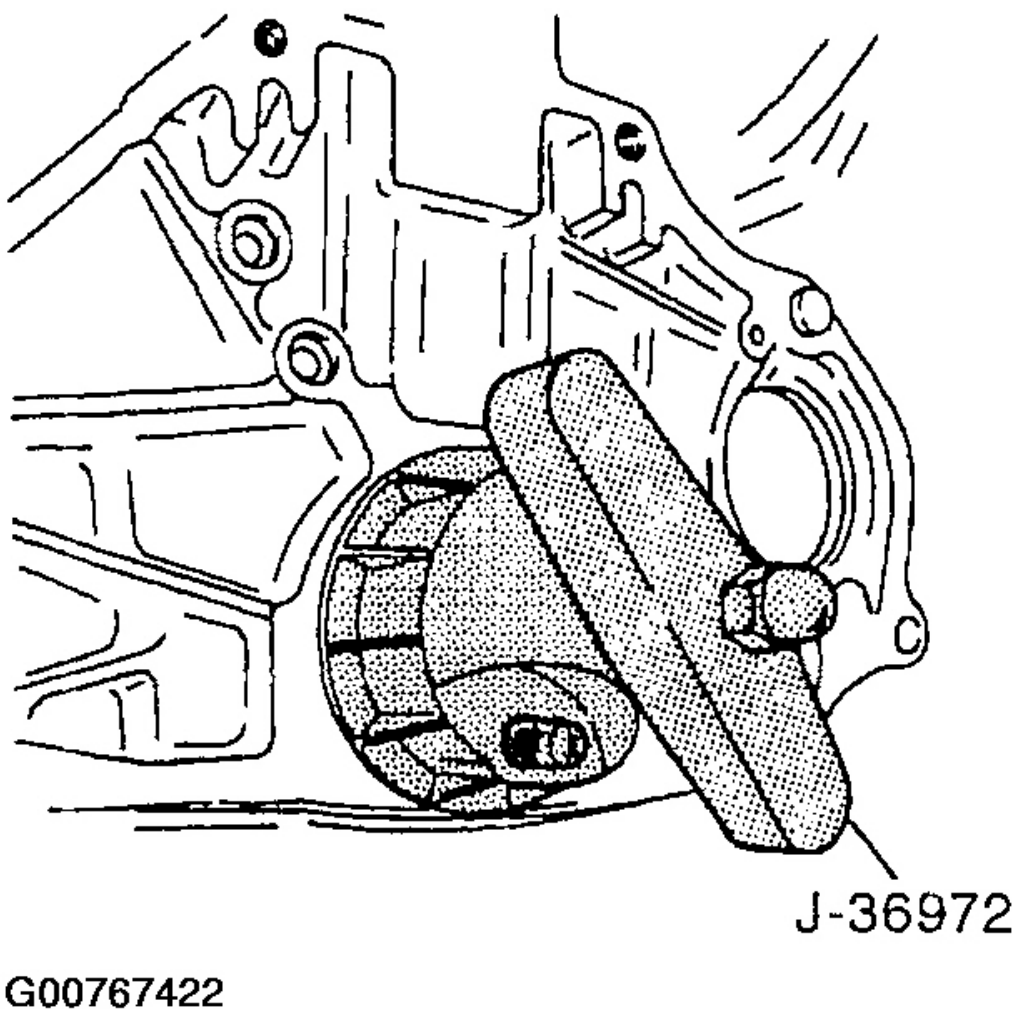


Fig. 205: Installing New Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

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 degrees plus 15 degrees. For the automatic transmission, tighten the flexible plate bolts to 45 N.m (33 lb-ft).

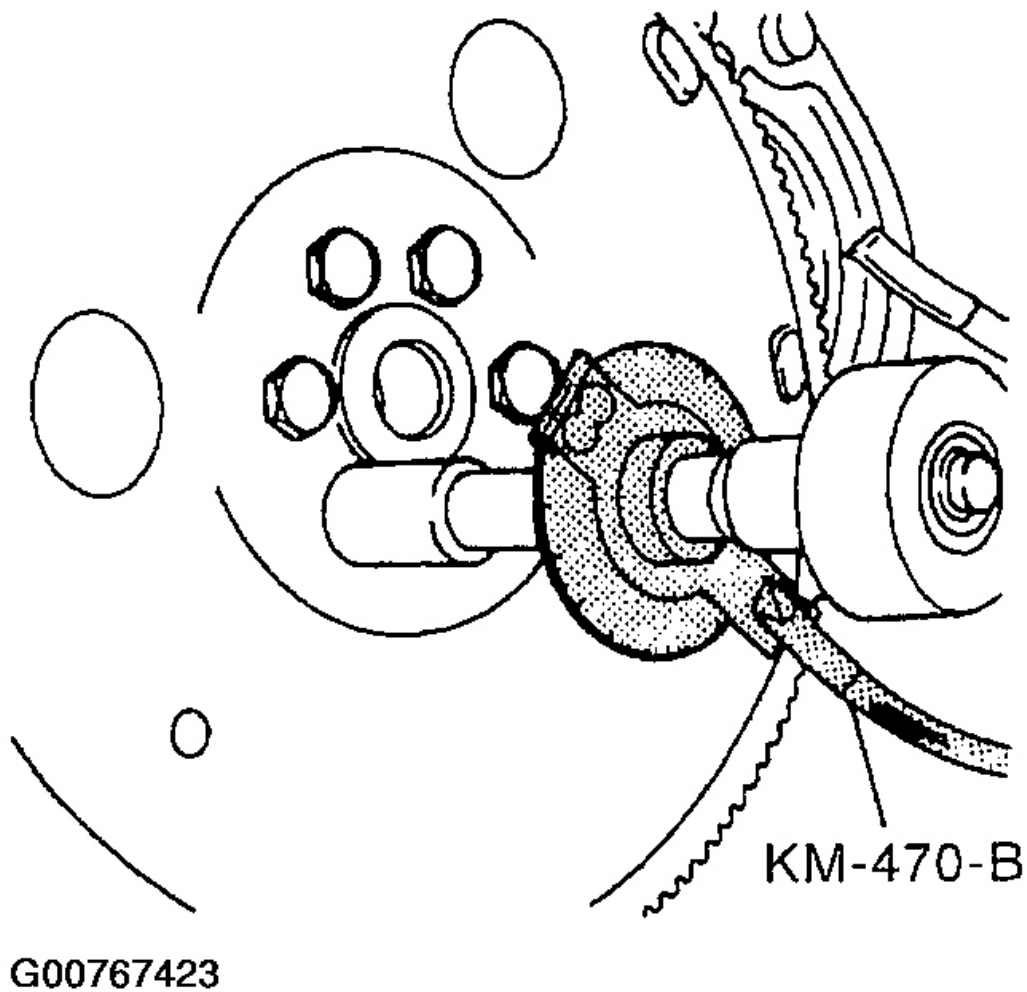


Fig. 206: Installing Flywheel Bolts Using The Angular Torque Gauge
Courtesy of SUZUKI OF AMERICA CORP.

65. Install the engine. Refer to ENGINE REMOVAL AND INSTALLATION.

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**.

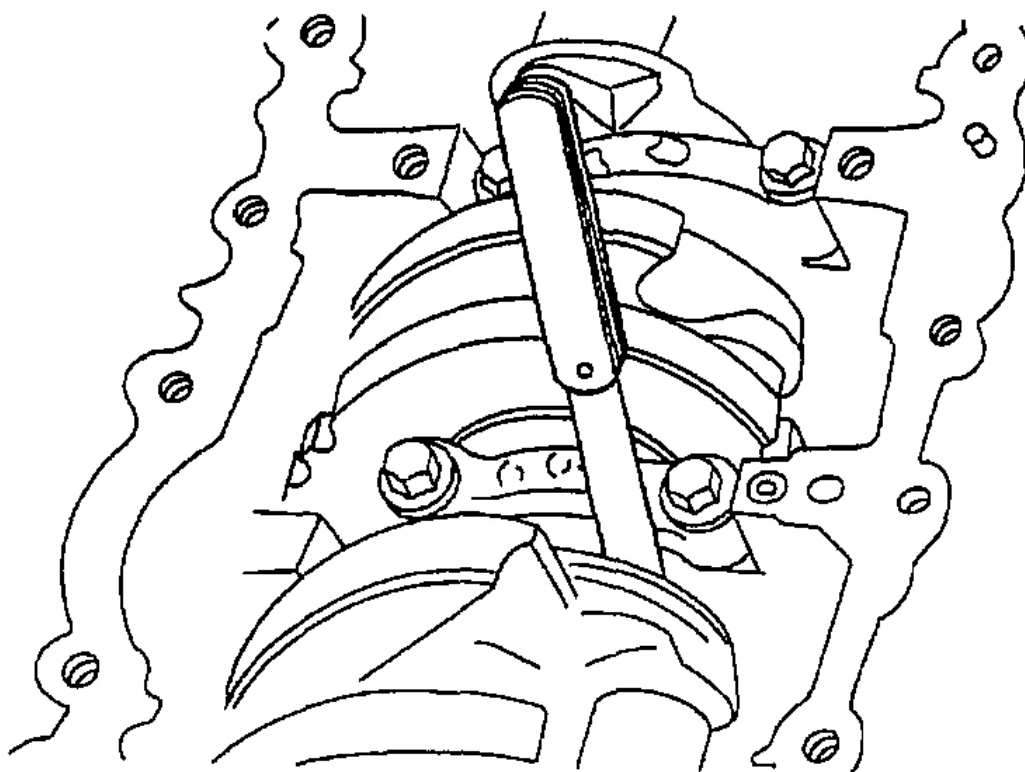
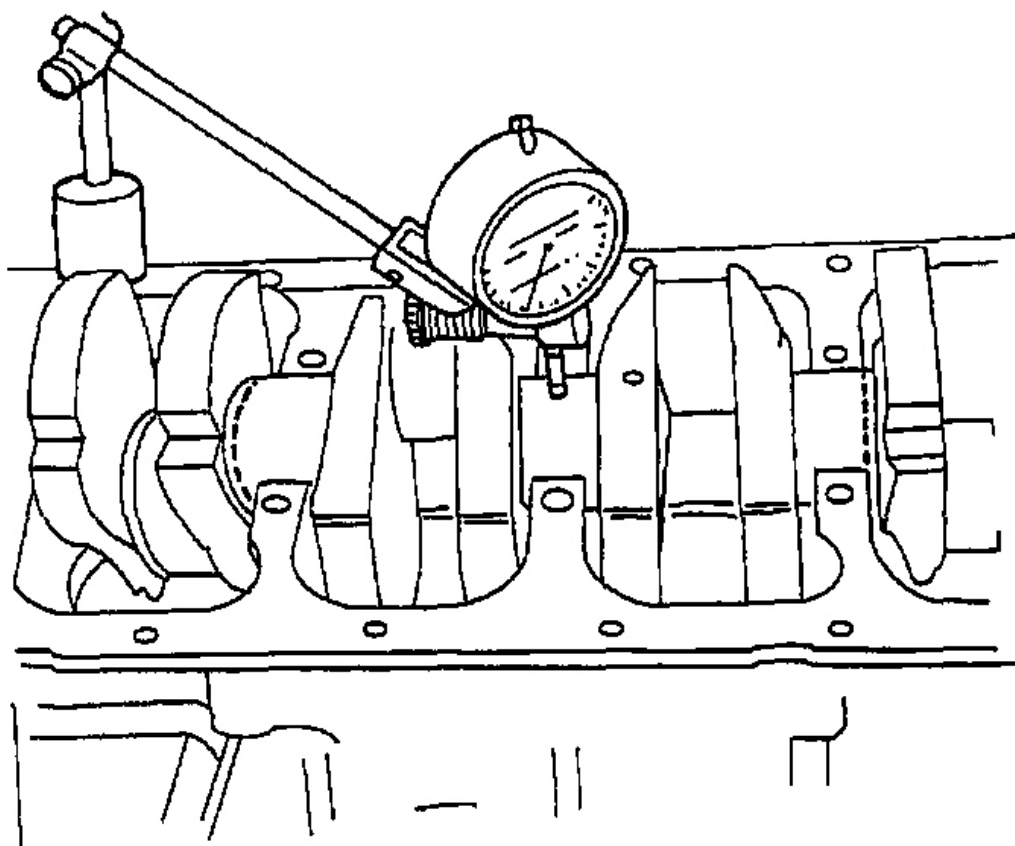
**G00767424**

Fig. 207: 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**.

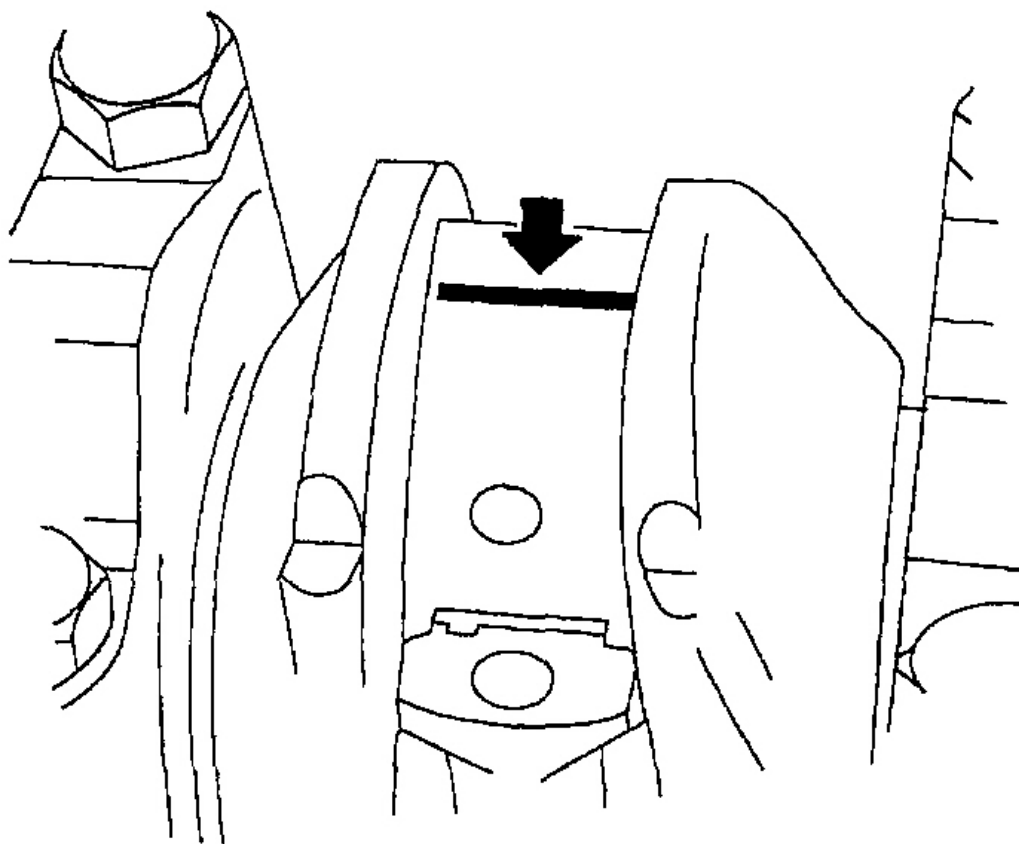


G00767425

Fig. 208: Checking The Middle Crankshaft Journal Runout
Courtesy of SUZUKI OF AMERICA CORP.

NOTE: Grease the crankshaft journals and lubricate the crankshaft bearings slightly so that the plastic gauging thread does not tear when the crankshaft bearing caps are removed.

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.



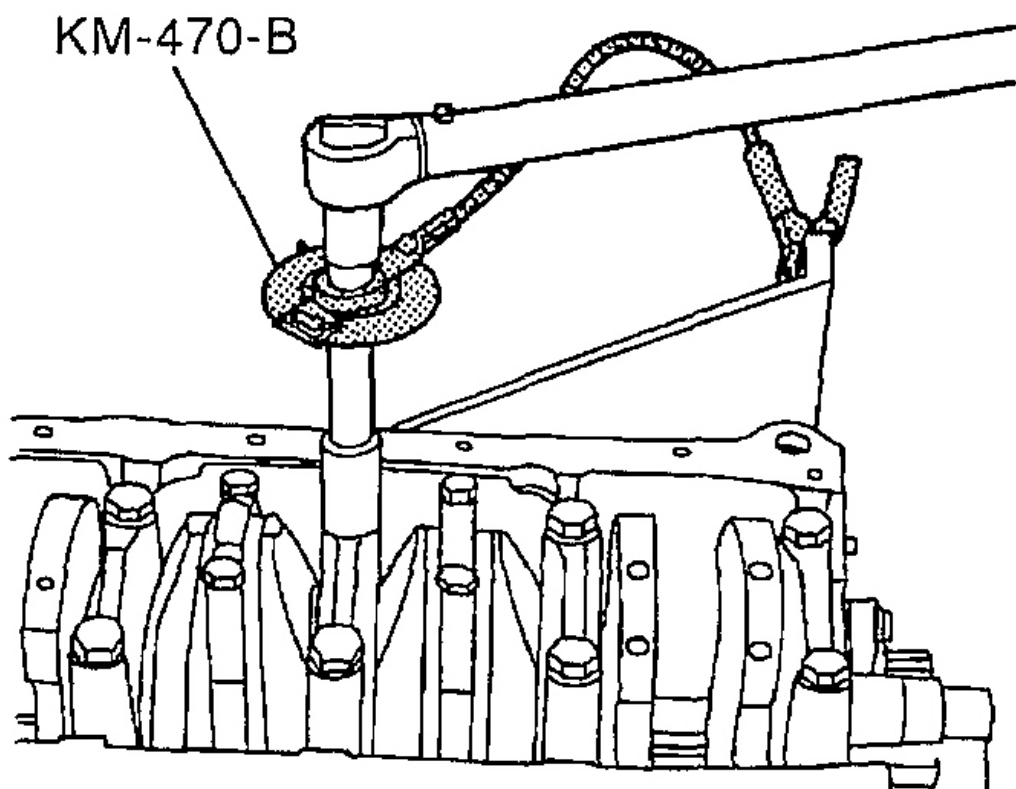
G00767426

Fig. 209: Applying Plastic Gauging
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

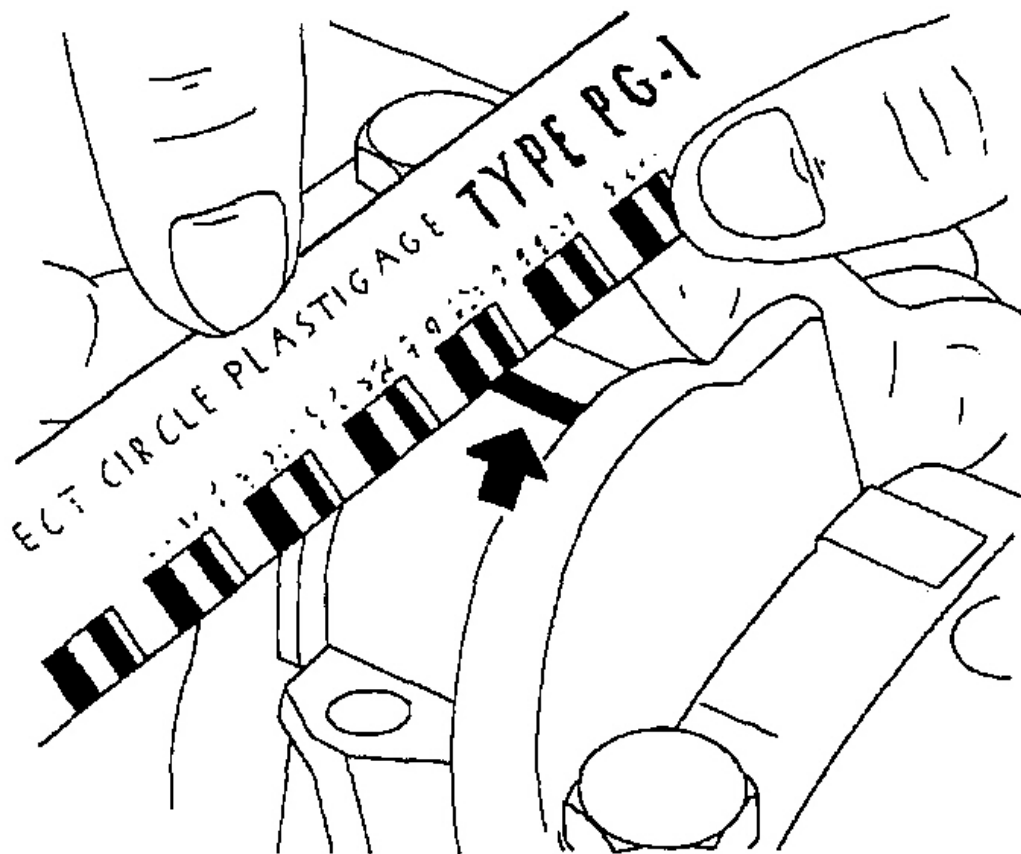
Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft). Using the angular torque gauge KM-470-B, tighten the crankshaft bearing cap bolts another 45 degrees plus 15 degrees.



G00767427

Fig. 210: Tightening The Crankshaft Bearing Cap Bolts Using Angular Torque Gauge
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**.



G00767428

Fig. 211: Measuring The Width Of The Plastic Gauging
Courtesy of SUZUKI OF AMERICA CORP.

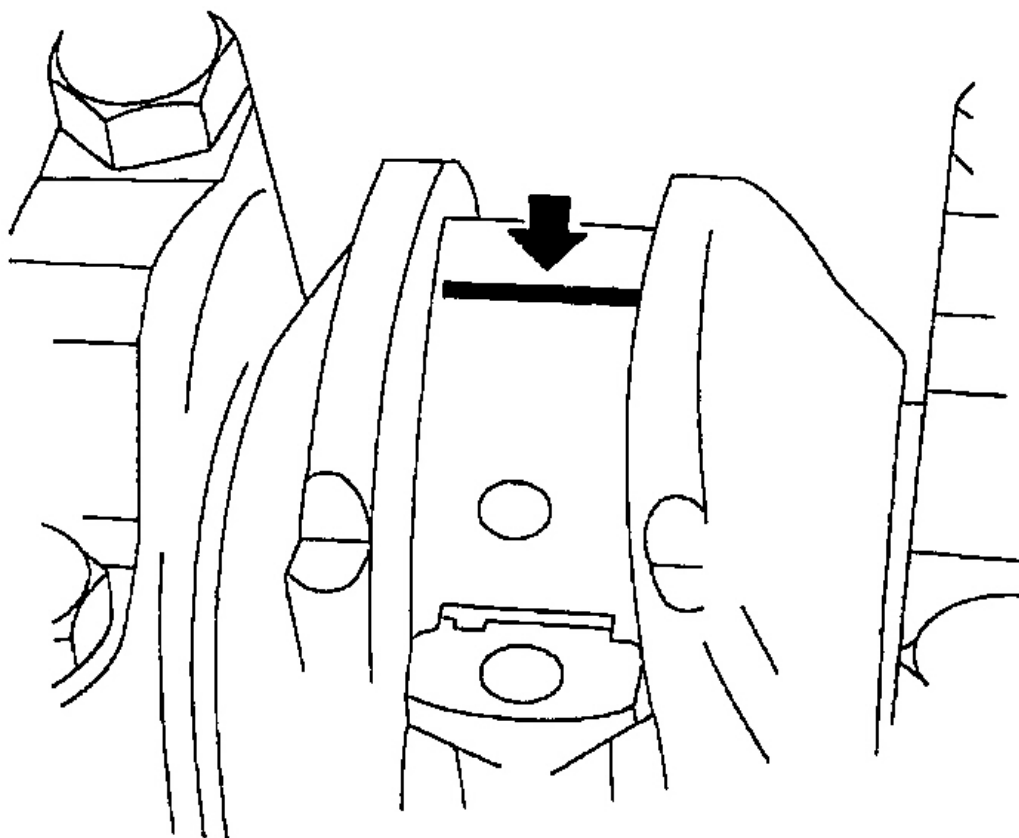
Inspection - Connecting Rods

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.

NOTE: Grease the connecting rod journals and lubricate the connecting rod bearings slightly so that the plastic gauging thread does not tear when the connecting rod bearing caps are removed.

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.



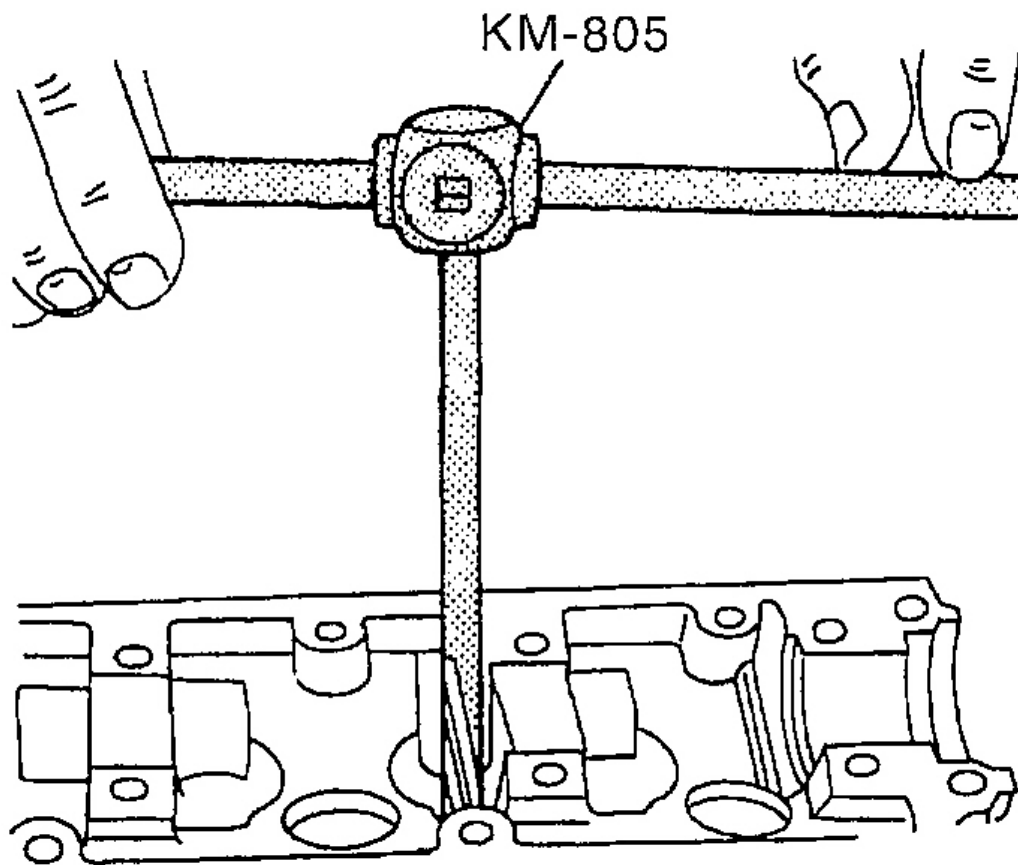
G00767429

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

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

Tighten

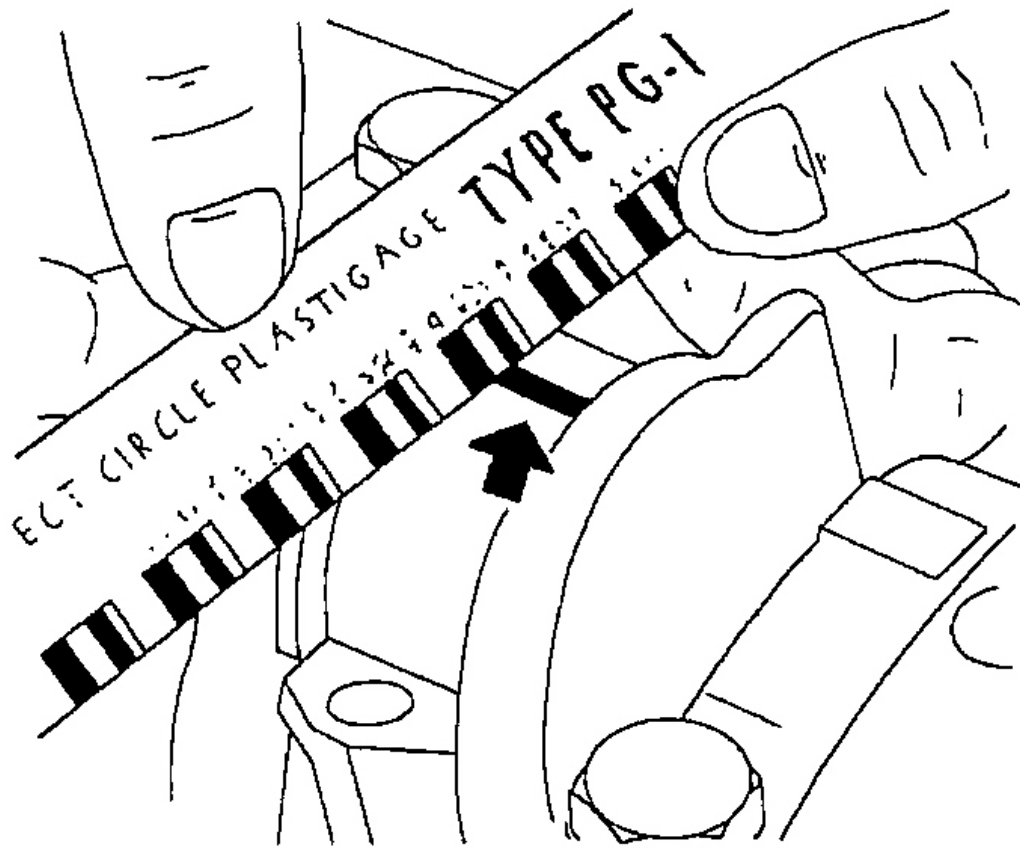
Tighten the connecting rod bearing cap bolts to 35 N.m (26 lb-ft). Using the angular torque gauge KM-470-B, tighten the connecting rod bearing cap bolts another 45 degrees plus 15 degrees.



G00767430

Fig. 213: Tightening The Connecting Rod Bearing Cap Bolts Using Angular Torque Gauge
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**.



G00767431

Fig. 214: Measuring The Width Of The Plastic Gauging
 Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

Engine Specifications

Engine Specification Chart

Application	Description
General Data:	
Engine Type	U20SED
Displacement	1,998 cm ³ (121.92 in ³)
Bore Stroke	86 x 86 mm (3.38 in. x 3.38 in.)
Compression Ratio	9.6 ± 0.02:1
Firing Oder	1-3-4-2

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

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	0.3~0.5 mm (0.011~0.019 in.)
Ring, End Gap: Second Compression	0.3~0.5 mm (0.011~0.019 in.)

Piston Pin:

Diameter	20.9970~20.9985 mm (0.82665~0.82671 in.)
Pin Offset	0.8 mm (0.03 in.) Towards Thrust Side
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:


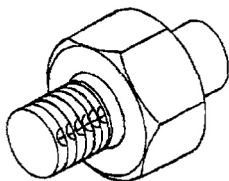

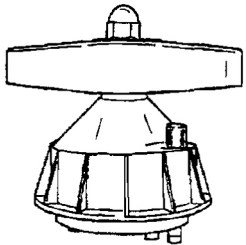
	Main Journal: Diameter (All)	57.974~57.995 mm (2.2824~2.2832 in.)
	Out of Round (Maximum)	0.003 mm (0.0001 in.)
Main Bearing Clearance (All)		0.015~0.040 mm (0.00059~0.00157 in.)
Crankshaft End Play		0.070~0.302 mm (0.0027~0.0118 in.)
Service Oversize		Available in 2 sizes 0.25 mm and 0.50 mm (0.0098~0.0196 in.)

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

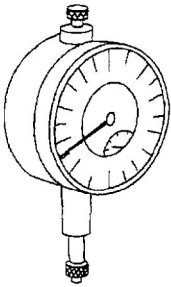
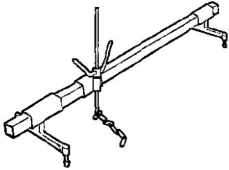
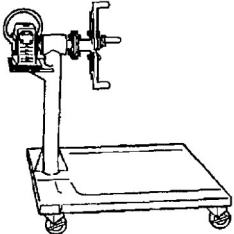
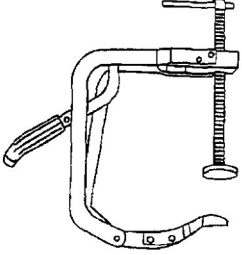
Connecting Rod Journal:		
	Diameter (All)	48.970~48.988 mm (1.9279~1.9287 in.)
	Out of Round (Maximum)	0.004 mm (0.00015 in.)
Cylinder Head:		
Valve Stem Protrusion		39.2~39.8 mm (1.54~1.56 in.)
Valve Guide Height		13.7~14.0 mm (0.54~0.57 in.)
Overall Height		134 ± 0.025 mm (5.2755~0.0009 in.)
Minimum 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)

Tightening Torque SpecificationsSee **TORQUE SPECIFICATIONS.****SPECIAL TOOLS AND EQUIPMENT****Special Tool**

	<p>KM-653 Adapter</p>
	<p>KM-135 Adapter</p>
	<p>KM-805 Valve Guide Reamer</p>
	<p>J-36792 Crankshaft Rear Oil Seal Installer</p>

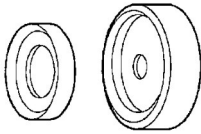
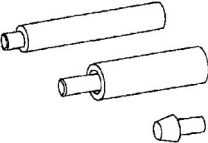

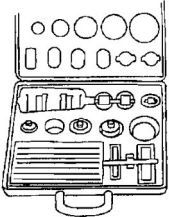
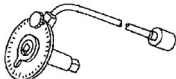
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Fig. 215: Identifying Special Tools (1 Of 4)
Courtesy of SUZUKI OF AMERICA CORP.

	<p>KM-571-B Gauge</p>
	<p>DW110-060 Engine Assembly Support Fixture</p>
	<p>KM-412 Engine Overhaul Stand</p>
	<p>KM-348 Valve Spring Compressor</p>

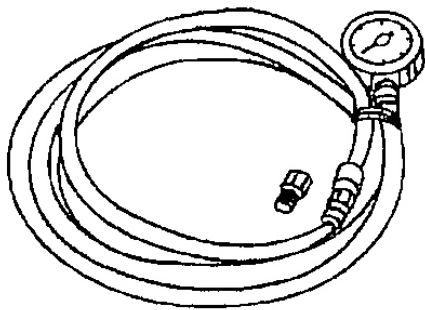
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Fig. 216: Identifying Special Tools (2 Of 4)
Courtesy of SUZUKI OF AMERICA CORP.

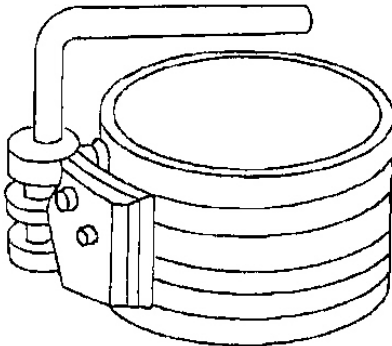
	<p>KM-635 Crankshaft Rear Oil Seal Installer</p>
	<p>KM-427 Piston Pin Service Set</p>
	<p>J-8087 Cylinder Bore Check Gauge</p>
	<p>KM-340-0 Cutter Set Includes: KM-340-7 Guide Drift KM-340-13 Cutters KM-340-26 Cutters</p>
	<p>KM-470-B Angular Torque Gauge</p>

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Fig. 217: Identifying Special Tools (3 Of 4)
Courtesy of SUZUKI OF AMERICA CORP.



KM-498-B
Pressure Gauge



J-8037
Universal Piston
Ring Compressor

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Fig. 218: Identifying Special Tools (4 Of 4)
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE LUBRICATION SYSTEM

GENERAL DESCRIPTION

Oil Pan Description

The engine oil pan is mounted to the bottom of the cylinder block. The engine oil pan houses the crankcase and is made of cast aluminum.

Engine oil is pumped from the oil pan by the oil pump.

After it passes through the oil filter, it is fed through two paths to lubricate the cylinder block and cylinder head. In one path, the oil is pumped through oil passages in the crankshaft to the connecting rods, then to the pistons and cylinders. It then drains back to the oil pan. In the second path, the oil is pumped through passages to the camshaft. The oil passes through the internal passageways in the camshafts to lubricate the valve assemblies before draining back to the oil pan.

Oil Pump Description

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or other engine components. When the crankshaft rotates, the oil pump driven gear rotates. This causes the space between the gears to constantly open and narrow, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and valve keep the bypass closed, directing all of the oil pumped to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

DIAGNOSTIC INFORMATION AND PROCEDURES

Oil Pressure Test

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

Step	Action	Value(s)	Yes	No
1	Is the oil pressure warning lamp on?	-	Go to Step 2	System OK
2	Check the oil level in the crankcase. Is the oil level low?	-	Go to Step 3	Go to Step 4
3	Add oil so that the oil level is up to the full mark on the indicator. Is the repair complete?	-	Go to Step 1	-
4	Check the idle speed. Is the idle speed below the specified value?	825 rpm	Go to Step 5	Go to Step 6
5	Increase the idle speed. Is the speed increased?	-	Go to Step 1	-
6	Inspect the oil pressure switch. Is the oil pressure switch incorrect or malfunctioning?	-	Go to Step 7	Go to Step 8
7	Install a new oil pressure switch. Is the repair complete?	-	Go to Step 1	-
8	Inspect the oil pressure gauge. Is the oil pressure gauge incorrect or malfunctioning?	-	Go to Step 9	Go to Step 10
9	Install a new oil pressure gauge. Is the repair complete?	-	Go to Step 1	-
10	Inspect the engine oil. Is the engine oil in the crankcase diluted or of the improper viscosity?	-	Go to Step 11	Go to Step 12
11	Install new engine oil of the proper viscosity for the expected temperatures. Is the repair complete?	-	Go to Step 1	-
12	Inspect the oil pump. Is the pump worn or dirty?	-	Go to Step 13	Go to Step 14
13	Replace the oil pump. Is the repair complete?	-	Go to Step 1	-

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Fig. 219: Oil Pressure Test Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

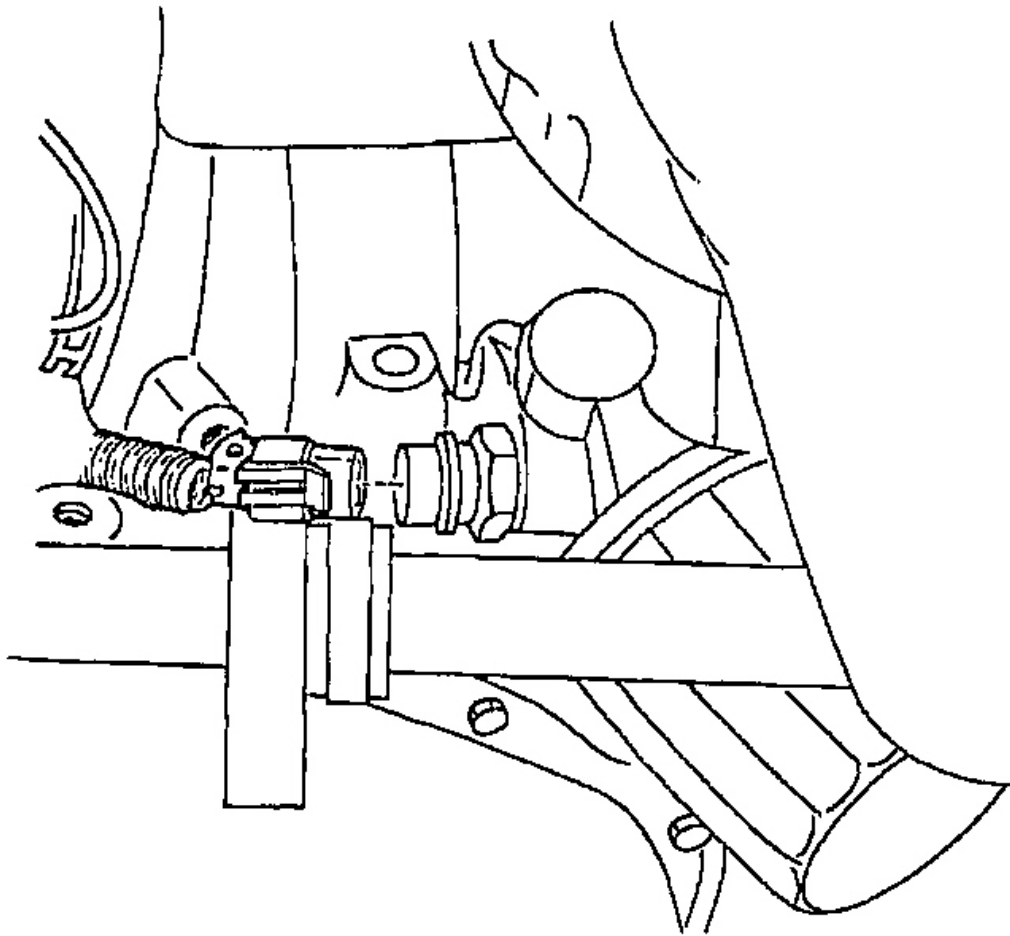
Step	Action	Value(s)	Yes	No
14	Inspect the oil filter. Is the oil filter plugged?	-	Go to Step 15	Go to Step 16
15	Install a new oil filter. Is the repair complete?	-	Go to Step 1	-
16	Inspect the oil pickup screen. Is the oil pickup screen loose or plugged?	-	Go to Step 17	Go to Step 18
17	Tighten or replace the oil pickup screen, as necessary. Is the repair complete?	-	Go to Step 1	-
18	Inspect the oil pickup tube. Are there any holes in the oil pickup tube?	-	Go to Step 19	Go to Step 20
19	Replace the oil pickup tube. Is the repair complete?	-	Go to Step 1	-
20	Inspect the bearing clearances. Are the bearing clearances more than the specified values?	Crankshaft 0.026 ~0.046 mm (0.0010~0.0018 in.) Connecting Rod 0.019 ~ 0.070 mm (0.0007 ~ 0.0027 in.)	Go to Step 21	Go to Step 22
21	Replace the bearing, if necessary. Is the repair complete?	-	Go to Step 1	-
22	Inspect the oil galleries. Are the oil galleries cracked, porous, or plugged?	-	Go to Step 23	Go to Step 24
23	Repair or replace the engine block. Is the repair complete?	-	Go to Step 1	-
24	Inspect the gallery plugs. Are any of the gallery plugs missing or installed improperly?	-	Go to Step 25	Go to Step 26
25	Install the plugs or repair, as necessary. Is the repair complete?	-	Go to Step 1	-
26	Inspect the camshaft. Is the camshaft worn or is there evidence of poor machining?	-	Go to Step 27	System OK
27	Replace the camshaft. Is the repair complete?	-	Go to Step 1	-

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Fig. 220: Oil Pressure Test Chart (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Engine Oil Pressure Inspection

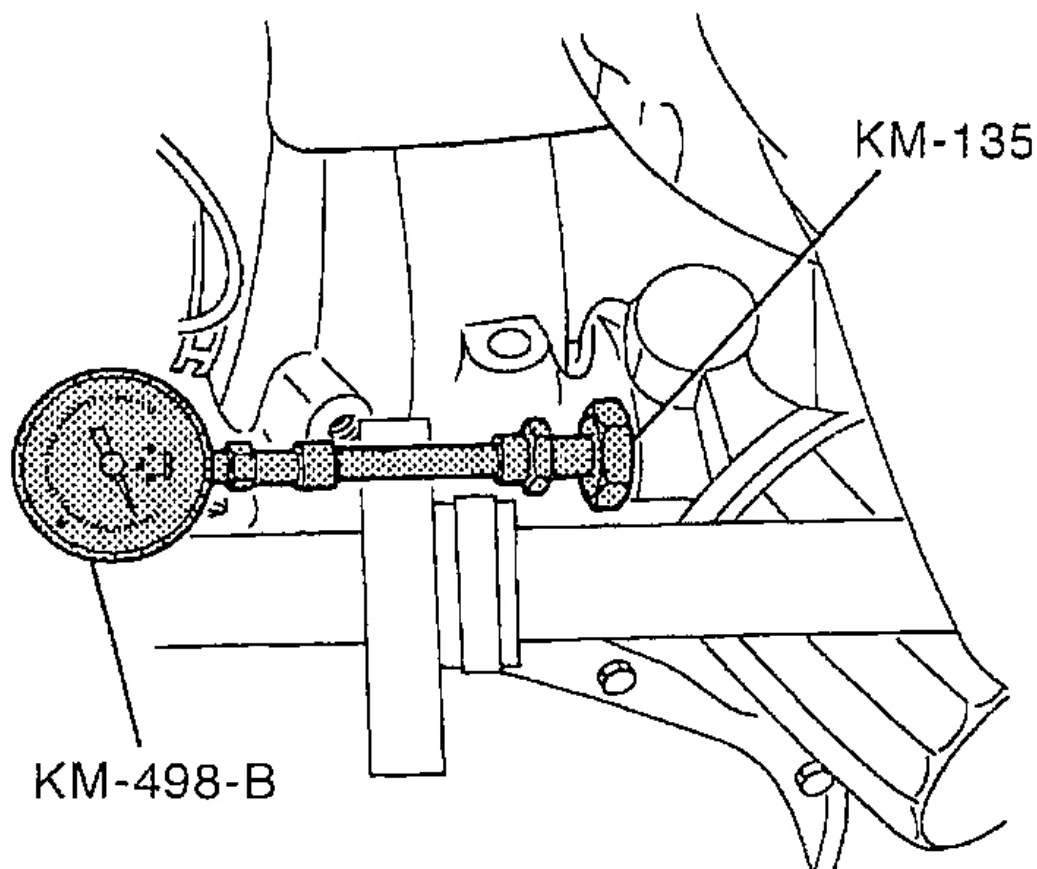
1. Remove the right front wheel well oil pan scraper.
2. Disconnect the oil pressure switch connector.



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Fig. 221: Disconnecting Oil Pressure Switch Connector
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the adapter KM-135 in place of the oil pressure switch.
4. Connect the pressure gauge KM-498-B to the adapter.



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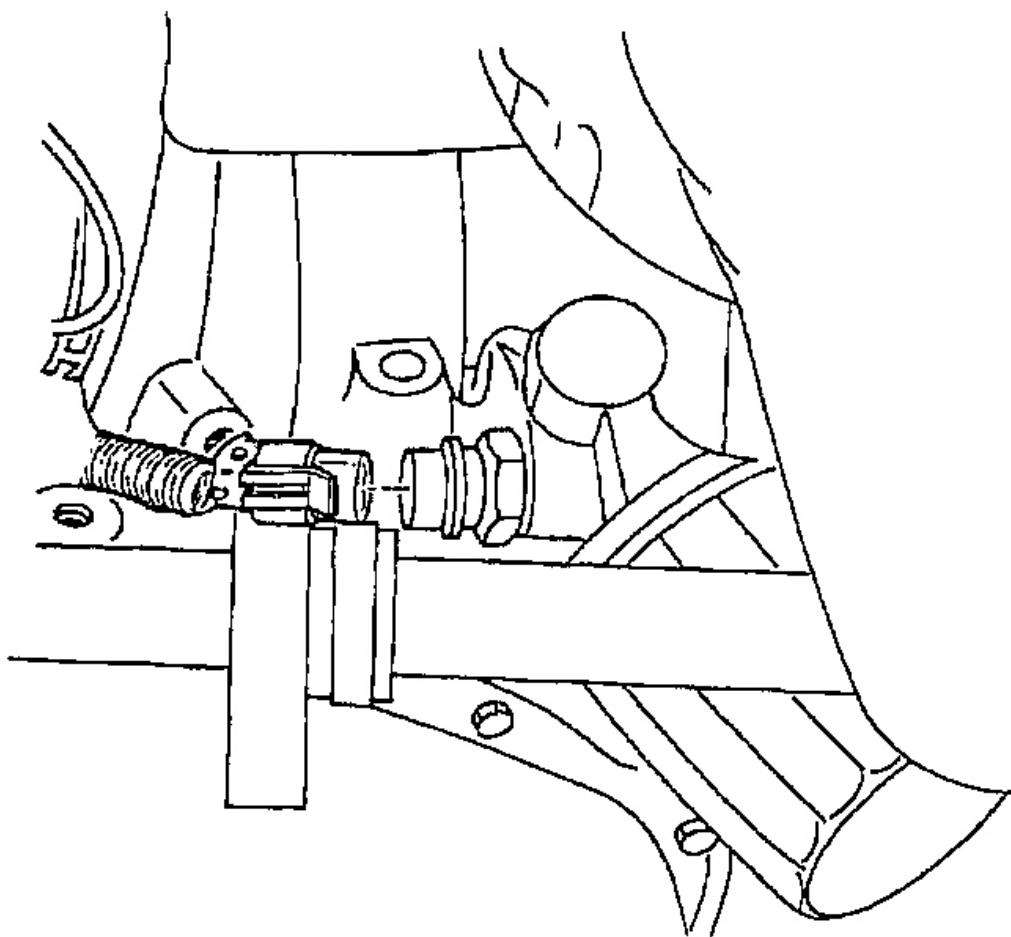
Fig. 222: Identifying Gauge And Adapter
Courtesy of SUZUKI OF AMERICA CORP.

5. Start the engine and check the oil pressure at idle speed and engine temperature of 80° (176°F). The minimum oil pressure should be 30 kPa (4.35 psi).
6. Stop the engine and remove the pressure gauge KM-498-B and the adapter KM-135.
7. Install the oil pressure switch.

Tighten

Tighten the oil pressure switch to 40 N.m (30 lb-ft).

8. Connect the electrical connector to the oil pressure switch.



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Fig. 223: Connecting The Electrical Connector To The Oil Pressure Switch
Courtesy of SUZUKI OF AMERICA CORP.

9. Install the right front wheel well oil pan scraper.
10. Check the oil level. Add oil until it reaches the full mark.

Oil Leak Diagnosis

Most fluid oil leaks are easily located and repaired by visually finding the leak and replacing or repairing the necessary parts. On some occasions, a fluid leak may be difficult to locate or repair. The following procedures may help you in locating and repairing most leaks.

Finding the Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, power steering fluid, etc.
2. Identify where the fluid is leaking from.
 1. After running the vehicle at normal operating temperature, park the vehicle over a large sheet of paper.
 2. Wait a few minutes.
 3. Find the approximate location of the leak by the drippings on the paper.
3. Visually check around the suspected component.

Check around all the gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.

4. If the leak still cannot be found, it may be necessary to clean the suspected area with a degreaser, steam, or spray solvent.
 1. Thoroughly clean the area.
 2. Dry the area.
 3. Operate the vehicle for several miles at normal operating temperature and varying speeds.
 4. After operating the vehicle, visually check the suspected component.
 5. If you still cannot locate the leak, try using the powder or black light and dye method.

Powder Method:

1. Clean the suspected area.
2. Apply an aerosol-type powder, (such as foot powder), to the suspected area.
3. Operate the vehicle under normal operating conditions.
4. Visually inspect the suspected component. Trace the leak path over the white powder surface to the source.

Black Light and Dye Method:

A dye and light kit is available for finding leaks. Refer to the manufacturer's directions when using the kit.

1. Pour the specified amount of dye into the engine oil fill tube.
2. Operate the vehicle under normal operating conditions as directed in the kit.
3. Direct the light toward the suspected area. The dyed fluid will appear as a yellow path leading to the source.

Repairing the Leak

Once the origin of the leak has been pinpointed and traced back to its source, the cause of the leak must be determined in order for it to be repaired properly. If a gasket is replaced, but the sealing flange is bent, the new gasket will not repair the leak. The bent flange must be repaired also. Before attempting to repair a leak, check for the following conditions and correct them as they may cause a leak.

Gaskets:

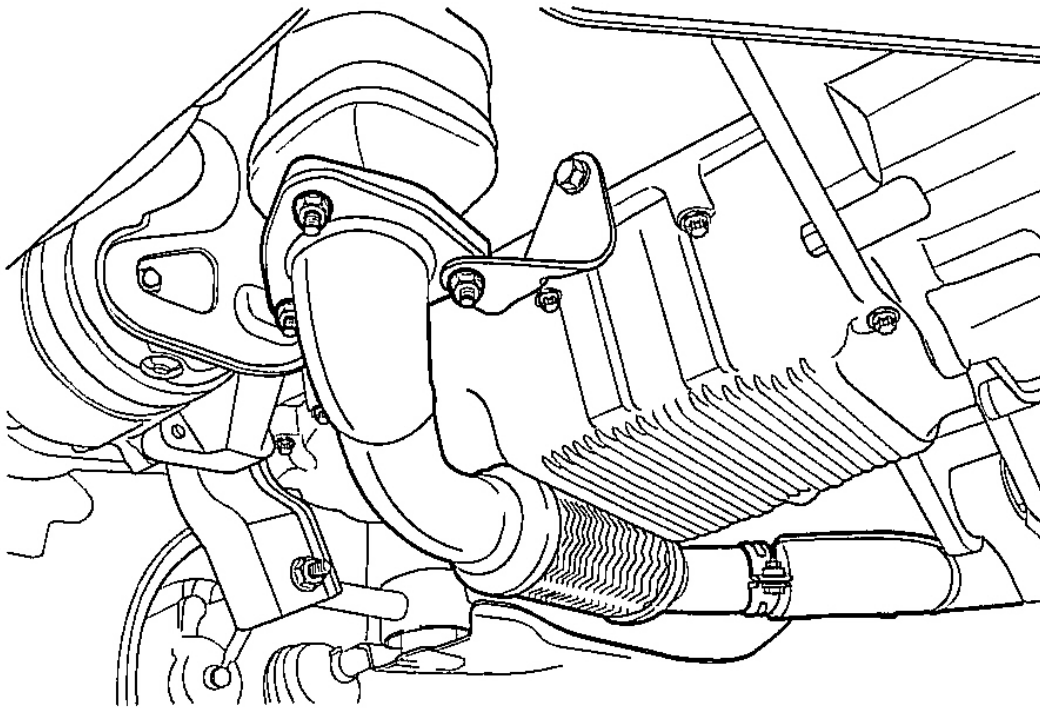
- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The fasteners are improperly tightened or the threads are dirty or damaged.
- The flanges or the sealing surface is warped.
- There are scratches, burrs or other damage to the sealing surface.
- The gasket is damaged or worn.
- There is cracking or porosity of the component.
- An improper seal was used, (where applicable).

Seals:

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The seal bore is damaged, scratched, burred or nicked.
- The seal is damaged or worn.
- Improper installation is evident.
- There are cracks in the component.
- The shaft surface is scratched, nicked or damaged.
- A loose or worn bearing is causing excess seal wear.

REPAIR INSTRUCTIONS**Oil Pan Removal and Installation****Removal**

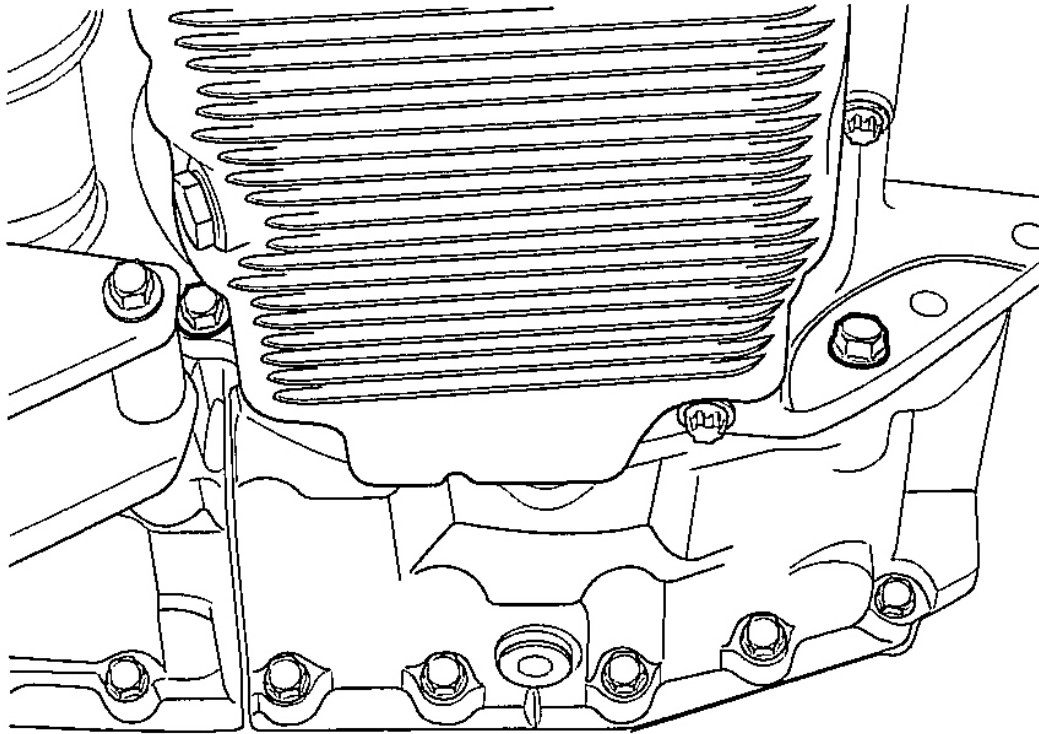
1. Disconnect the negative battery cable.
2. Drain the engine oil from the engine crankcase.
3. Remove the exhaust front pipe. Refer to **MUFFLER - FRONT REMOVAL AND INSTALLATION** .



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Fig. 224: Removing The Exhaust Front Pipe
Courtesy of SUZUKI OF AMERICA CORP.

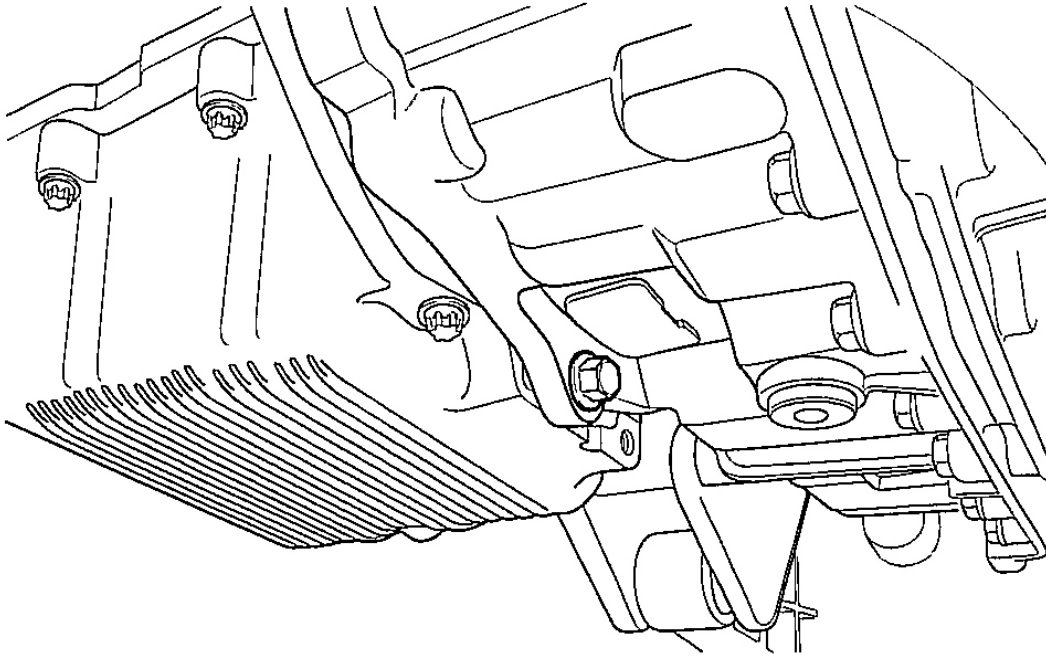
4. Remove the oil pan flange-to-transaxle retaining bolts.



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Fig. 225: Removing The Oil Pan Flange-To-Transaxle Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

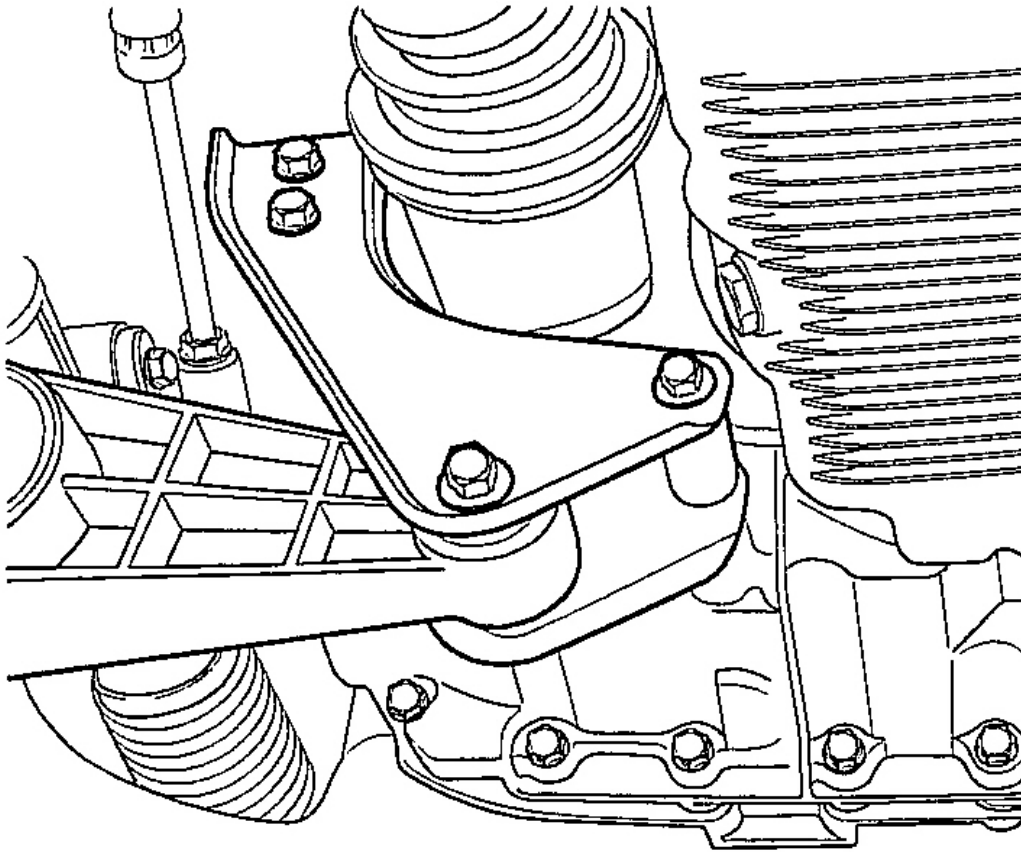
5. Remove the transaxle-to-oil pan flange retaining bolt.



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Fig. 226: Removing The Transaxle-To-Oil Pan Flange Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

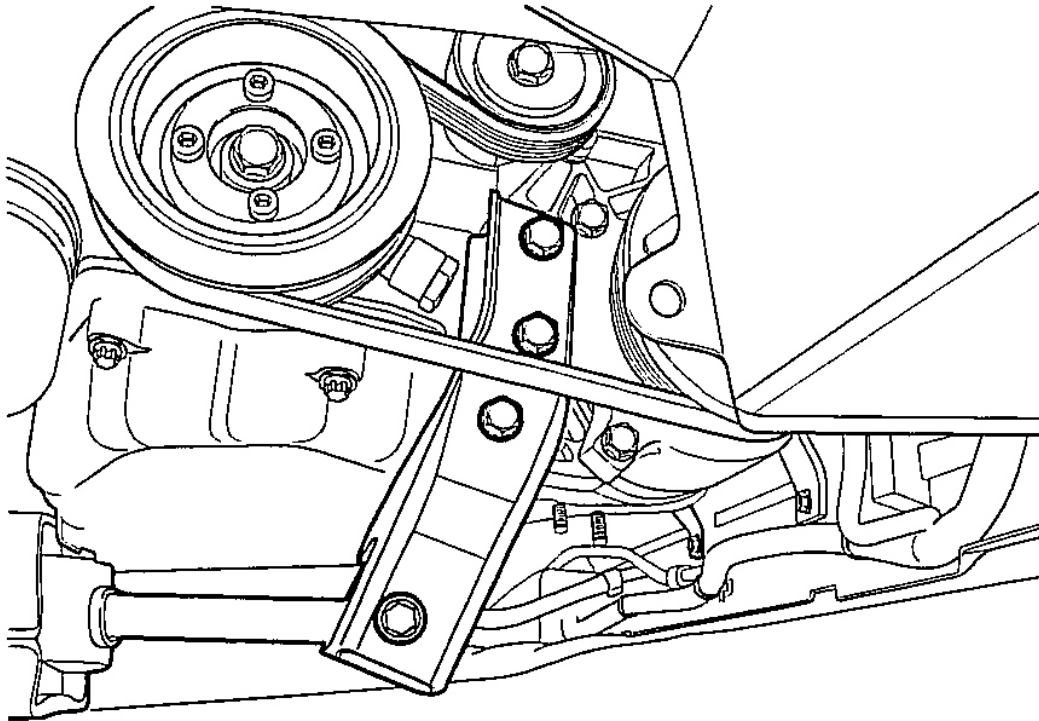
6. Remove the transaxle rear mount bracket.



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Fig. 227: Removing The Transaxle Rear Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

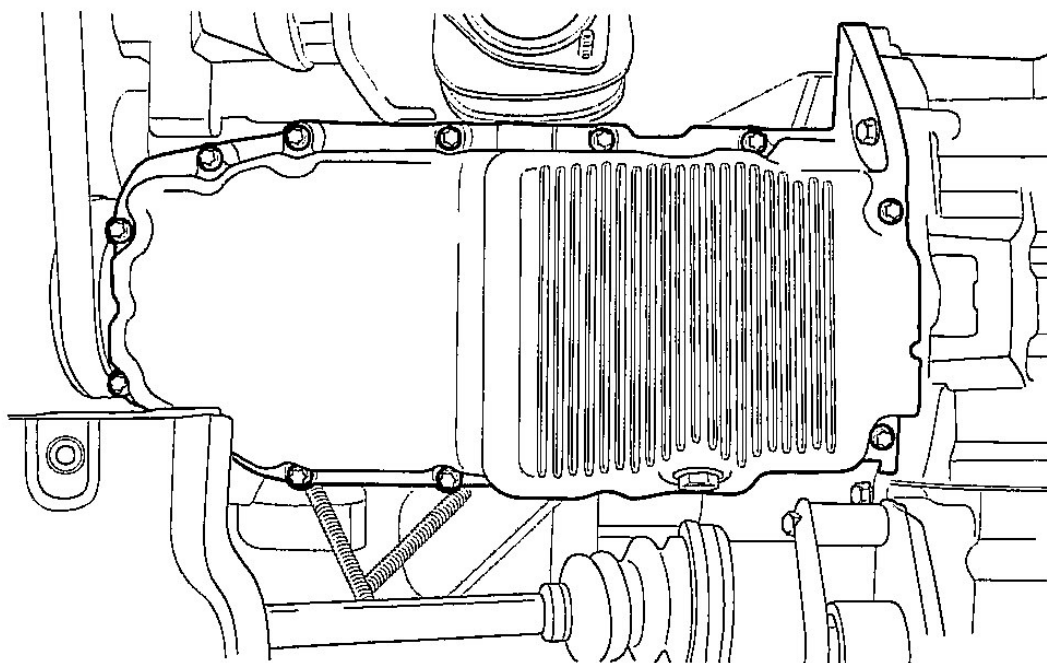
7. Remove the lower reaction rod.



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Fig. 228: Removing The Lower Reaction Rod
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the oil pan retaining bolts.



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Fig. 229: Removing The Oil Pan Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

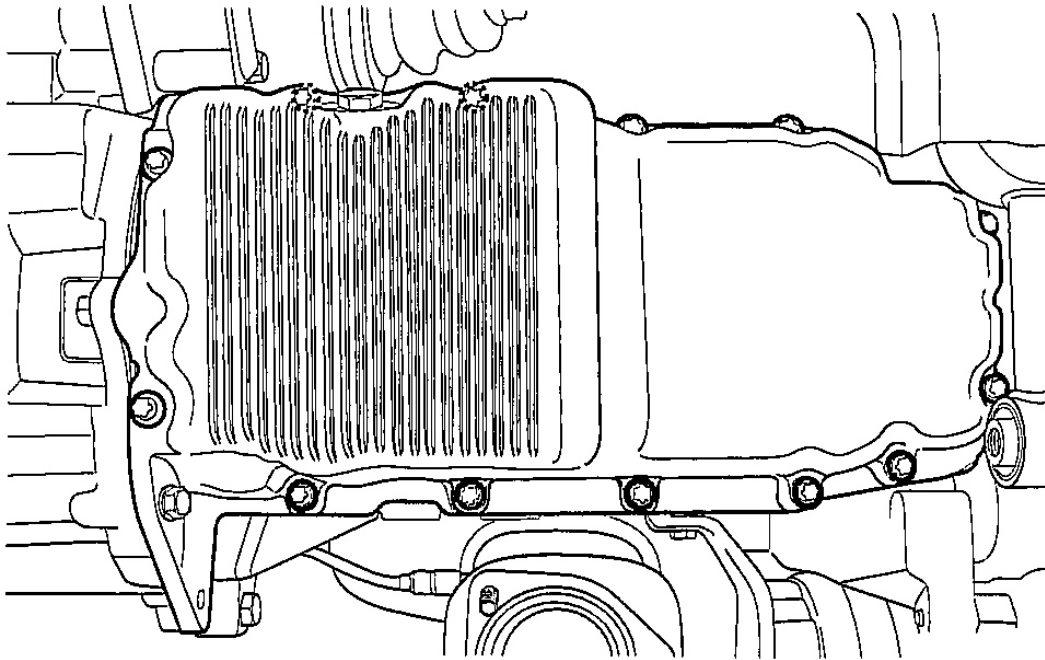
9. Remove the oil pan from the engine block with pushing the engine assembly forward.

Installation

1. Coat the new oil pan gasket with sealant.

NOTE: **Install the oil pan within 5 minutes after applying the liquid gasket to the oil pan.**

2. Install the oil pan to the engine block.
3. Install the oil pan retaining bolts.



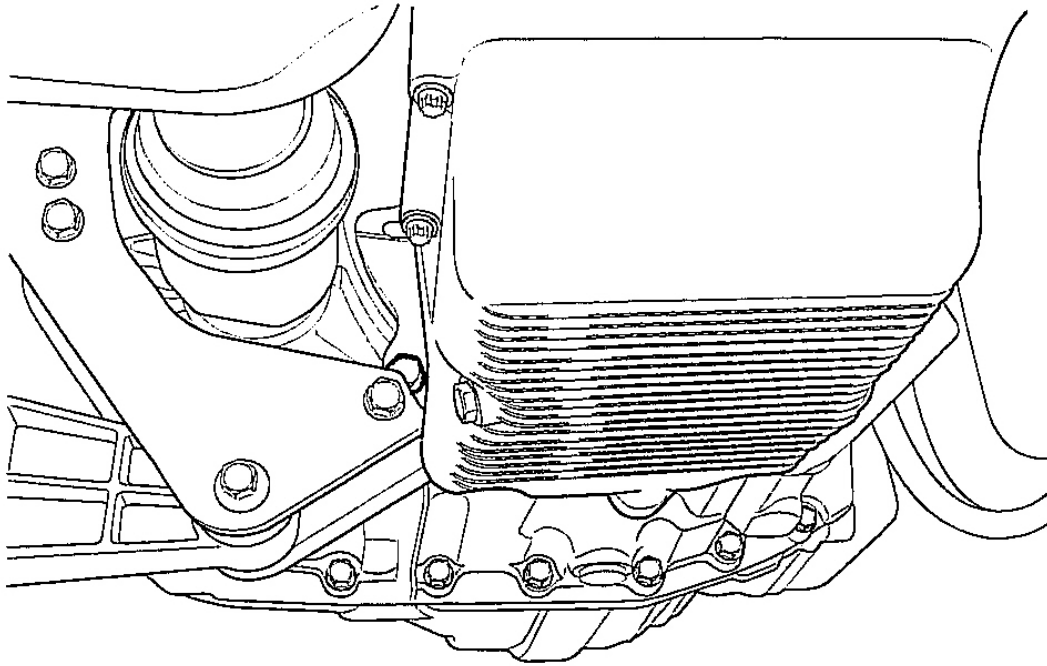
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Fig. 230: Installing The Oil Pan Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

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



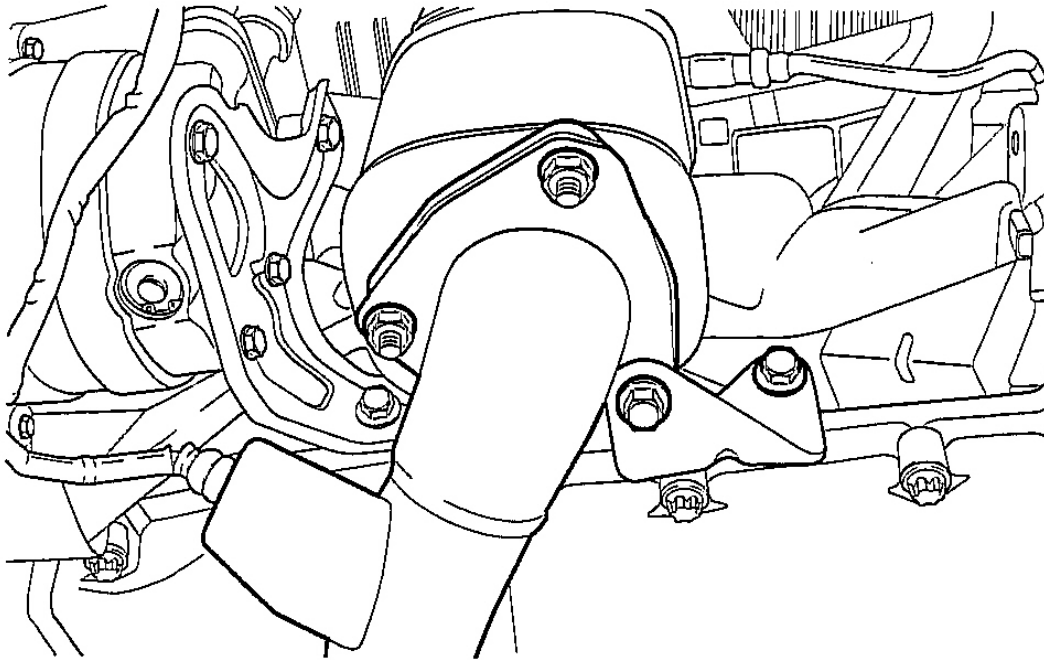
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Fig. 231: Installing The Oil Pan Flange-To-Transaxle Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

5. Install the exhaust flex pipe.
6. Install the exhaust flex pipe retaining nuts to the exhaust manifold.



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Fig. 232: Installing The Exhaust Flex Pipe Retaining Nuts
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

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

7. 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).

8. Connect the negative battery cable.
9. Install the oil pan drain plug.

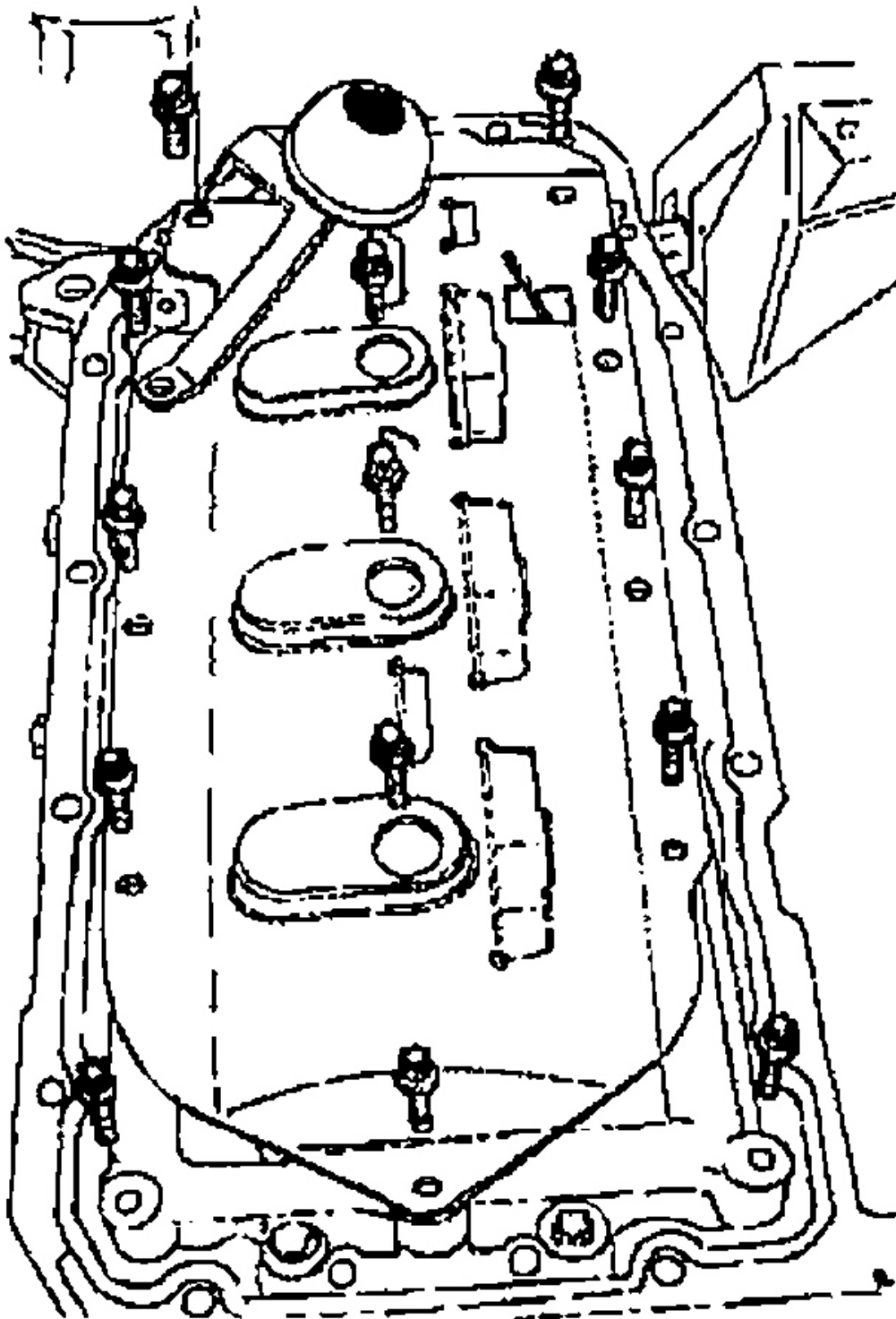
Tighten

Tighten the oil pan drain plug to 35 N.m (26 lb-ft).

10. Refill the engine crankcase with engine oil.

Oil Pan Cleaning

1. Clean the oil pan sealing surface.
2. Clean the engine block sealing surface.
3. Clean the oil pan retaining bolts.
4. Clean the oil pan attaching bolt holes in the engine block.
5. Clean the oil pan scraper.



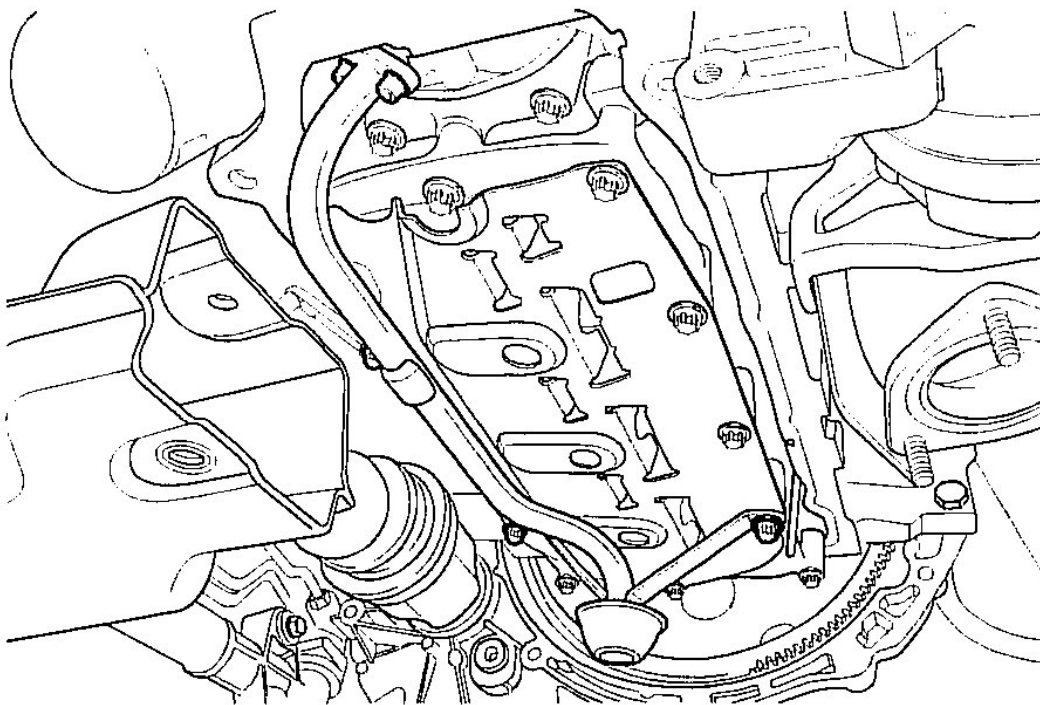
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Fig. 233: Identifying Oil Pan Scraper
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pump 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 rear timing belt cover. Refer to **REAR TIMING BELT COVER REMOVAL AND INSTALLATION**.
4. Disconnect the oil pressure switch connector.
5. Remove the oil pan. Refer to **OIL PAN REMOVAL AND INSTALLATION**.
6. Remove the oil suction pipe and support bracket bolts.
7. Remove the oil suction pipe.

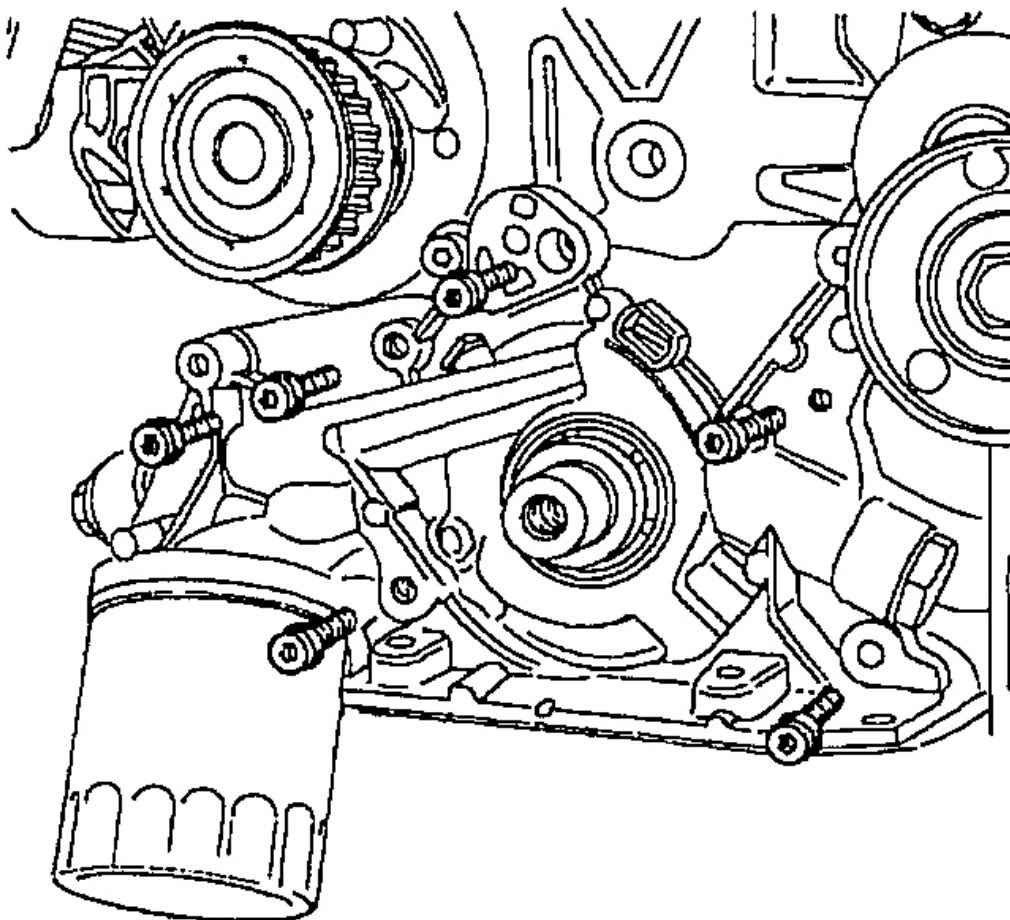


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Fig. 234: Removing The Oil Suction Pipe And Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the oil pump retaining bolts.

9. Carefully separate the oil pump and gasket from the engine block and oil pan.
10. Remove the oil pump.



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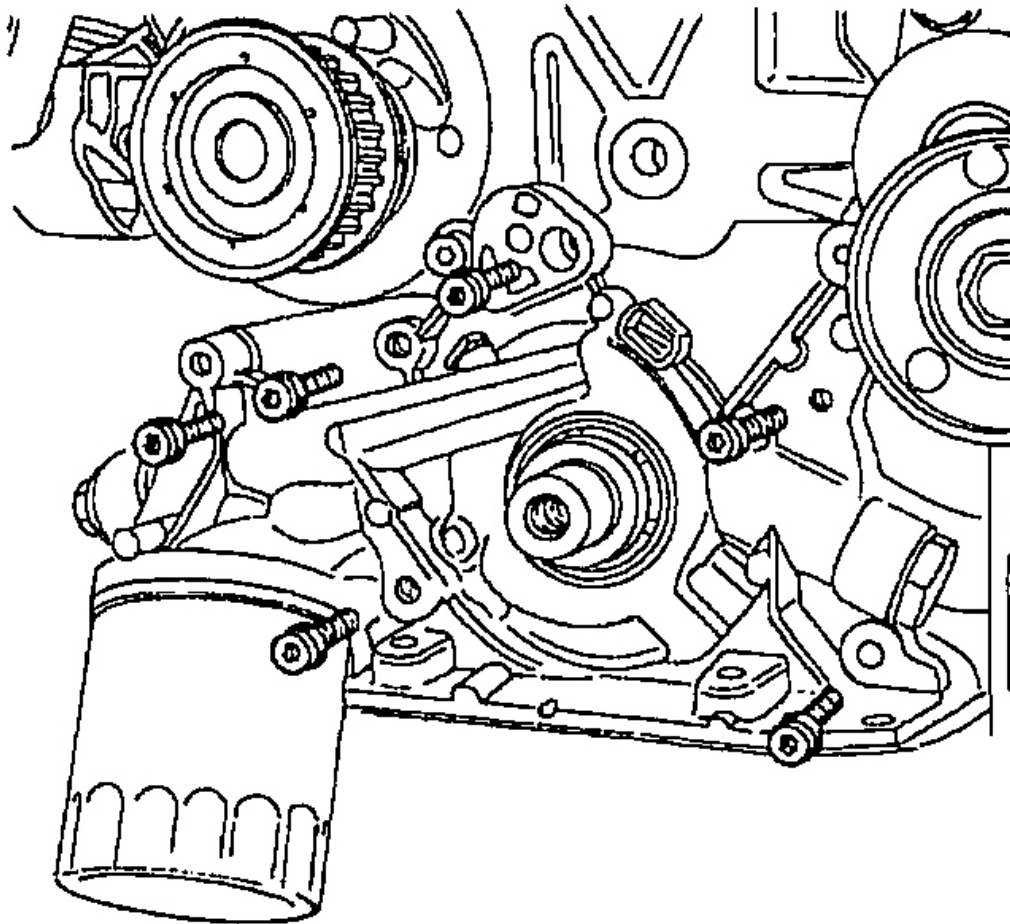
Fig. 235: Removing The Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

Installation

1. Apply Loctite® 242 to the oil pump bolts and room temperature vulcanizing (RTV) sealant to the new oil pump gasket.
2. Install the gasket to the oil pump and install the oil pump to the engine block with the bolts.

Tighten

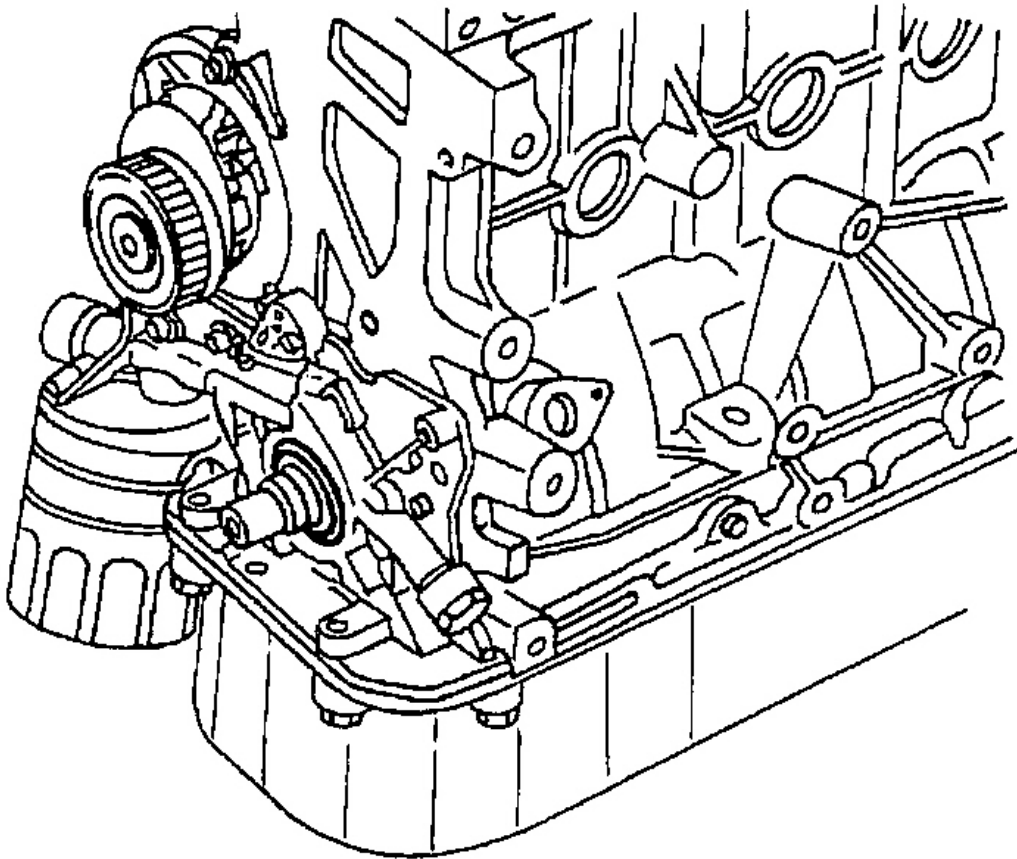
Tighten the oil pump retaining bolts to 10 N.m (89 lb in).



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Fig. 236: Installing The Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

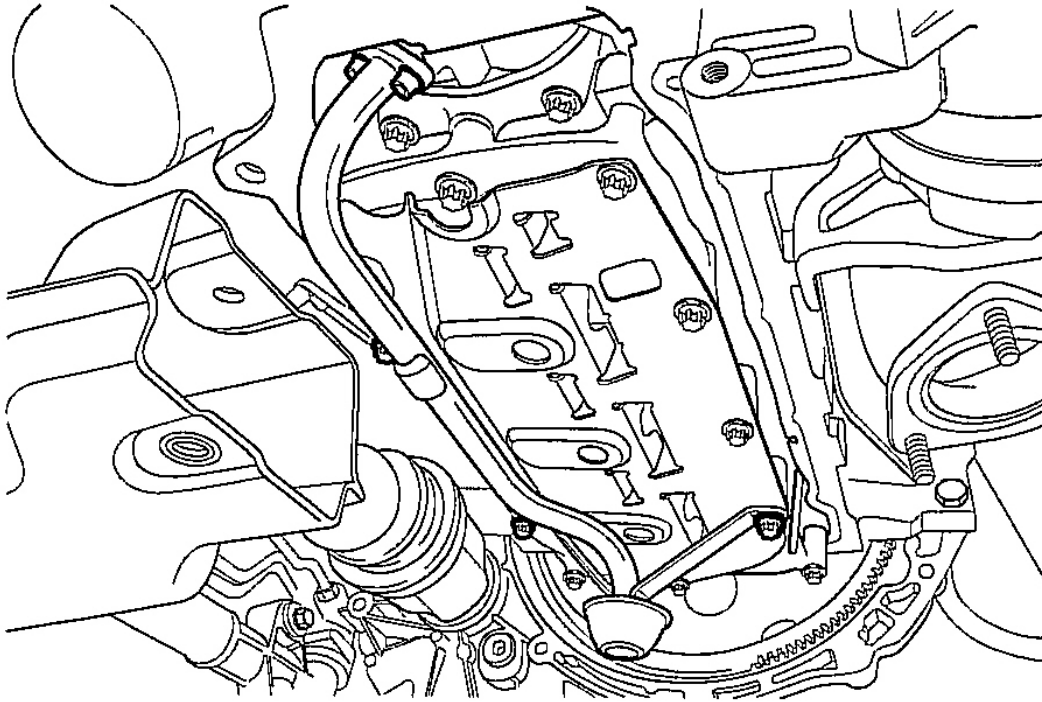
3. Install a new oil pump-to-crankshaft seal. Coat the lip of the seal with a thin coat of grease.



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Fig. 237: Installing Oil Pump-To-Crankshaft Seal
Courtesy of SUZUKI OF AMERICA CORP.

4. Coat the threads of the oil suction pipe and support bracket bolts with Loctite® 242.
5. Install the oil suction pipe and the bolts.



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Fig. 238: Installing The Oil Suction Pipe
Courtesy of SUZUKI OF AMERICA CORP.

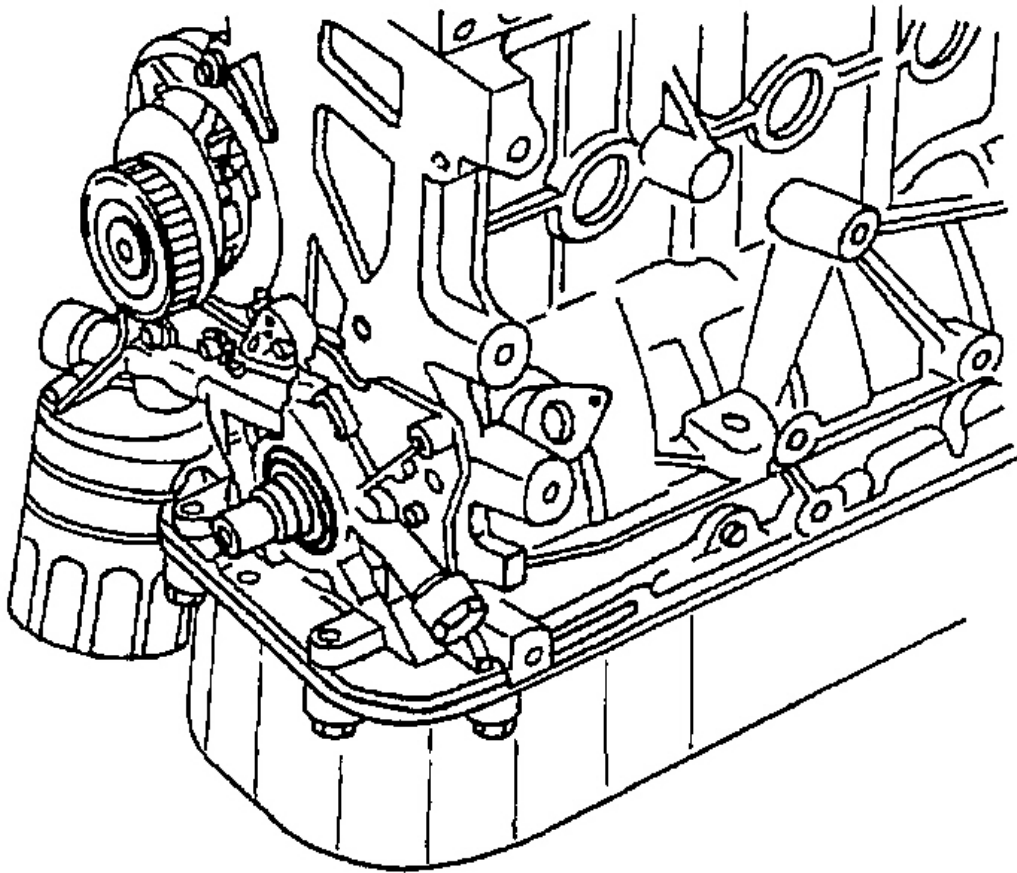
Tighten

Tighten the oil suction pipe bolts to 10 N.m (89 lb-in) and support bracket bolts to 6 N.m (53 lb-in).

6. Install the oil pan. Refer to **OIL PAN REMOVAL AND INSTALLATION**.
7. Connect the oil pressure switch connector.
8. Install the rear timing belt cover. Refer to **REAR TIMING BELT COVER REMOVAL AND INSTALLATION**.
9. Install the timing belt. Refer to **TIMING BELT REMOVAL AND INSTALLATION**.
10. Connect the negative battery cable.

Oil Pump Inspection

1. Clean the oil pump and the engine block gasket mating surface areas.
2. Remove the safety relief valve bolt.
3. Remove the safety relief valve and the spring.
4. Remove the oil pump-to-crankshaft seal.



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Fig. 239: Removing The Oil Pump-To-Crankshaft Seal
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove the oil pump rear cover bolts.
6. Remove the rear cover.
7. Clean the oil pump housing and all the oil pump parts.
8. Inspect all the oil pump parts for signs of wear. Refer to **SYSTEM SPECIFICATIONS**. Replace the worn oil pump parts.

CAUTION: Pack the oil pump gear cavity with petroleum jelly to ensure an oil pump prime, or engine damage could result.

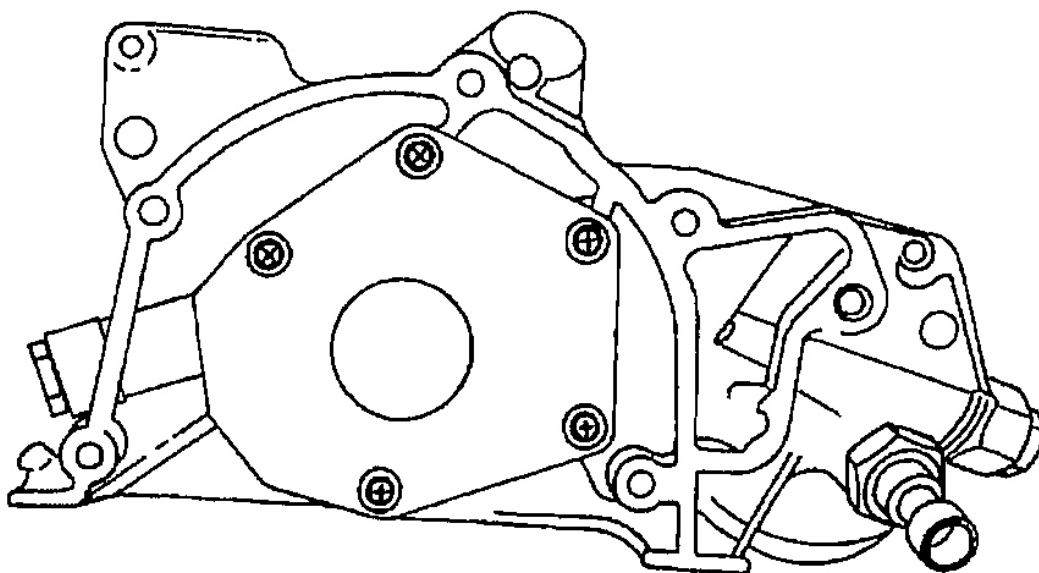
9. Coat all the oil pump parts with clean engine oil. Install the oil pump parts.

10. Apply Loctite® 242 to the oil pump rear cover bolts and install the cover and bolts.

Tighten

Tighten the oil pump rear cover bolts to 6 N.m (53 lb-in).

11. Install the safety relief valve, spring, washer and bolt.



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Fig. 240: Installing The Safety Relief Valve, Spring, Washer And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

Tighten

Tighten the safety relief valve bolt to 30 N.m (22 lb-ft).

SPECIFICATIONS**System Specifications**

Application	Description
Oil Pump:	
Gear Lash	0.10~0.20 mm (0.003~0.007 in.)
Outer Gear to Body	0.11~0.19 mm (0.004~0.007 in.)
Outer Gear to Crescent	0.40~0.50 mm (0.015~0.019 in.)
Inner Gear to Crescent	0.35~0.40 mm (0.013~0.015 in.)
End Clearance	0.030~0.10 mm (0.001~0.003 in.)
Sealants and Adhesives:	
Oil Pan Bolts	HN 1256 (Loctite® 242)
Oil Pump Bolts	HN 1256 (Loctite® 242)
Oil Pan Pickup Tube Bolts	HN 1256 (Loctite® 242)

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Fig. 241: System Specifications Chart (1 Of 2)
 Courtesy of SUZUKI OF AMERICA CORP.

Application	Description
Oil Gallery Plug	HN 1256 (Loctite® 242)

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Fig. 242: System Specifications Chart (2 Of 2)
 Courtesy of SUZUKI OF AMERICA CORP.

Tightening Torque Specifications

See **TORQUE SPECIFICATIONS**.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Automatic Tensioner Bolt	18 (25)
Camshaft Bearing Bridge & Oil Pan Scraper Bolt	(1) 15 (20)
Connecting Pipe Retaining Nut	26 (35)
Connecting Rod Bearing Cap Bolt	(2) 26 (35)
Crankshaft Bearing Bridge/Oil Pan Scraper Bolt	15 (20)
Crankshaft Bearing Cap Bolt	(3) 37 (50)
Crankshaft Gear Bolt	(4) 107 (145)
Crankshaft Pulley Bolt	15 (20)
Cylinder Head Bolt	(5) 18 (25)
Direct Ignition System Coil & Exhaust Gas Recirculation Mounting Bracket Bolt	18 (25)
Engine Mount Bracket Retaining Bolt/Nut	41 (55)
Engine Mount Retaining Bolt	33 (45)
Engine-To-Intake Manifold Support Bracket Bolt	15 (20)
Exhaust Camshaft Gear Bolt	(6) 37 (50)
Exhaust Flex Pipe-To-Exhaust Manifold Retaining Nut	26 (35)
Exhaust Manifold Retaining Nut	16 (22)
Flexible Plate Bolt	33 (45)
Flywheel Bolt	(7) 48 (65)
Generator-To-Intake Manifold Strap Bracket Bolt	16 (22)
Generator-To-Intake Manifold Support Bracket Bolt	27 (37)
Intake Camshaft Gear Bolt	(8) 37 (50)
Intake Manifold Retaining Bolt/Nut	(9) 16 (22)
Intake Manifold Support Bracket Lower Bolt	18 (25)
Intake Manifold Support Bracket Upper Bolt	18 (25)
Lower Block Support Bracket & Splash Shield Bolt	26 (35)
Lower Reaction Rod Bracket Bolt	51 (69)
Lower Reaction Rod Mount Bolt	41 (55)
Oil Pan Drain Plug	26 (35)
Oil Pan Flange-To-Transaxle Bolt	30 (40)
Oil Pressure Switch	30 (40)
Safety Relief Valve Bolt	26 (30)
Spark Plugs	15 (20)
Timing Belt Automatic Tensioner Bolt	18 (25)
Timing Belt Idler Pulley Bolt	18 (25)
Timing Belt Idler Pulley Nut	18 (25)

2004 Suzuki Forenza LX

2004 ENGINES 2.0L 4-Cylinder

Transaxle Bell Housing Bolt	55 (75)
Transaxle Torque Converter Bolt	44 (60)
Water Pump Mounting Bolt	18 (25)
INCH Lbs. (N.m)	
Air Cleaner Housing Bolt	88 (10)
Camshaft Bearing Cap Bolt	⁽¹⁰⁾ 71 (8)
Camshaft Cover Bolt	71 (8)
Charcoal Canister Purge & Exhaust Gas Recirculation Solenoid Bracket Bolt	71 (8)
Coolant By-Pass Housing & Mounting Bolt	133 (15)
Exhaust Manifold Heat Shield Bolt	71 (8)
Front Timing Belt Cover Bolt	53 (6)
Oil Pan Retainer Bolt	88 (10)
Oil Pump Rear Cover Bolt	53 (6)
Oil Pump Retainer Bolt	88 (10)
Oil Suction Pipe Bolt	71 (8)
Oil Suction Pipe Support Bracket Bolt	88 (10)
Pulse Pick-Up Sensor Disc	115 (13)
Rear Timing Belt Cover Bolt	62 (7)
Spark Plug Cover Bolt	71 (8)
Thermostat Housing Mounting Bolt	133 (15)
Throttle Cable Bracket Bolt	71 (8)

(1) Turn the camshaft bearing bridge and oil pan scraper bolts additional 45°.

(2) Turn the connecting rod bearing cap bolts additional 45° plus 15°.

(3) Turn the crankshaft bearing cap bolts additional 45° plus 15°.

(4) Turn the crankshaft gear bolts additional 30° plus 15°.

(5) Turn the cylinder head bolts additional 3 turns of 90°.

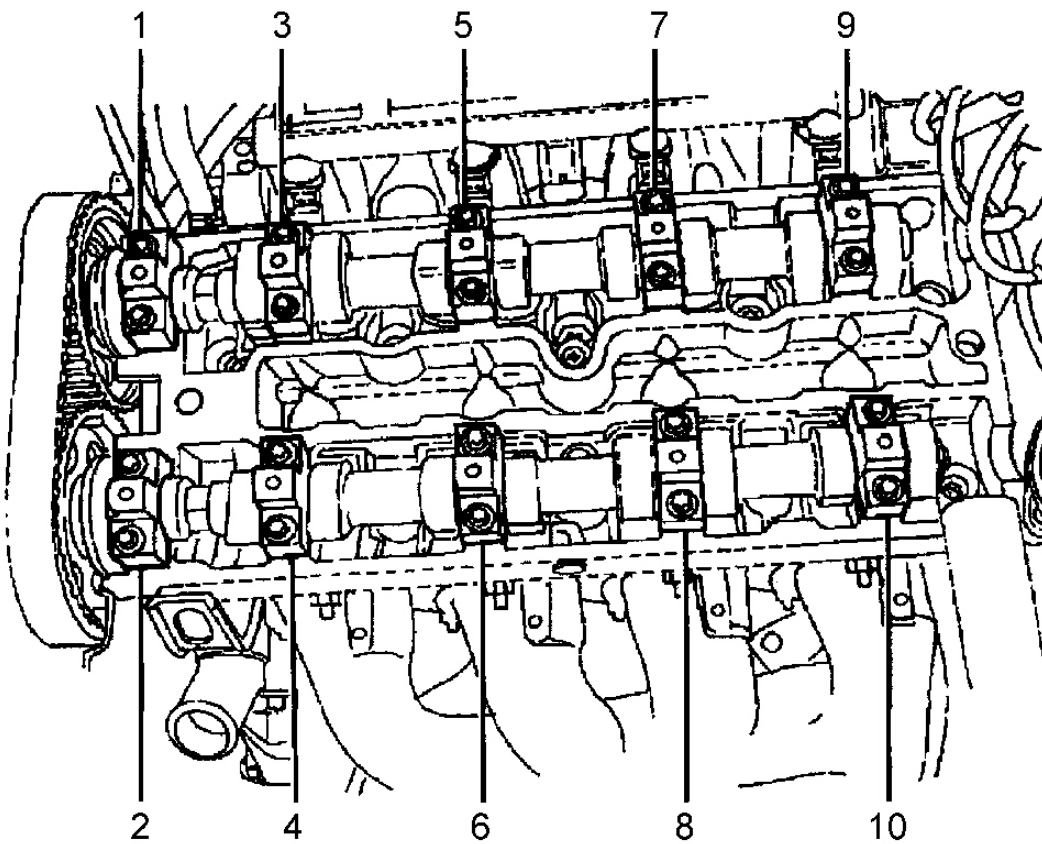
(6) Turn the exhaust camshaft gear bolts additional 60° plus 15°.

(7) Turn the flywheel bolts additional 30° plus 15°.

(8) Turn the intake camshaft gear bolts additional 60° plus 15°.

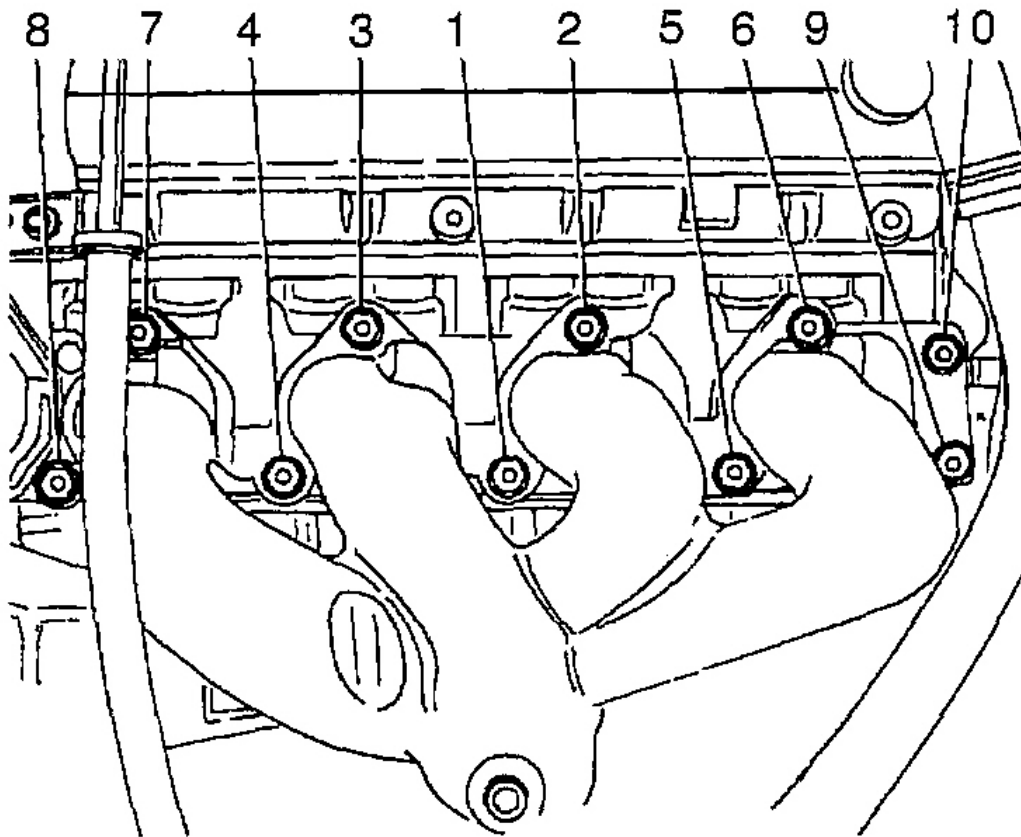
(9) For intake manifold retaining bolt tightening sequence, see **Fig. 245**

(10) For camshaft bearing cap bolt tightening sequence, see **Fig. 243**.



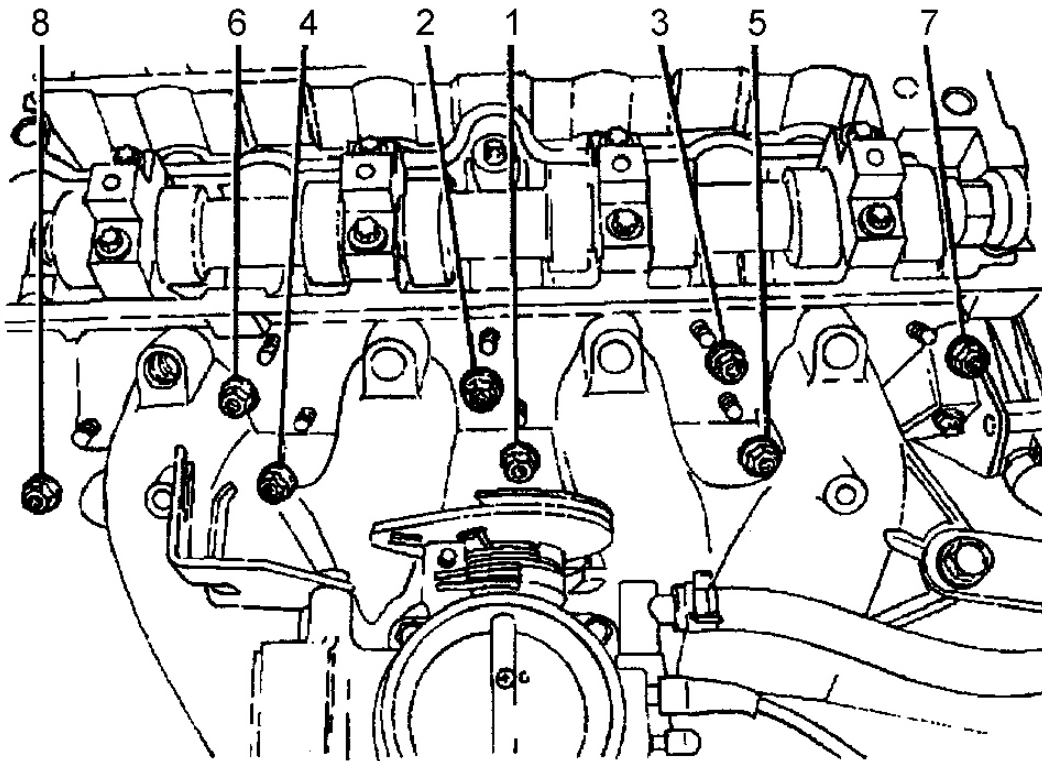
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Fig. 243: Camshaft Bearing Cap Bolt Tightening Sequence
 Courtesy of SUZUKI OF AMERICA CORP.



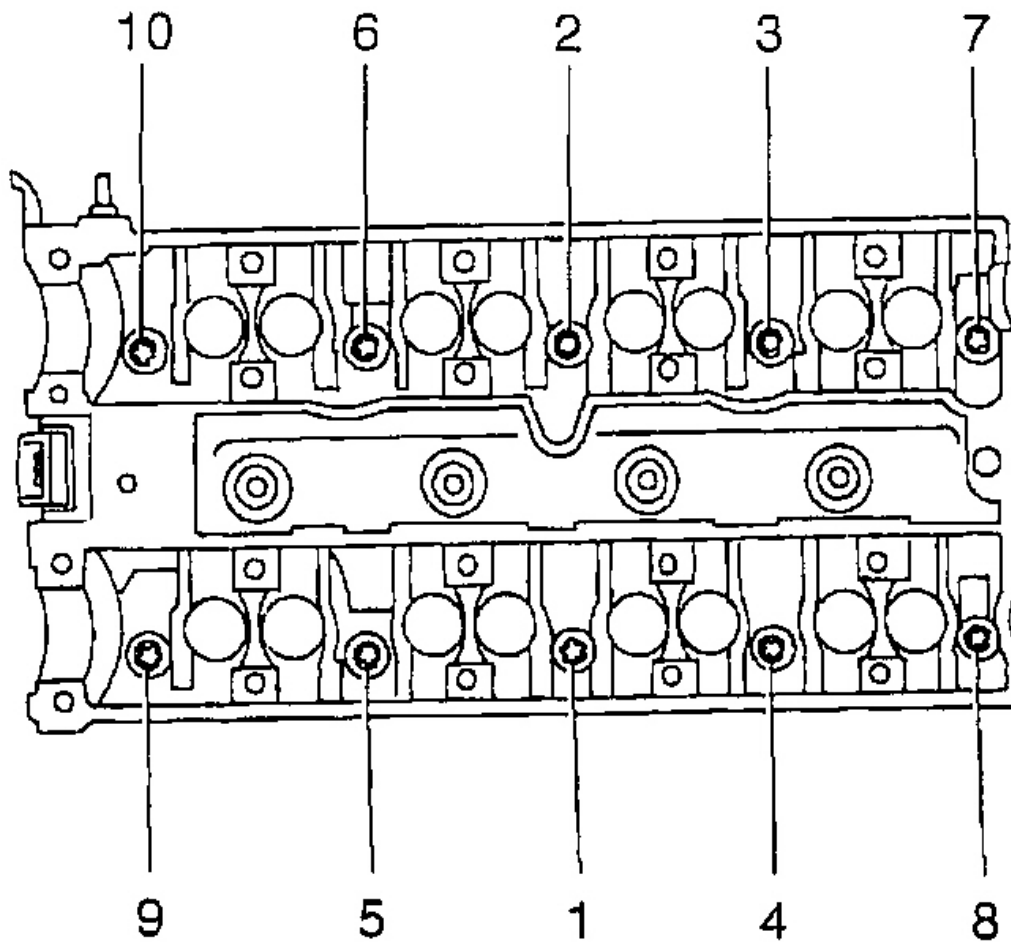
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Fig. 244: Installing The Exhaust Manifold Retaining Nuts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 245: Intake Manifold Retaining Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.



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Fig. 246: Cylinder Head Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.