

2005 ENGINE**Engine Mechanical - Forenza/Reno****GENERAL DESCRIPTION****CYLINDER HEAD AND GASKET DESCRIPTION**

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

CRANKSHAFT DESCRIPTION

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

TIMING BELT DESCRIPTION

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

INTAKE MANIFOLD DESCRIPTION

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

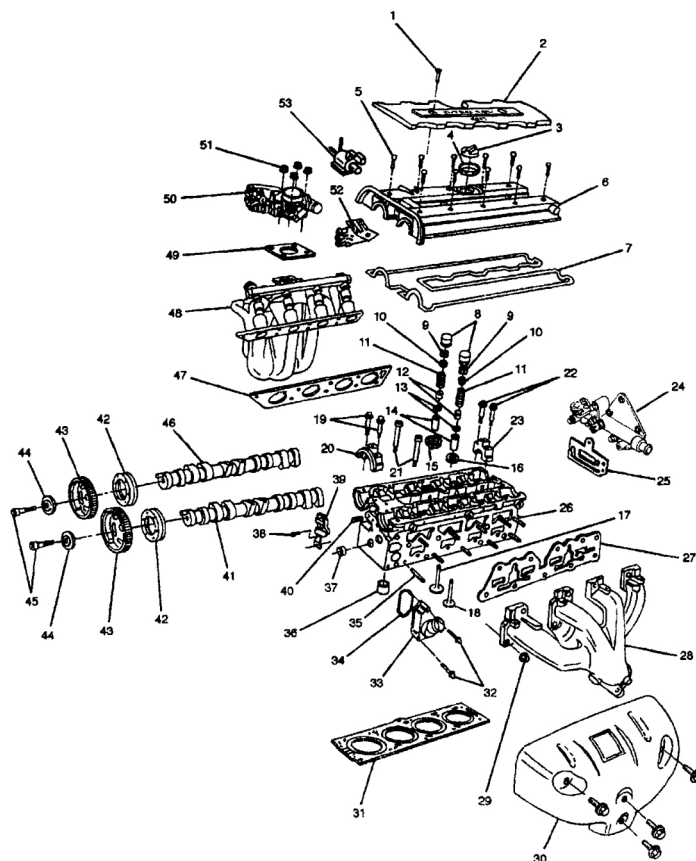
CAMSHAFTS DESCRIPTION

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

COMPONENT LOCATION**UPPER END LOCATION**

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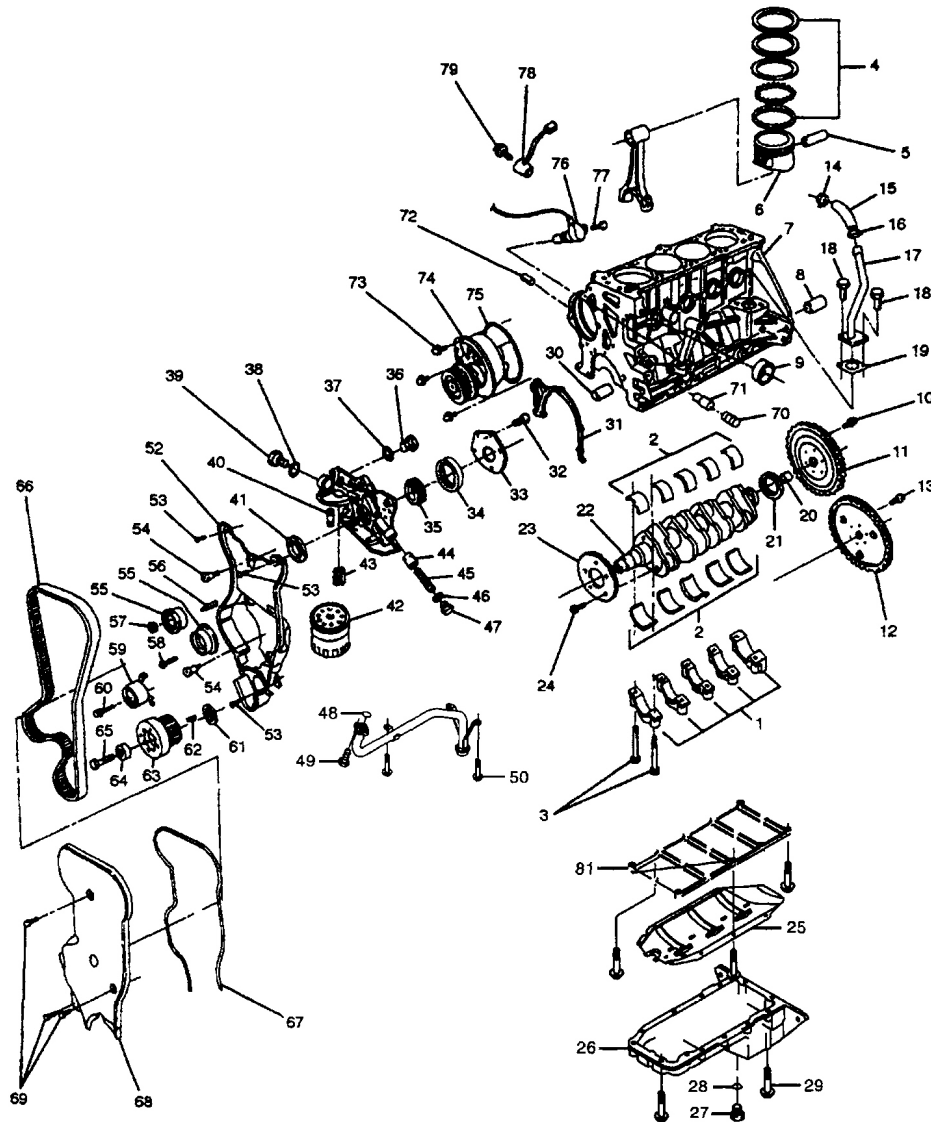
1. Bolt	19. Bolt	37. Plug
2. Spark Plug Cover	20. Front Camshaft Cap	38. Bolt
3. Oil Filler Cap	21. Head Bolt	39. Camshaft Position Sensor
4. Oil Filler Cap Seal	22. Bolt	40. Oil Gallery Plug
5. Bolt	23. Intermediate Camshaft Cap	41. Exhaust Camshaft
6. Camshaft Cover	24. Exhaust Gas Recirculation Adapter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

Fig. 1: Identifying Engine - Upper End Component Location
Courtesy of SUZUKI OF AMERICA CORP.

LOWER END LOCATION

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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

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

DIAGNOSTIC INFORMATION AND PROCEDURES

COMPRESSION TEST

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

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

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

KNOCK DIAGNOSIS

Definition for Knock

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

Engine Knocks Cold and Continues for Two-Three Minutes and/or Knock Increases with Engine Torque

ENGINE KNOCKS COLD AND KNOCK INCREASES WITH ENGINE TORQUE - DIAGNOSTIC PROCEDURE

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
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete? ⁽¹⁾	-	Go to Step 1	-
8	Inspect the connecting rod. Is the connecting rod bent?	-	Go to Step 9	System OK
9	Replace the connecting rod. Is the repair complete?	-	Go to Step 1	-
(1) Cold engine piston knock usually disappears when the cylinder is grounded out. Cold engine piston knock, which disappears in about 1.5 minutes, is considered acceptable.				

Heavy Knock Hot with Torque Applied
HEAVY KNOCK HOT WITH TORQUE - DIAGNOSTIC PROCEDURE

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

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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	-

Light Knock Hot

LIGHT KNOCK HOT - DIAGNOSTIC PROCEDURE

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

Knocks during Initial Start-Up But Last Only A Few Seconds

KNOCKS DURING INITIAL START-UP BUT LAST ONLY FEW SECONDS - DIAGNOSTIC PROCEDURE

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? ⁽¹⁾	-	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	-

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

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

Knocks at Idle Hot

KNOCKS AT IDLE HOT - DIAGNOSTIC PROCEDURE

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

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5	Replace the faulty A/C compressor or the generator. Is the repair complete?	-	Go to Step 1	-
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	-

NOISE DIAGNOSIS

Main Bearing Noise

MAIN BEARING NOISE - DIAGNOSTIC PROCEDURE

Step	Action	Value(s)	Yes	No
1	Are dull thuds or knocks heard with every engine revolution?	-	Go to Step 2	System OK
2	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to " <u>OIL PRESSURE TEST</u> :"	Go to Step 3

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3	Inspect the crankshaft end play. Does the crankshaft end play exceed the specified value?	0.1 mm (0.0039 in.)	Go to " <u>CRANKSHAFT DISASSEMBLY AND ASSEMBLY:</u> "	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 " <u>CRANKSHAFT DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 5
5	Inspect the belt tension. Does the belt tension exceed the specified value?	-	Go to " <u>TIMING BELT REMOVAL AND INSTALLATION:</u> "	Go to Step 6
6	Inspect the crankshaft pulley. Is the crankshaft pulley loose?	-	Go to " <u>CRANKSHAFT DISASSEMBLY AND ASSEMBLY:</u> "	System OK

Connecting Rod Bearing Noise Symptom

CONNECTING ROD BEARING NOISE SYMPTOM - DIAGNOSTIC PROCEDURE

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 " <u>CRANKSHAFT DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 3
3	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to " <u>OIL PRESSURE TEST :</u> "	Go to Step 4
4	Inspect the crankshaft connecting rod journals. Are the journals out-of-round?	-	Go to " <u>CRANKSHAFT DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 5
5	Inspect the connecting rods. Is there a misaligned connecting rod?	-	Go to " <u>PISTONS AND RODS REMOVAL AND INSTALLATION:</u> "	Go to Step 6
6	Inspect the connecting rod bolts. Are the connecting rod bolts torqued properly?	-	System OK	Go to " <u>PISTONS AND RODS REMOVAL AND INSTALLATION:</u> "

Piston Noises

PISTON NOISES - DIAGNOSTIC PROCEDURE

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

Valve Mechanism or Valve Train Noises

VALVE MECHANISM OR VALVE TRAIN NOISES - DIAGNOSTIC PROCEDURE

Step	Action	Value (s)	Yes	No
1	Is a light tapping sound heard from the engine?	-	Go to Step 2	System OK
2	Inspect the valve springs. Are the springs weak or broken?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 3
3	Inspect the valves. Are the valves sticking or warped?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 4
4	Inspect the valve lifters. Are the valve lifters dirty, stuck or worn?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 5
5	Inspect the camshaft lobes. Are the camshaft lobes damaged or improperly machined?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 6
6	Check the oil supply to the valve train. Is the oil supply insufficient or poor?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 7

7	Inspect the valve guides. Are the valve guides worn?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	Go to Step 8
8	Inspect the valve spring seat. Is the valve spring seat incorrect?	-	Go to " <u>CYLINDER HEAD AND VALVE TRAIN COMPONENTS DISASSEMBLY AND ASSEMBLY:</u> "	System OK

REPAIR INSTRUCTIONS

CAMSHAFT COVER REMOVAL AND INSTALLATION

Removal

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

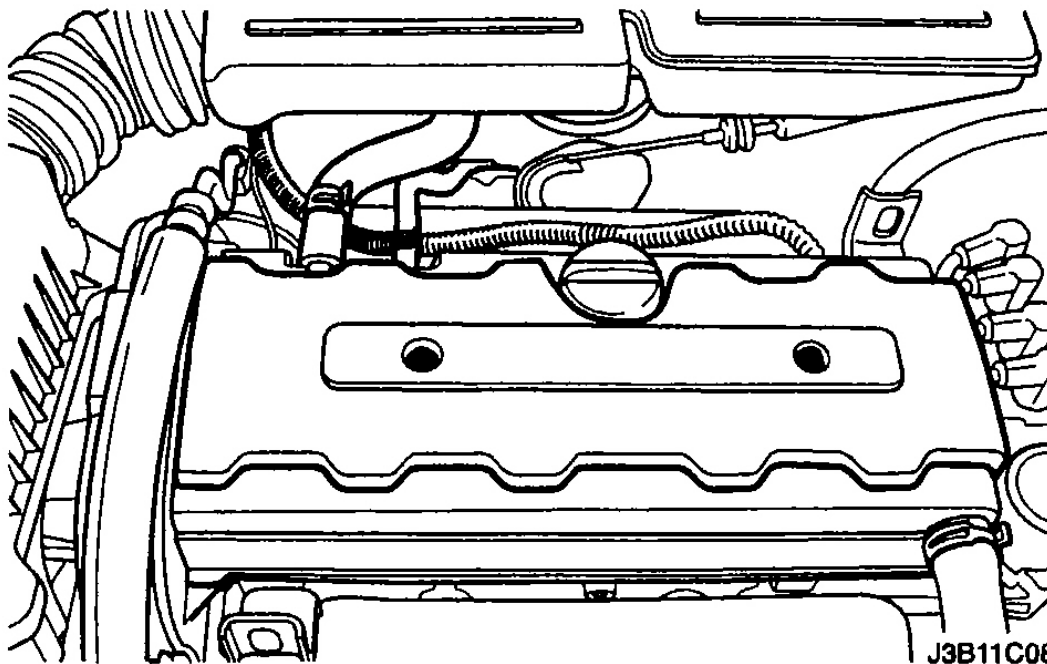


Fig. 3: Removing Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect the ignition wires from the spark plugs.

7. Disconnect the camshaft position sensor connector.
8. Remove the camshaft cover bolts.

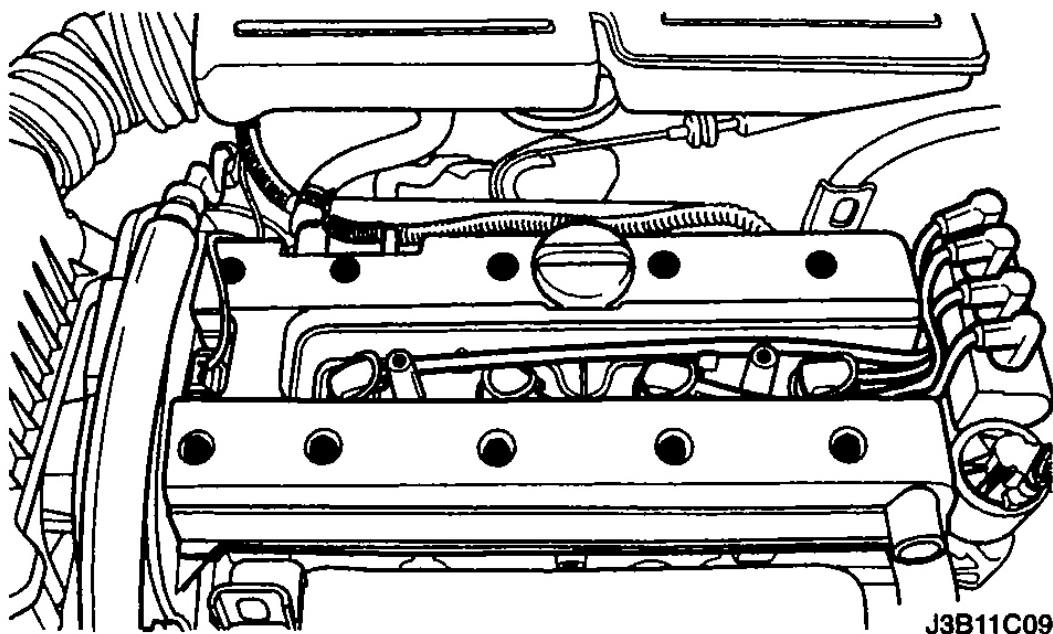
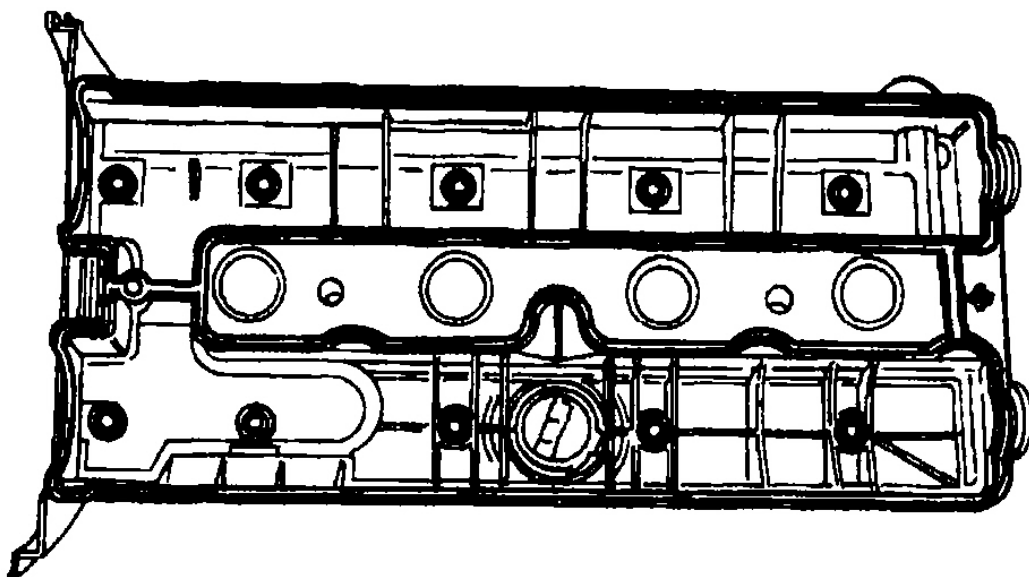


Fig. 4: Removing Camshaft Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

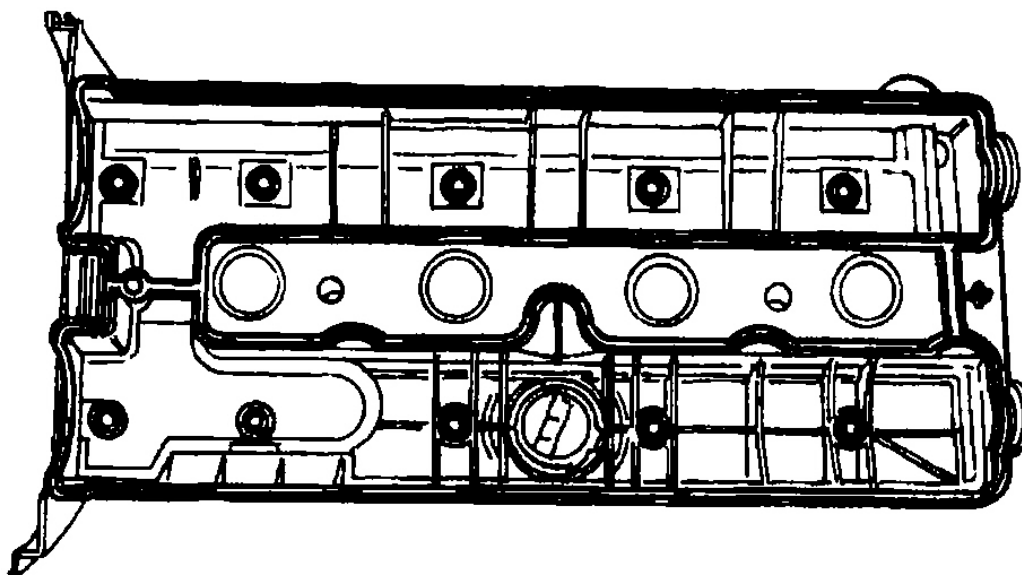


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Fig. 5: Removing Camshaft Cover Gasket From Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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. 6: Installing Camshaft Cover Gasket To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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).

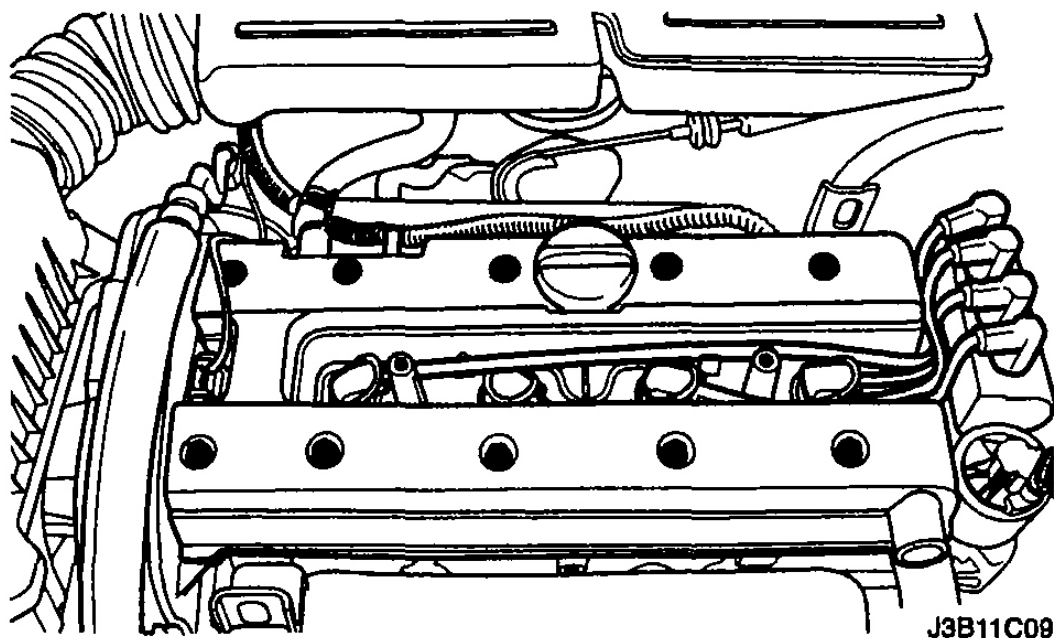


Fig. 7: Installing Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the spark plug cover bolts.
8. Connect the camshaft position sensor connector.
9. Connect all of the necessary vacuum lines.
10. Connect the breather tube to the camshaft cover.
11. Connect the negative battery cable.

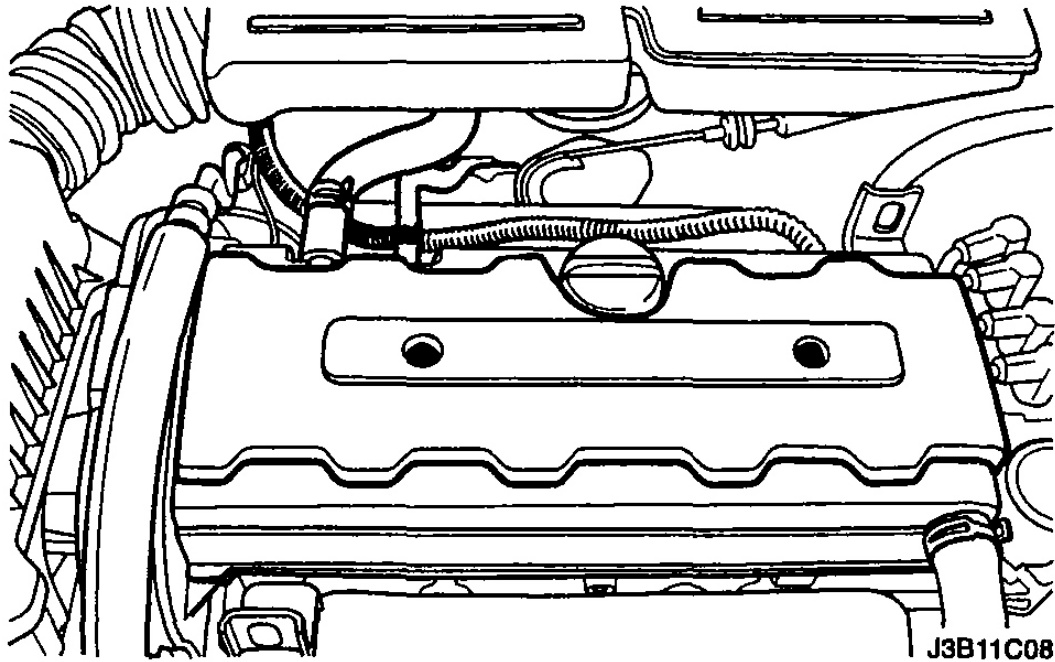


Fig. 8: Installing Spark Plug Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION

Tools Required

KM-470-B Angular Torque Gauge

J-28467-B (2005), DW110-060 (2006 & 2007) Engine Assembly Support Fixture

Removal

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the electronic control module (ECM) ground terminal.
5. Drain the engine coolant. Refer to "**DRAINING AND REFILLING THE COOLING SYSTEM** :".

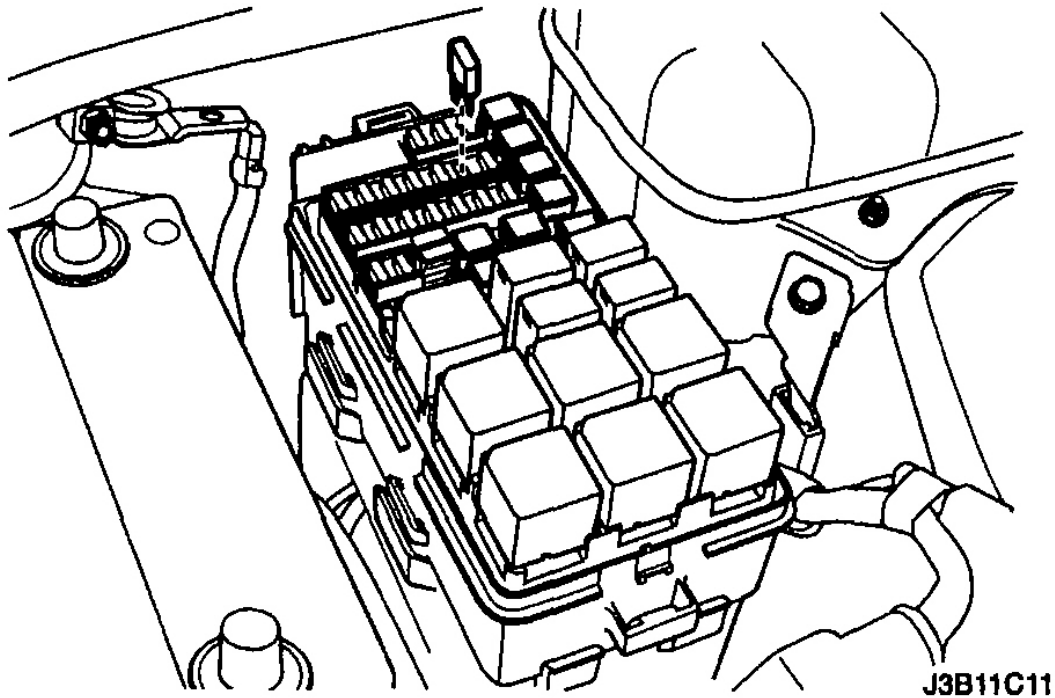


Fig. 9: Removing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect the manifold air temperature (MAT) sensor connector.
7. Disconnect the breather tube from the camshaft cover.
8. Disconnect the air cleaner outlet hose from the throttle body.

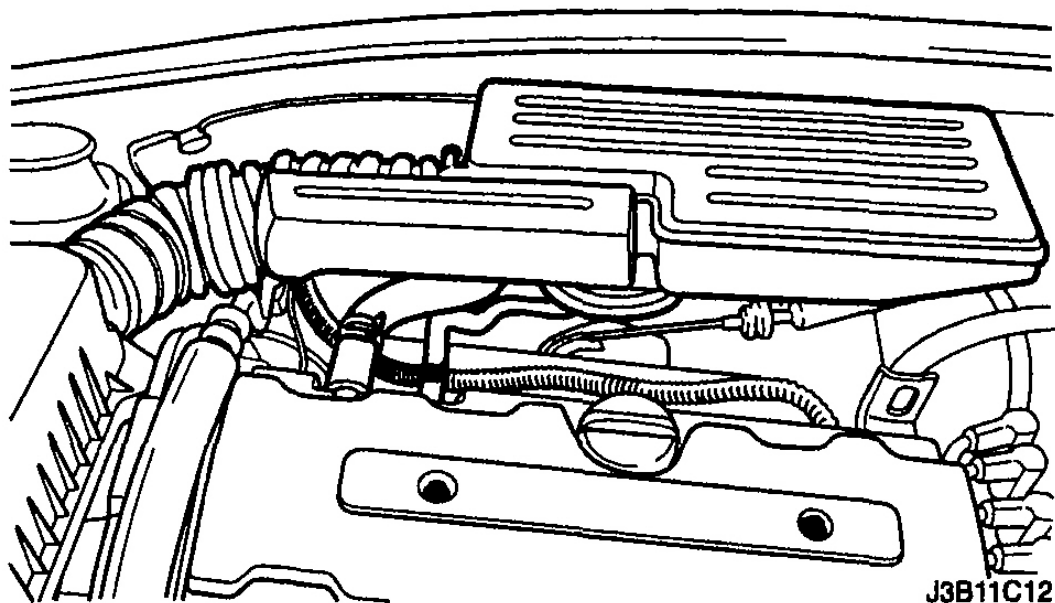


Fig. 10: Disconnecting Air Cleaner Outlet Hose From Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.

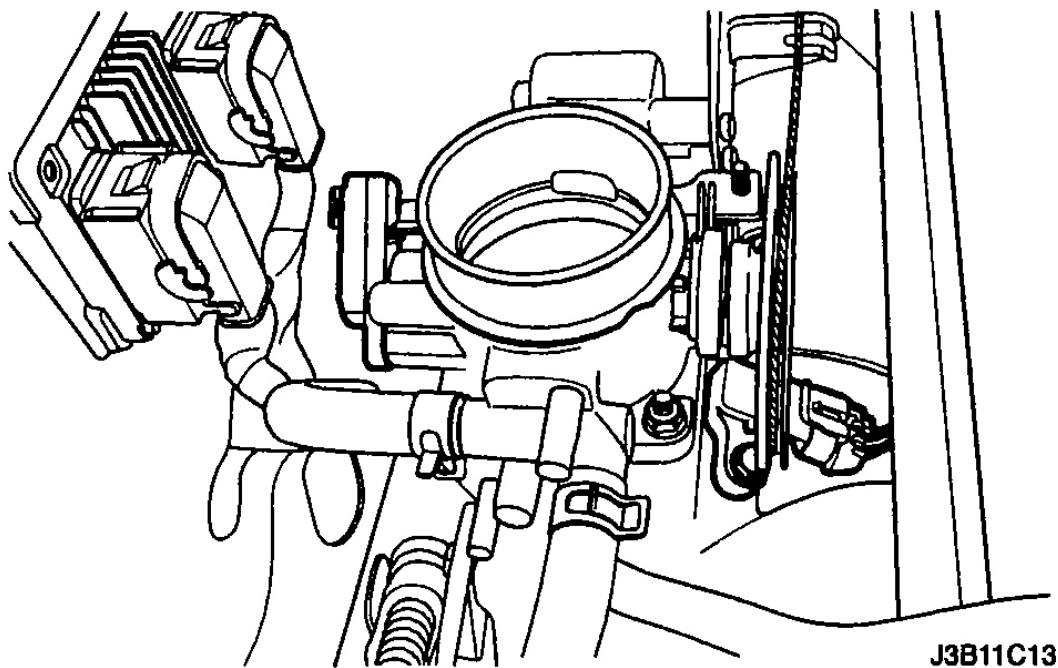


Fig. 11: Disconnecting Throttle Position Sensor Connector
Courtesy of SUZUKI OF AMERICA CORP.

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.

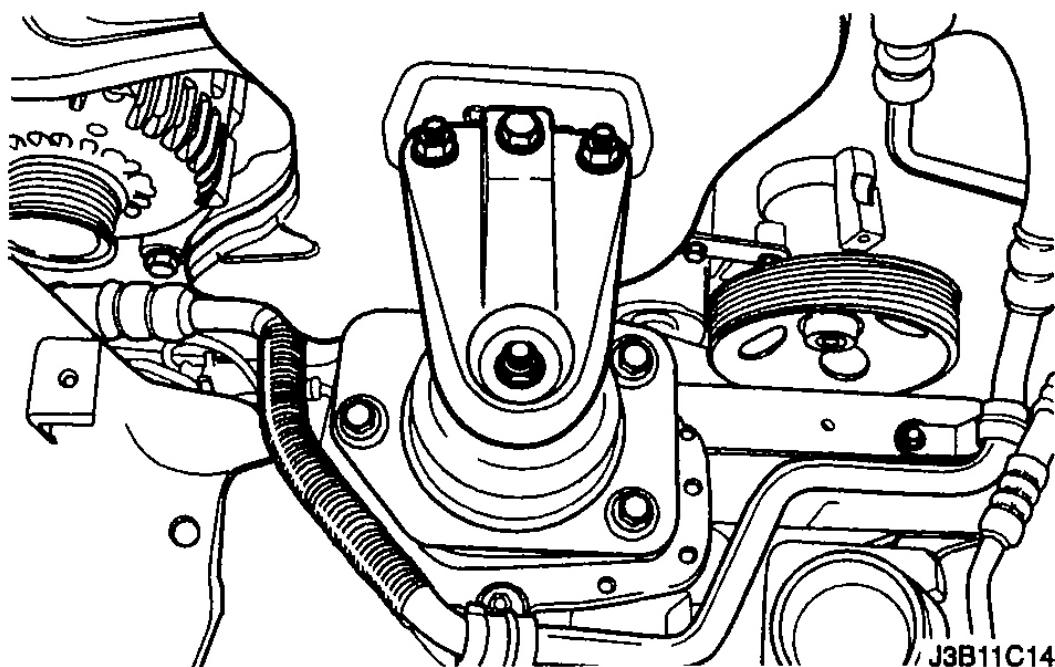


Fig. 12: Removing Engine Mount Bracket And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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.

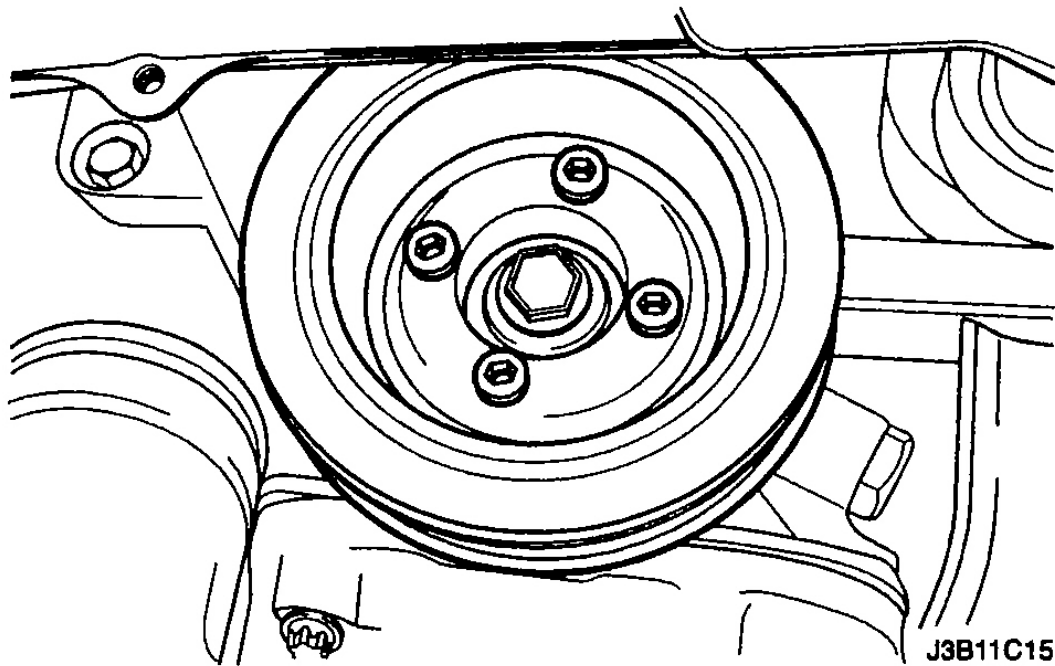


Fig. 13: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

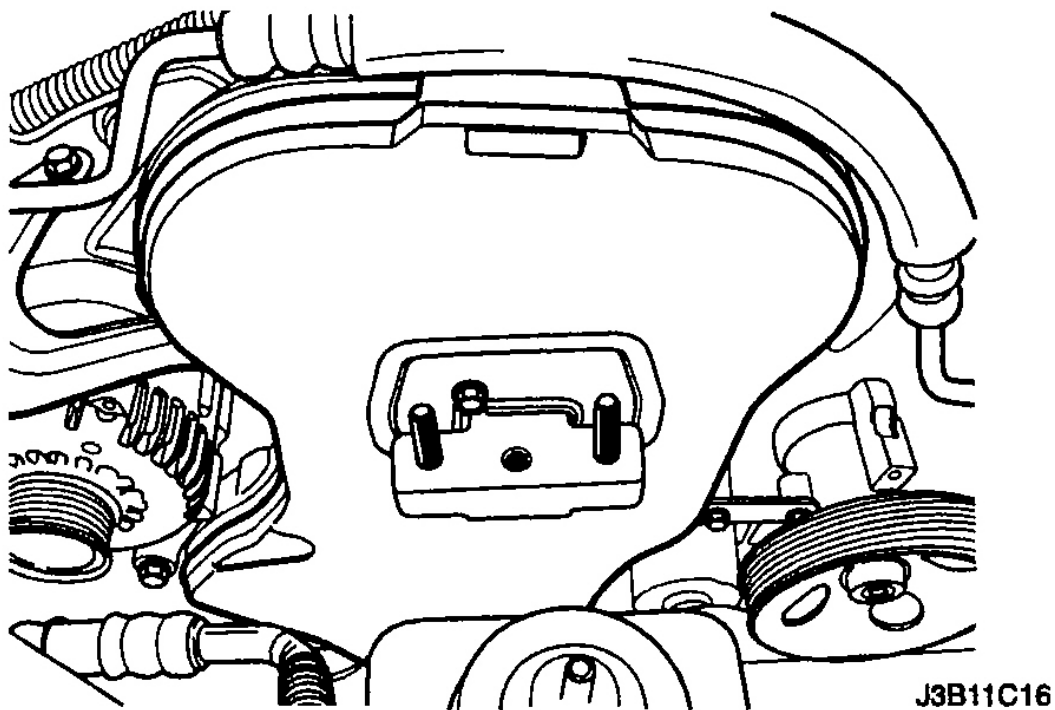


Fig. 14: Removing Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.

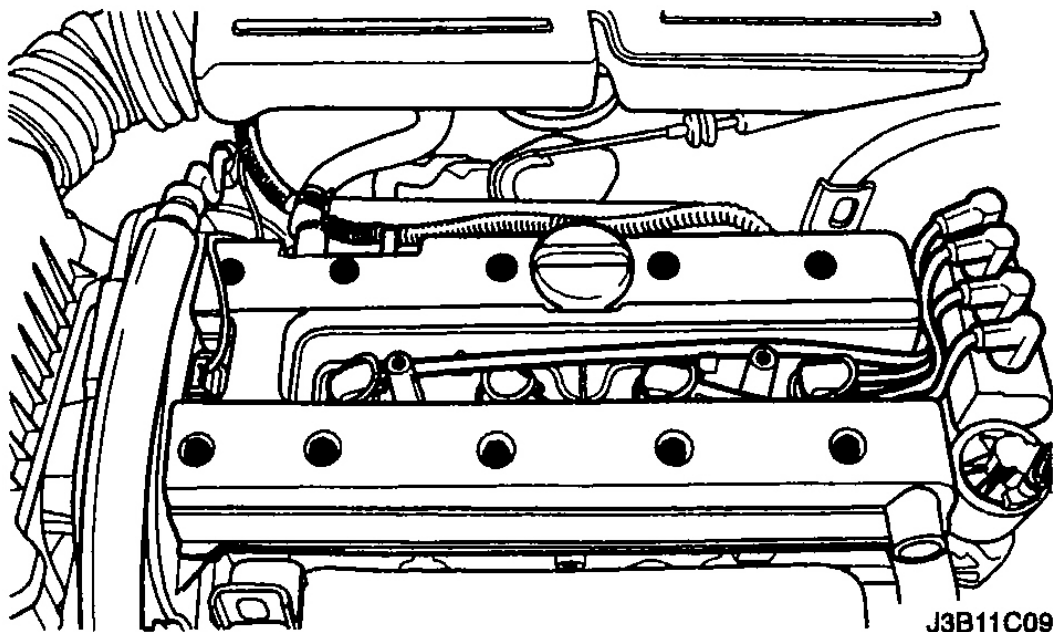
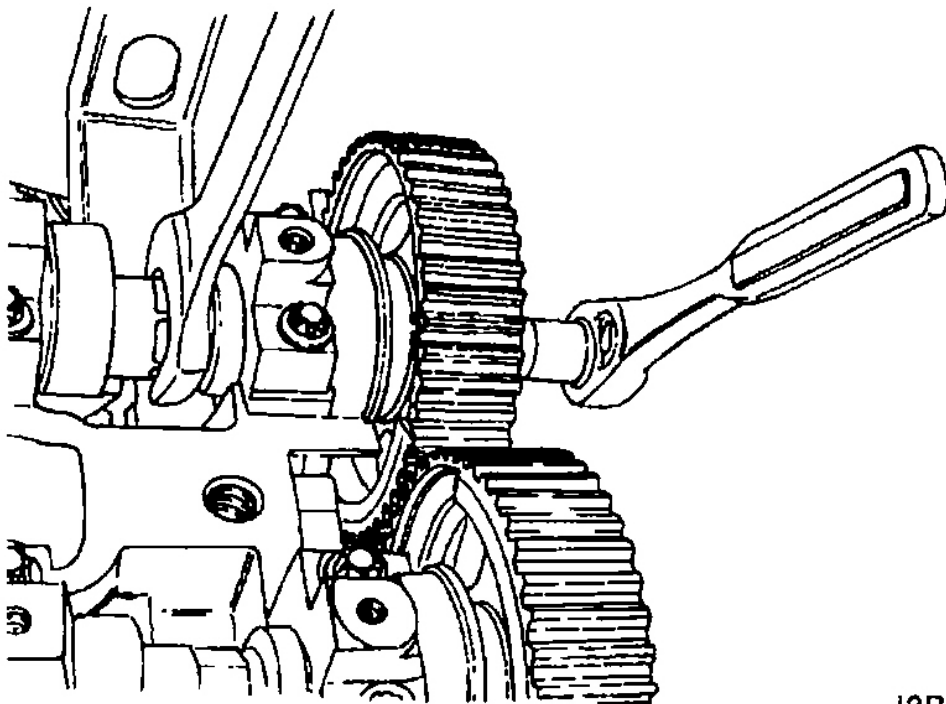


Fig. 15: Removing Camshaft Cover And Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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

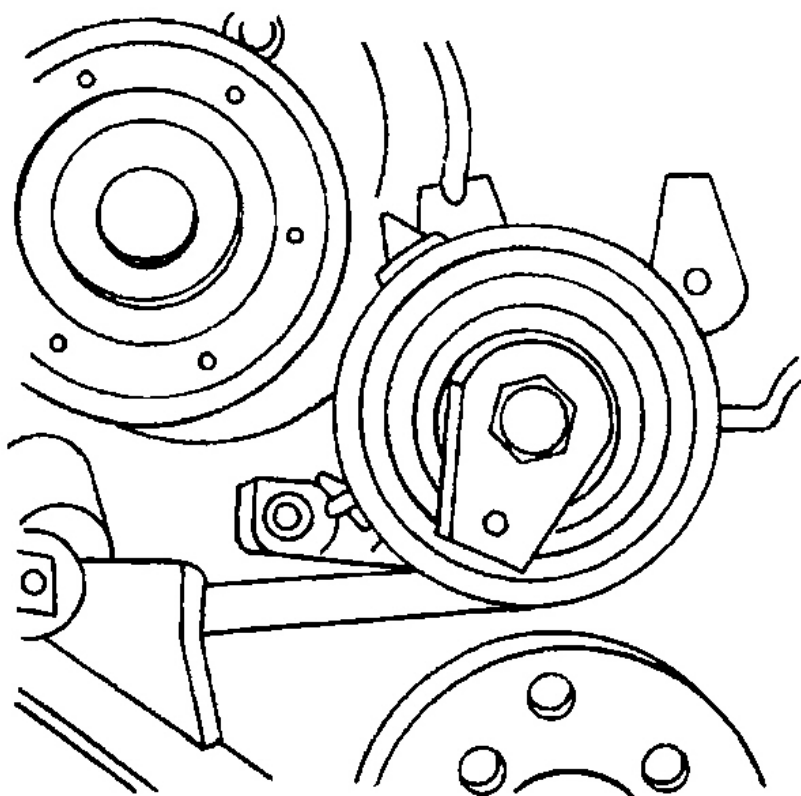
34. While holding the intake camshaft firmly in place, remove the intake camshaft gear bolt.
35. Remove the intake camshaft gear.
36. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft gear bolt.
37. Remove the exhaust camshaft gear.



J3B11C17

Fig. 16: Removing Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

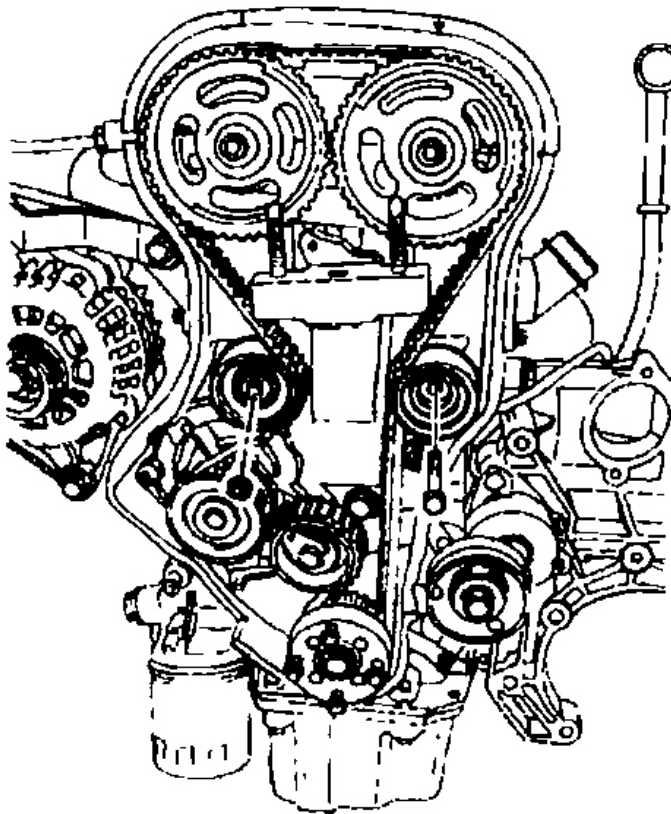
38. Remove the timing belt automatic tensioner bolts.
39. Remove the timing belt automatic tensioner.



J3B11C18

Fig. 17: Removing 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.



J3B11C19

Fig. 18: Removing Timing Belt Idler Pulleys
Courtesy of SUZUKI OF AMERICA CORP.

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

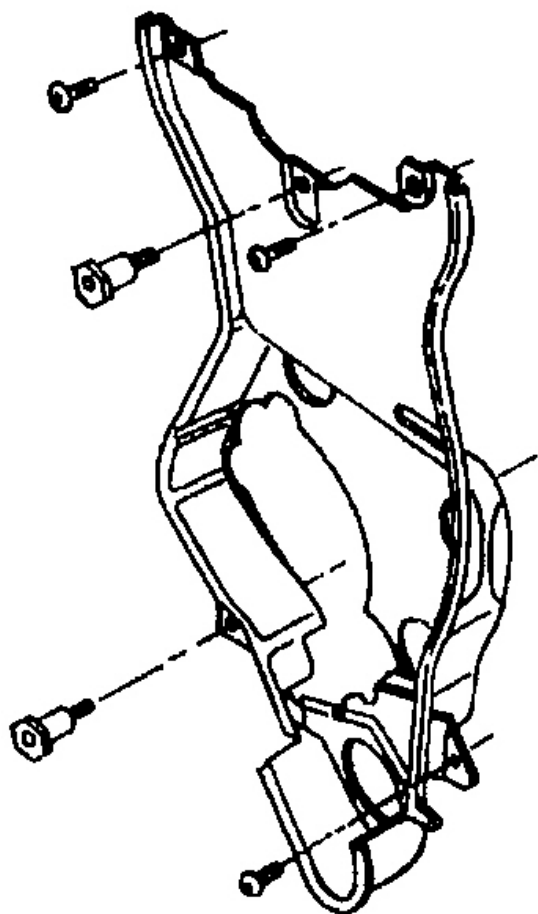
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Fig. 19: Removing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

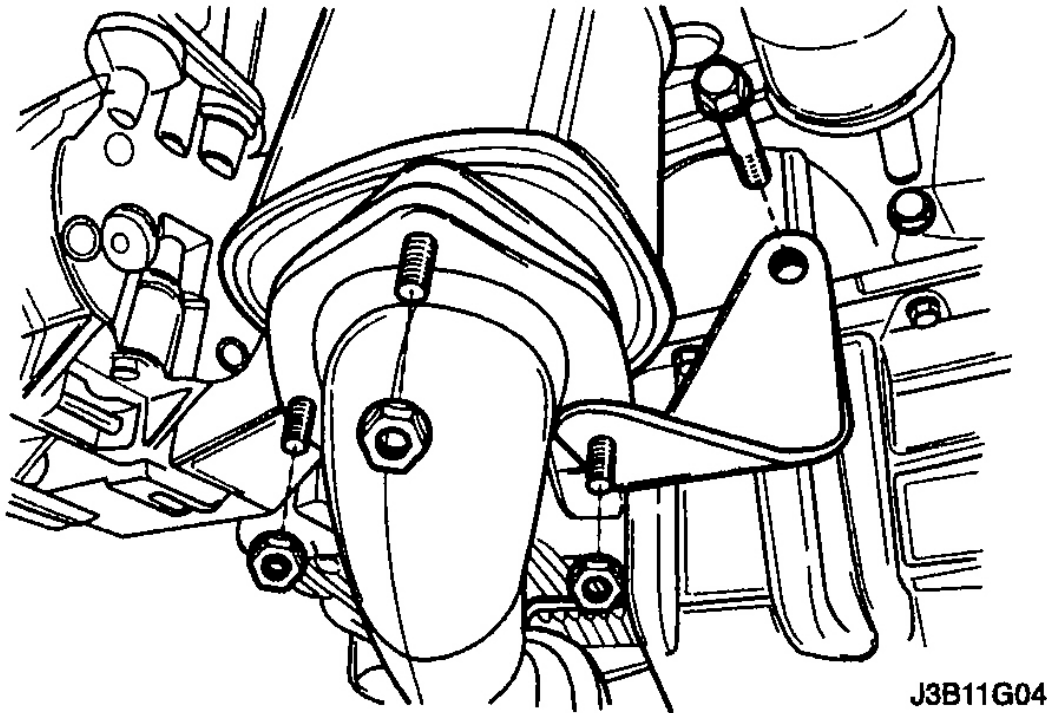


Fig. 20: Removing Exhaust Flex Pipe Retaining Nuts
Courtesy of SUZUKI OF AMERICA CORP.

51. Disconnect the fuel feed line at the fuel rail.
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** :".

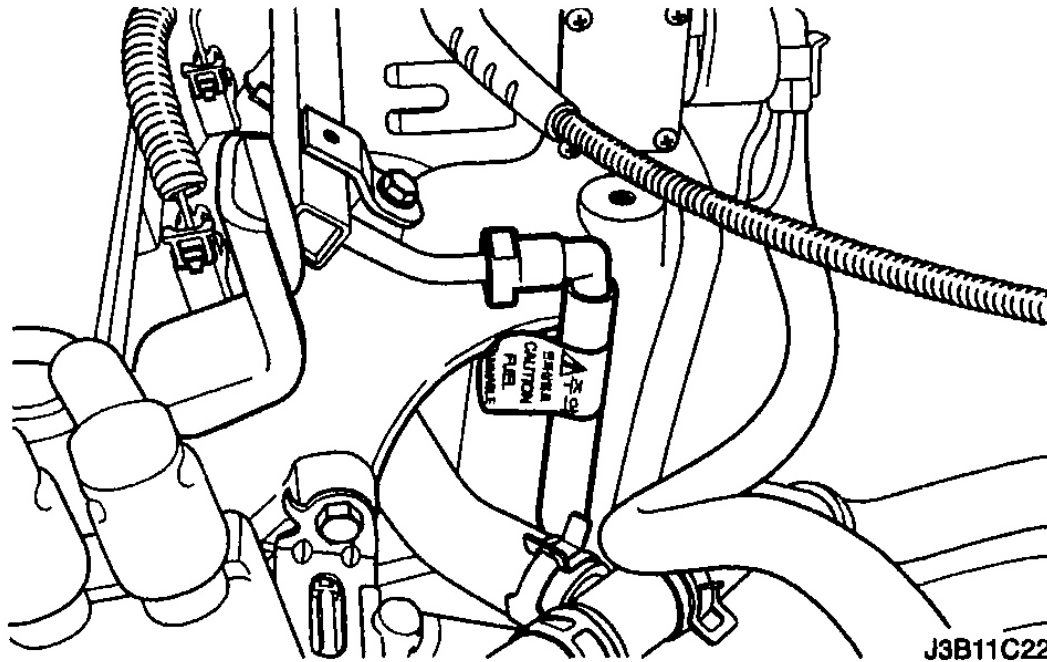


Fig. 21: Removing Coolant Hose

Courtesy of SUZUKI OF AMERICA CORP.

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.

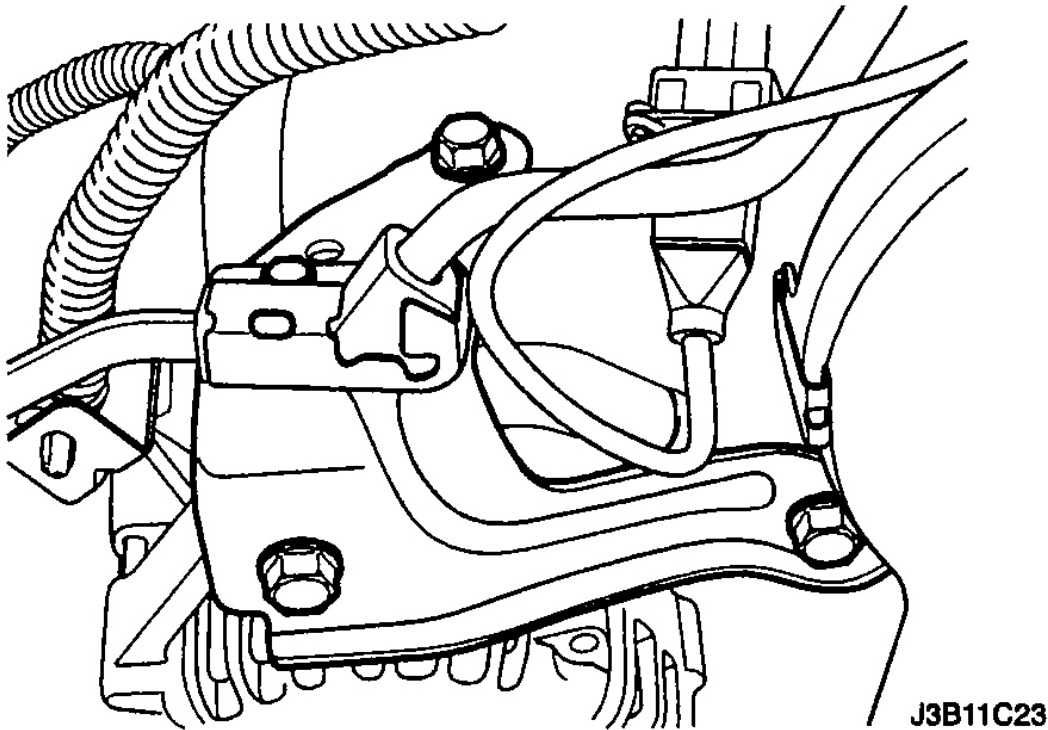


Fig. 22: Removing EGR Solenoid Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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 in illustration.
63. Remove the camshaft.
64. Remove the cylinder head bolts.
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.

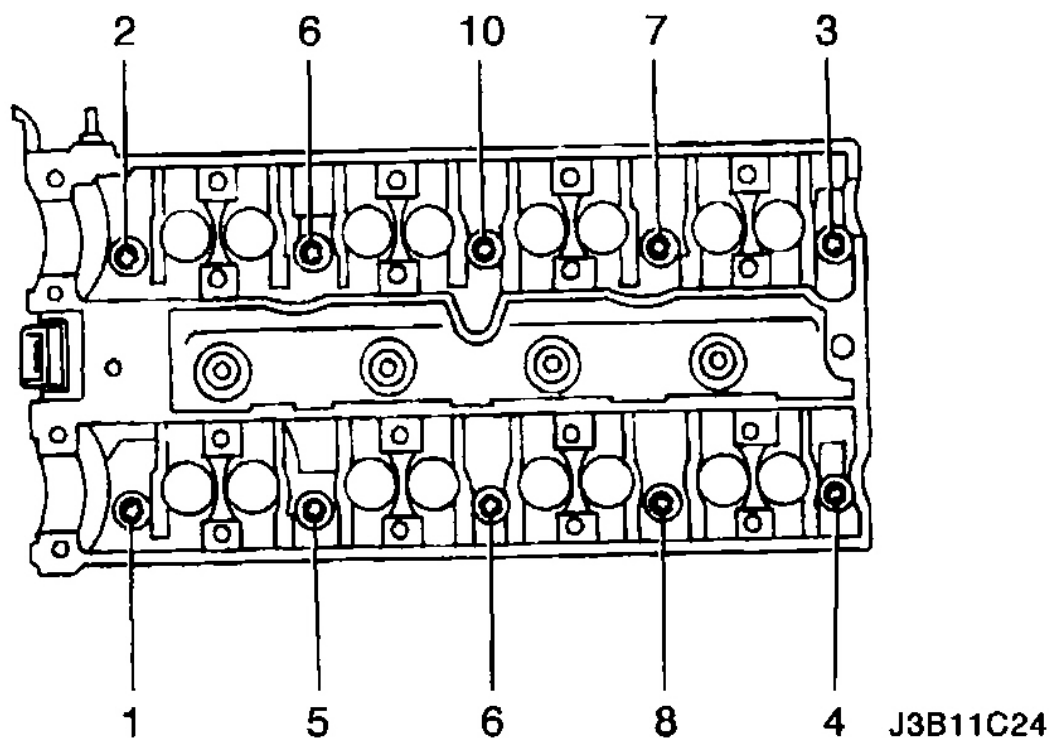


Fig. 23: Removing Cylinder Head Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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 in illustration. See **Fig. 24**.

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. See **Fig. 25**.

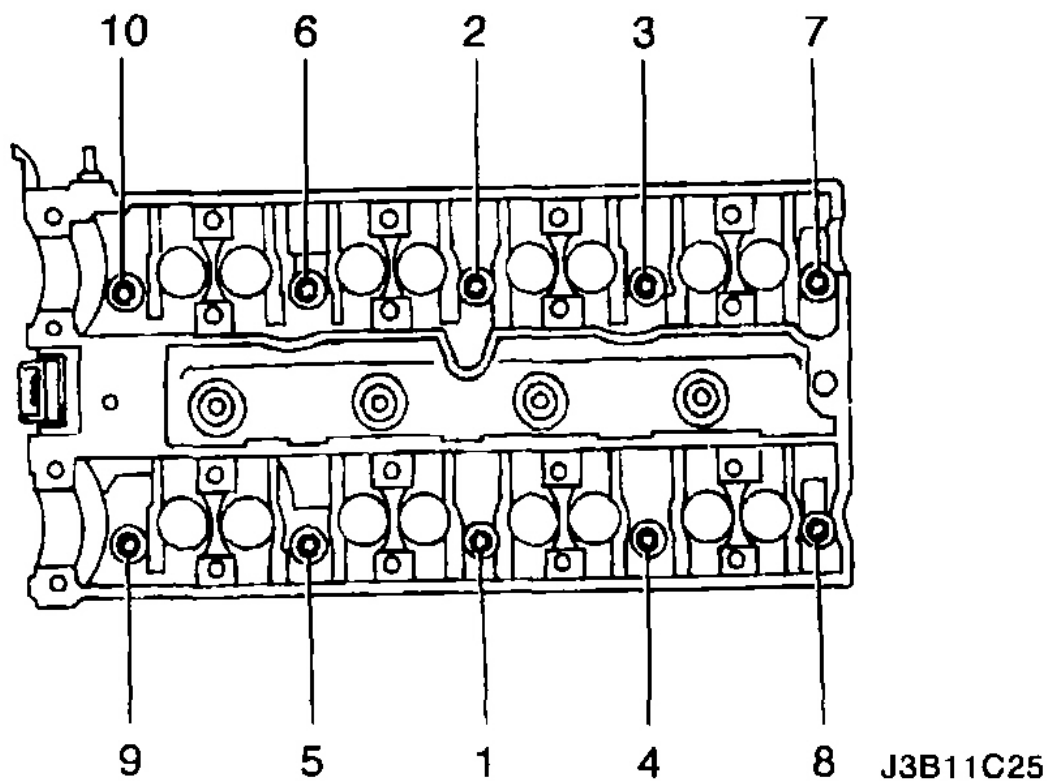


Fig. 24: Cylinder Head Bolt Tightening Sequence
 Courtesy of SUZUKI OF AMERICA CORP.

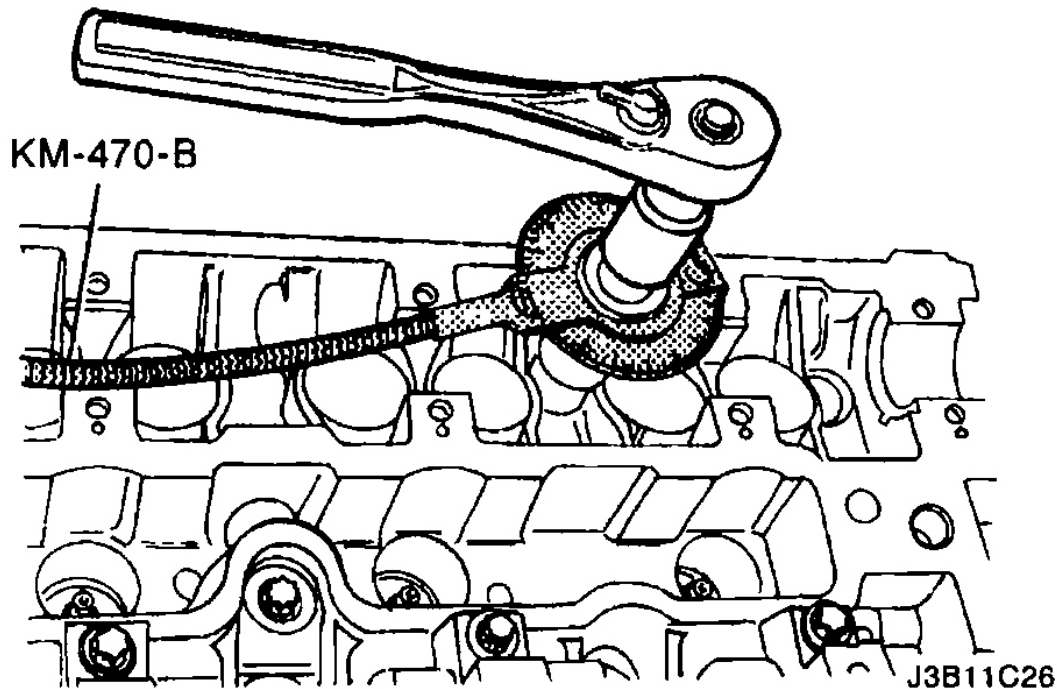


Fig. 25: Tightening Cylinder Head Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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.

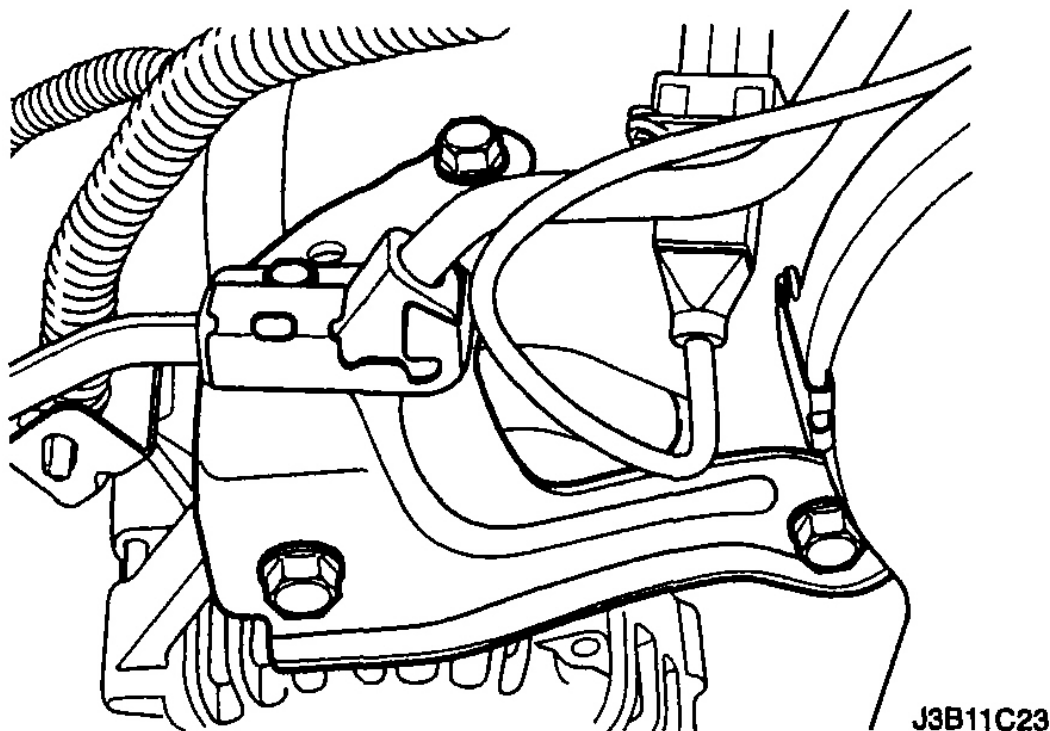


Fig. 26: Installing EGR Bracket
Courtesy of SUZUKI OF AMERICA CORP.

12. Connect the fuel feed line at the fuel rail.
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** :".

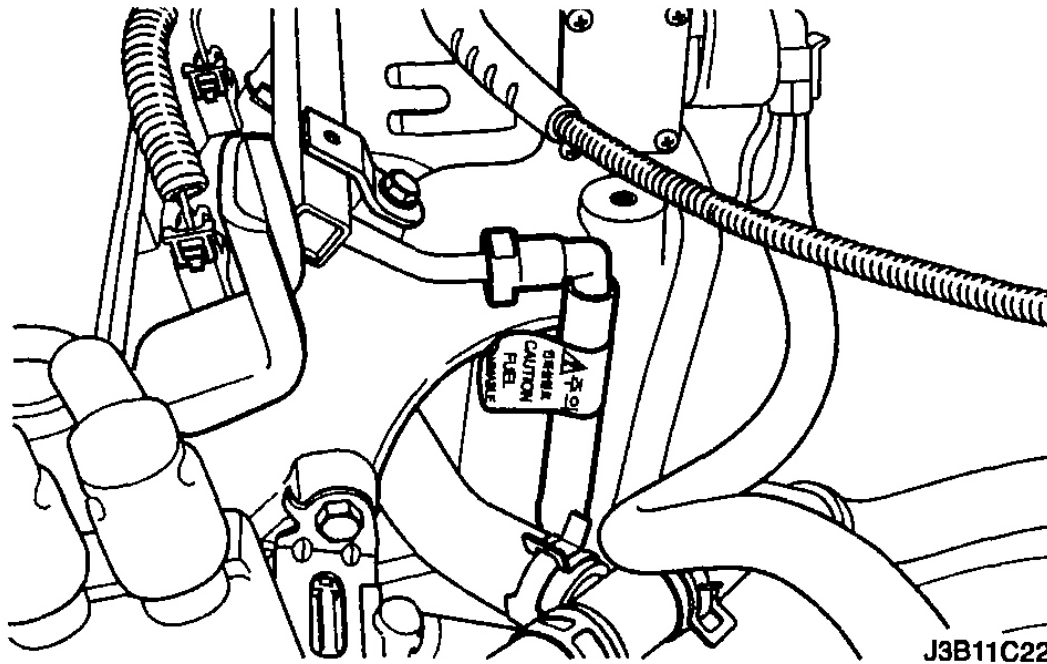


Fig. 27: Installing Coolant Hoses And Fuel Rail Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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).

19. Install the engine mount and the retaining bolts.

Tighten

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

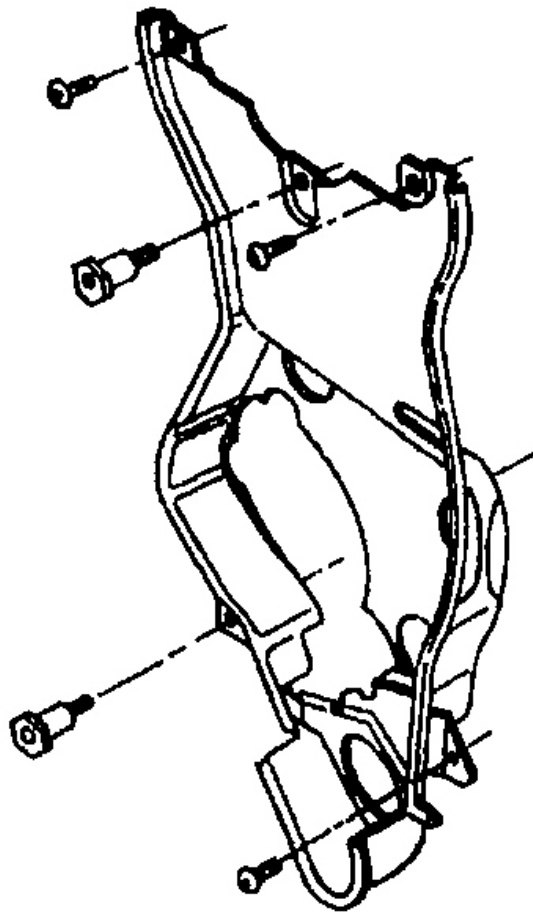
**J3B11C20**

Fig. 28: Installing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

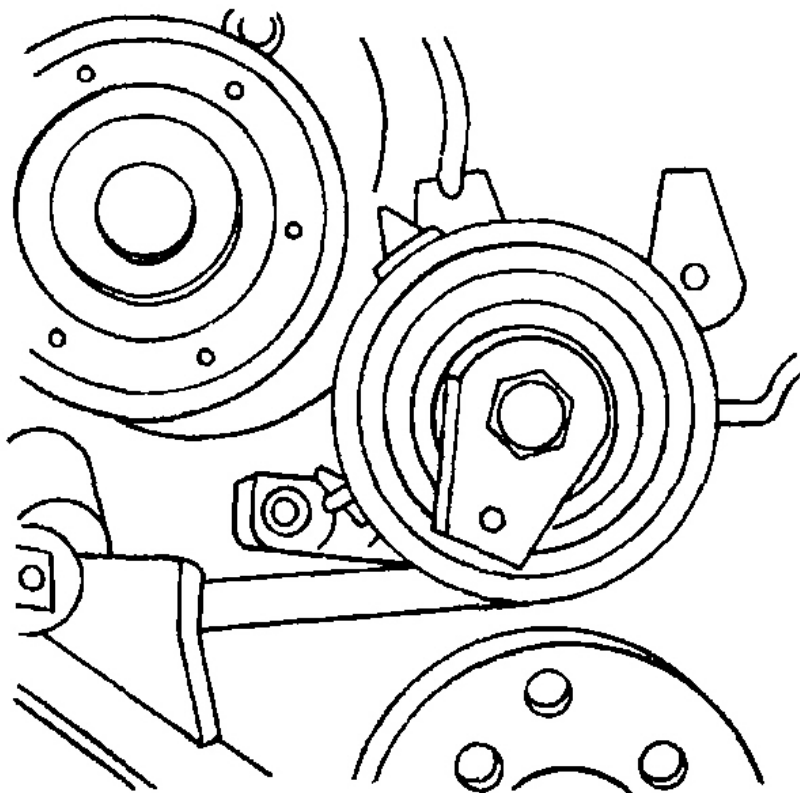
Tighten the timing belt automatic tensioner bolts to 25 N.m (18 lb-ft).

25. Install the timing belt idler pulleys.

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

Tighten

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



J3B11C18

Fig. 29: Installing Timing Belt Idler Pulley Bolt And Nut
Courtesy of SUZUKI OF AMERICA CORP.

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.

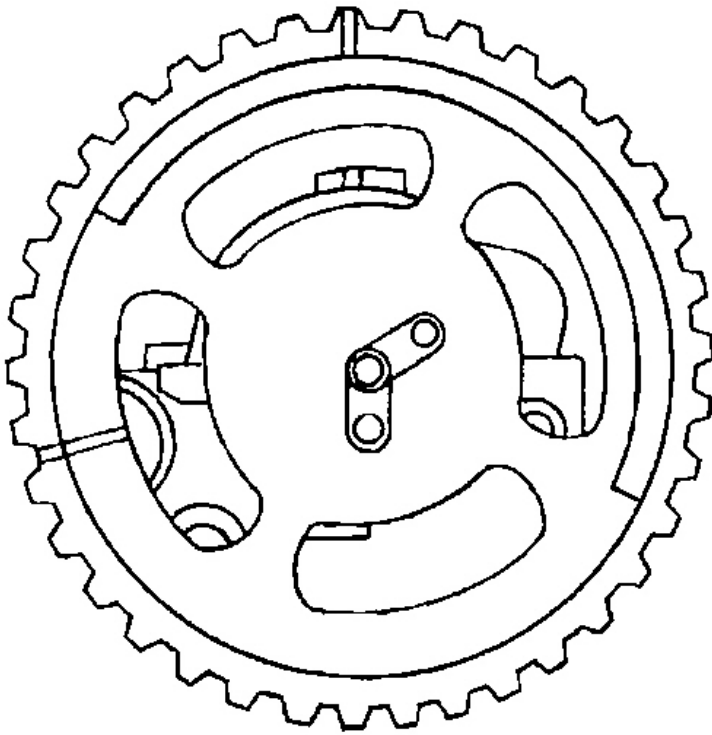
**J3B11C27**

Fig. 30: Installing Camshaft Gears With Timing Marks At Front
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.

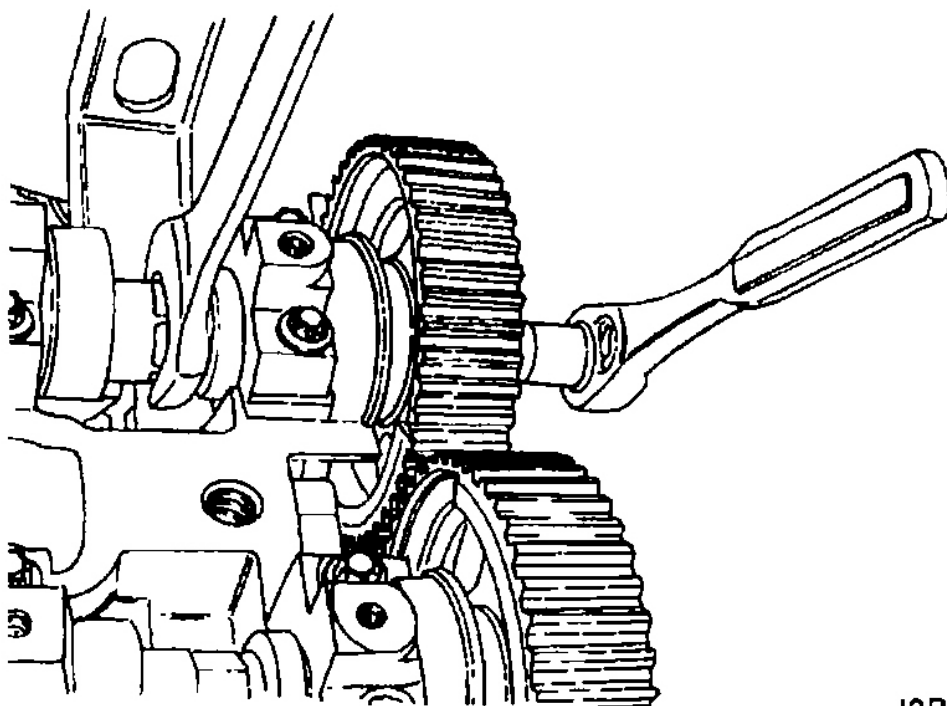
Tighten

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.



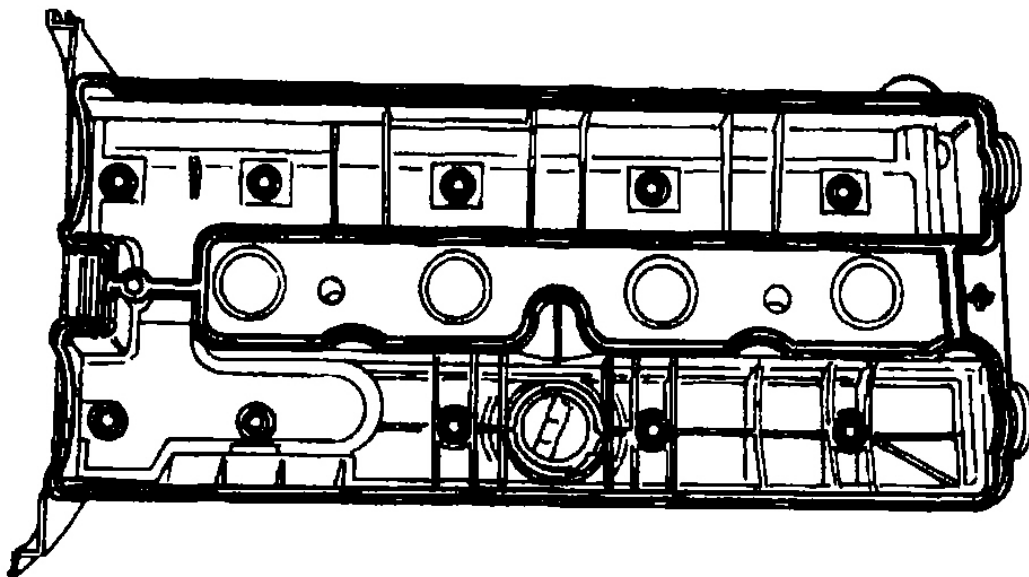
J3B11C17

Fig. 31: Installing Camshaft Gear With Bolt To Camshaft
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.
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).



J3B11C10

Fig. 32: Installing Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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.

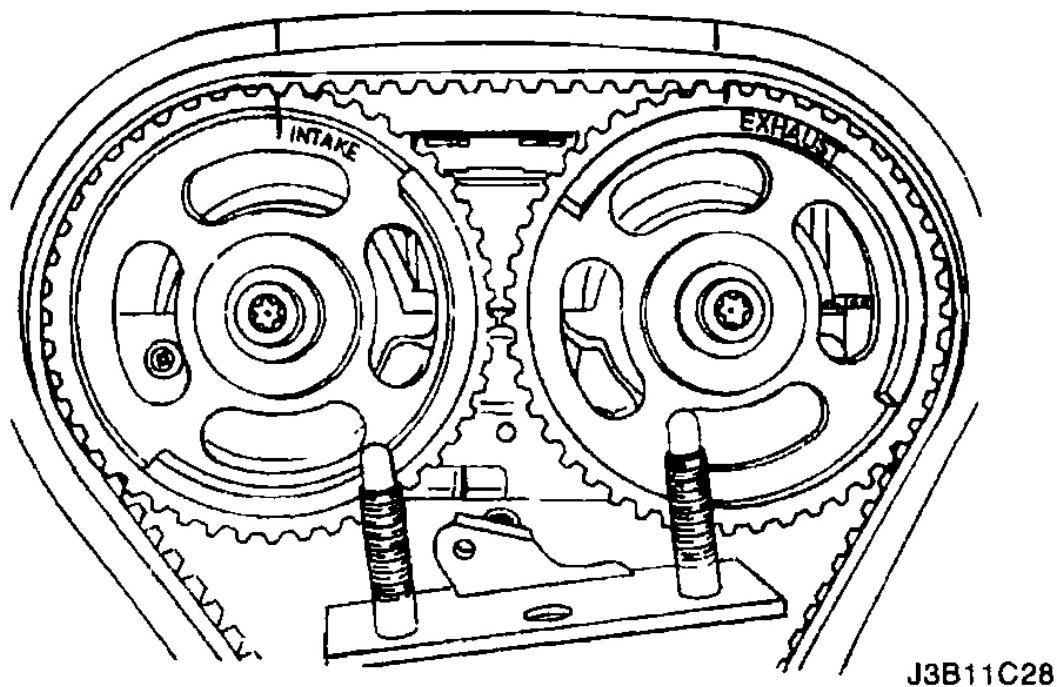
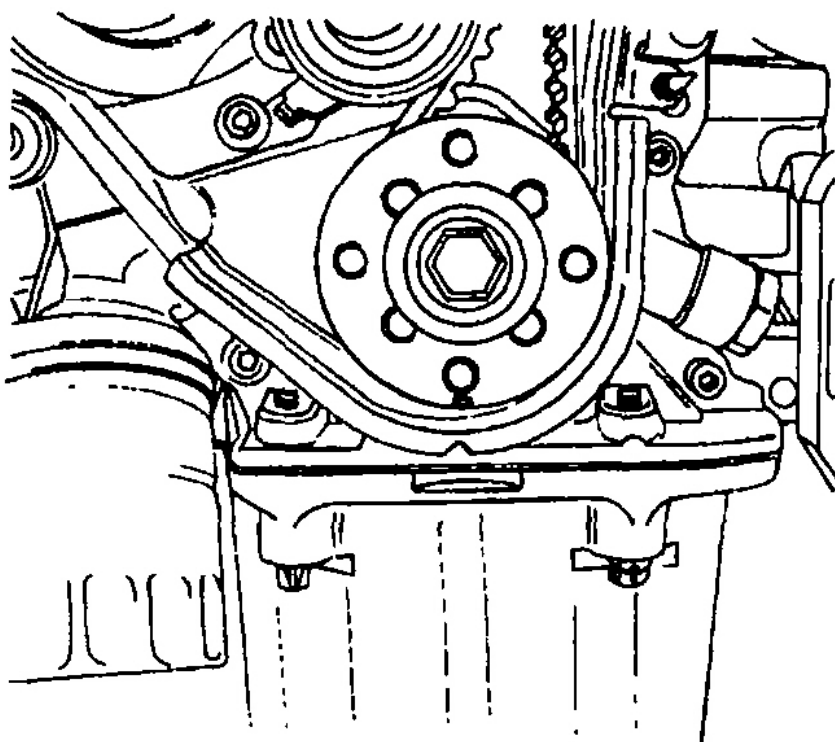


Fig. 33: Aligning Timing Marks On Camshaft Gears To Notches
Courtesy of SUZUKI OF AMERICA CORP.

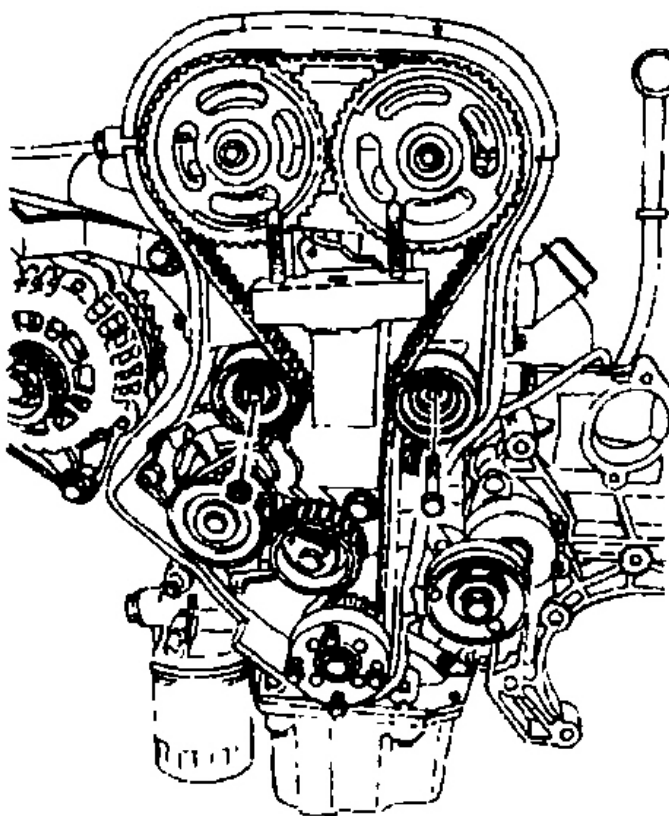
42. Align the mark on the crankshaft gear with the notch at the bottom of the rear timing belt cover.



J3B11C29

Fig. 34: Aligning Mark On Crankshaft Gear With Notch At Bottom Of Rear Timing Belt Cover
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**".



J3B11C19

Fig. 35: Installing Timing Belt
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).

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

Tighten

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

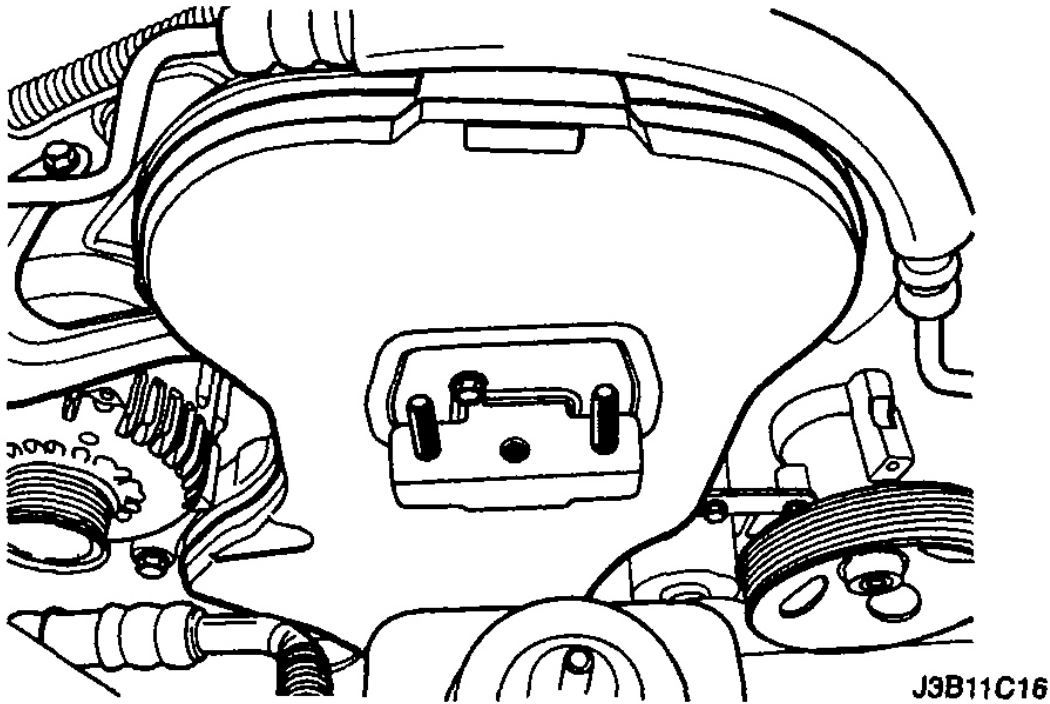


Fig. 36: Installing Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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).

50. Remove 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** :".

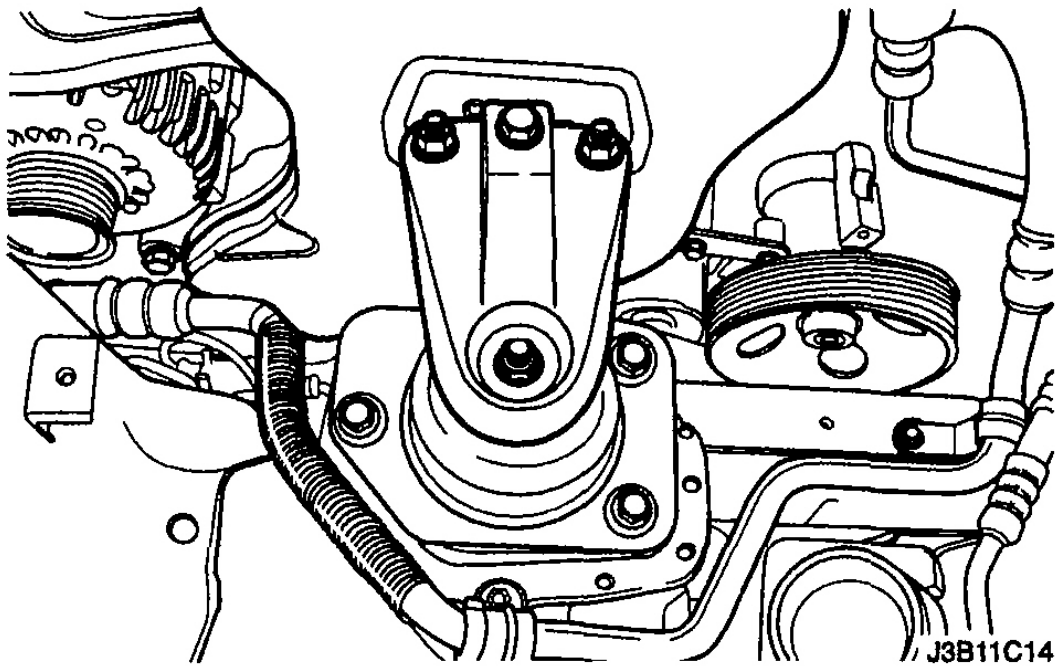


Fig. 37: Installing Engine Mount Bracket And Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

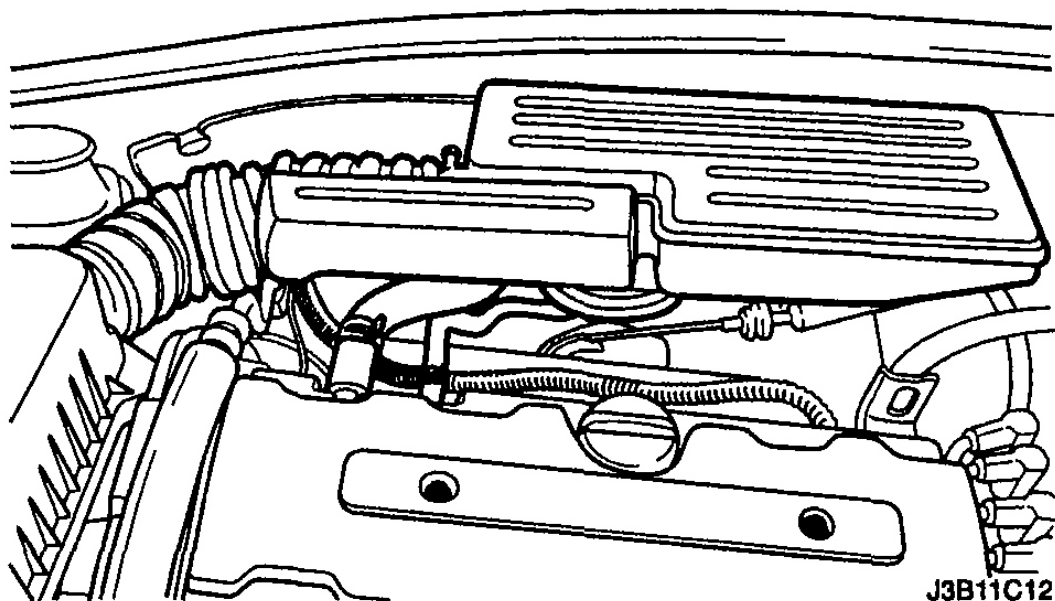


Fig. 38: Connecting Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

60. Connect the CTS connector.
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).

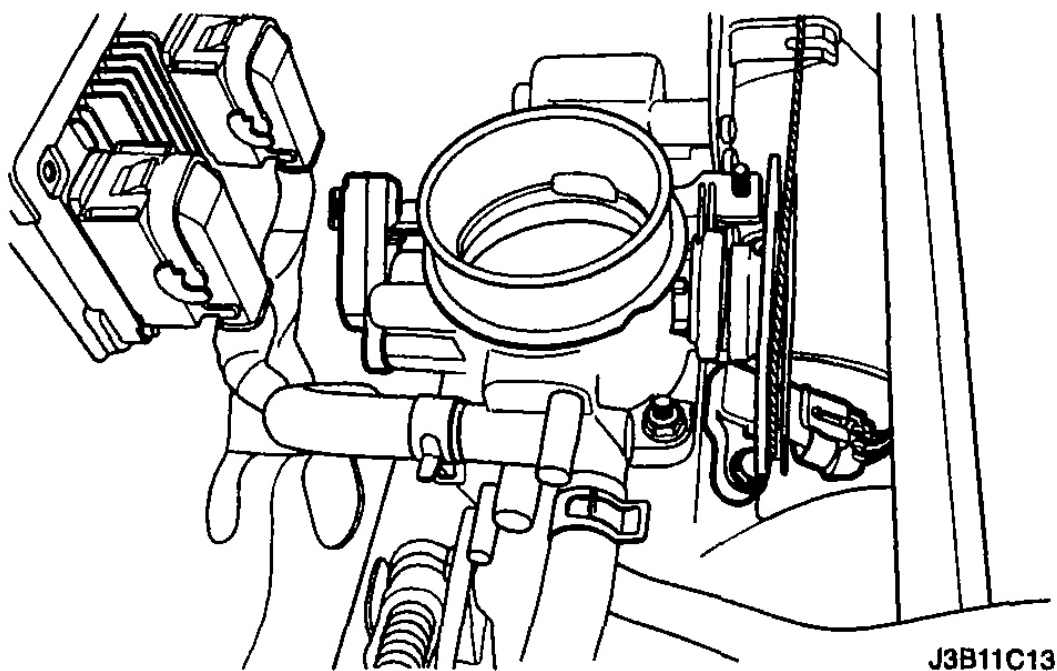


Fig. 39: Connecting TPS Sensor Connector
Courtesy of SUZUKI OF AMERICA CORP.

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

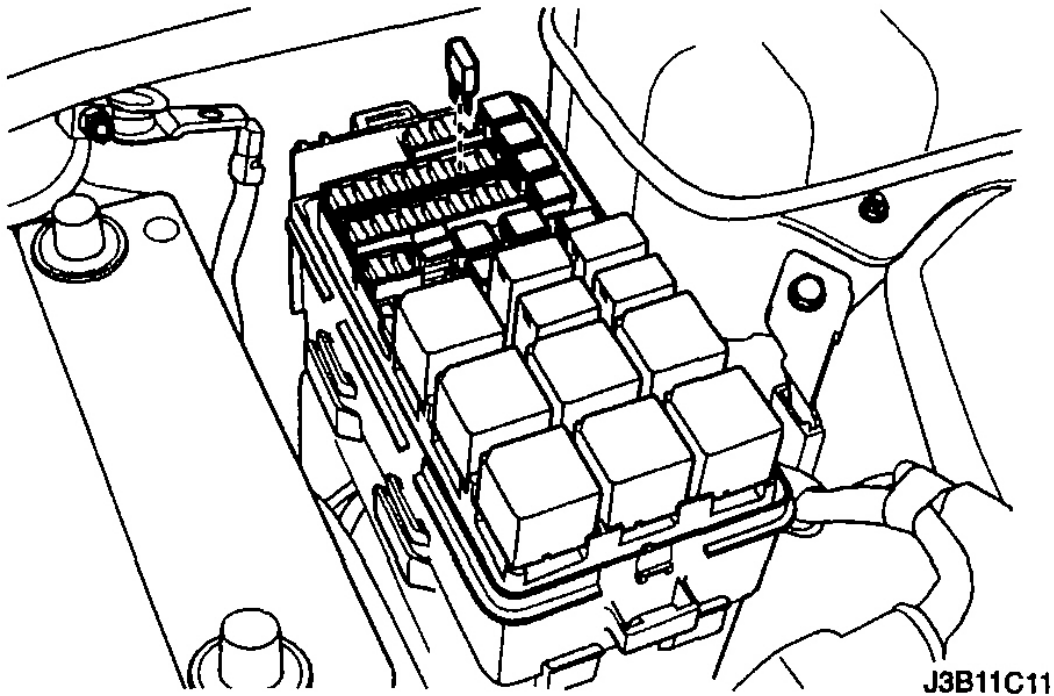


Fig. 40: Installing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

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.

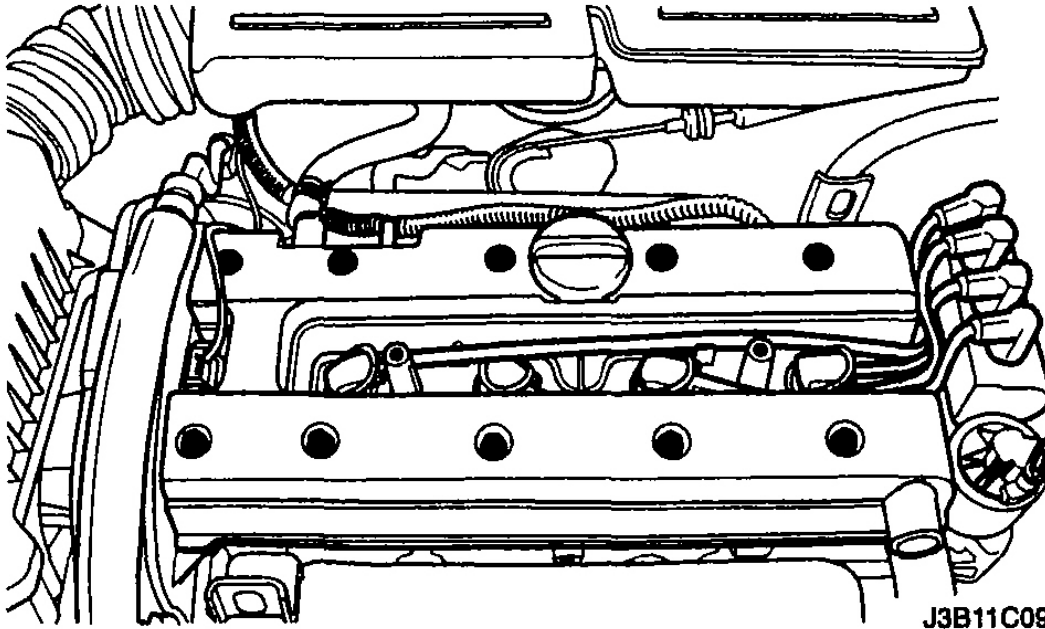
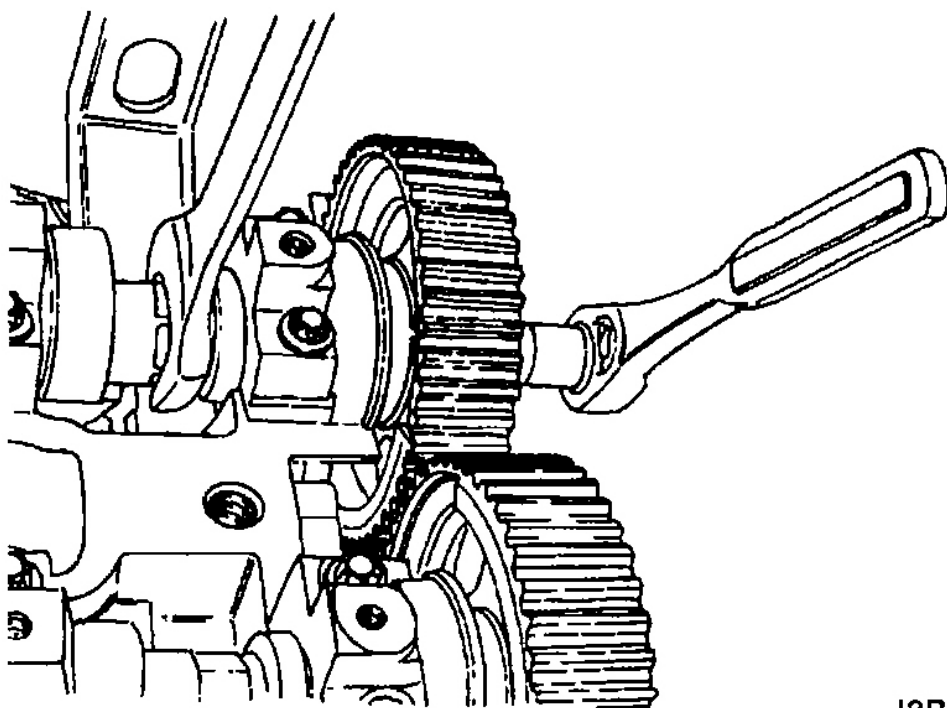


Fig. 41: Removing Camshaft Cover And Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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. 42: Removing Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

14. Loosen the camshaft bearing cap bolts in stages of one-half to one turn.
15. Remove the camshaft bearing cap bolts from the cylinder head.
16. Remove the camshafts.
17. Remove the seal ring from the camshafts.

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.

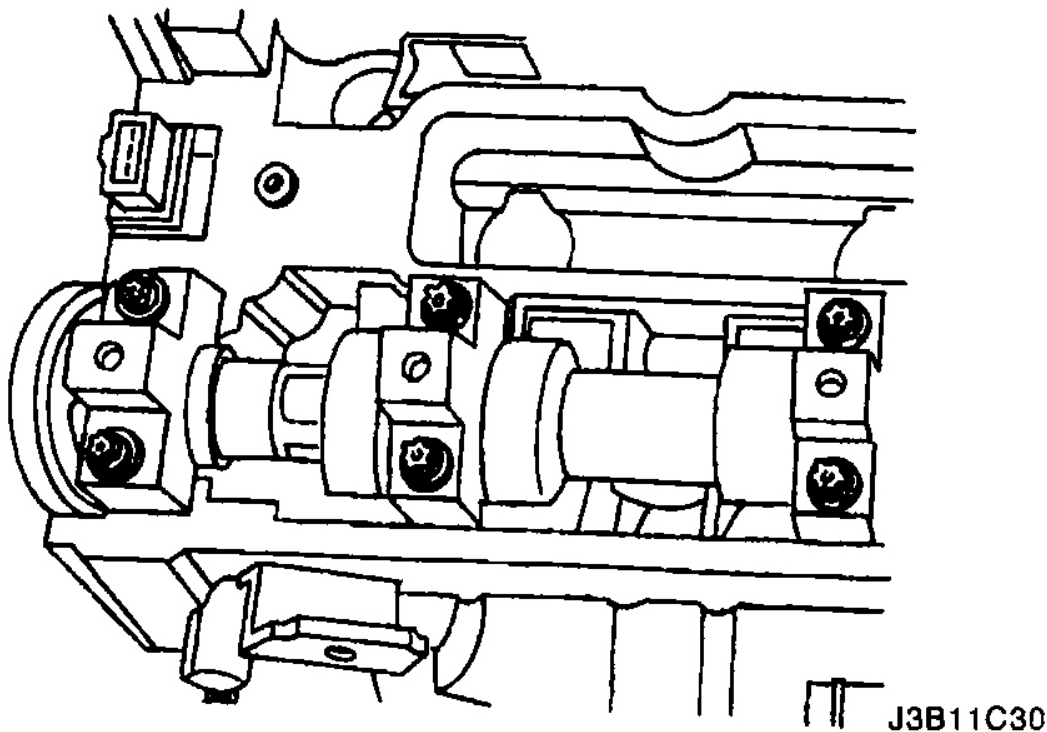


Fig. 43: Checking Camshaft And Bearing Seats For Wear
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

1. Lubricate the camshaft journals and the camshaft caps with engine oil.
2. Install the intake camshaft.
3. Install the intake camshaft caps in their original positions.
4. Install the intake camshaft cap bolts.
5. Install the exhaust camshaft.
6. Install the exhaust camshaft caps in their original positions.
7. Install the exhaust camshaft cap bolts.
8. Tighten the camshaft cap bolts gradually and in the sequence shown in illustration for each camshaft cap.

Tighten

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

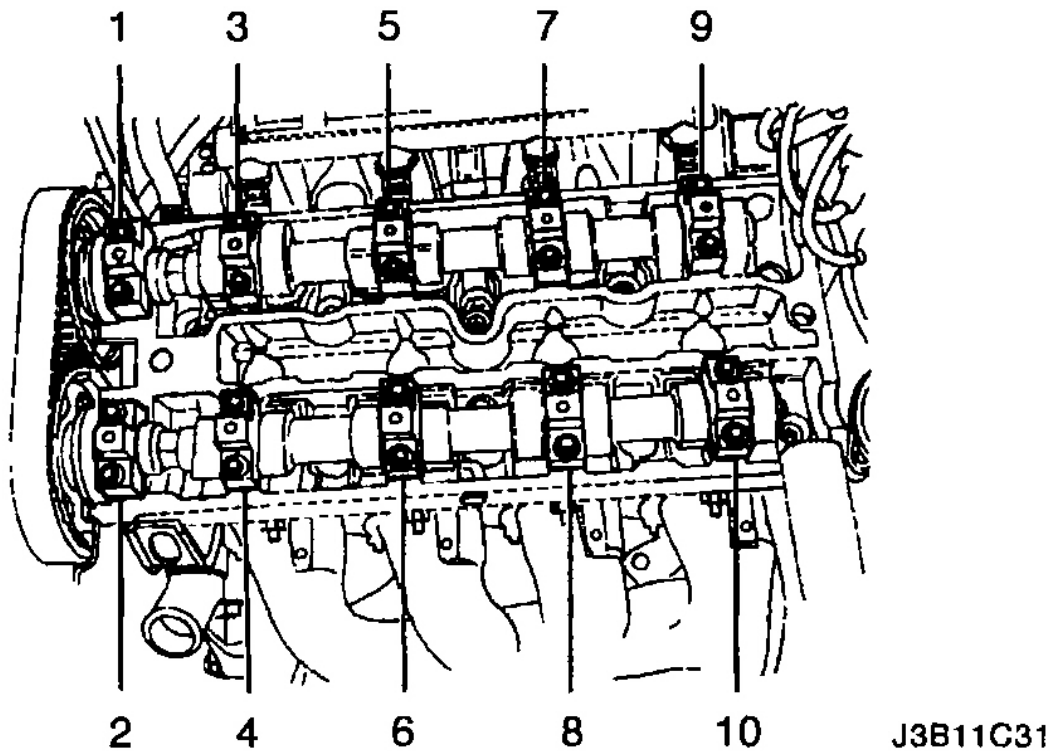


Fig. 44: Installing Exhaust Camshaft Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

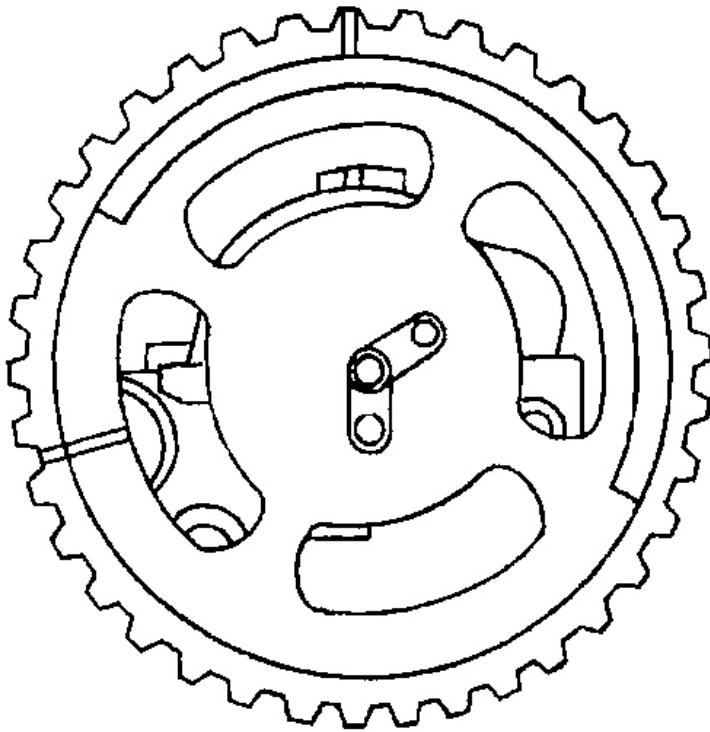
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Fig. 45: Installing Intake Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

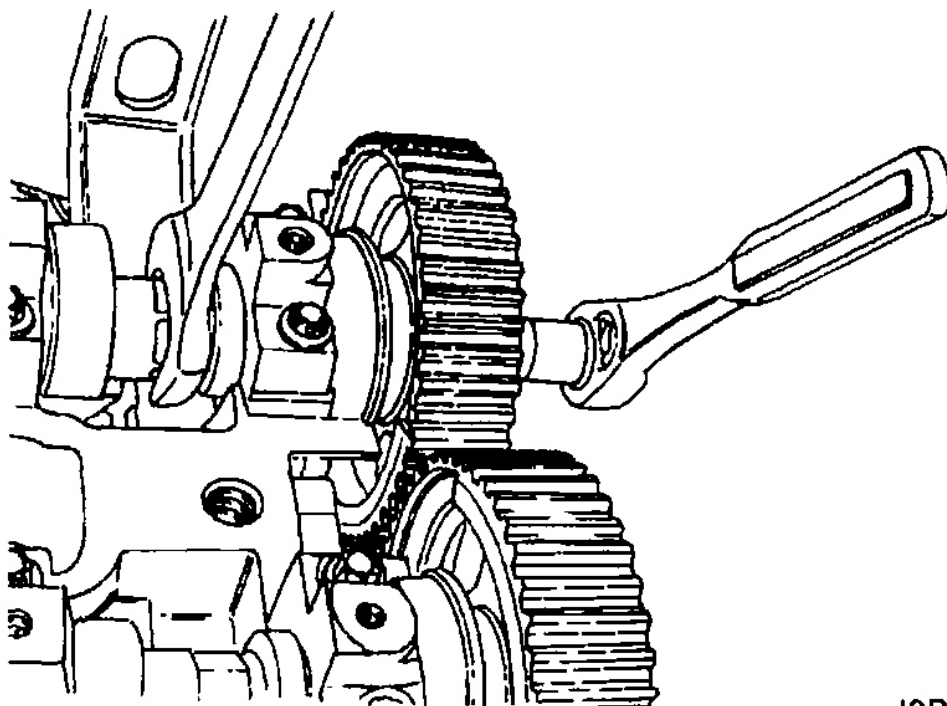
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Fig. 46: Installing Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

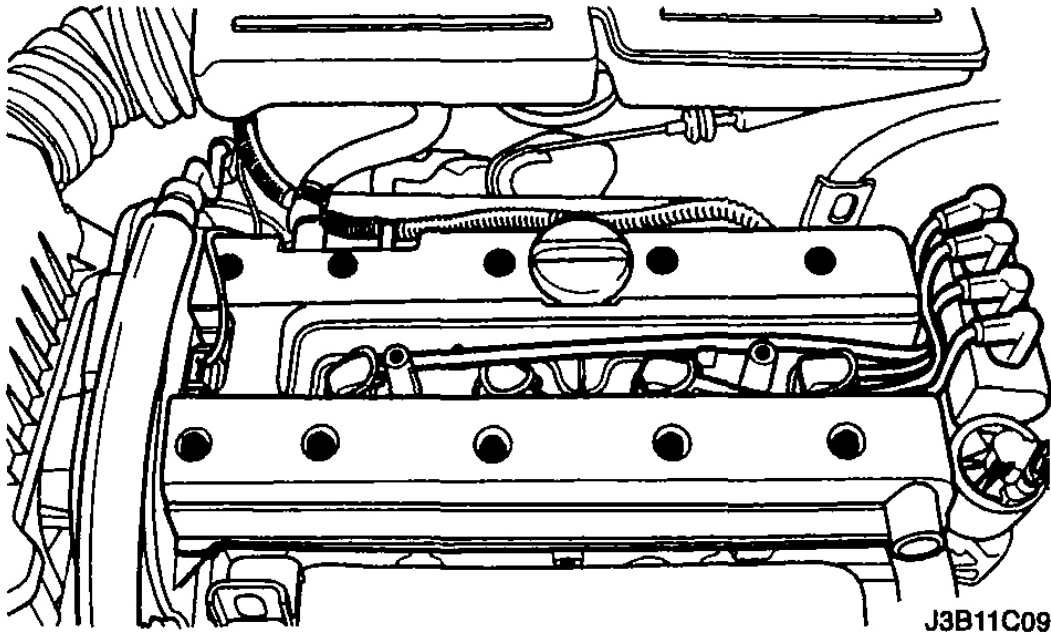


Fig. 47: Installing Camshaft Cover And Camshaft Cover Gasket
 Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

20. Connect the breather tube to the camshaft cover.
21. Connect the engine ventilation hose to the camshaft cover.
22. Install the timing belt. Refer to "**TIMING BELT REMOVAL AND INSTALLATION:**".

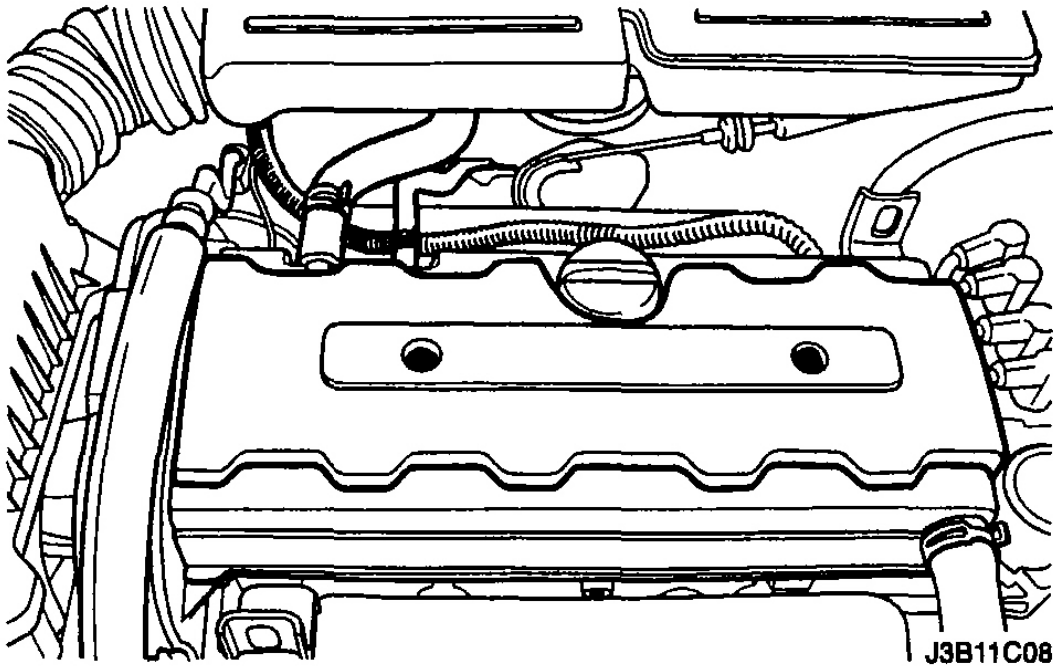


Fig. 48: Connecting Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

TIMING BELT CHECK AND ADJUST

1. Disconnect the negative battery cable.
2. Disconnect the manifold air temperature (MAT) sensor connector.
3. Remove the air cleaner outlet hose from the throttle body.
4. Remove the breather tube from the camshaft cover.
5. Remove the air cleaner housing bolts.
6. Remove the air cleaner housing.
7. Remove the right front wheel. Refer to "**WHEEL REMOVAL AND INSTALLATION**".
8. Remove the right front wheel well splash shield.

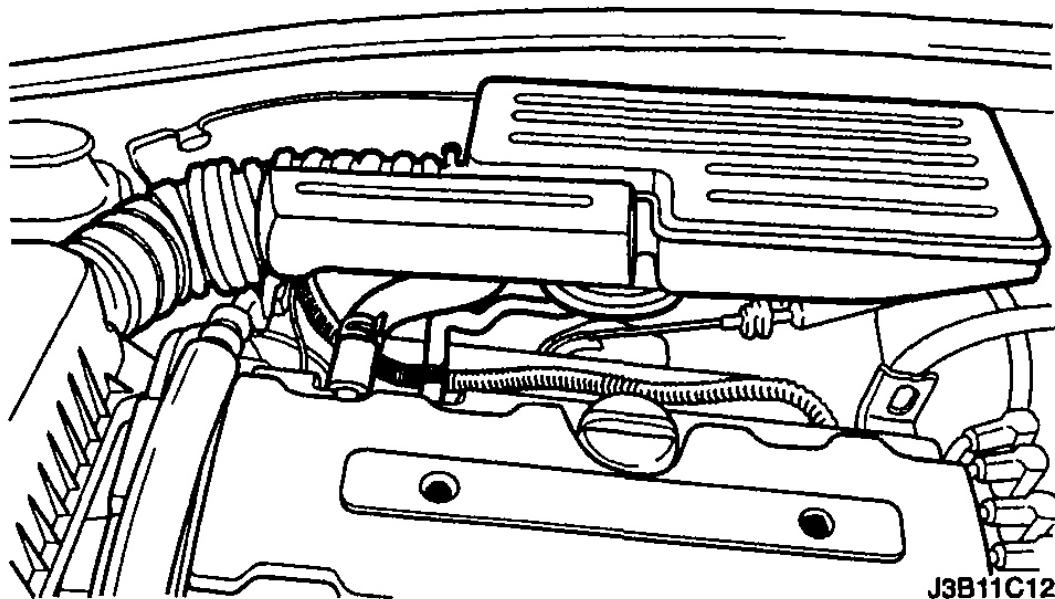


Fig. 49: Removing Air Cleaner Housing
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the serpentine accessory drive belt. Refer to "**SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** :".
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to "**ENGINE MOUNT REMOVAL AND INSTALLATION**:".

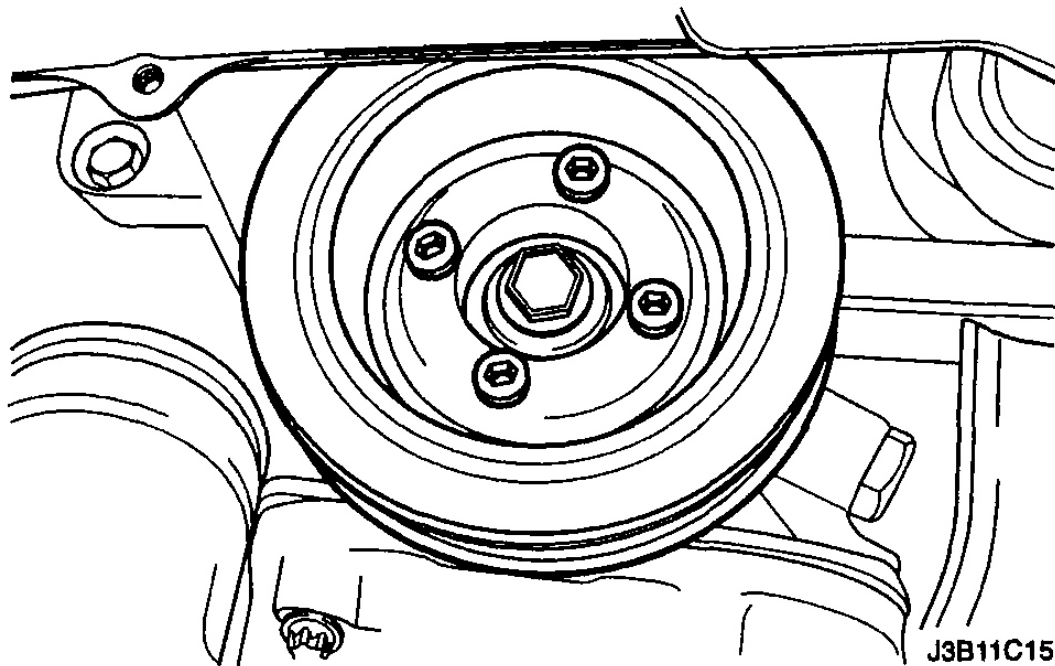


Fig. 50: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

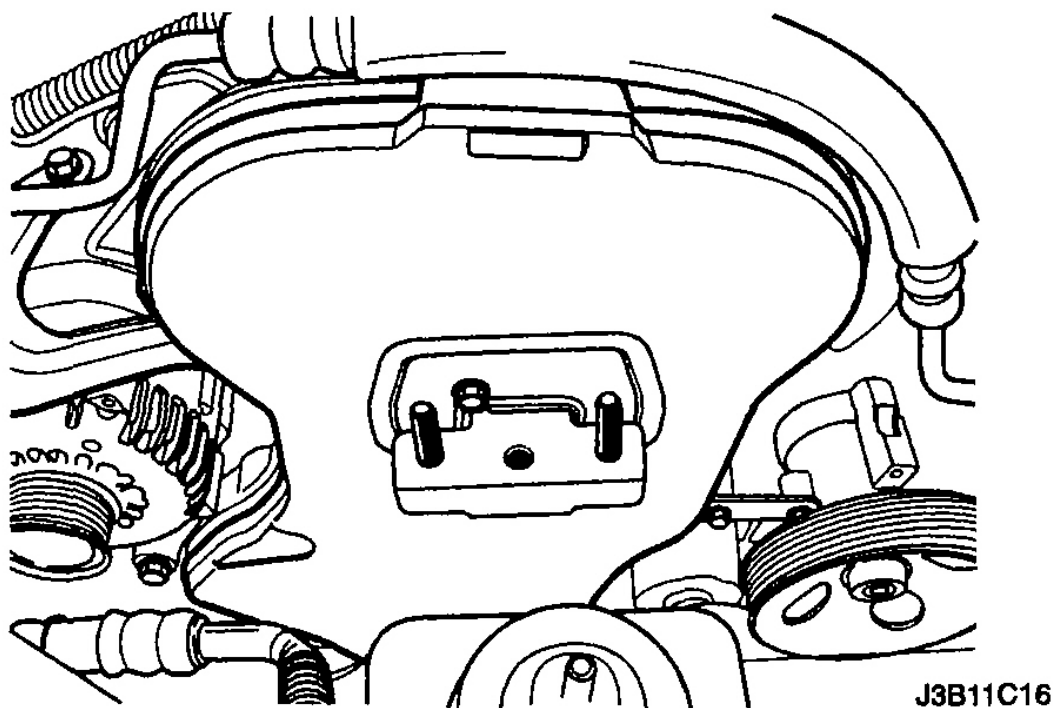
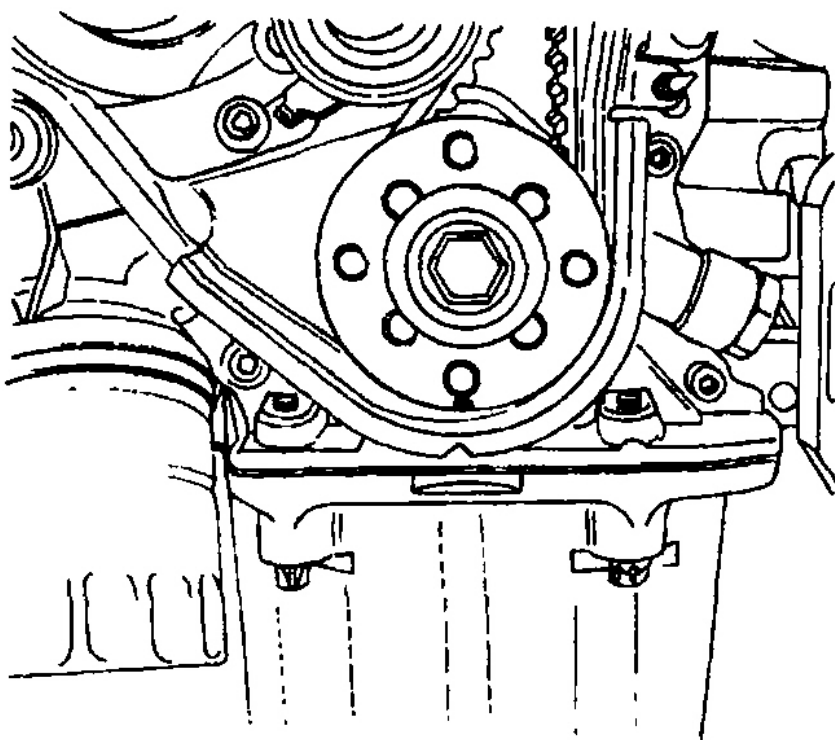


Fig. 51: Removing Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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



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Fig. 52: Rotating Crankshaft Using Crankshaft Gear Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

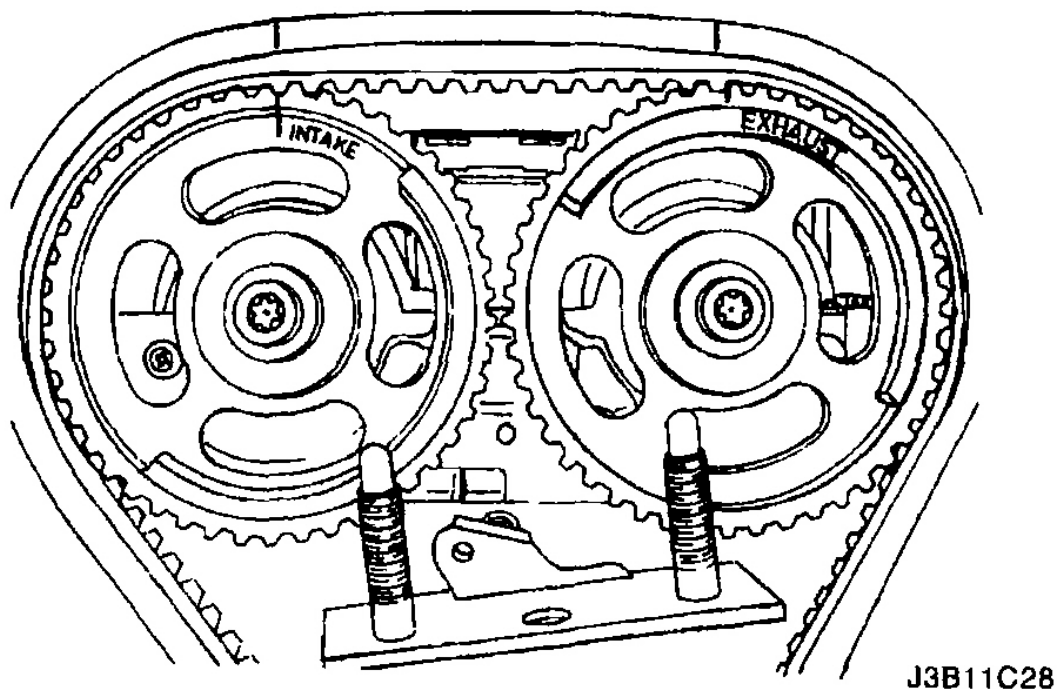
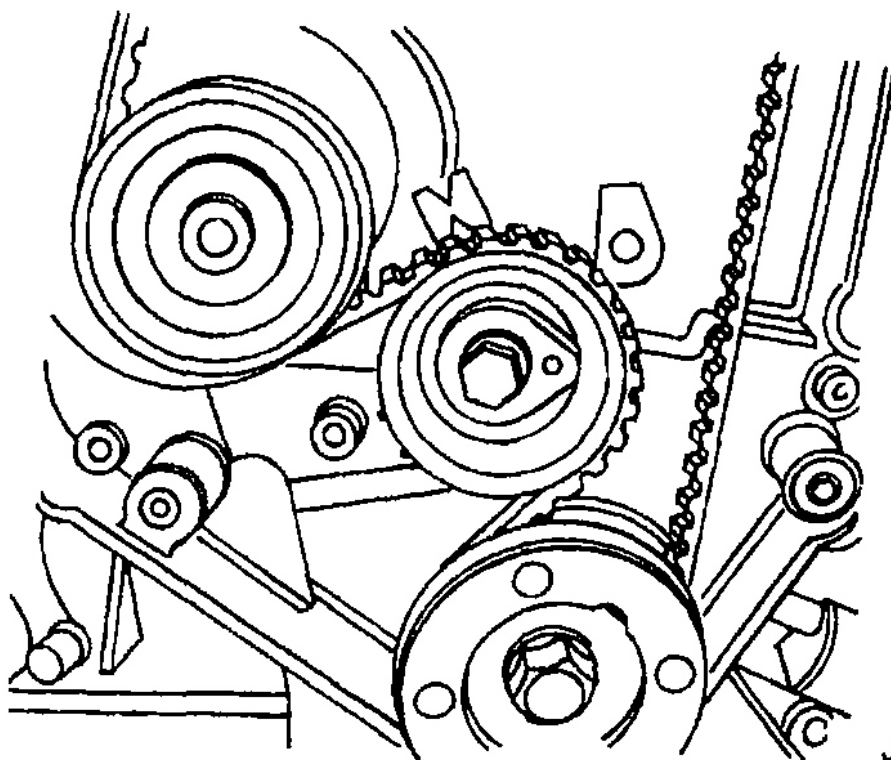


Fig. 53: Aligning Camshaft Gear Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

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.



J3B11C34

Fig. 54: Rotating Automatic Tensioner Hex-Key Tab Clockwise
Courtesy of SUZUKI OF AMERICA CORP.

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

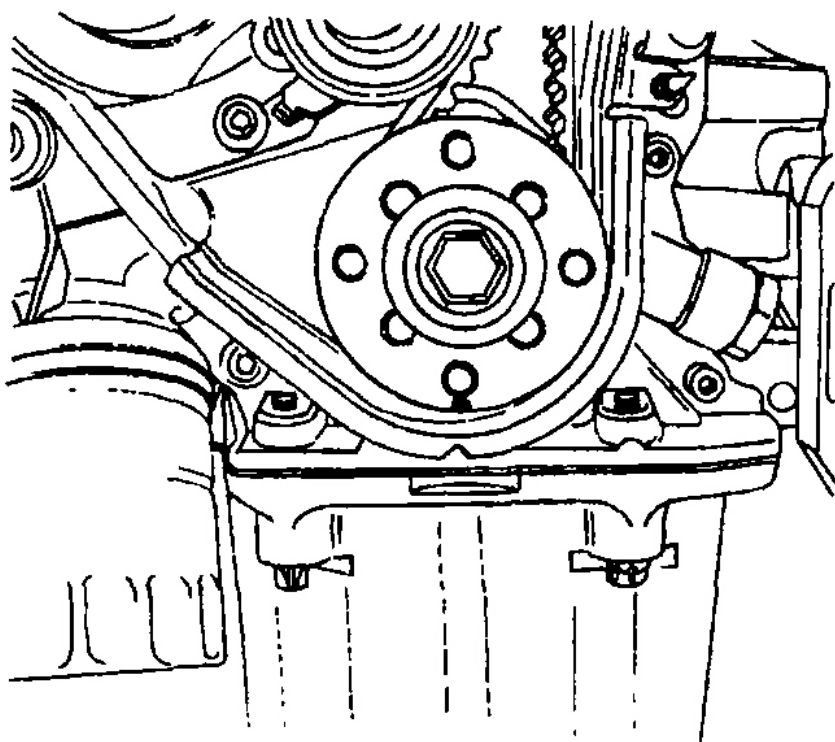
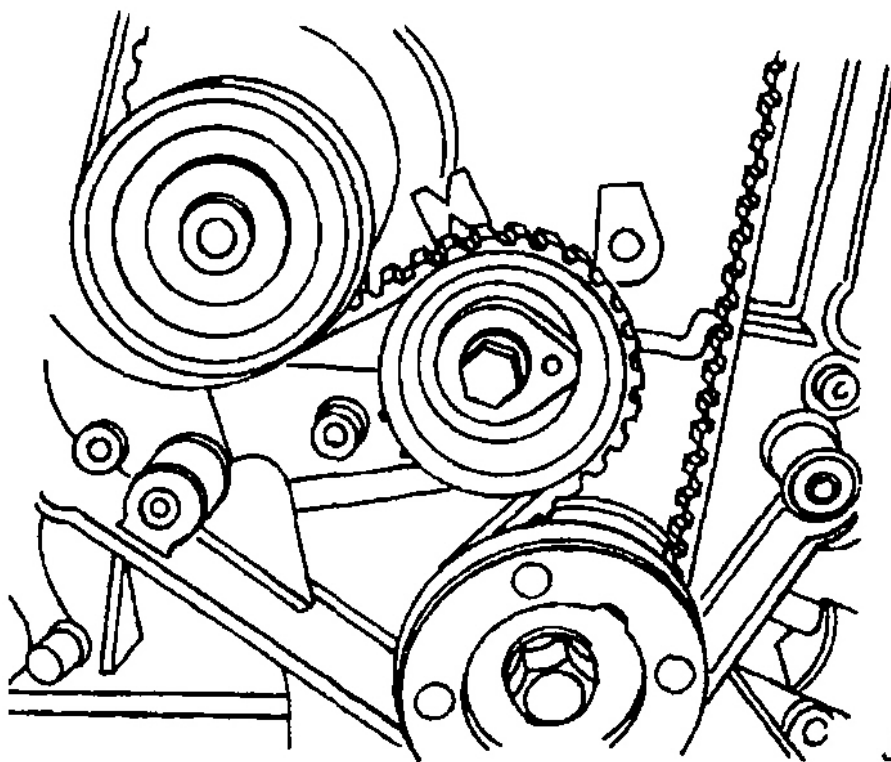
**J3B11C29**

Fig. 55: Checking Automatic Tensioner Pointer
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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



J3B11C34

Fig. 56: Adjusting Arm Pointer
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

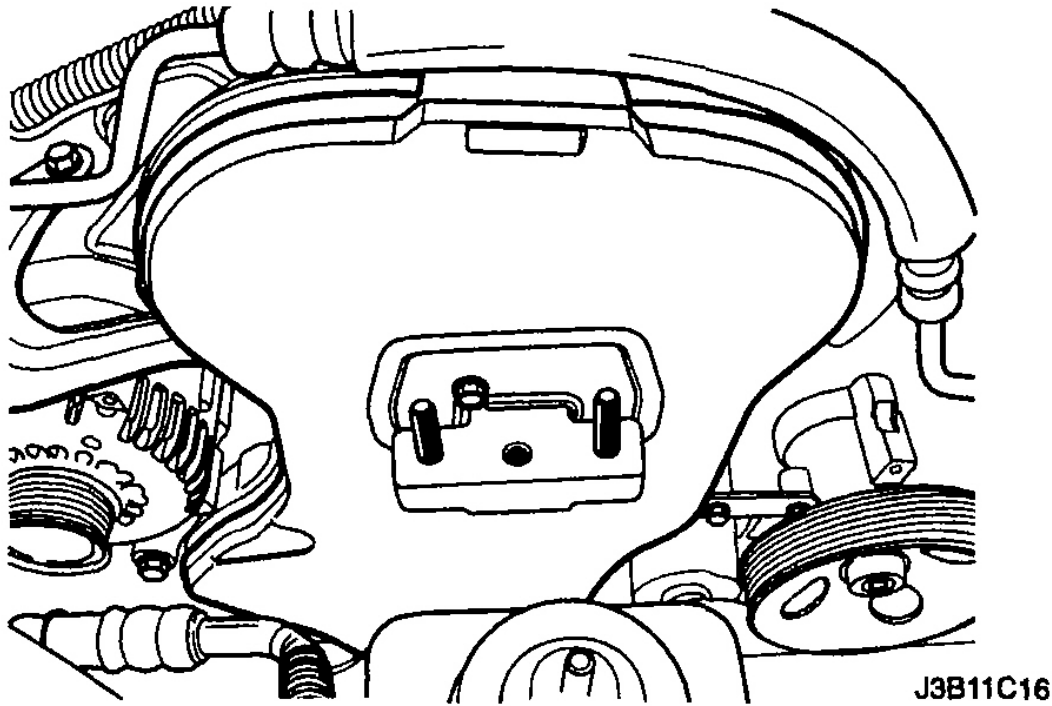


Fig. 57: Installing Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

28. Install the right engine mount bracket. Refer to "**ENGINE MOUNT REMOVAL AND INSTALLATION**".
29. Install the serpentine accessory drive belt. Refer to "**SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION**".
30. Install the right front wheel well splash shield.
31. Install the right front wheel. Refer to "**WHEEL REMOVAL AND INSTALLATION**".
32. Install the air cleaner housing.
33. Install the air cleaner housing bolts.

Tighten

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

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

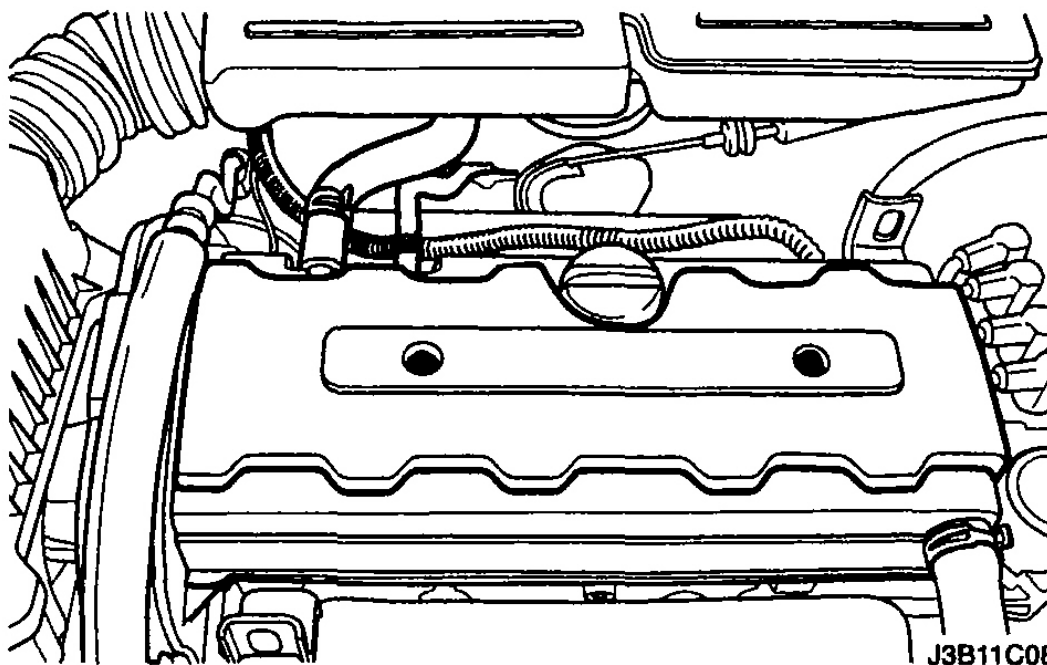


Fig. 58: Installing Air Cleaner Housing
Courtesy of SUZUKI OF AMERICA CORP.

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

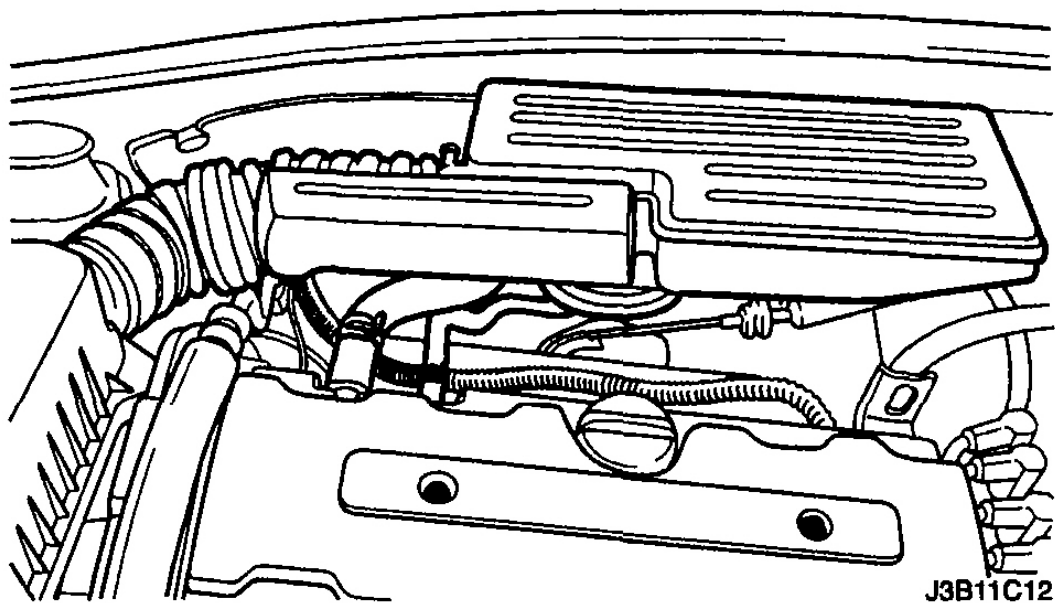
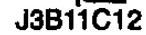


Fig. 59: Connecting Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

TIMING BELT REMOVAL AND INSTALLATION

Removal

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



Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the right front wheel well splash shield.

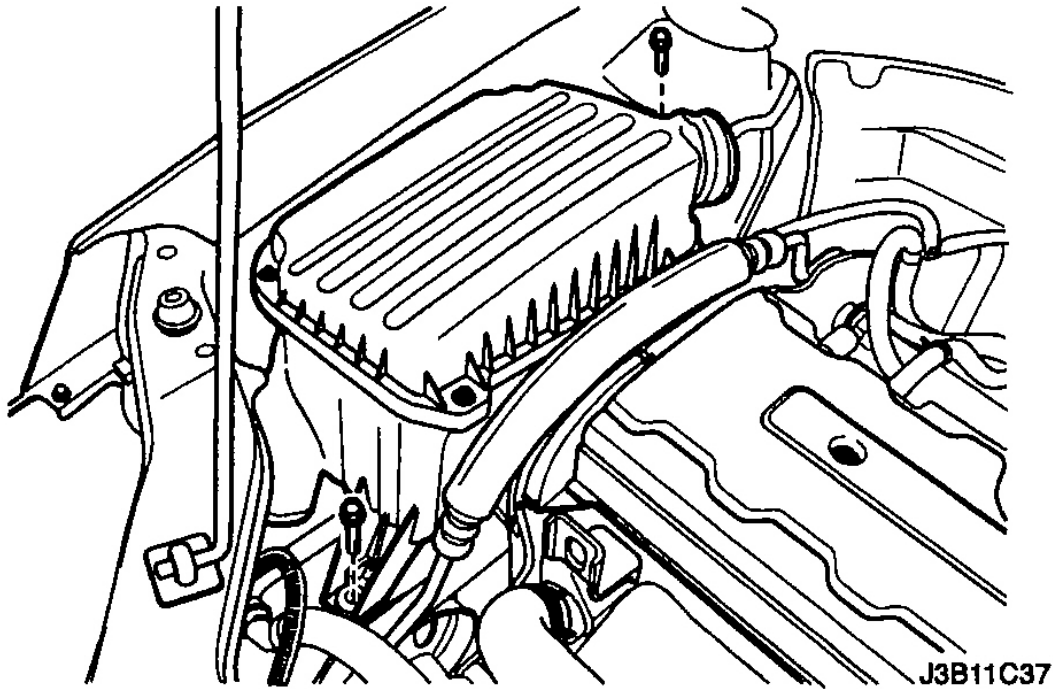


Fig. 61: Removing Air Cleaner Housing
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the serpentine accessory drive belt. Refer to "**SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** :".
10. Remove the crankshaft pulley bolts.
11. Remove the crankshaft pulley.
12. Remove the right engine mount bracket. Refer to "**ENGINE MOUNT REMOVAL AND INSTALLATION**:".
13. Remove the front timing belt cover bolts.
14. Remove the front timing belt cover.

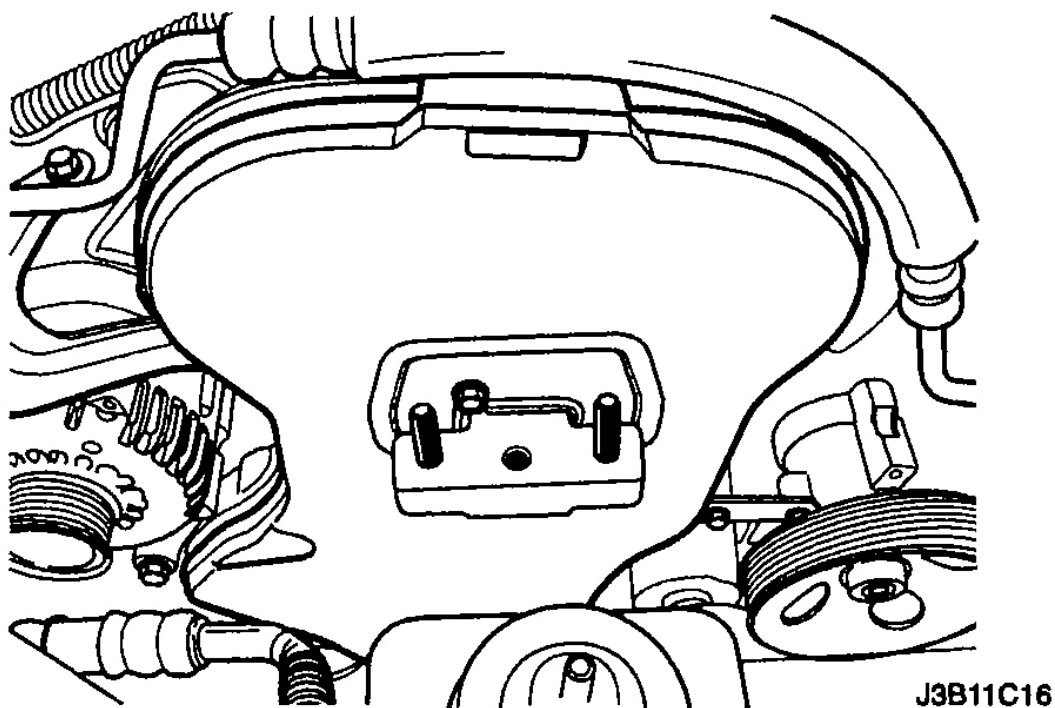
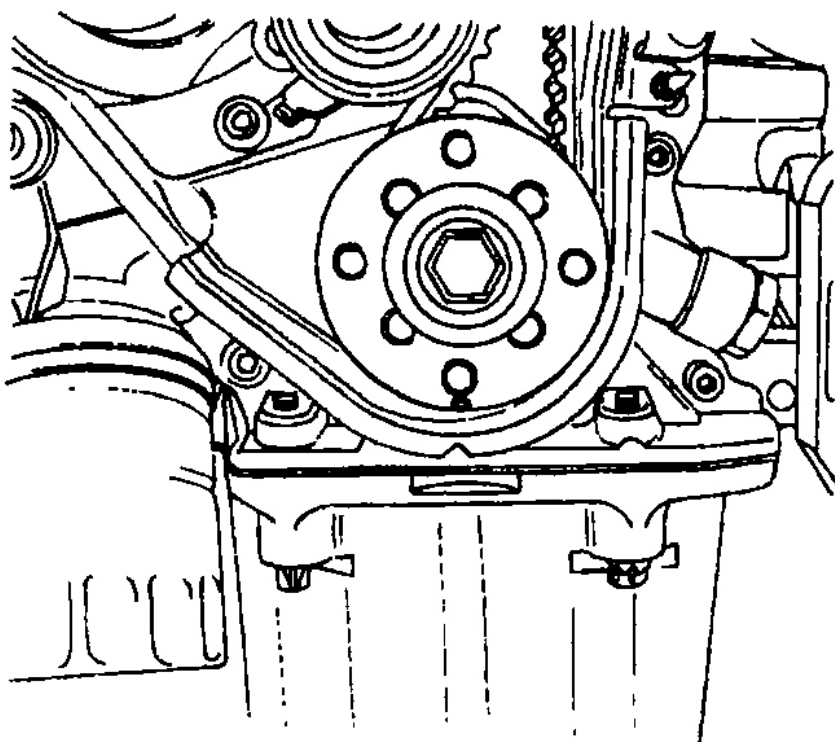


Fig. 62: Removing Front Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.



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Fig. 63: Aligning Timing Mark On Crankshaft Gear With Notch On Bottom Of Timing Belt Cover
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.

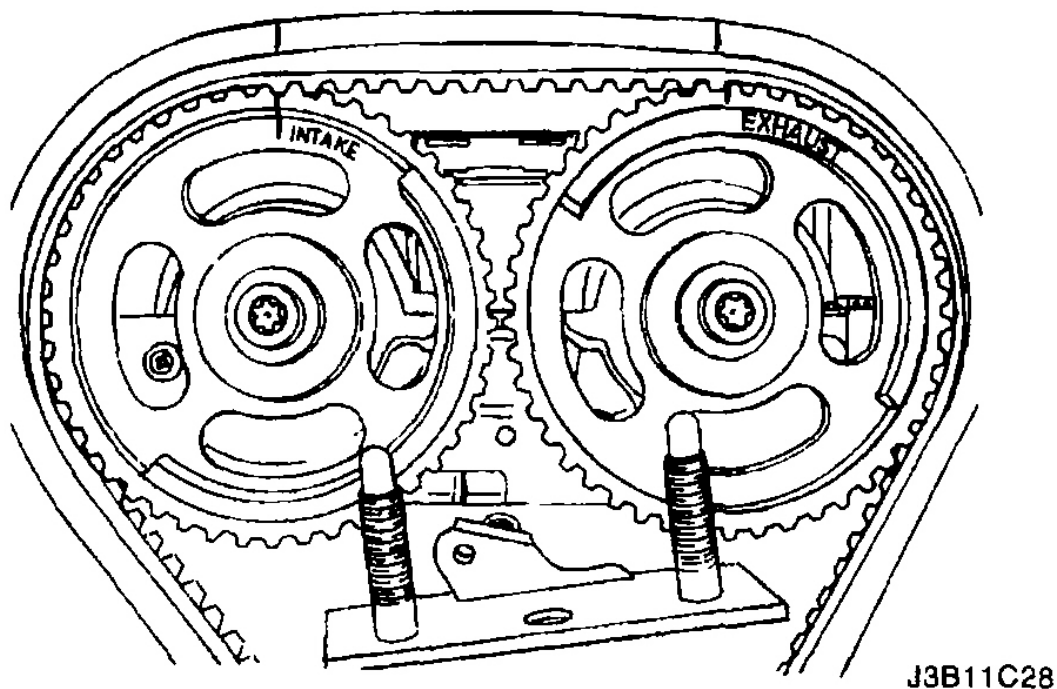
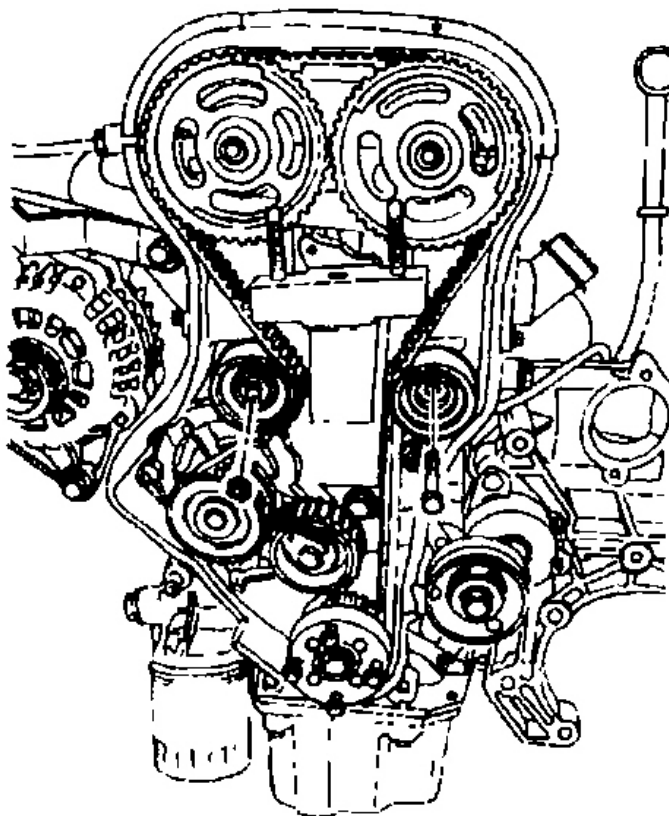


Fig. 64: Aligning Camshaft Gears With Notch On Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

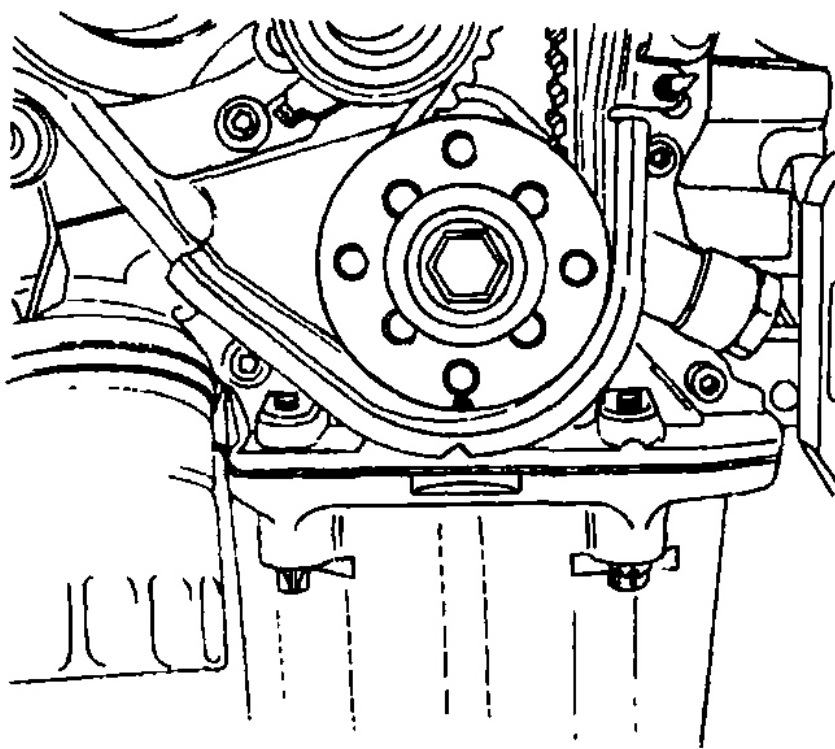


J3B11C19

Fig. 65: Loosening 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.



J3B11C29

Fig. 66: Aligning Timing Mark On Crankshaft Gear With Notch On Bottom Of Timing Belt Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

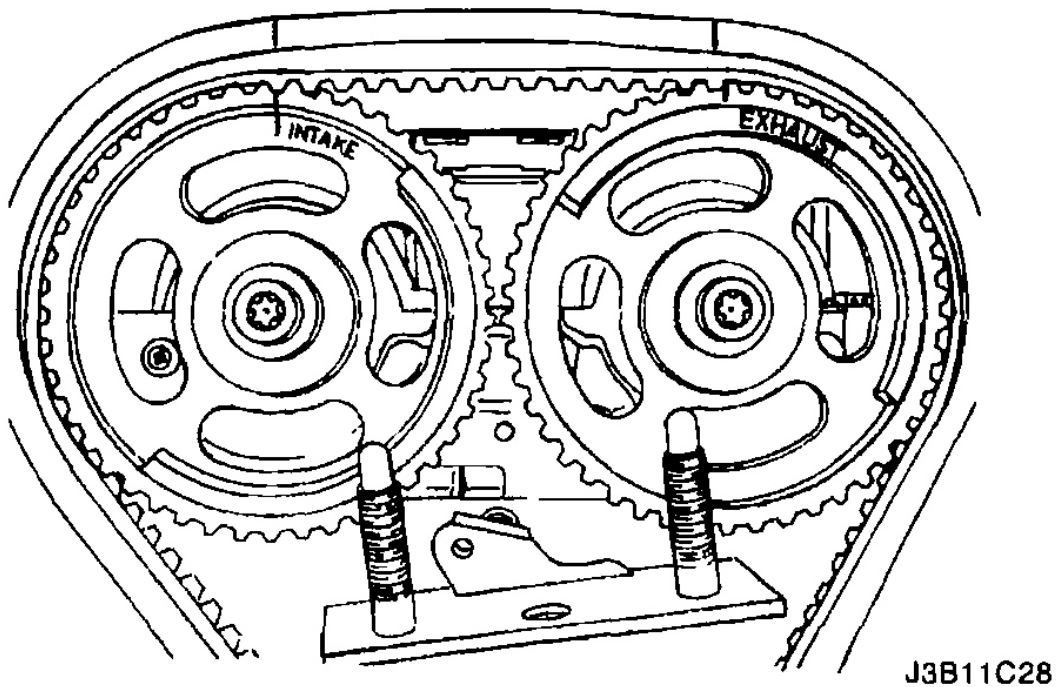
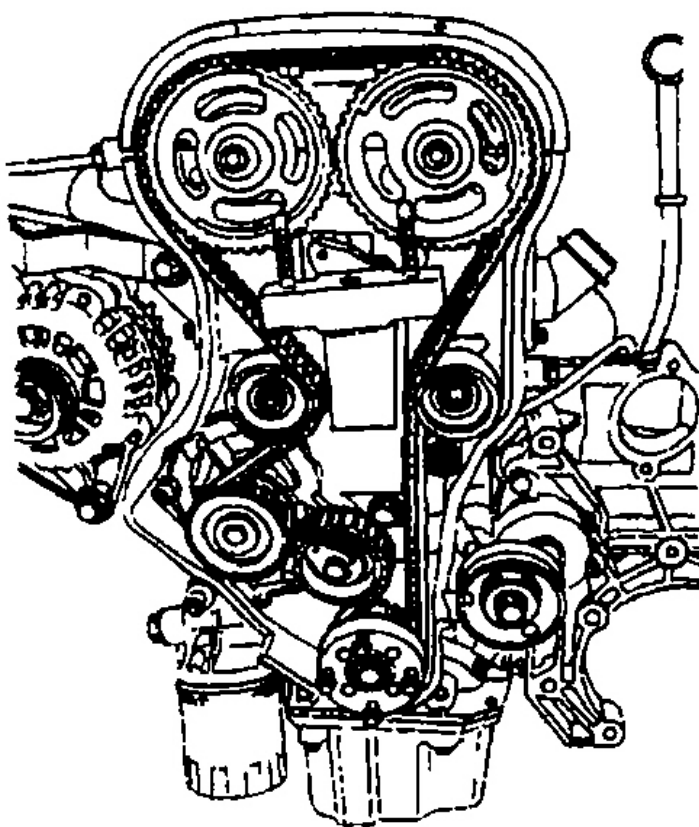


Fig. 67: Aligning Camshaft Gears With Notch On Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the timing belt.



J3B11C91

Fig. 68: Installing 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.

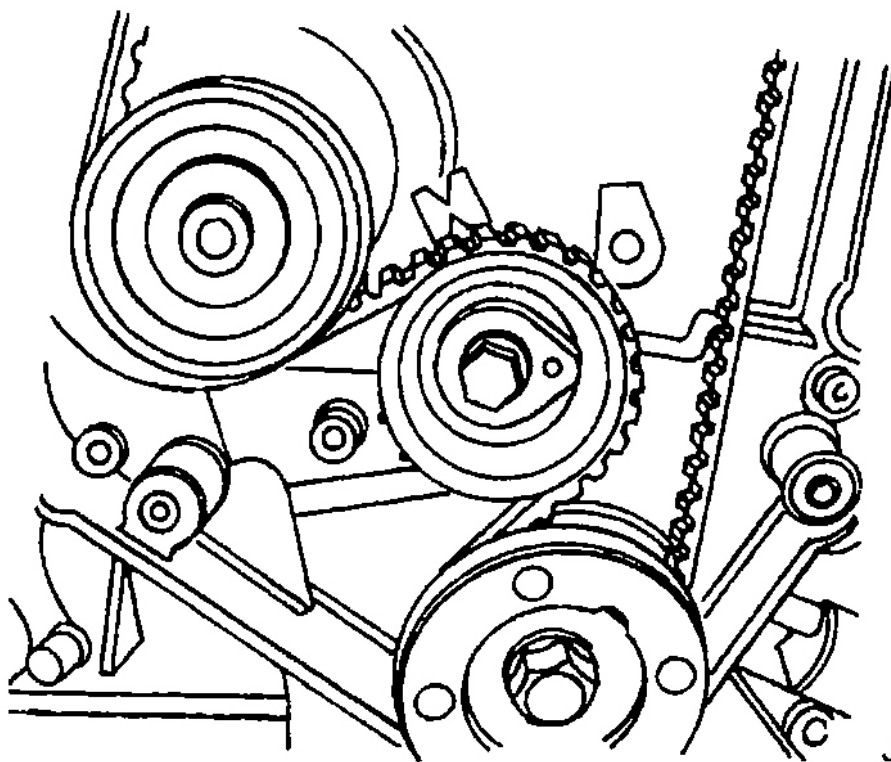


Fig. 69: Rechecking Automatic Tensioner Pointer
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

10. Install the right engine mount bracket.

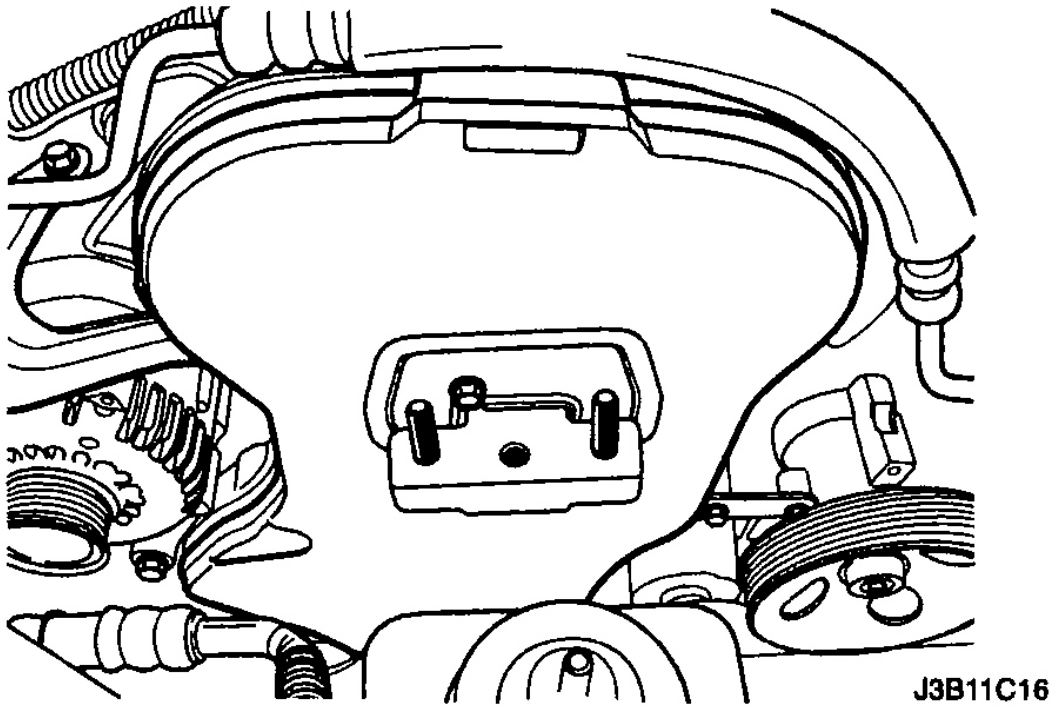


Fig. 70: Installing Right Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

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

Tighten

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

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

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

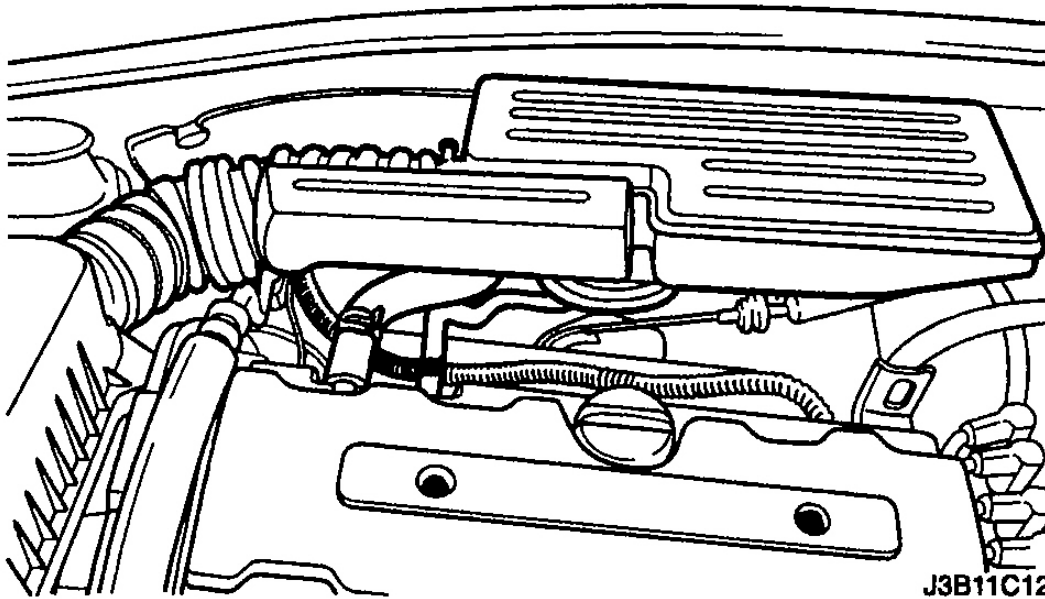


Fig. 71: Connecting Breather Tube To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

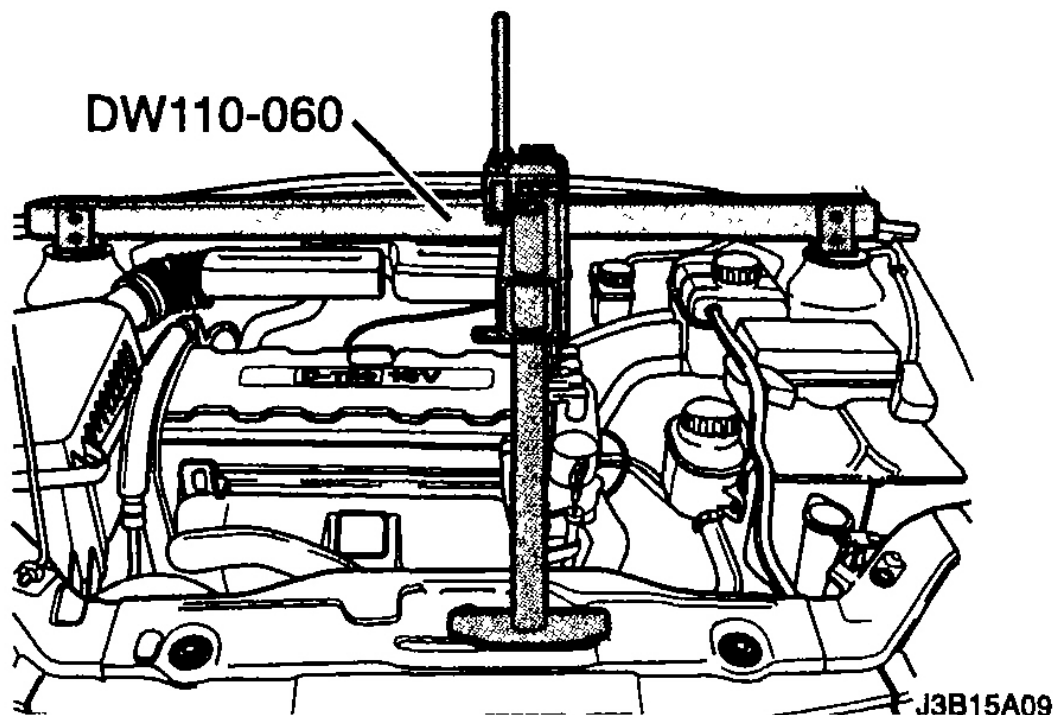


Fig. 72: Supporting Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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

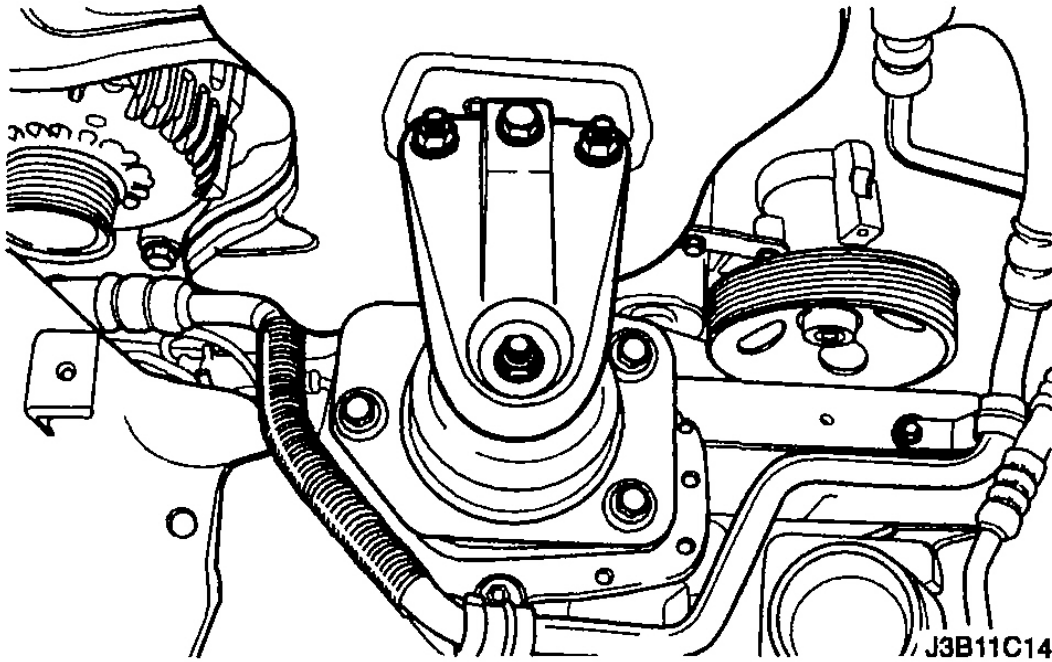


Fig. 73: Removing Engine Mount Bracket
 Courtesy of SUZUKI OF AMERICA CORP.

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

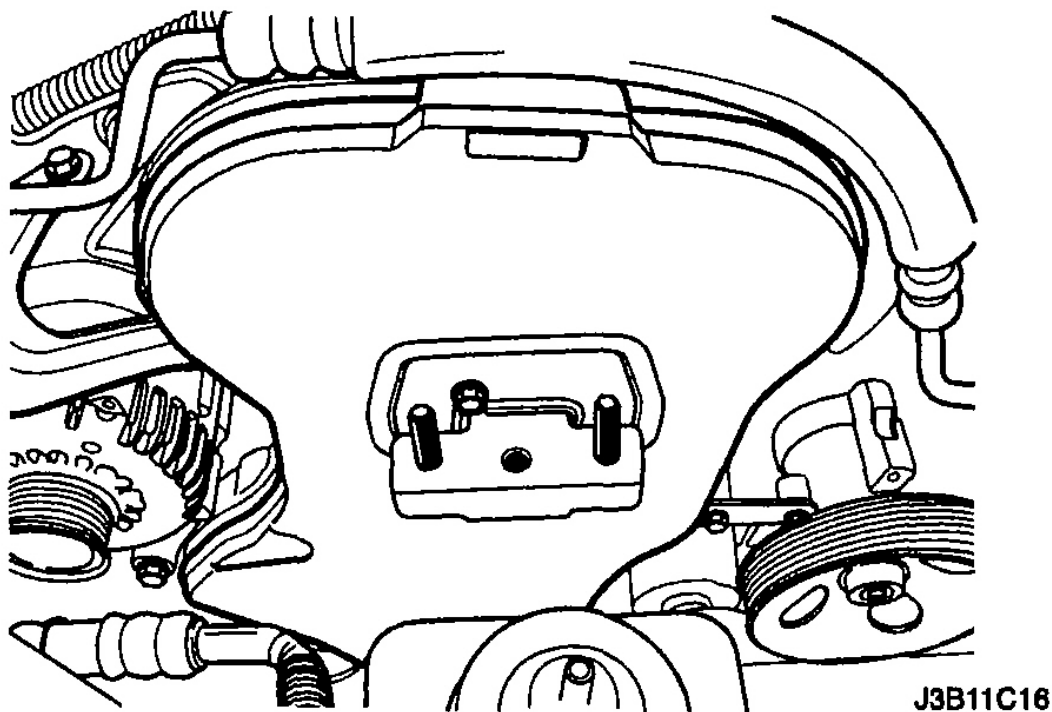


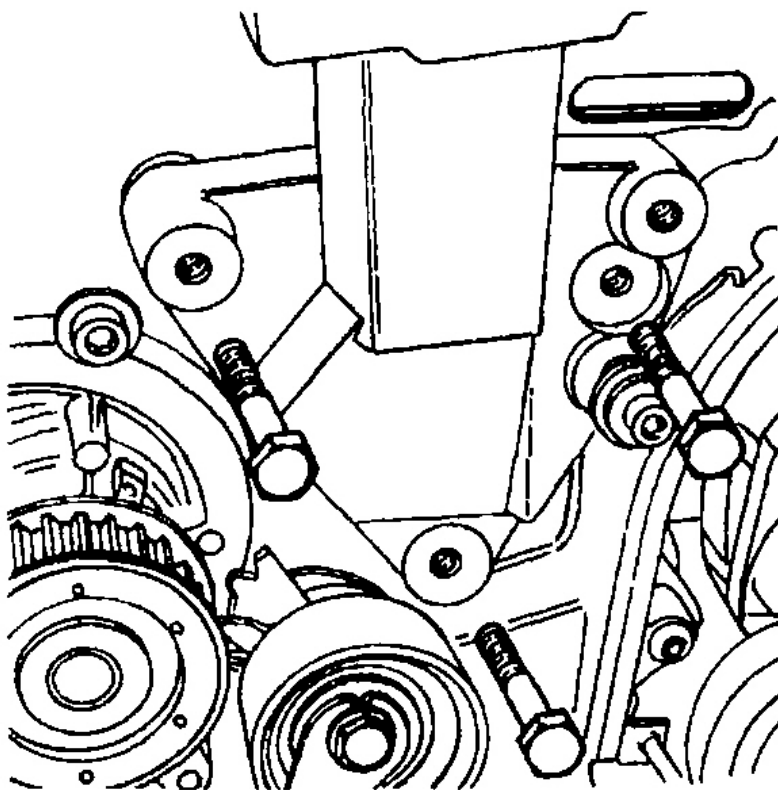
Fig. 74: Removing Engine Mount
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Tighten

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



J3B11C48

Fig. 75: 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.

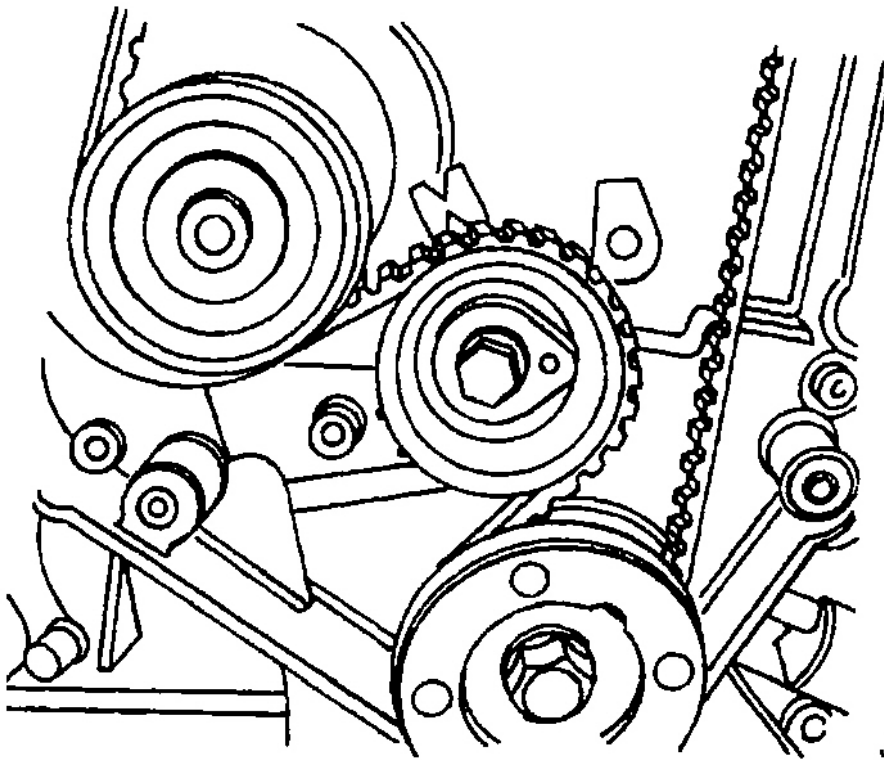
Tighten

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).



J3B11C34

Fig. 76: Tightening Timing Belt Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

8. Install the engine mount bracket and retaining bolts.

Tighten

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

9. Remove the engine assembly support fixture 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.

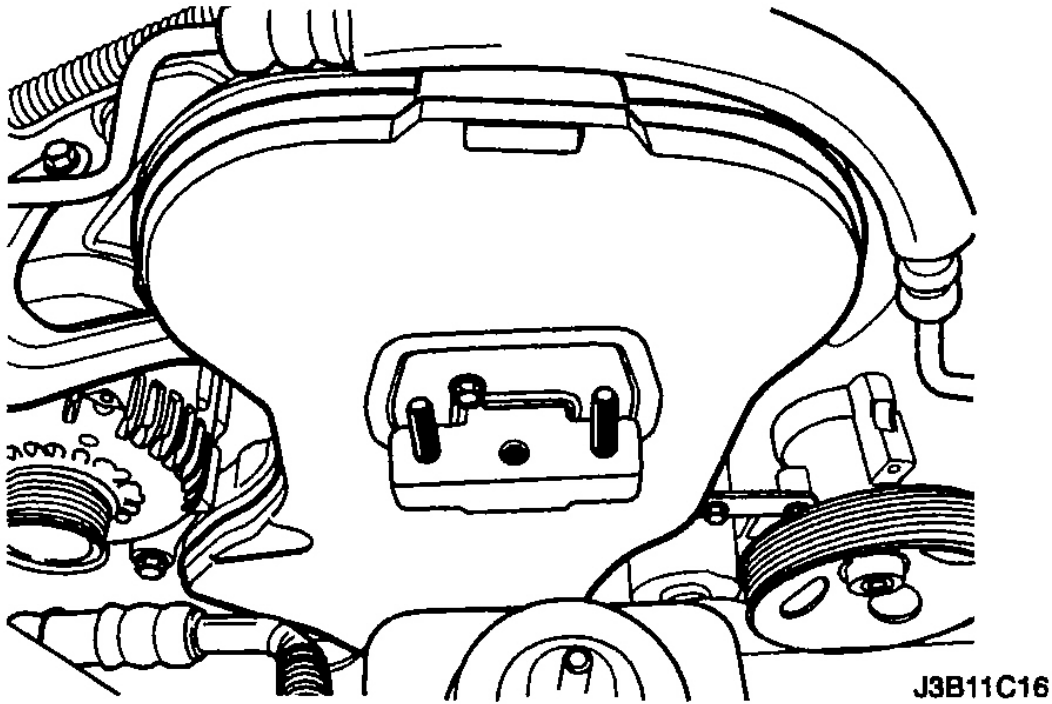


Fig. 77: Installing Engine Mount Bracket And Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

INTAKE MANIFOLD REMOVAL AND INSTALLATION

Removal

1. Remove the fuel pump fuse.
2. Start the engine. After it stalls, crank the engine for 10 seconds to rid the fuel system of fuel pressure.
3. Disconnect the negative battery cable.
4. Disconnect the charcoal canister purge (CCP) and exhaust gas recirculation (EGR) solenoid from the intake manifold and loosen the bracket bolt.
5. Drain the engine coolant. Refer to "**DRAINING AND REFILLING THE COOLING SYSTEM** :".

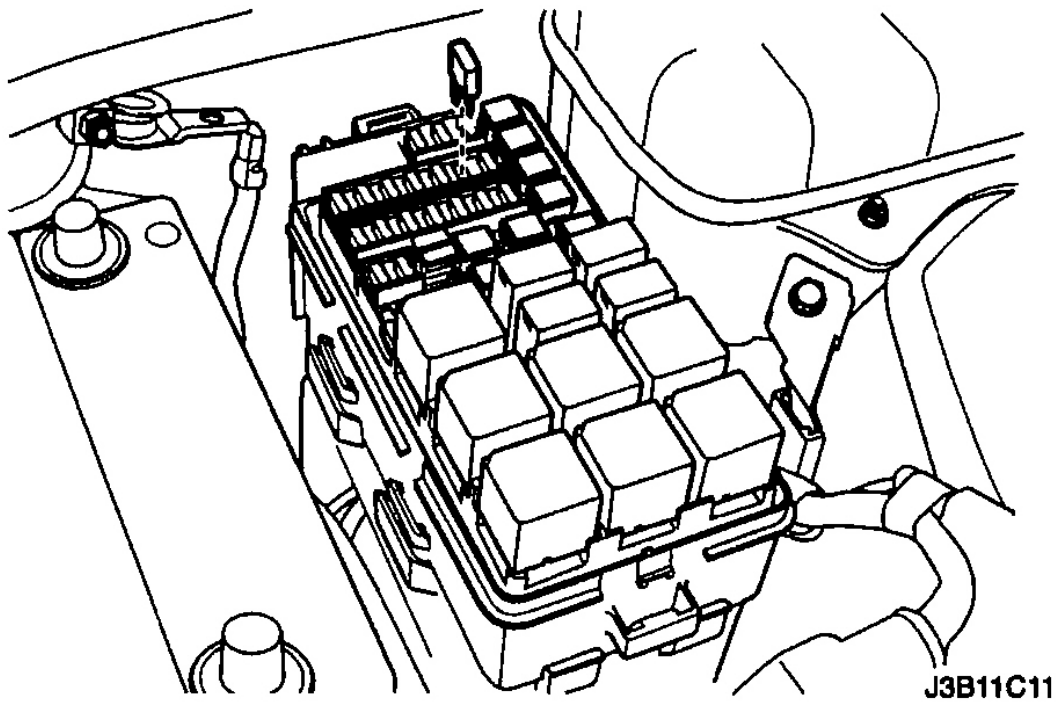


Fig. 78: Removing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

6. Disconnect the manifold air temperature sensor (MAT) connector.
7. Disconnect the air cleaner outlet hose from the throttle body.

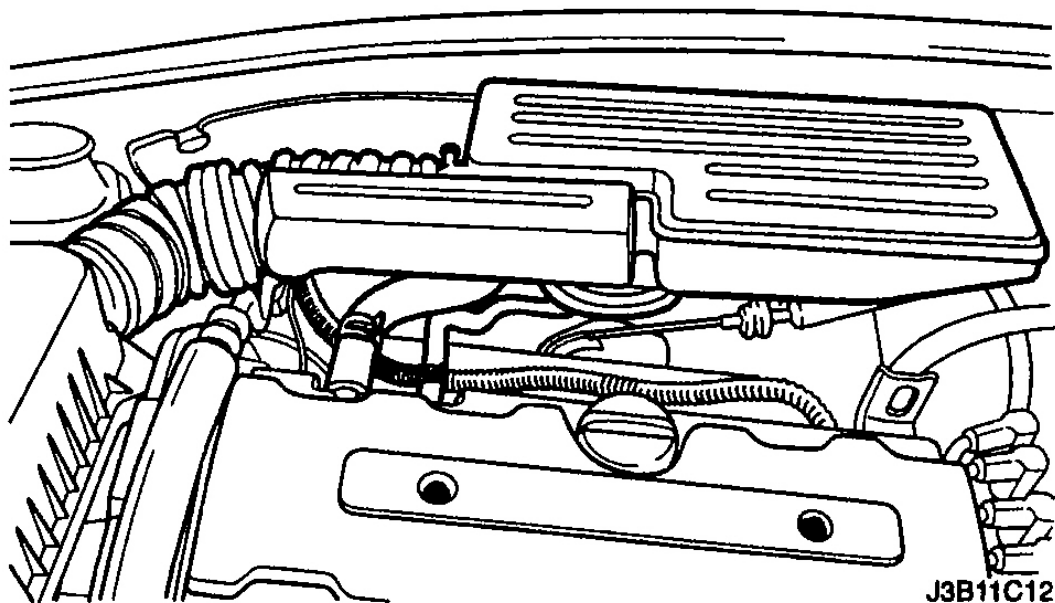


Fig. 79: Disconnecting Air Cleaner Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

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.

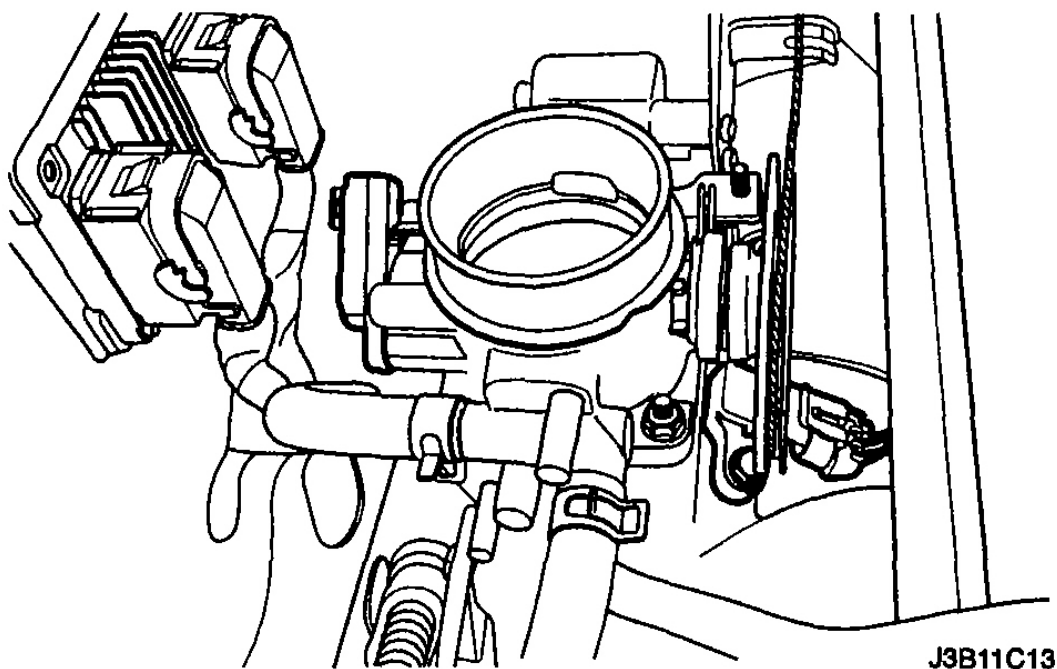


Fig. 80: Disconnecting Coolant Hoses At Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

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.
16. Remove the generator-to-intake manifold strap bracket bolts and strap.

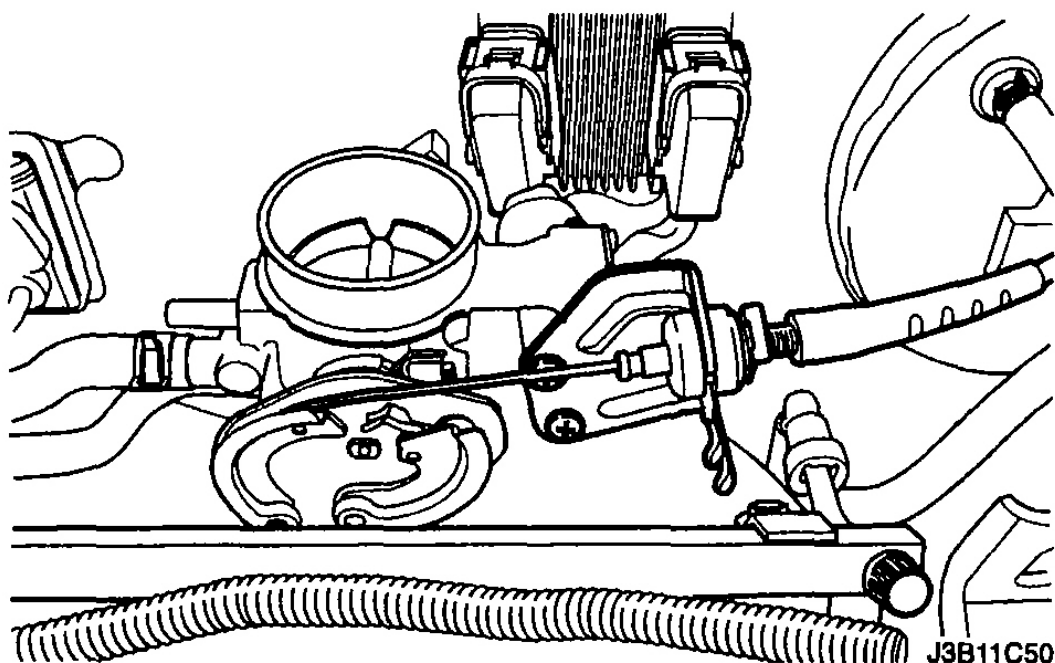


Fig. 81: Removing Throttle Cable Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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.
20. Remove the intake manifold support bracket bolt at the engine block and the intake manifold.
21. Remove the intake manifold support bracket.

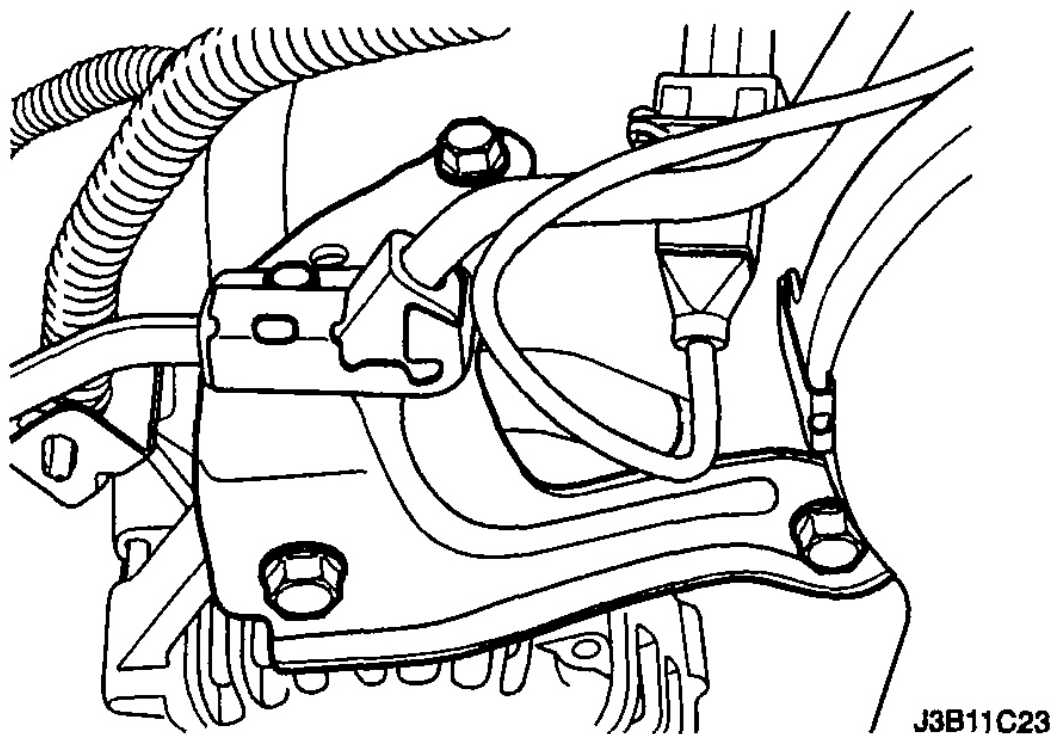


Fig. 82: Removing Bracket

Courtesy of SUZUKI OF AMERICA CORP.

22. Remove the intake manifold retaining bolt and nuts in the sequence shown in illustration.
23. Remove the intake manifold.
24. Remove the intake manifold gasket.
25. Clean the sealing surfaces of the intake manifold and the cylinder head.

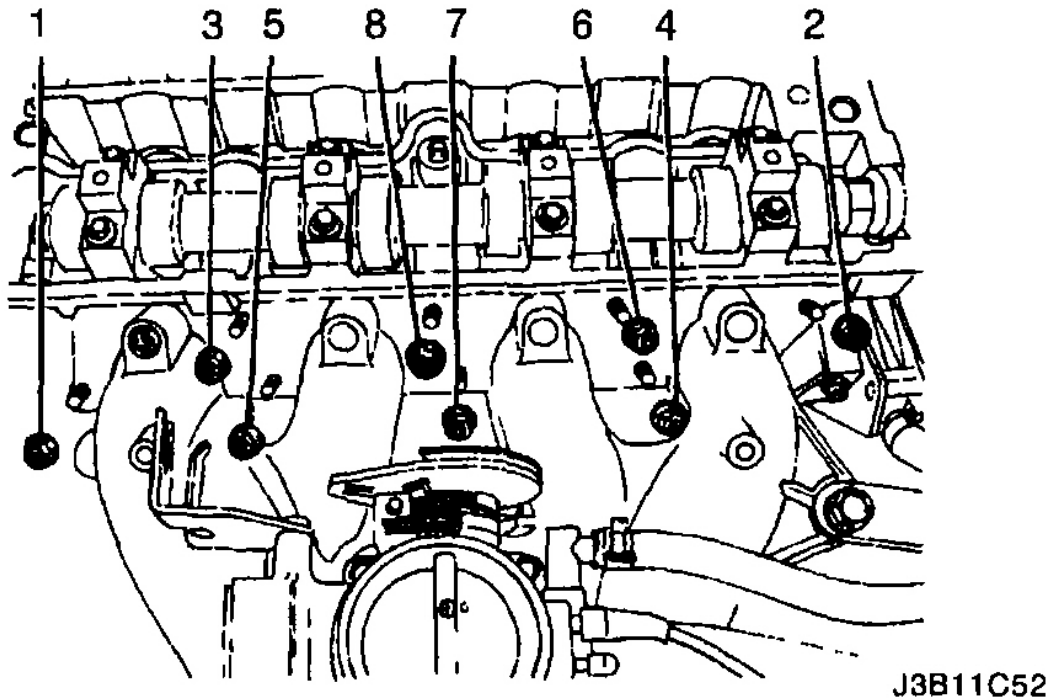


Fig. 83: Removing Intake Manifold Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Tighten

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

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

Tighten

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

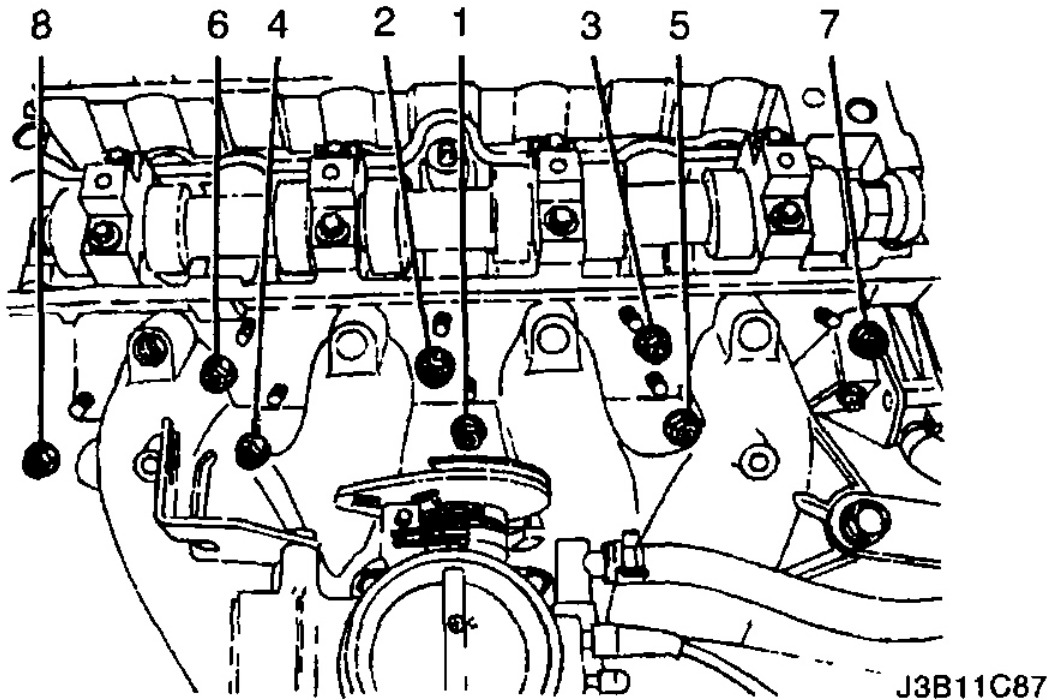


Fig. 84: Installing Intake Manifold Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

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

Tighten

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

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

Tighten

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

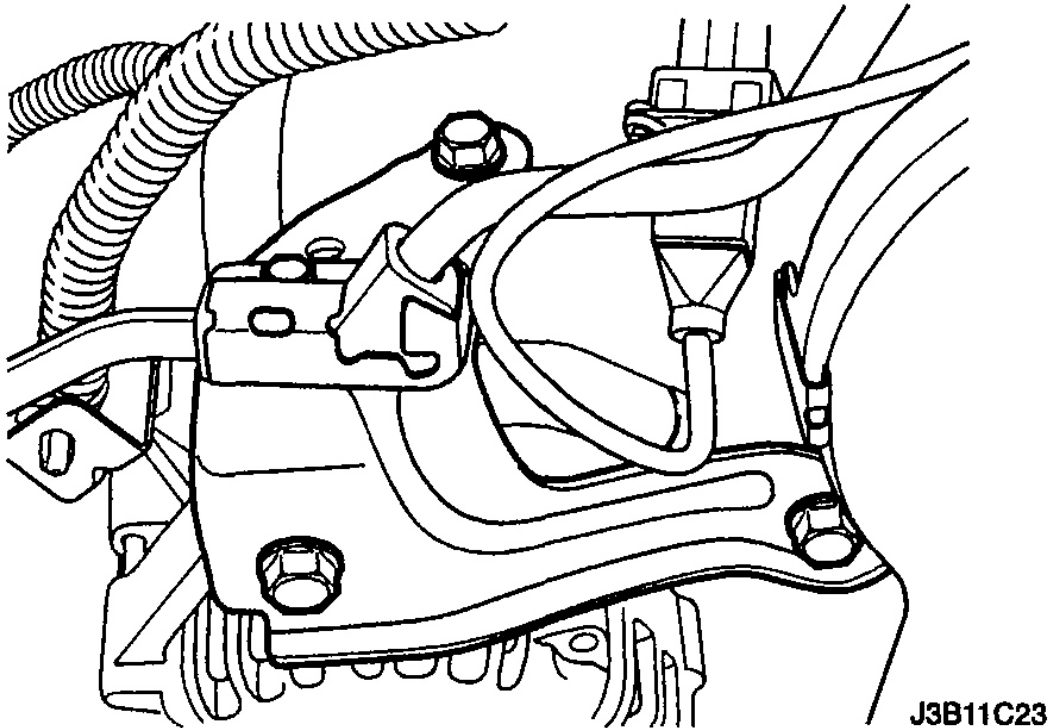


Fig. 85: Installing Generator-To-Intake Manifold Support Bracket And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

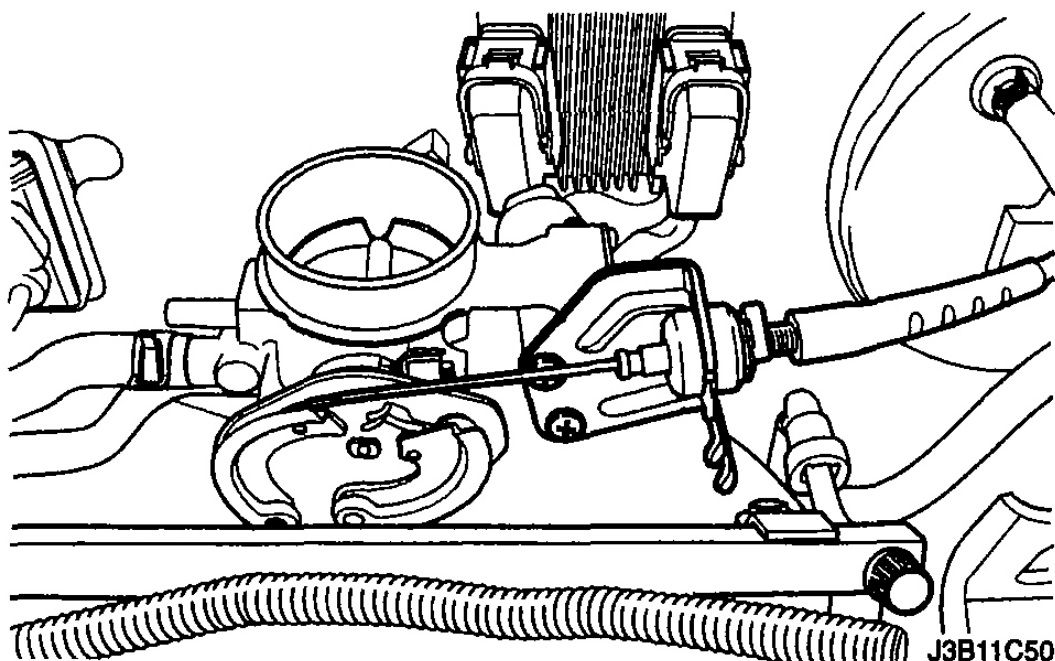


Fig. 86: Installing Throttle Cable Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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.

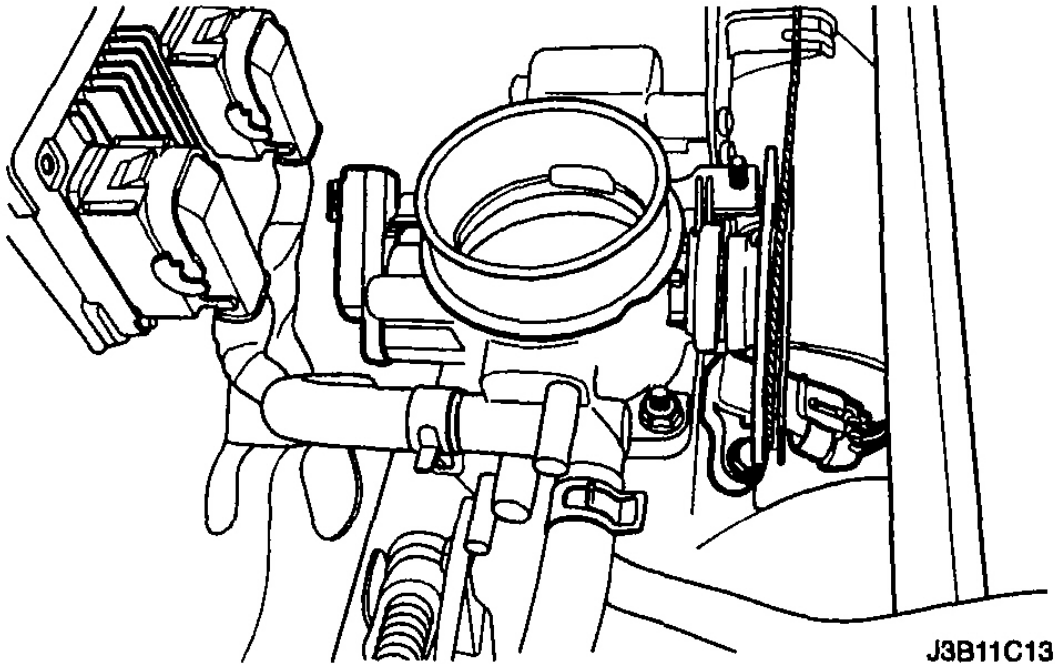


Fig. 87: Connecting TPS Connector
Courtesy of SUZUKI OF AMERICA CORP.

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**".

CAMSHAFT GEARS REMOVAL AND INSTALLATION

Removal

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "**TIMING BELT REMOVAL AND INSTALLATION**".

3. Remove the spark plug cover bolts.
4. Remove the spark plug cover.
5. Disconnect the ignition wires from the spark plugs.
6. Disconnect the breather tubes from the camshaft cover.

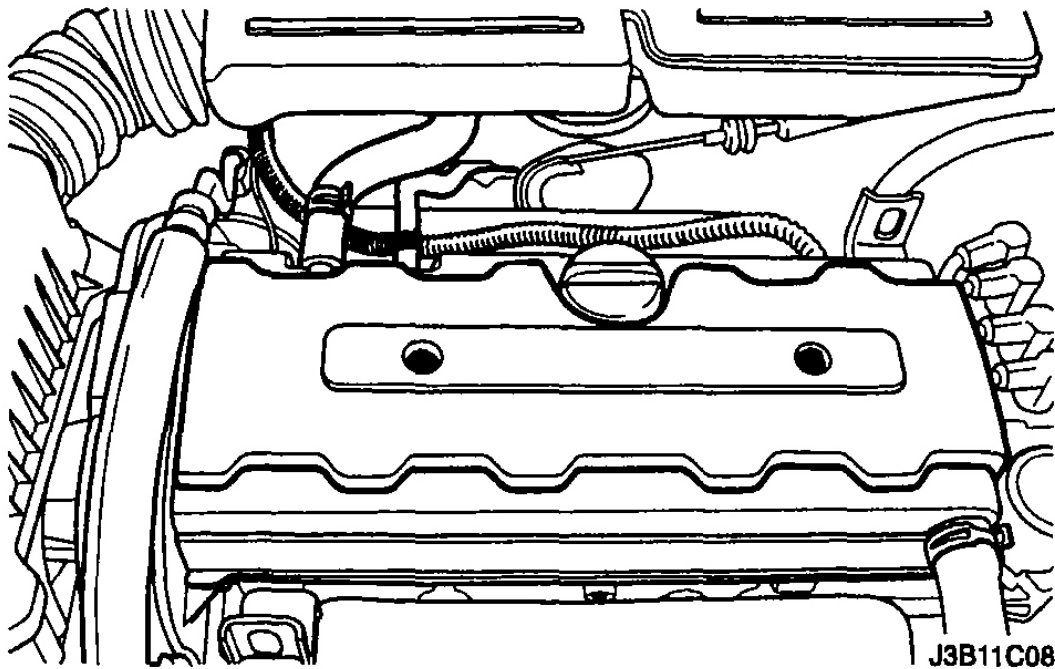


Fig. 88: Disconnecting Breather Tubes From Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

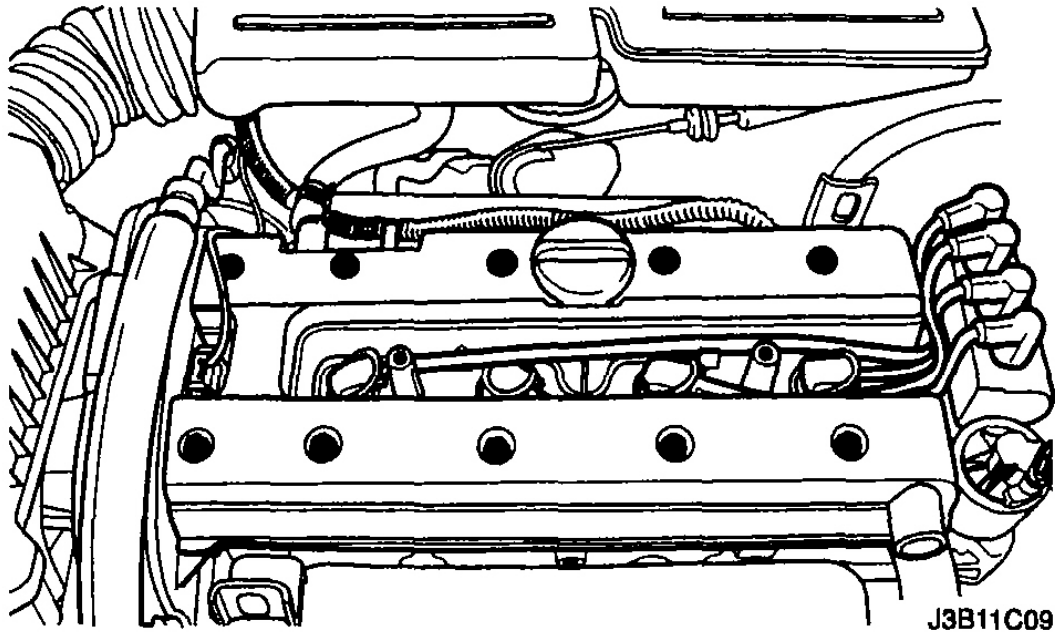
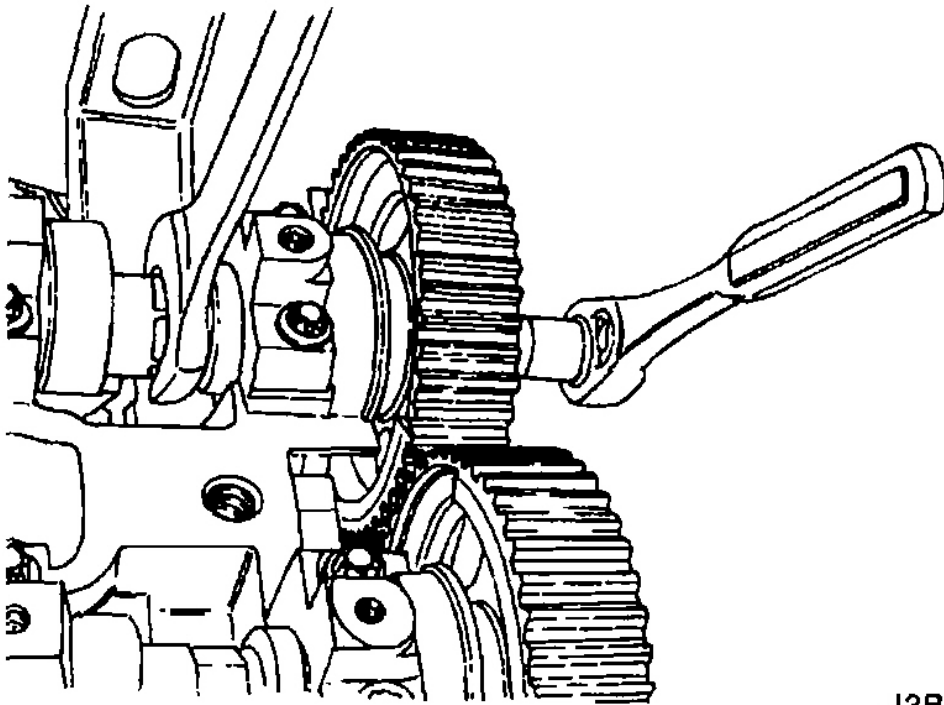


Fig. 89: Removing Camshaft Cover And Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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. 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.



J3B11C17

Fig. 90: Removing Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

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

Tighten

Tighten the intake camshaft gear bolt to 50 N.m (37 lb-ft) plus 60 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.
9. Install the camshaft cover washers.
10. Install the camshaft cover bolts.

Tighten

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

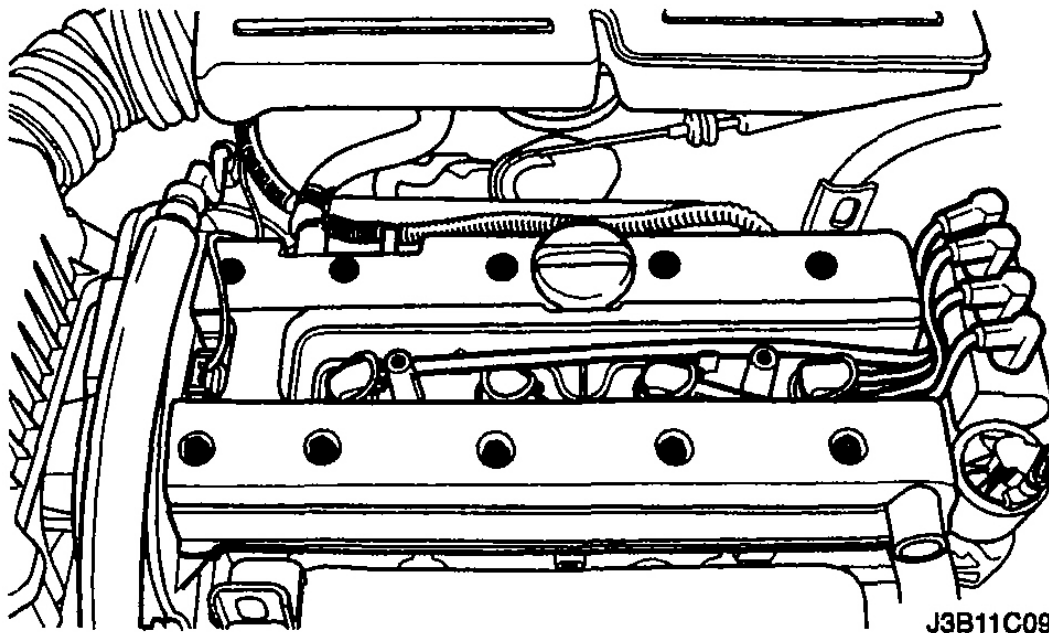


Fig. 91: Installing Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

15. Install the timing belt. Refer to "**TIMING BELT REMOVAL AND INSTALLATION:**".
16. Connect the negative battery cable.

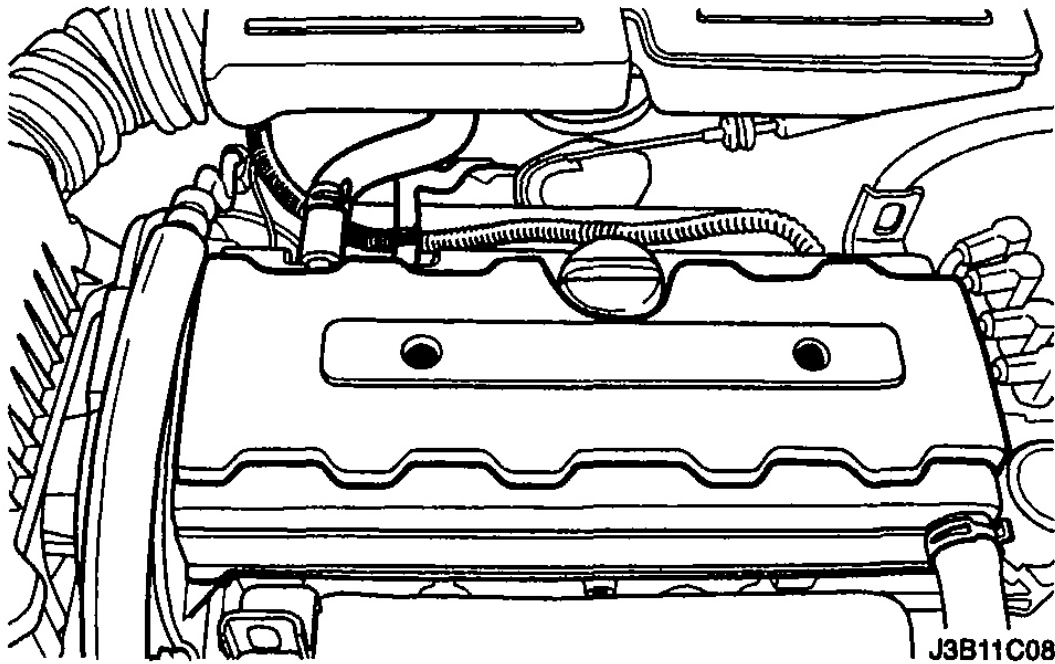


Fig. 92: Installing Spark Plug Cover
Courtesy of SUZUKI OF AMERICA CORP.

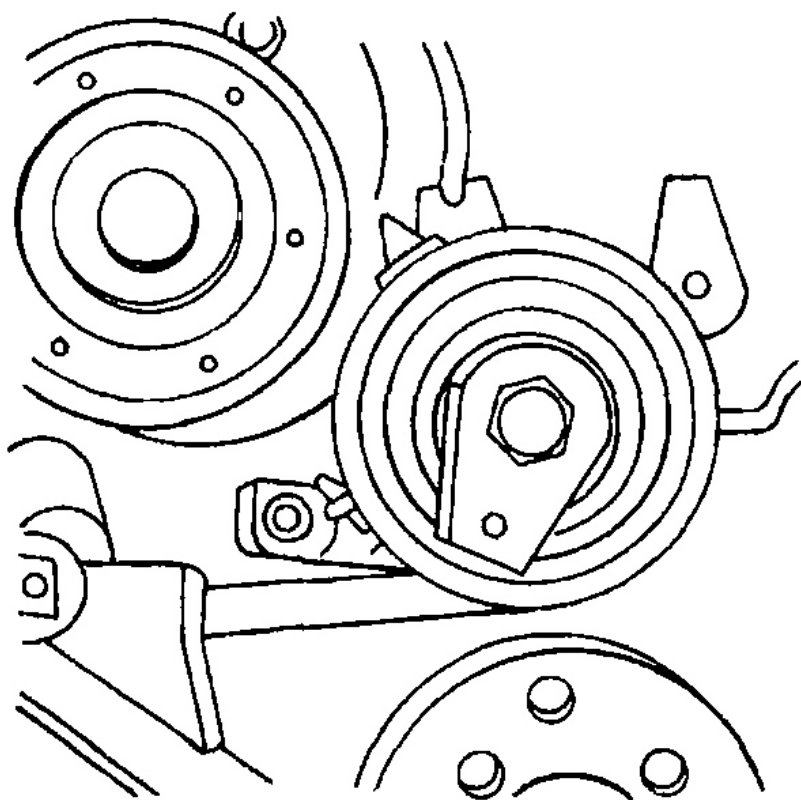
REAR TIMING BELT COVER REMOVAL AND INSTALLATION

Tools Required

KM-470-B Angular Torque Gauge

Removal

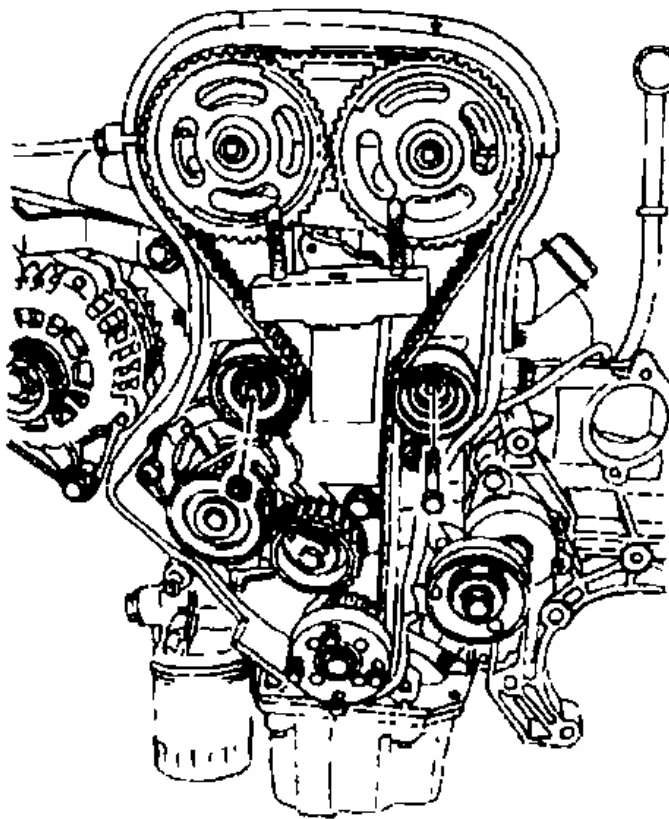
1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to "**TIMING BELT REMOVAL AND INSTALLATION:**".
3. Remove the camshaft gears. Refer to "**CAMSHAFT GEARS REMOVAL AND INSTALLATION:**".
4. Remove the timing belt automatic tensioner bolt.
5. Remove the timing belt automatic tensioner.



J3B11C18

Fig. 93: Removing Timing Belt Automatic Tensioner Bolt
Courtesy of SUZUKI OF AMERICA CORP.

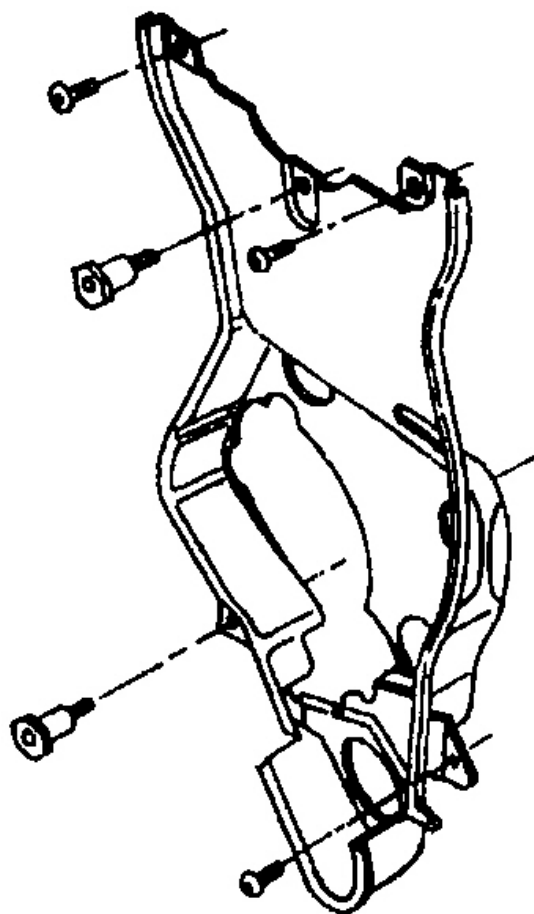
6. Remove the timing belt idler pulley bolt and nut.
7. Remove the timing belt idler pulleys.
8. Remove the engine mount retaining bolts.
9. Remove the engine mount.
10. Remove the crankshaft gear bolt.
11. Remove the crankshaft gear.



J3B11C19

Fig. 94: Removing Timing Belt Idler Pulleys
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C20

Fig. 95: Removing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

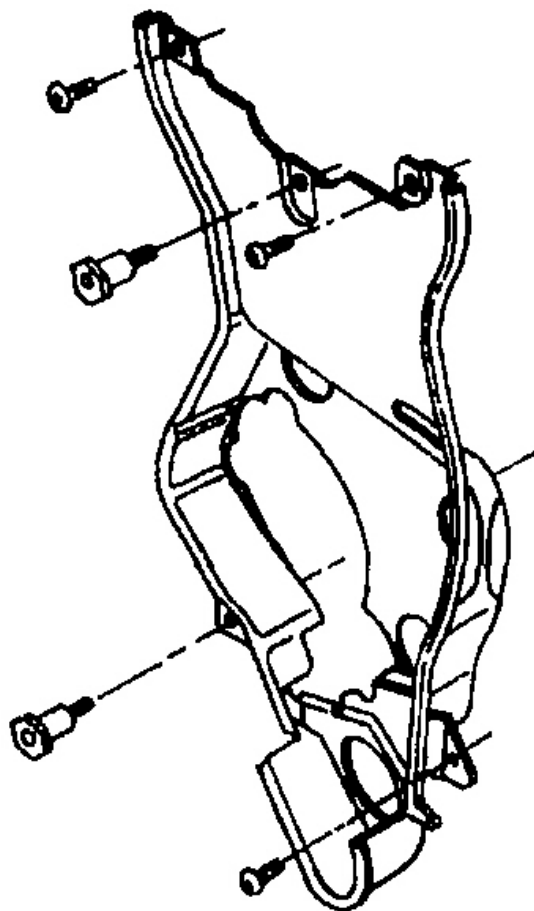
Tighten

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

3. Install the engine mount and retaining bolts.

Tighten

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



J3B11C20

Fig. 96: Installing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

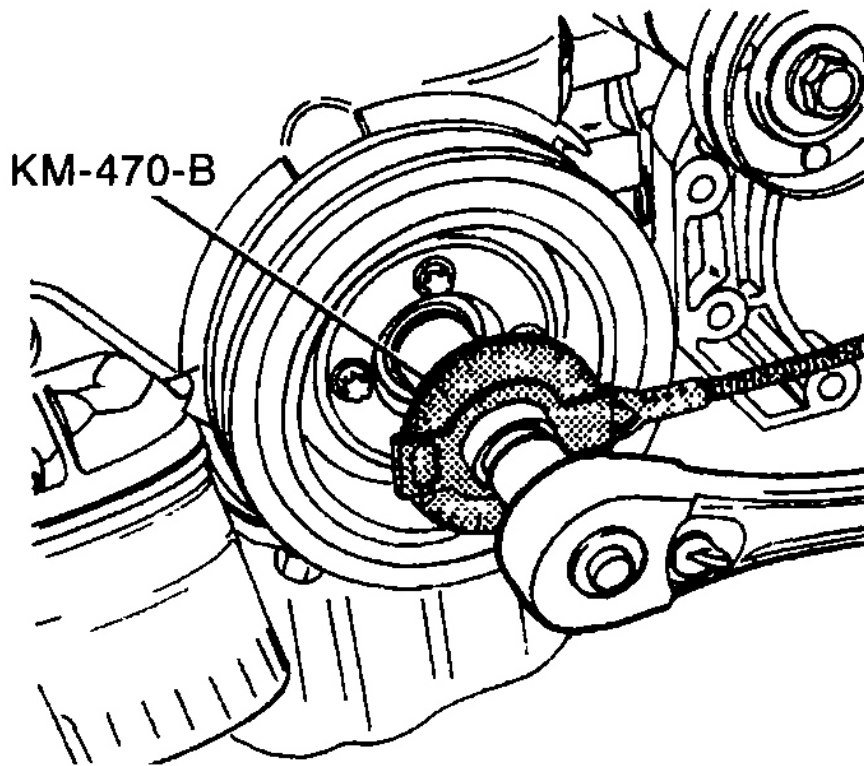
Tighten the timing belt idler pulley bolt to 25 N.m (18 lb-ft).

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

6. Install the crankshaft timing belt drive gear and bolt.

Tighten

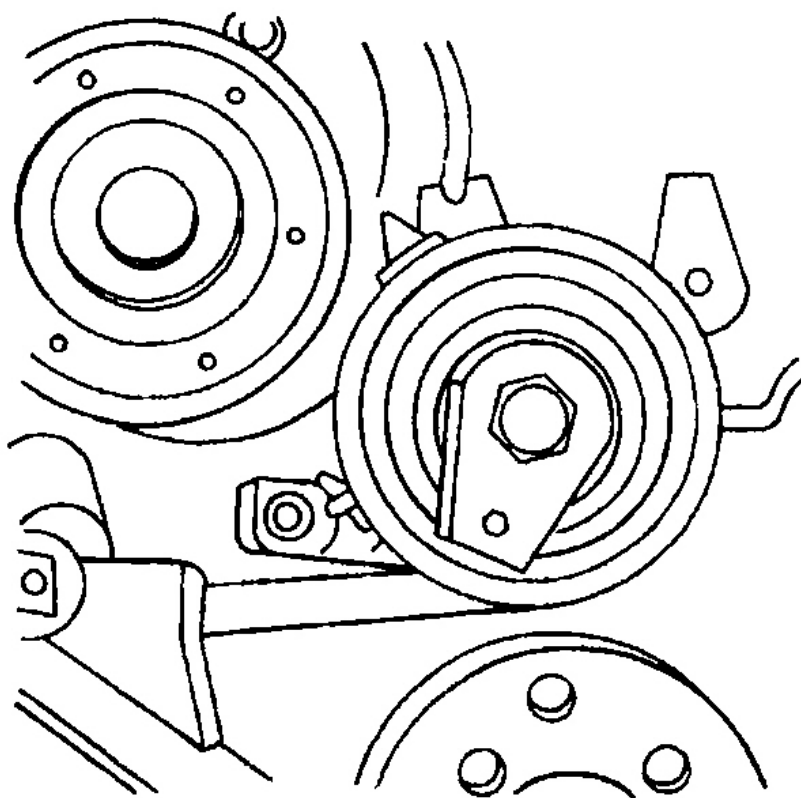
Tighten the crankshaft gear bolt to 145 N.m (107 lb-ft) plus 30 degrees and plus 15 degrees using the angular torque gauge KM-470-B.



J3B11C56

Fig. 97: Installing Crankshaft Timing Belt Drive Gear And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the timing belt automatic tensioner and bolt.
8. Install the camshaft gears. Refer to "**CAMSHAFT GEARS REMOVAL AND INSTALLATION**".
9. Install the timing belt and timing belt cover. Refer to "**TIMING BELT REMOVAL AND INSTALLATION**".
10. Connect the negative battery cable.



J3B11C18

Fig. 98: Installing Timing Belt Automatic Tensioner And Bolt
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE REMOVAL AND INSTALLATION

Removal

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

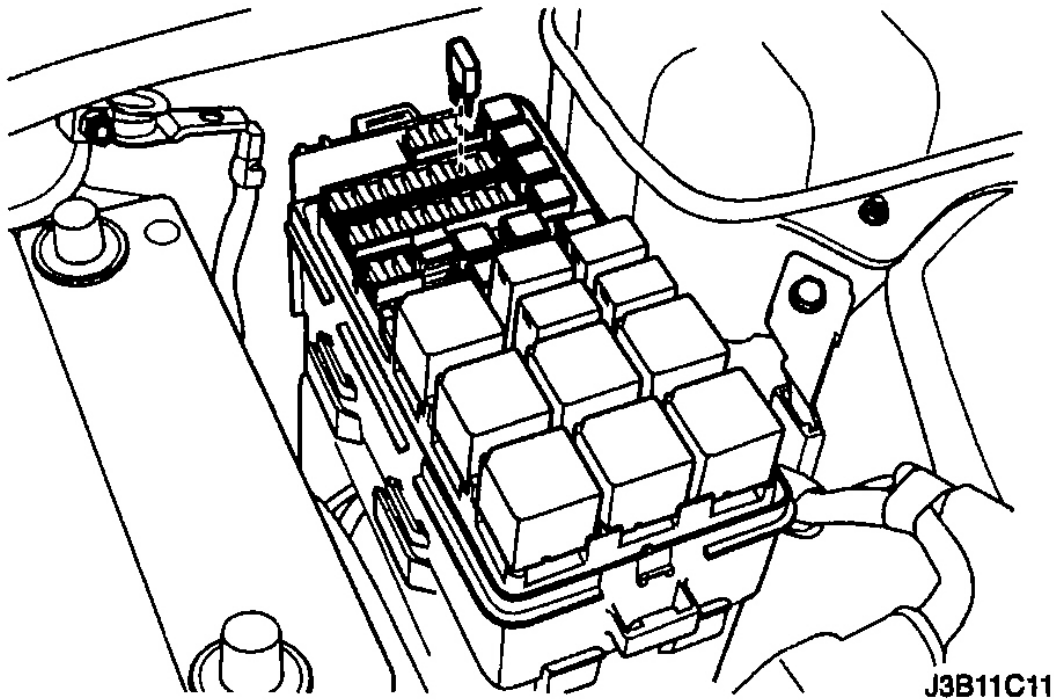


Fig. 99: Removing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

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

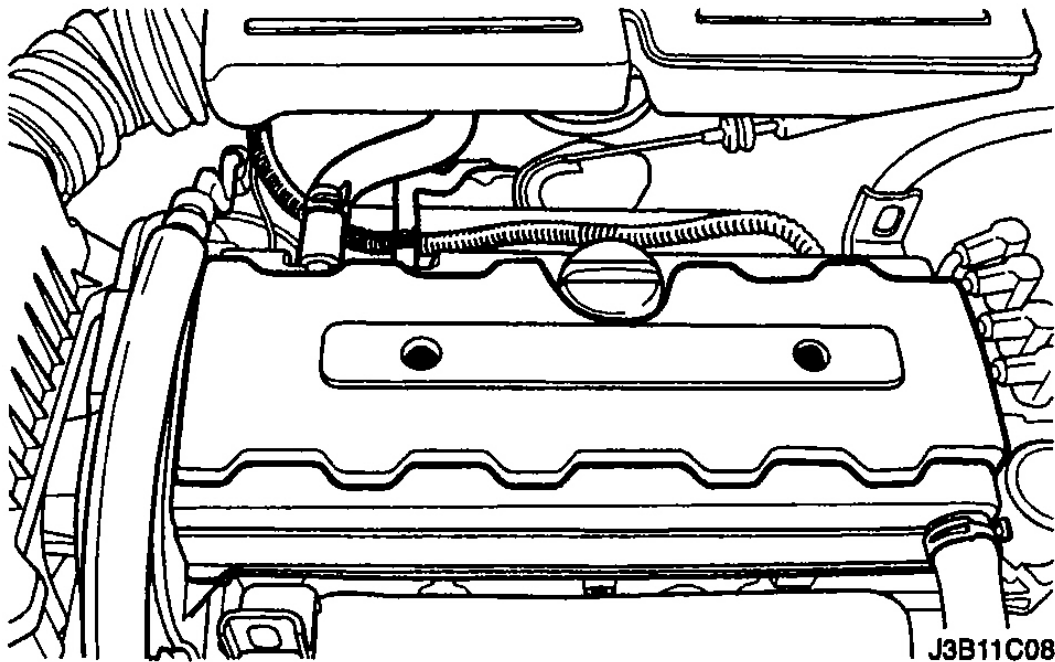


Fig. 100: Disconnecting Breather Tubes From Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

13. Drain the engine coolant. Refer to "**DRAINING AND REFILLING THE COOLING SYSTEM** :".
14. Remove the cooling system radiator and the engine cooling fans. Refer to "**RADIATOR REMOVAL AND INSTALLATION** :".
15. Disconnect the upper radiator hose from the thermostat housing.
16. Disconnect the power steering return hose from the power steering pump.
17. Disconnect the power steering pressure hose from the power steering pump.
18. Disconnect the electrical connector at the direct ignition system (DIS) coil and the 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.
22. Disconnect the engine coolant temperature sensor (CTS) connector.
23. Disconnect the generator voltage regulator connector and power lead.

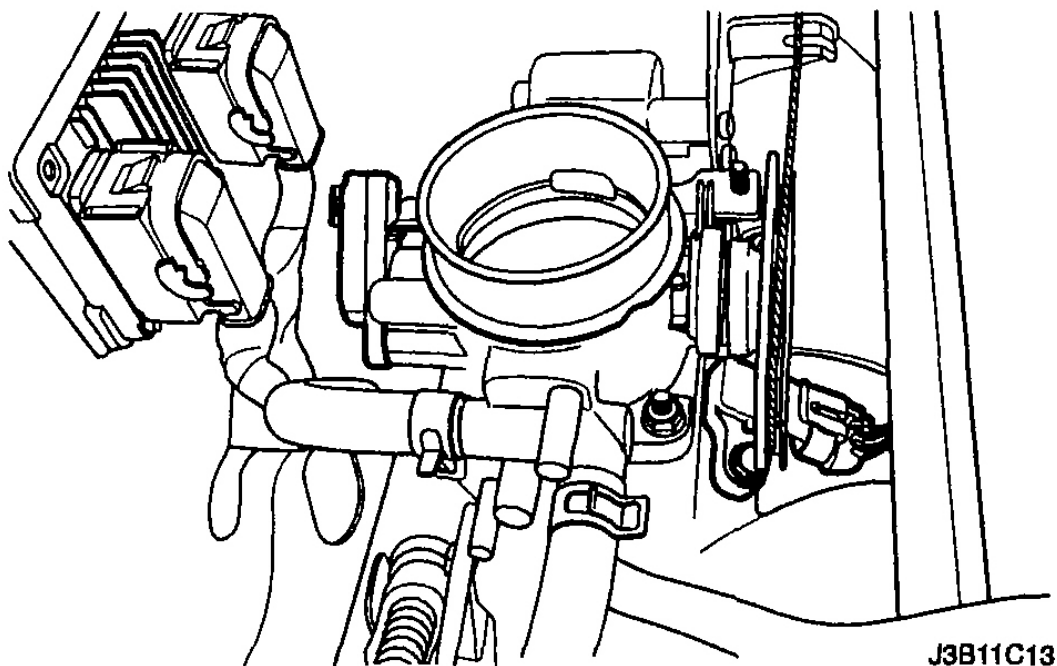


Fig. 101: Disconnecting TPS Connector
Courtesy of SUZUKI OF AMERICA CORP.

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.
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.

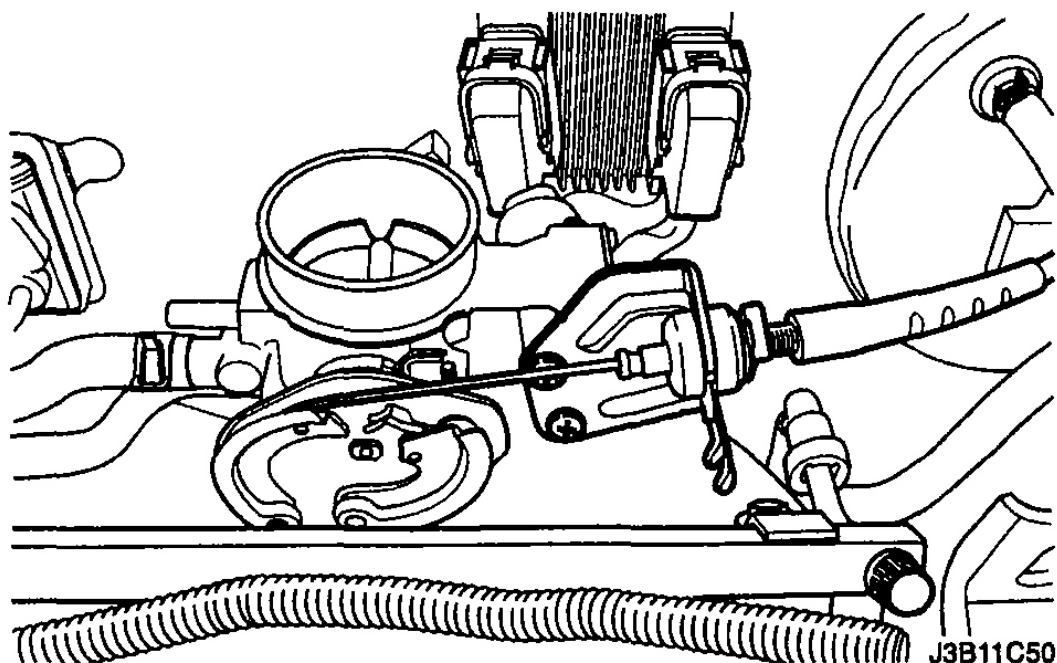


Fig. 102: Disconnecting Throttle Cable From Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

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.

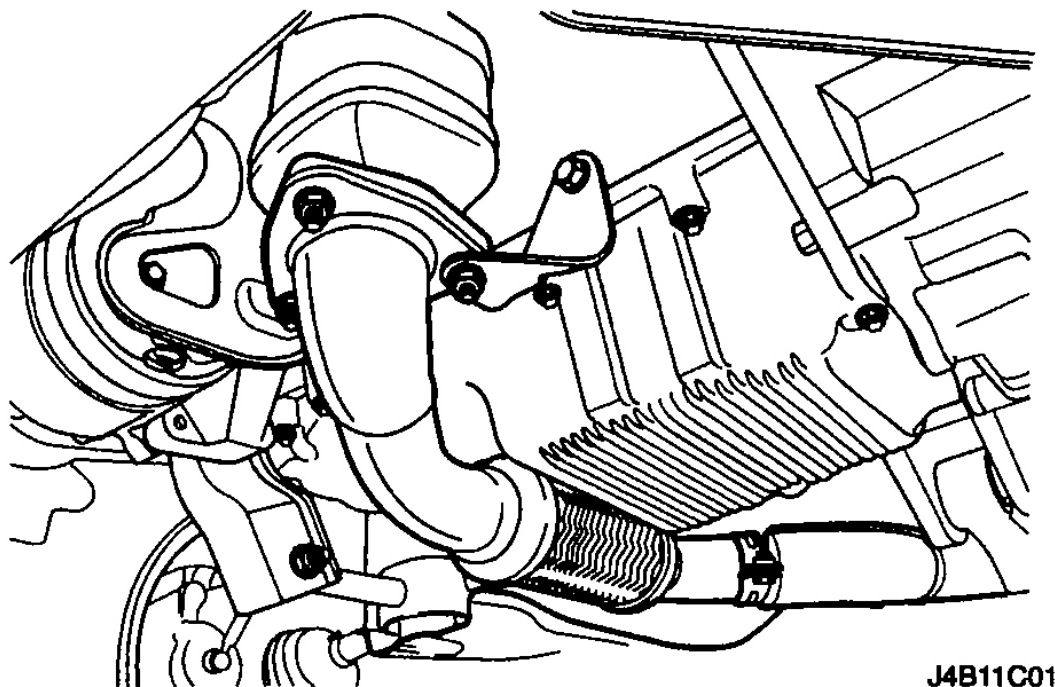


Fig. 103: Removing Exhaust Flex Pipe
Courtesy of SUZUKI OF AMERICA CORP.

39. Remove the crankshaft pulley bolts.
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.

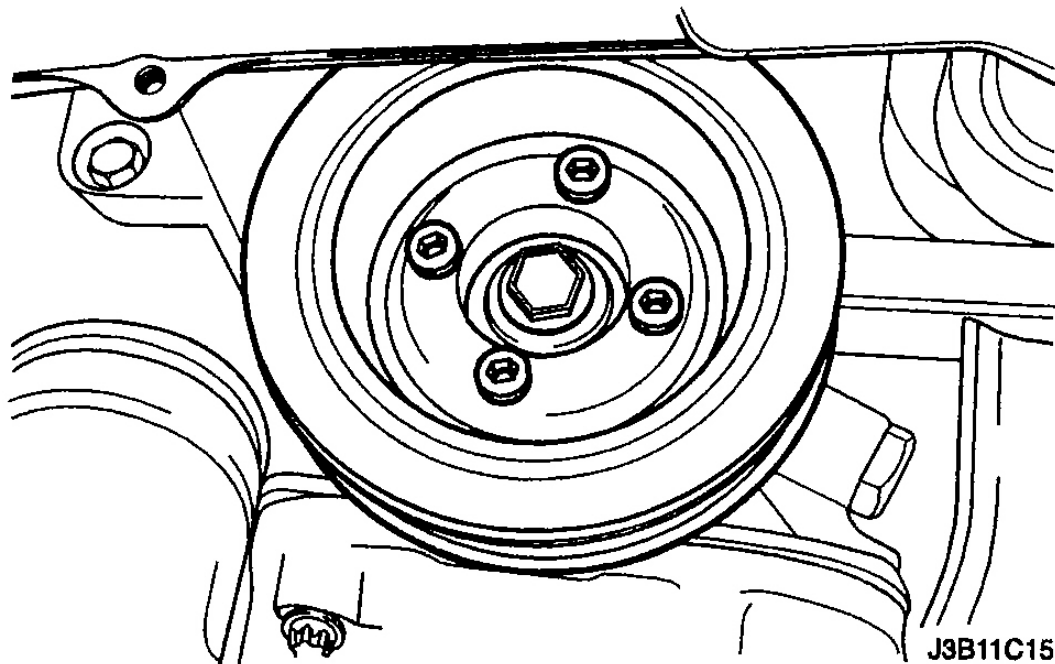
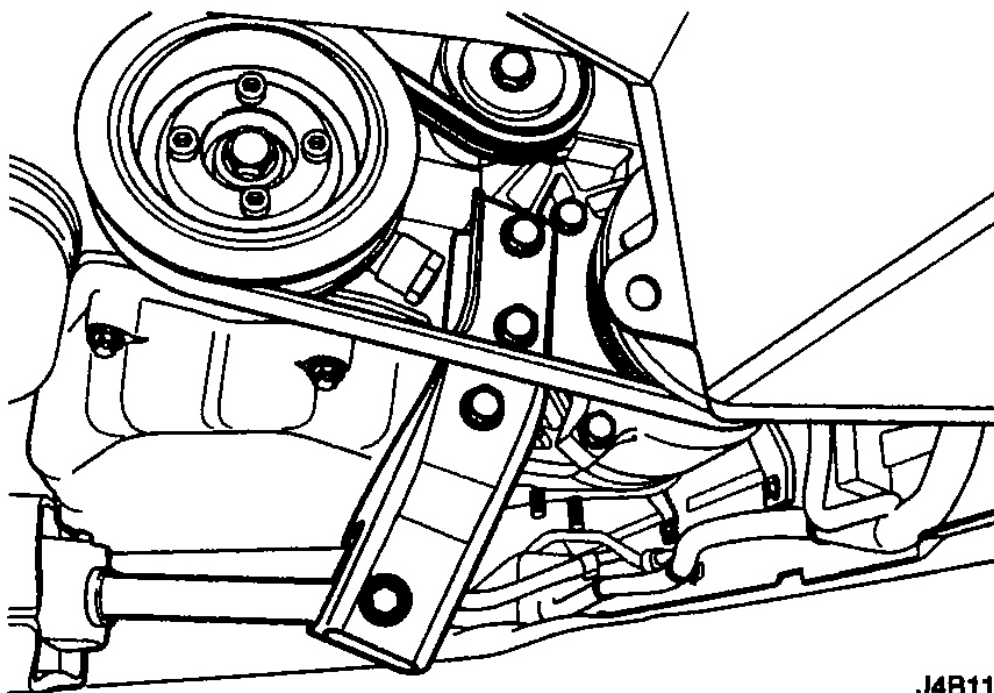


Fig. 104: Removing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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.



J4B11C06

Fig. 105: Removing Lower Reaction Rod Mount
Courtesy of SUZUKI OF AMERICA CORP.

50. Remove the rubber cover as a service hole.
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.

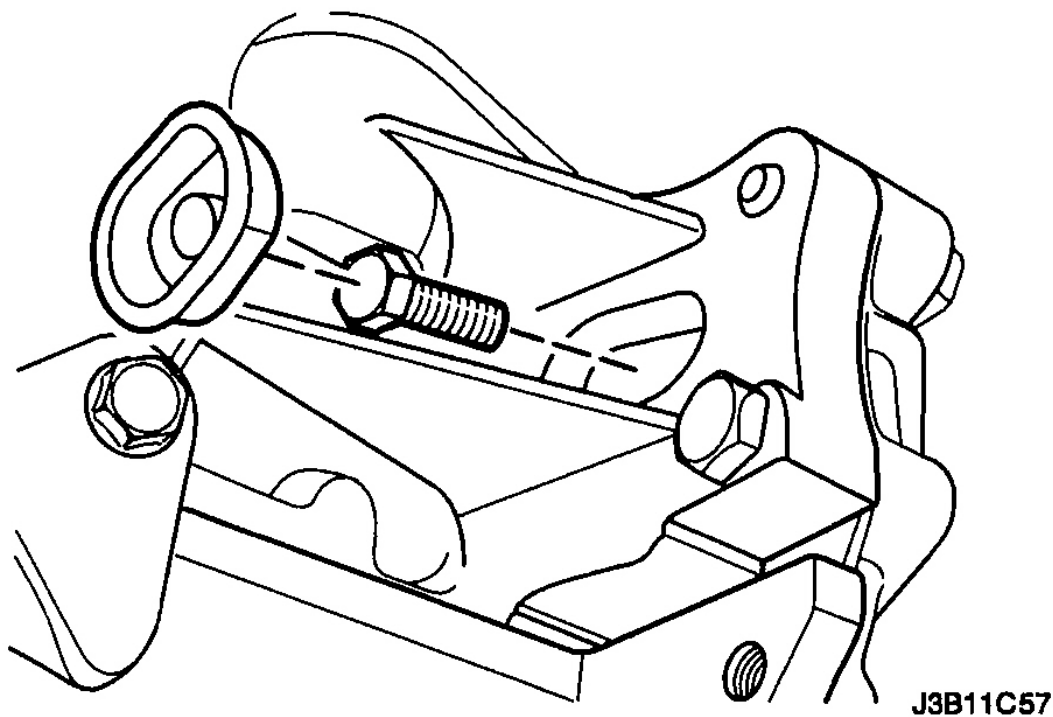


Fig. 106: Removing Rubber Cover
Courtesy of SUZUKI OF AMERICA CORP.

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

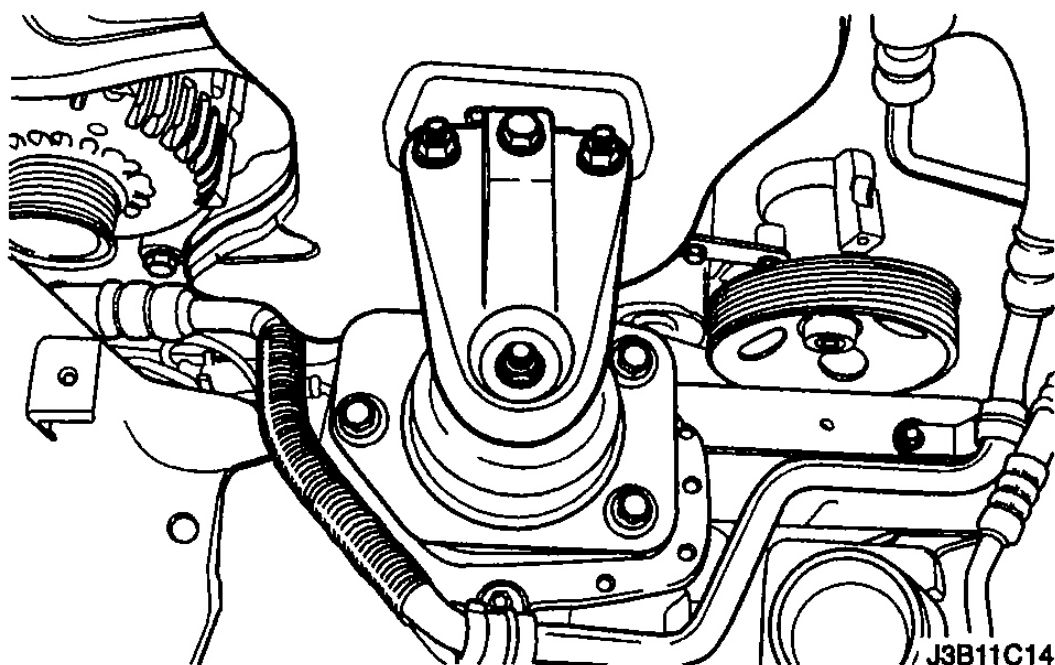


Fig. 107: Removing Right Engine Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

Tighten

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

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

Tighten

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

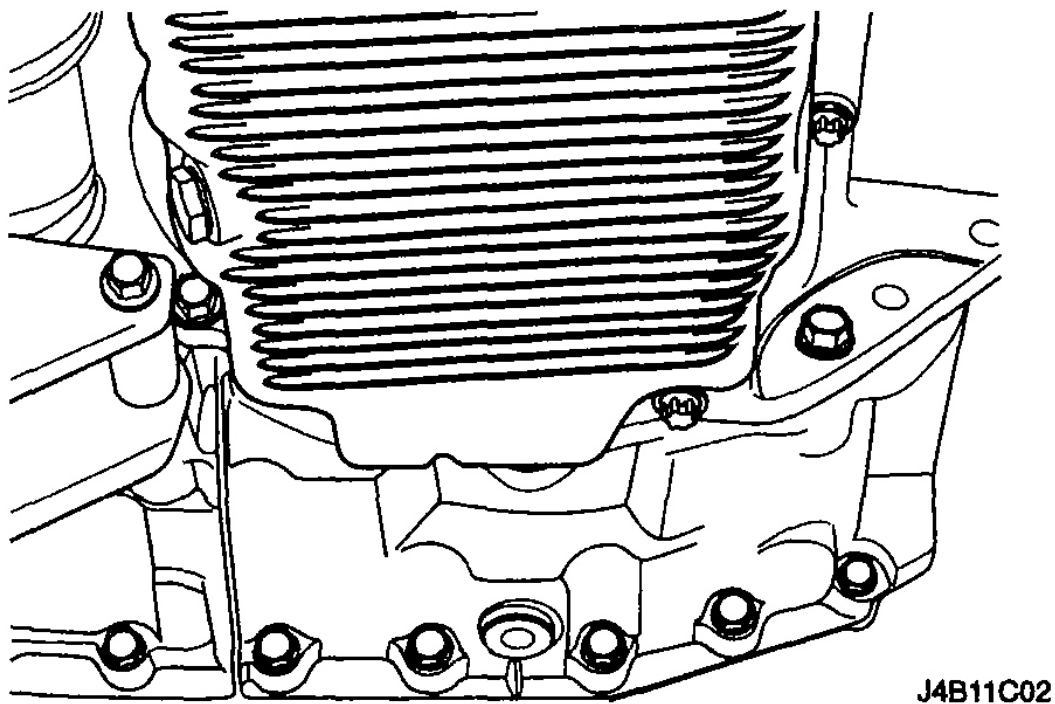


Fig. 108: Installing Oil Pan Flange-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

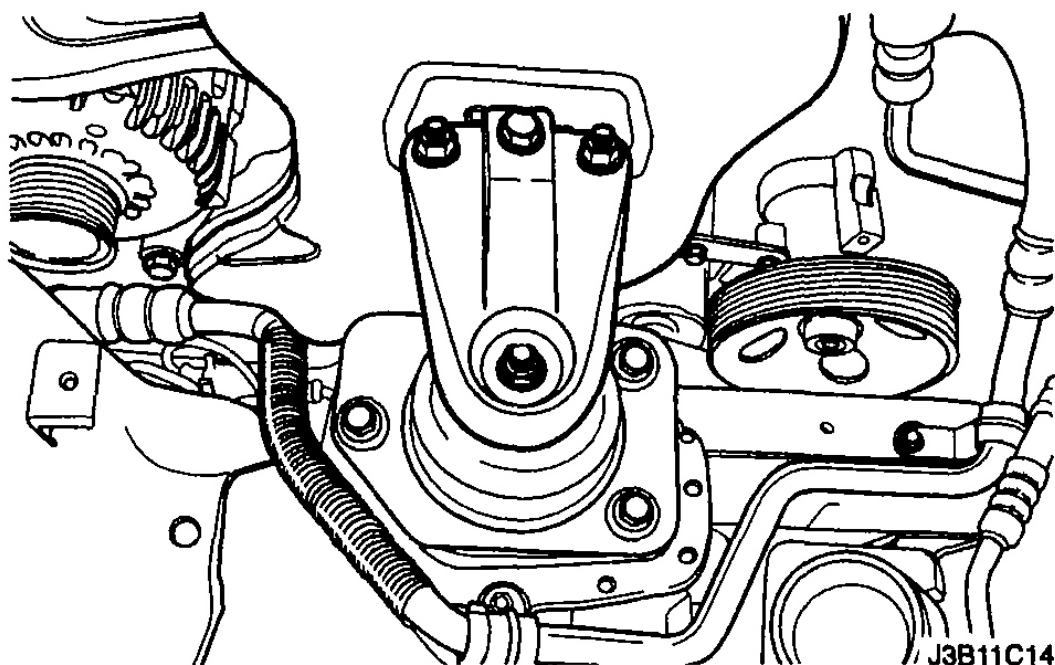


Fig. 109: Installing Right Engine Mount Bracket Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

10. Install the rubber cover as a service hole.

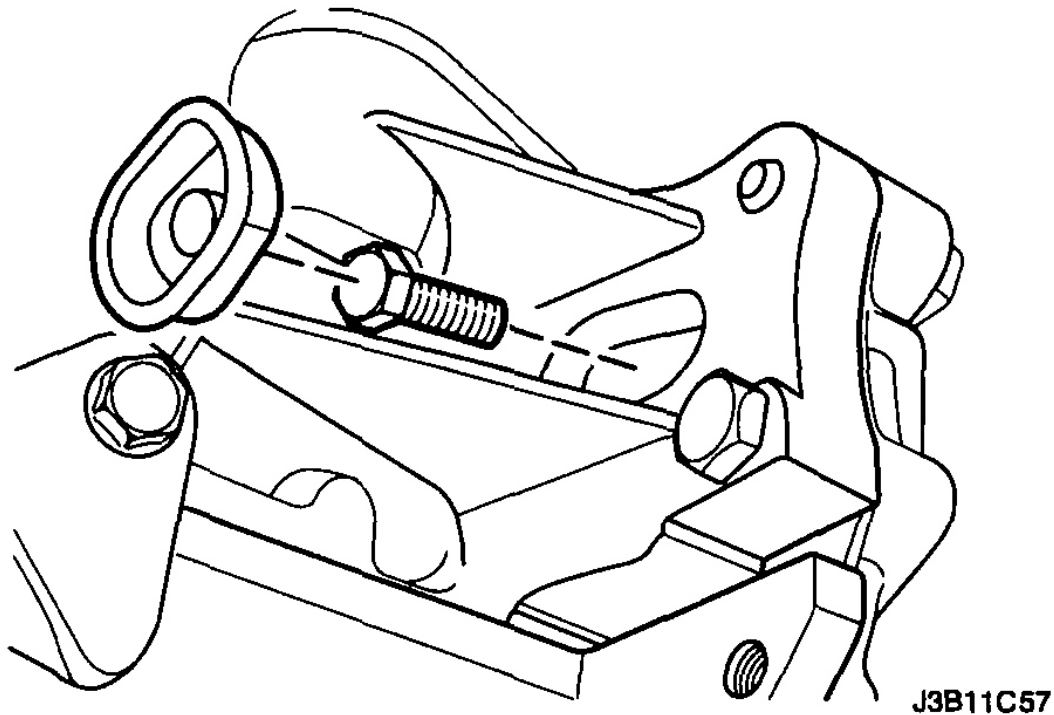


Fig. 110: Installing Rubber
Courtesy of SUZUKI OF AMERICA CORP.

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

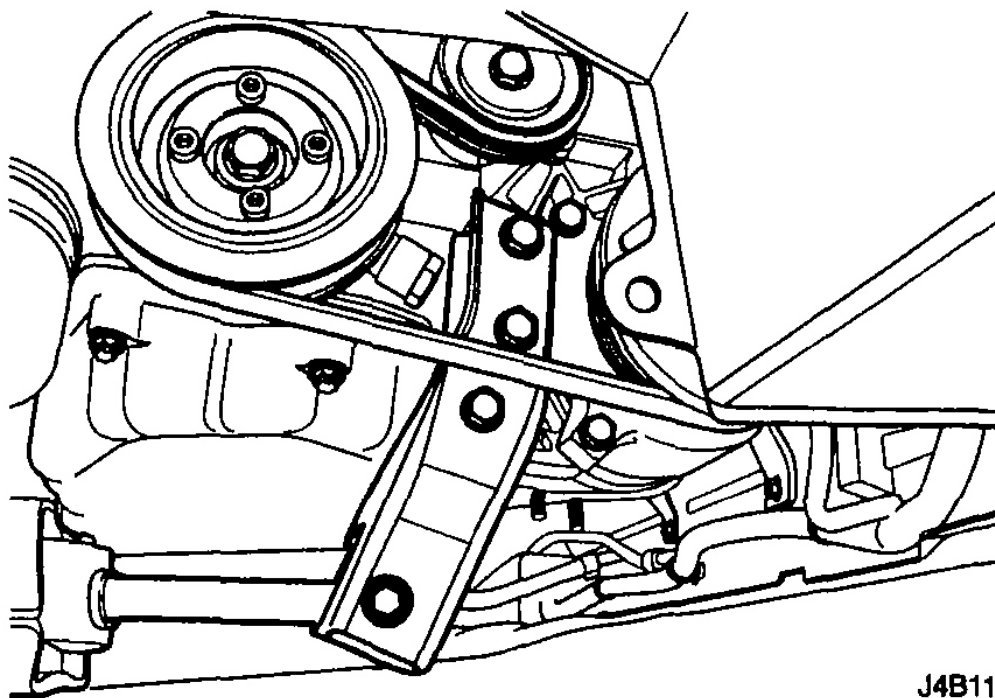
Tighten

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

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

Tighten

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



J4B11C06

Fig. 111: Installing Lower Reaction Rod Mount Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

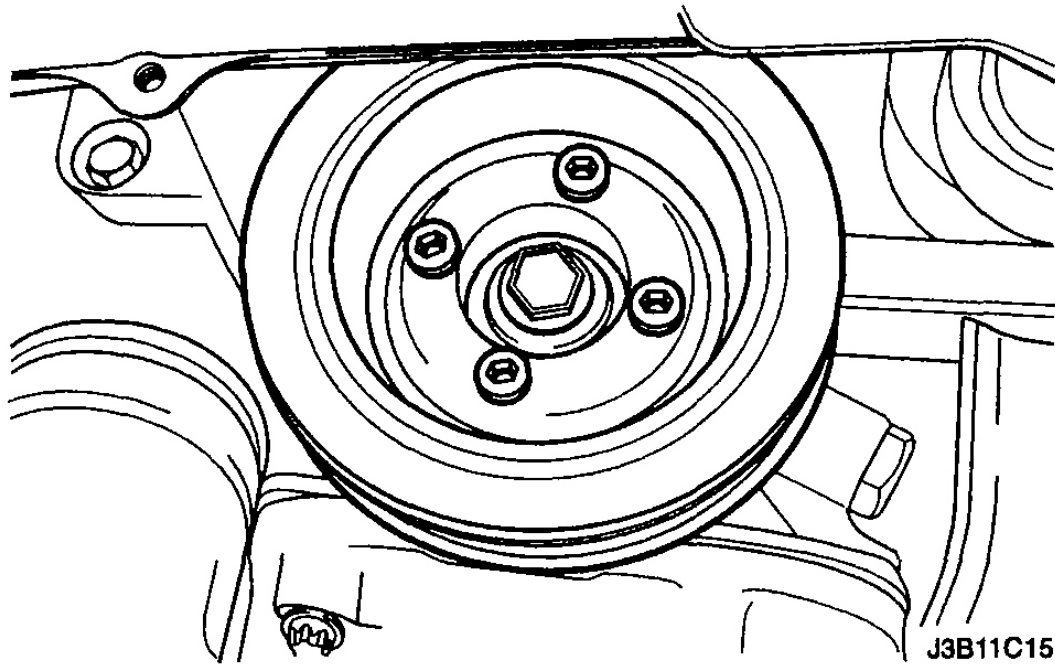
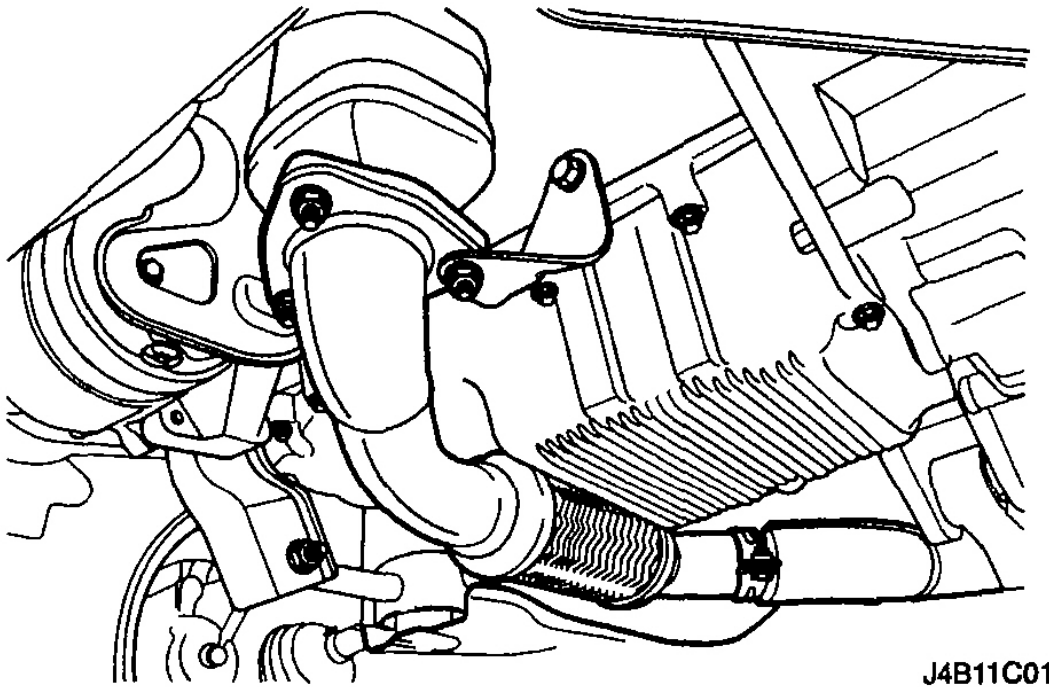


Fig. 112: Installing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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



J4B11C01

Fig. 113: Installing Exhaust Flex Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

24. Connect the power steering pressure hose.
25. Connect the power steering return hose.
26. Install the A/C compressor, if equipped. Refer to "**COMPRESSOR REMOVAL AND INSTALLATION** :".
27. Install the serpentine accessory drive belt. Refer to "**SERPENTINE ACCESSORY DRIVE BELT REMOVAL AND INSTALLATION** :".
28. Install the right front wheel well splash shield.
29. Install the right front wheel. Refer to "**WHEEL REMOVAL AND INSTALLATION** :".
30. Connect the fuel feed line to the fuel rail.
31. Connect the fuel return line to fuel rail.
32. Install the fuel rail and injector channel cover as an assembly. Refer to "**FUEL RAIL AND INJECTORS REMOVAL AND INSTALLATION** :".

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.
40. Connect the IAC valve connector.
41. Connect the MAP sensor connector.
42. Connect the knock sensor, if necessary.

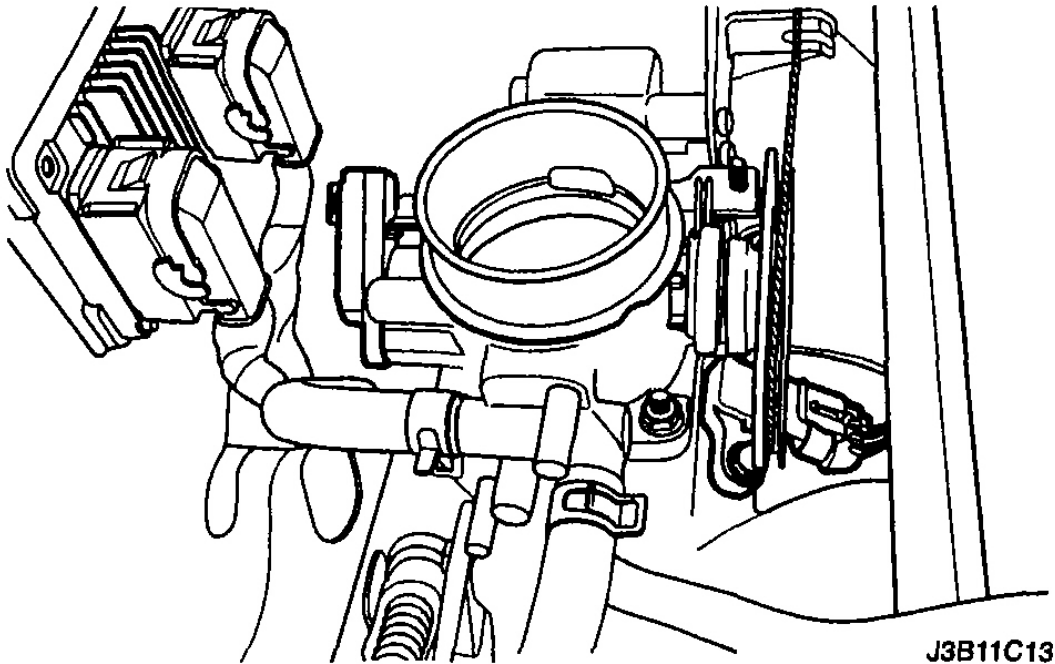


Fig. 114: Connecting TPS Connector
Courtesy of SUZUKI OF AMERICA CORP.

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.
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** :".

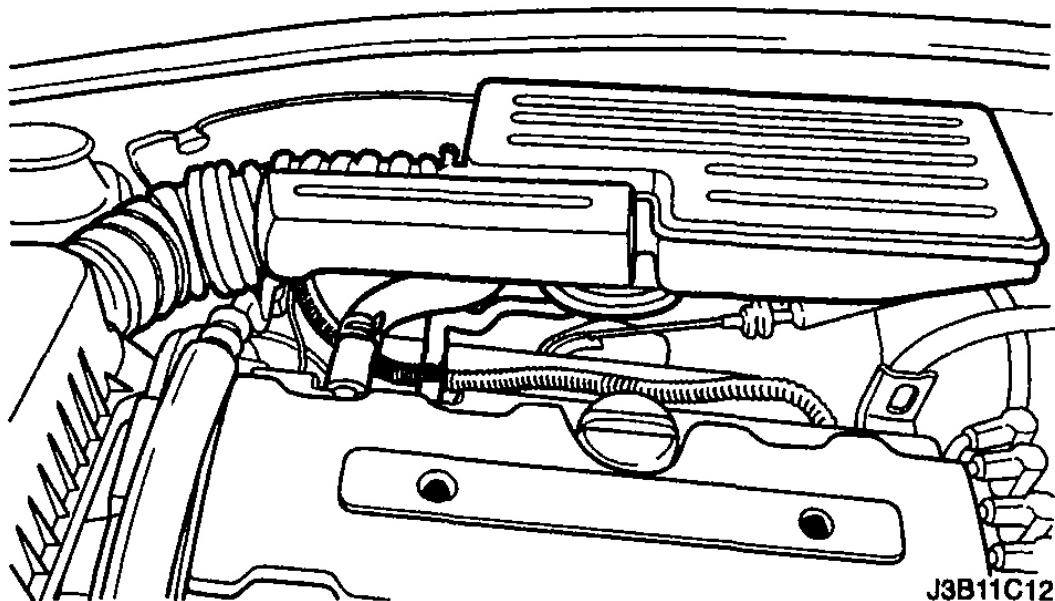


Fig. 115: Connecting Breather Tubes To Camshaft Cover
Courtesy of SUZUKI OF AMERICA CORP.

48. Connect the lower radiator hose to the coolant pipe.
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.

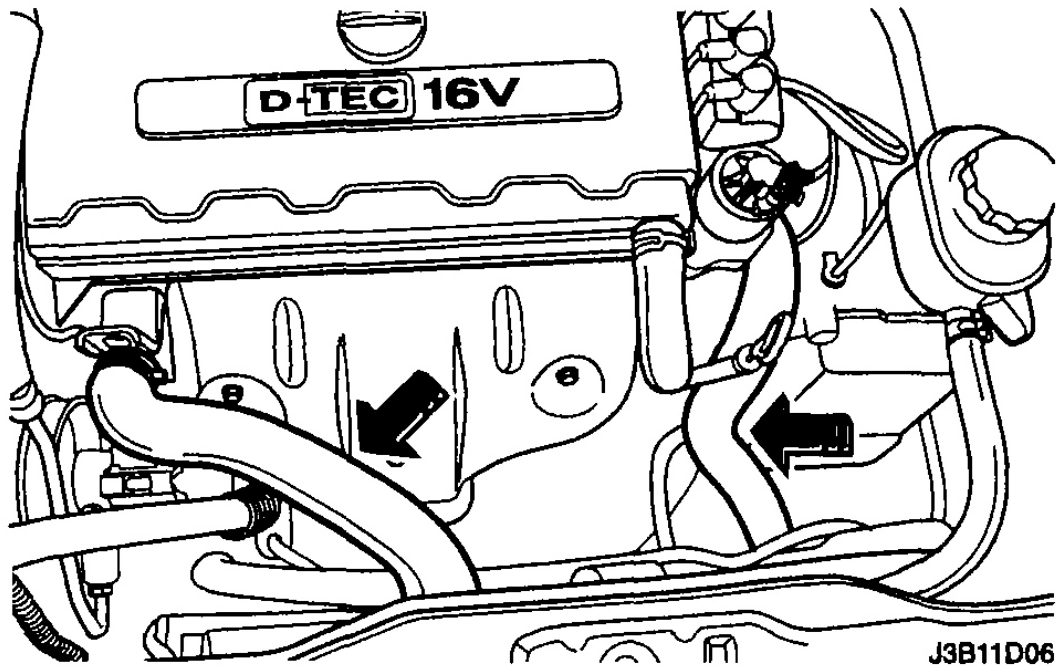


Fig. 116: Connecting Hoses

Courtesy of SUZUKI OF AMERICA CORP.

54. Connect the throttle cable to the throttle body and the intake manifold bracket.
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. Refer to "**HOOD REMOVAL AND INSTALLATION** :".

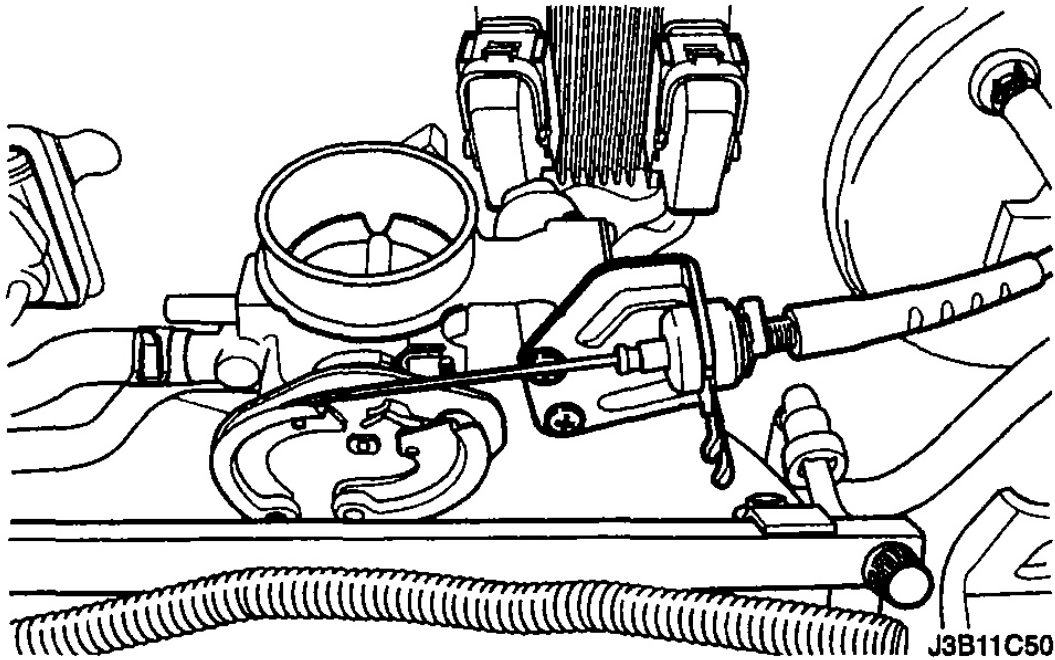


Fig. 117: Connecting Throttle Cable To Throttle Body
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS AND RODS REMOVAL AND INSTALLATION

Tools Required

J-8037 Universal Piston Ring Compressor

J-8087 Cylinder Bore Check Gauge

KM-427 Piston Pin Service Set

KM-470-B Angular Torque Gauge

Removal

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

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

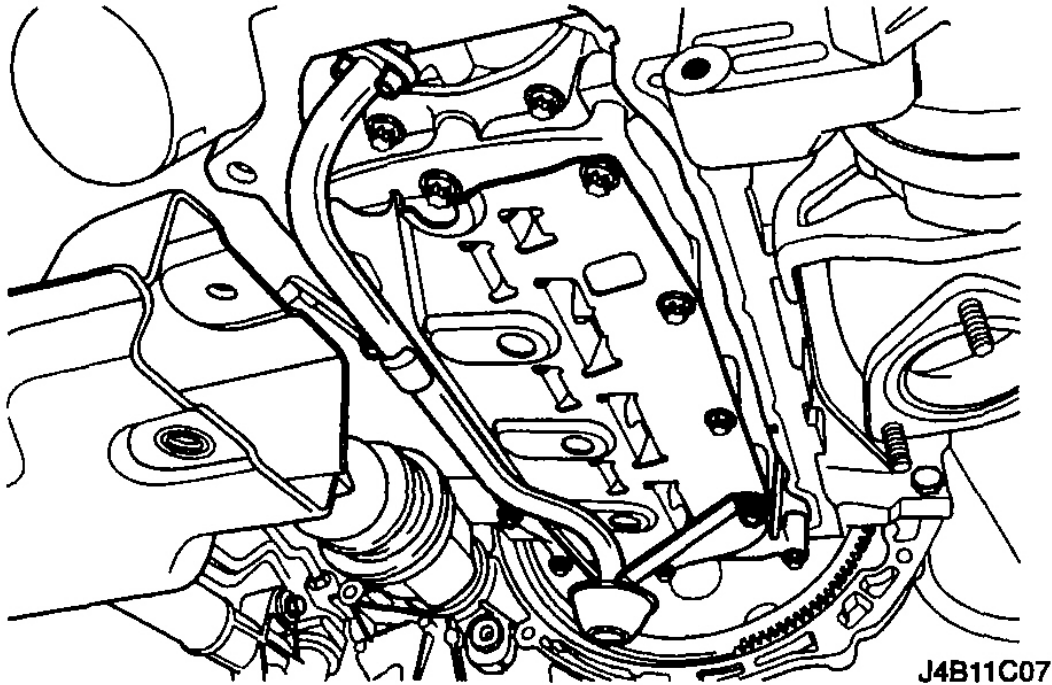
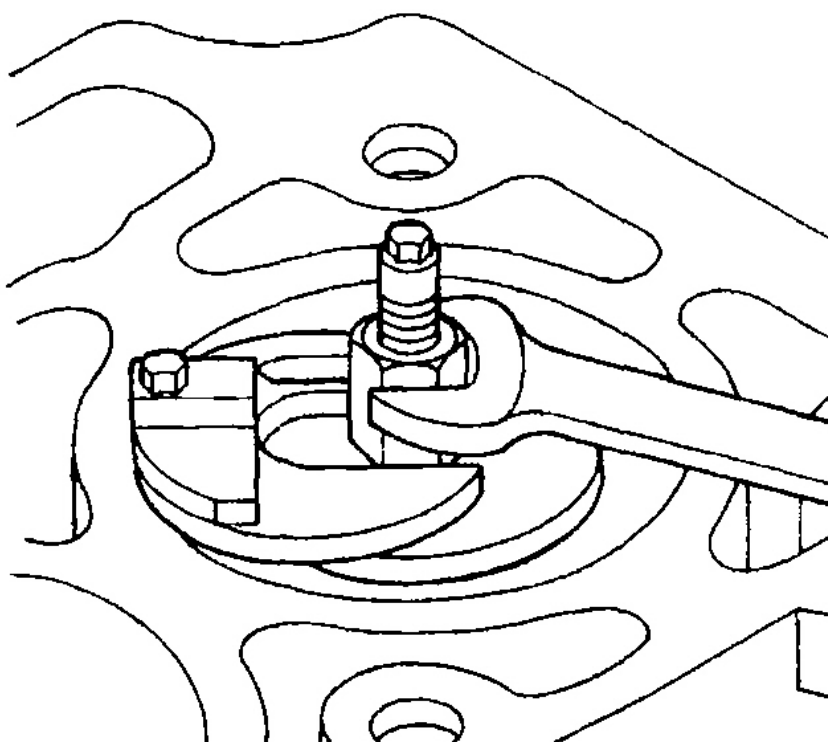


Fig. 118: Removing Crankshaft Bearing Bridge And Oil Pan Scraper
Courtesy of SUZUKI OF AMERICA CORP.

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

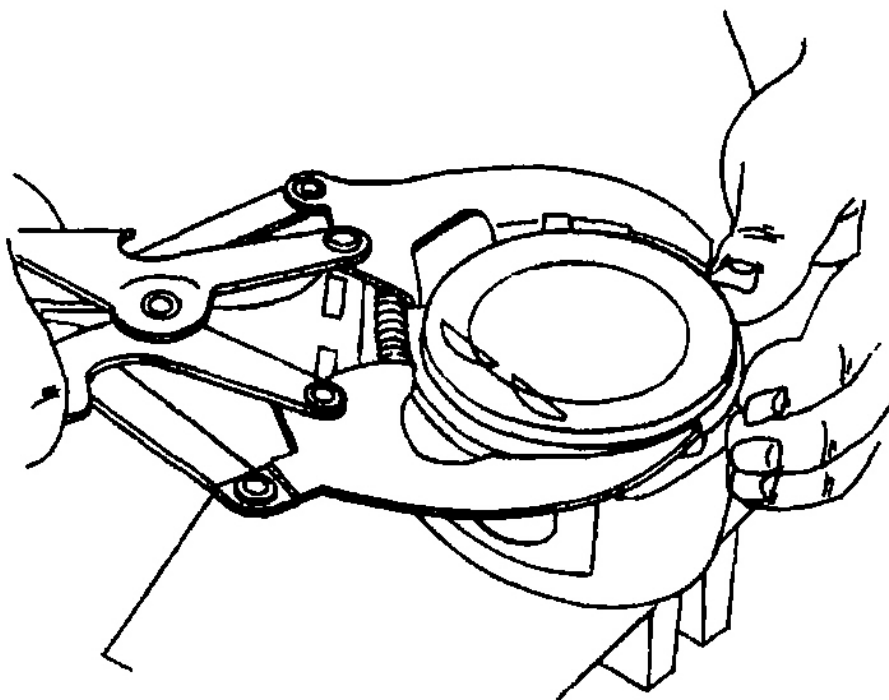


J3B11C59

Fig. 119: Reaming 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.
15. Remove the piston rings.

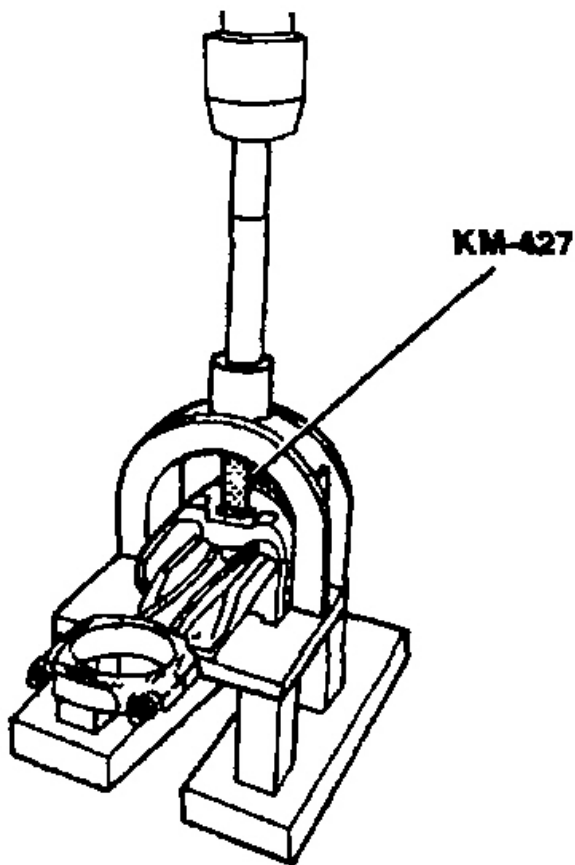


J3B11C60

Fig. 120: Removing Piston Rings

Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C61

Fig. 121: Removing Piston Pin From Piston And Connecting Rod Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Installation

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

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

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

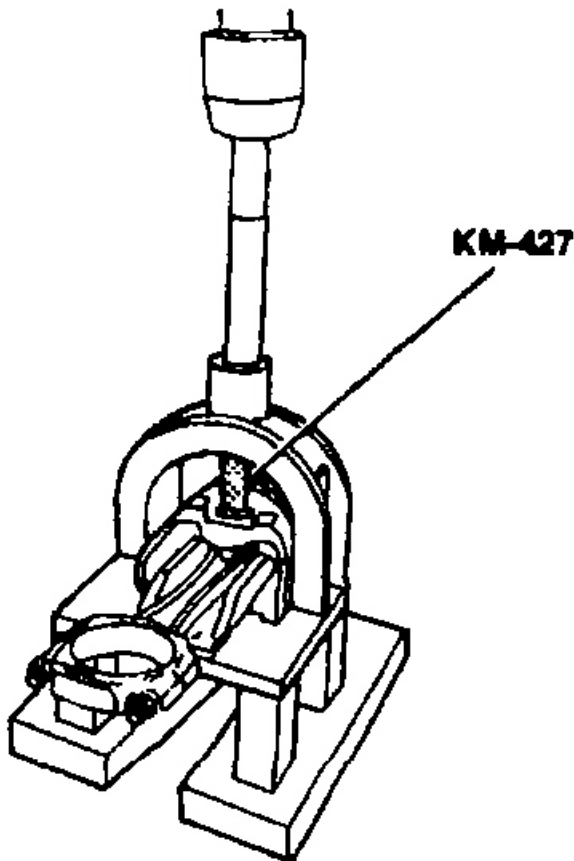
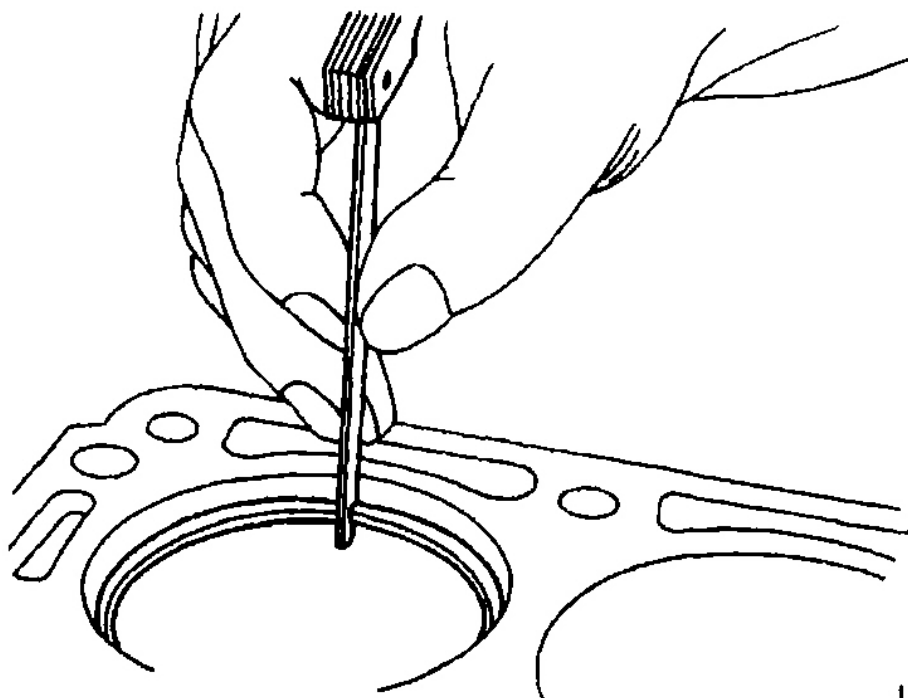
**J3B11C61**

Fig. 122: Installing Piston Pin Guide Through Piston And Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C65

Fig. 123: Measuring Piston Ring Gap Using Feeler Gauge
Courtesy of SUZUKI OF AMERICA CORP.

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

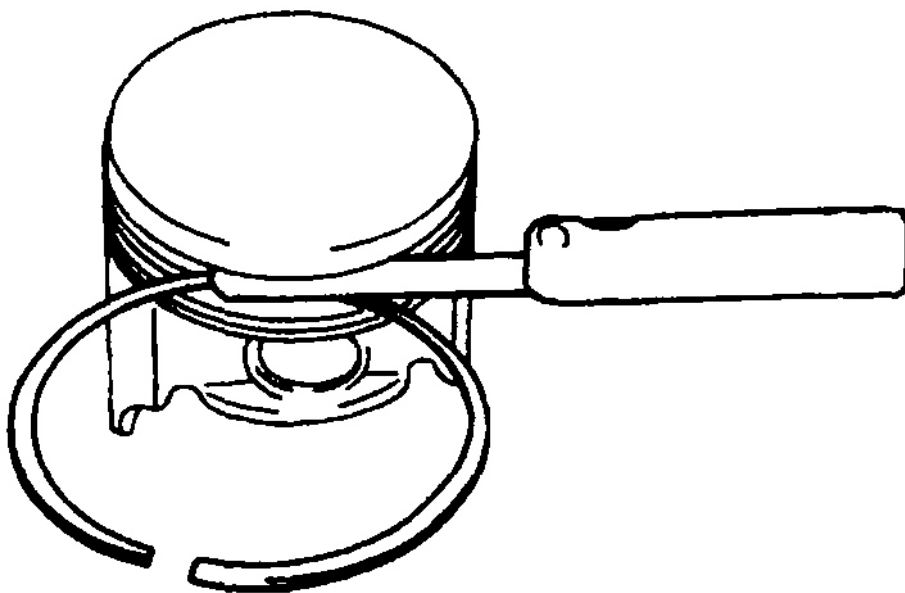
**J3B11C66**

Fig. 124: Measuring Piston Ring Side Clearance Using Feeler Gauge
Courtesy of SUZUKI OF AMERICA CORP.

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

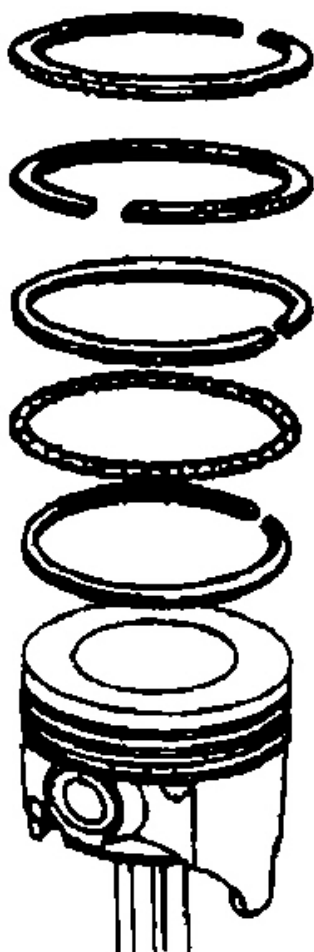
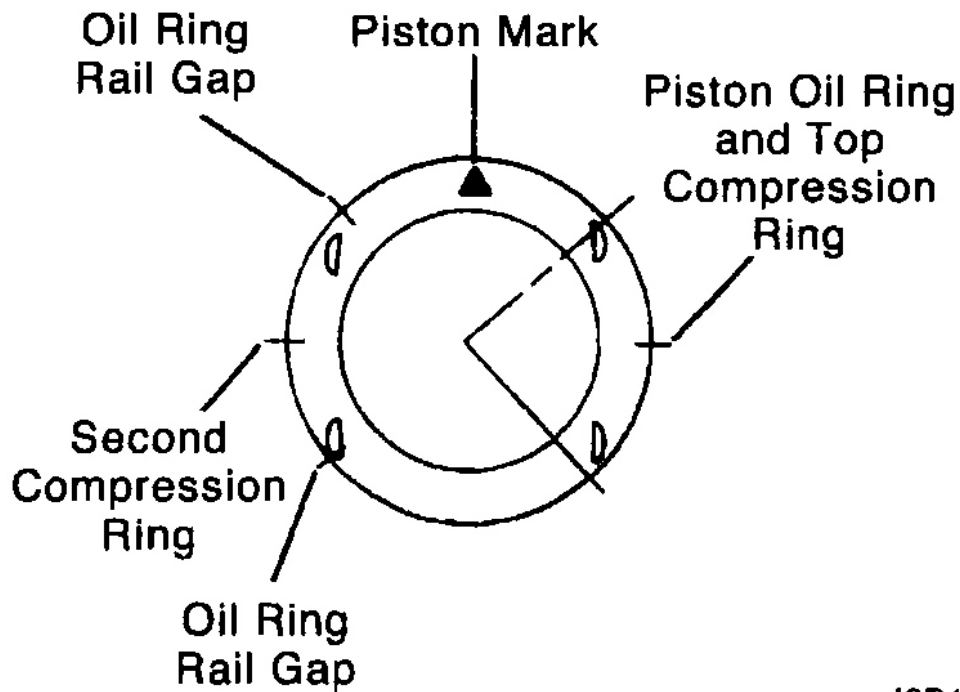
**J3B11C67**

Fig. 125: Installing 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.



J3B11C68

Fig. 126: Identifying Piston Ring Installing Position
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:**".

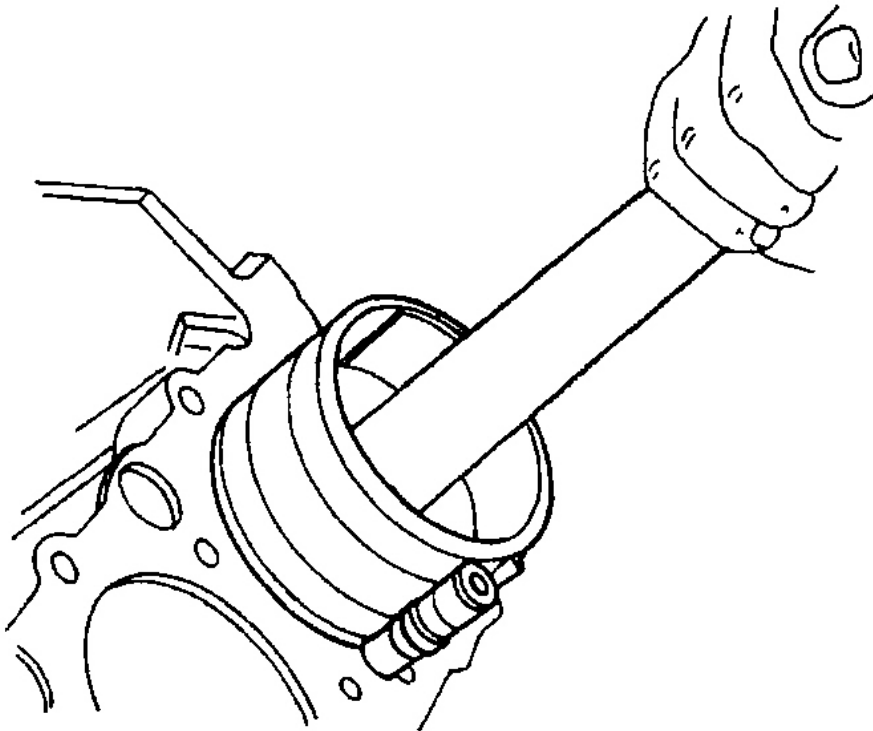
**J3B11C69**

Fig. 127: Installing 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.

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.

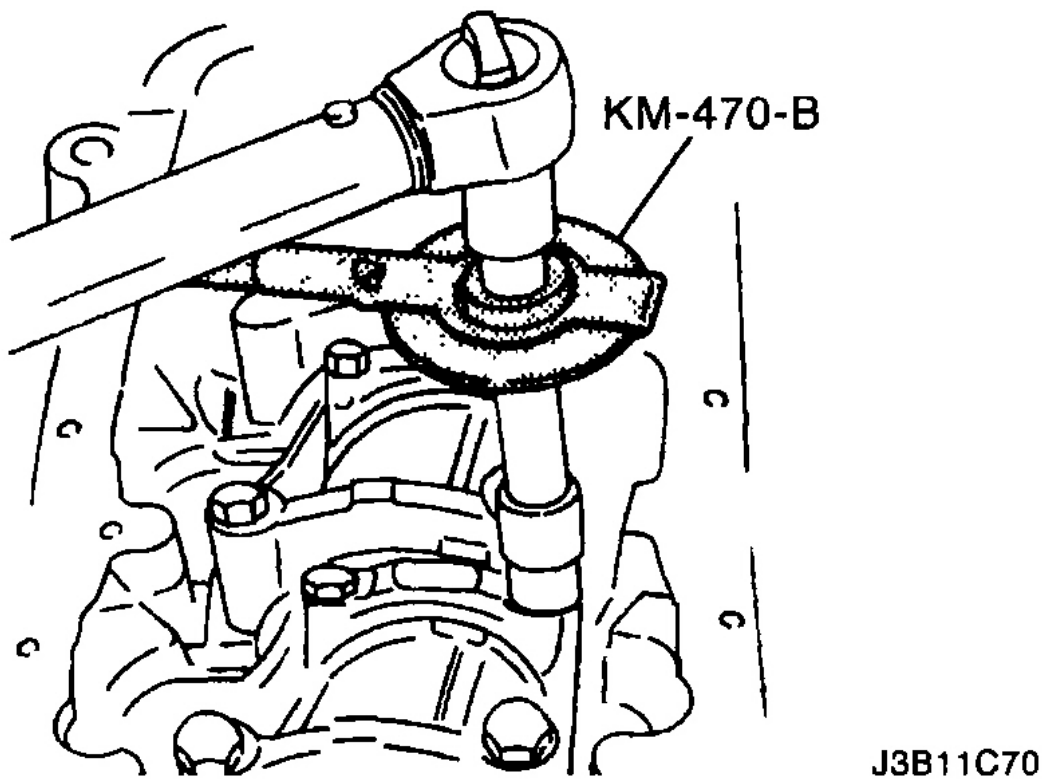


Fig. 128: Tightening Connecting Rod Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

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

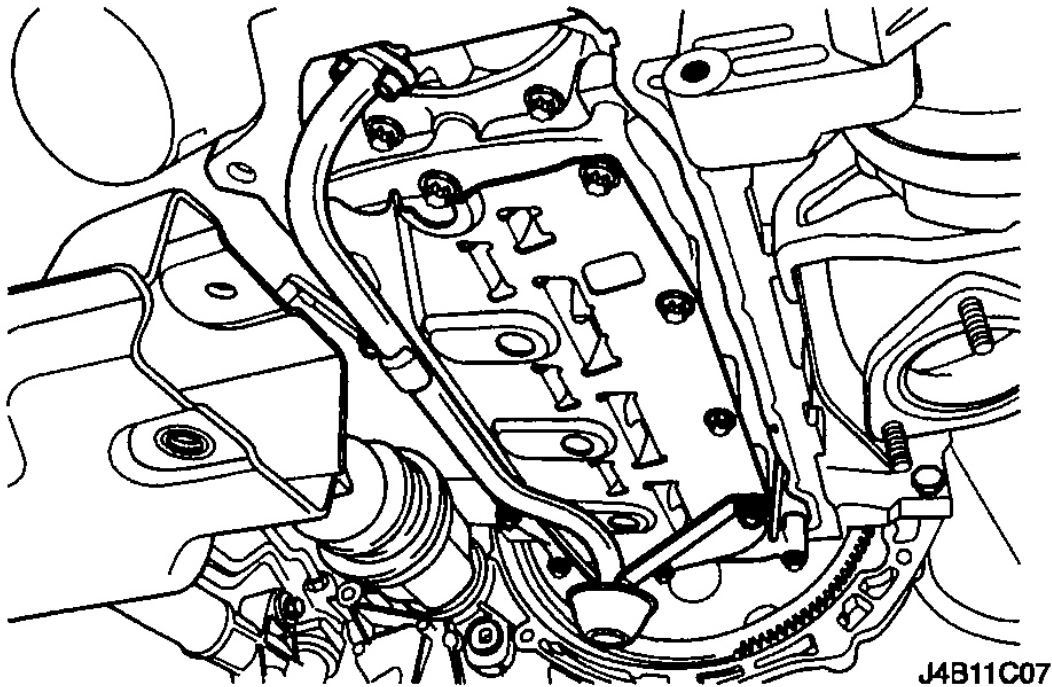
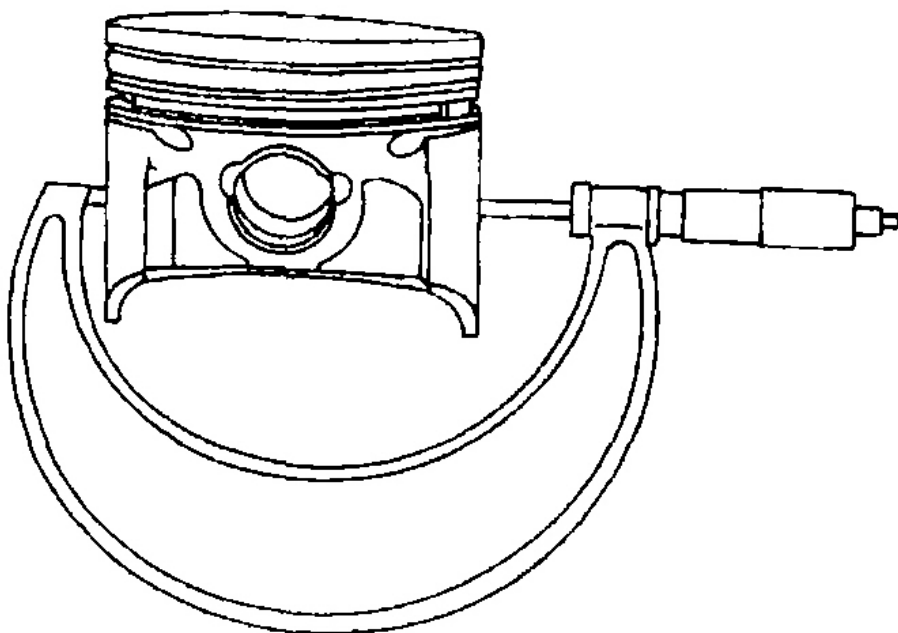


Fig. 129: Tightening Oil Suction Pipe Bolts
Courtesy of SUZUKI OF AMERICA CORP.

PISTONS AND RODS INSPECTION

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



J3B11C62

Fig. 130: Inspecting Piston For Taper Using Micrometer
Courtesy of SUZUKI OF AMERICA CORP.

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

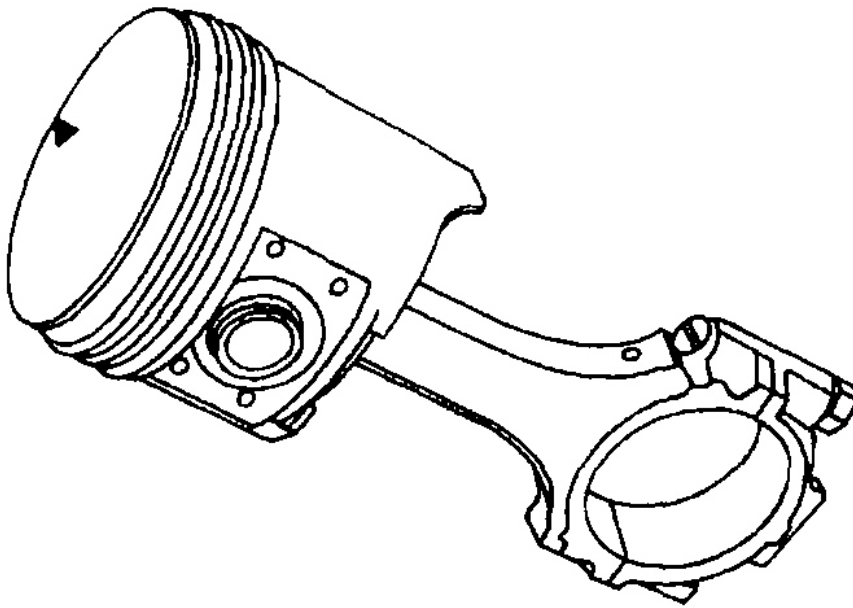
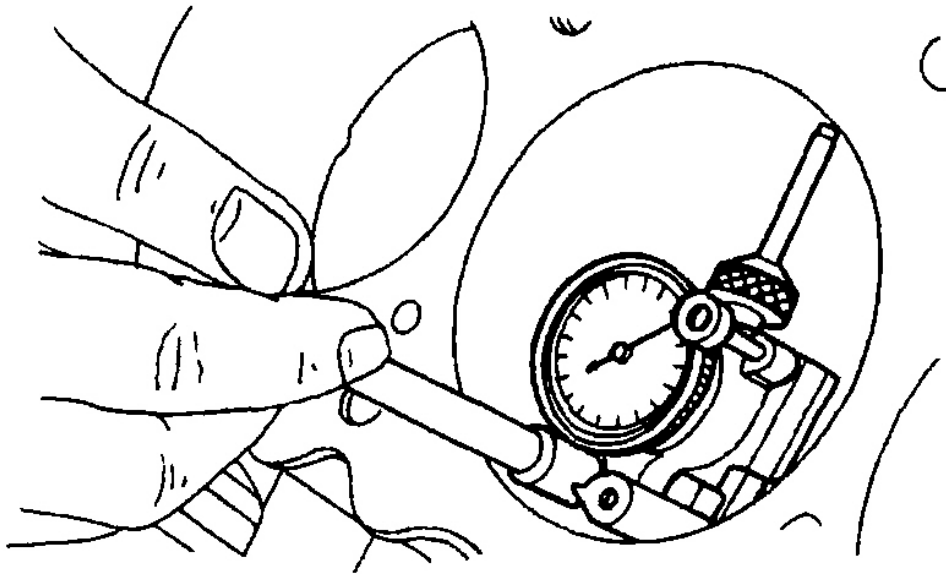
**J3B11C63**

Fig. 131: Inspecting Piston For Fit To Connecting Rod
Courtesy of SUZUKI OF AMERICA CORP.

9. Inspect the engine block deck surface for flatness using a straight edge and a feeler gauge. Refer to "**ENGINE SPECIFICATIONS**".
10. Inspect the bearing bore for concentricity and alignment using cylinder bore check gauge J-8087. Refer to "**ENGINE SPECIFICATIONS**". If the bearing bore is beyond specifications, replace the engine block.
11. Inspect the engine block cylinder bore for wear, runout, ridging and taper using a bore gauge. Refer to "**ENGINE SPECIFICATIONS**".
12. Inspect the engine block cylinder bore for glazing. Lightly hone the cylinder bore as necessary.



J3B11C64

Fig. 132: Inspecting Engine Block Cylinder Bore
Courtesy of SUZUKI OF AMERICA CORP.

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

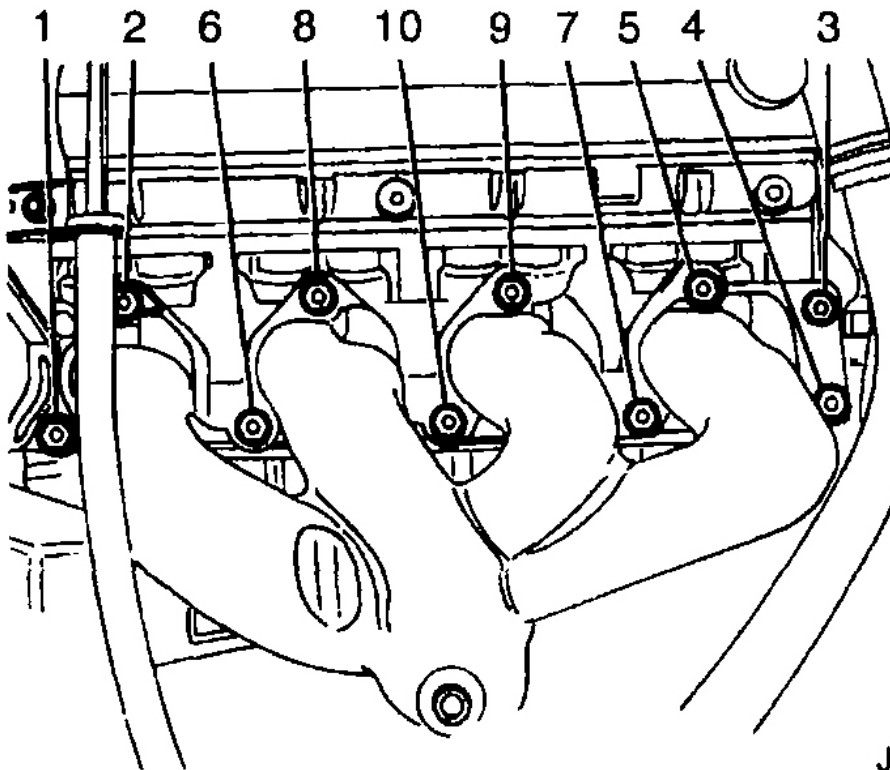
KM-348 Valve Spring Compressor

KM-653 Adapter

KM-805 Valve Guide Reamer

Disassembly

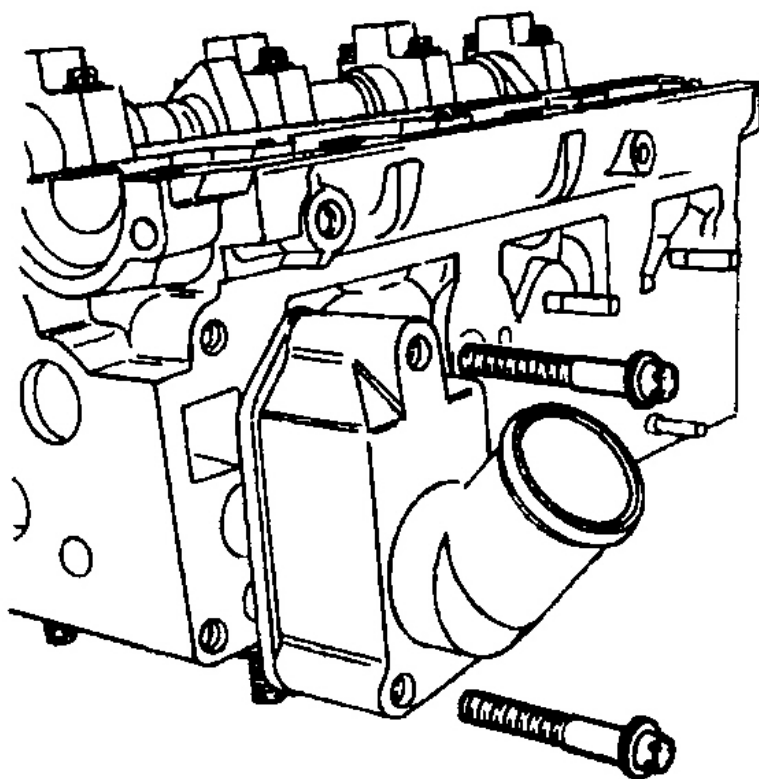
1. Remove the cylinder head with the intake manifold and the exhaust manifold attached. Refer to "**CYLINDER HEAD AND GASKET REMOVAL AND INSTALLATION**".
2. Remove the exhaust manifold heat shield bolts.
3. Remove the exhaust manifold heat shield.
4. Remove the exhaust manifold retaining nuts in the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



J3B11C54

Fig. 133: Removing Exhaust Manifold Heat Shield Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C71

Fig. 134: Removing Coolant Bypass Housing Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

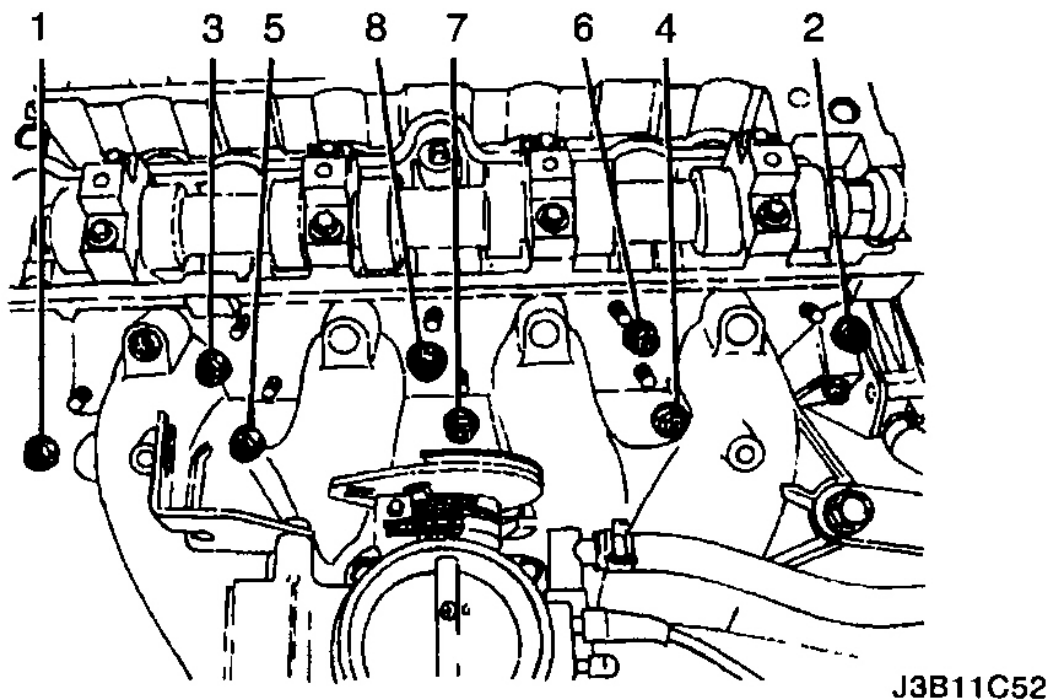


Fig. 135: Removing Intake Manifold Retaining Nuts And Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove the direct ignition system (DIS) coil and the exhaust gas recirculation (EGR) mounting bracket bolts.
16. Remove the DIS ignition coil and the EGR mounting bracket and ignition wires.
17. Remove the intake manifold studs.
18. Remove the spark plugs.

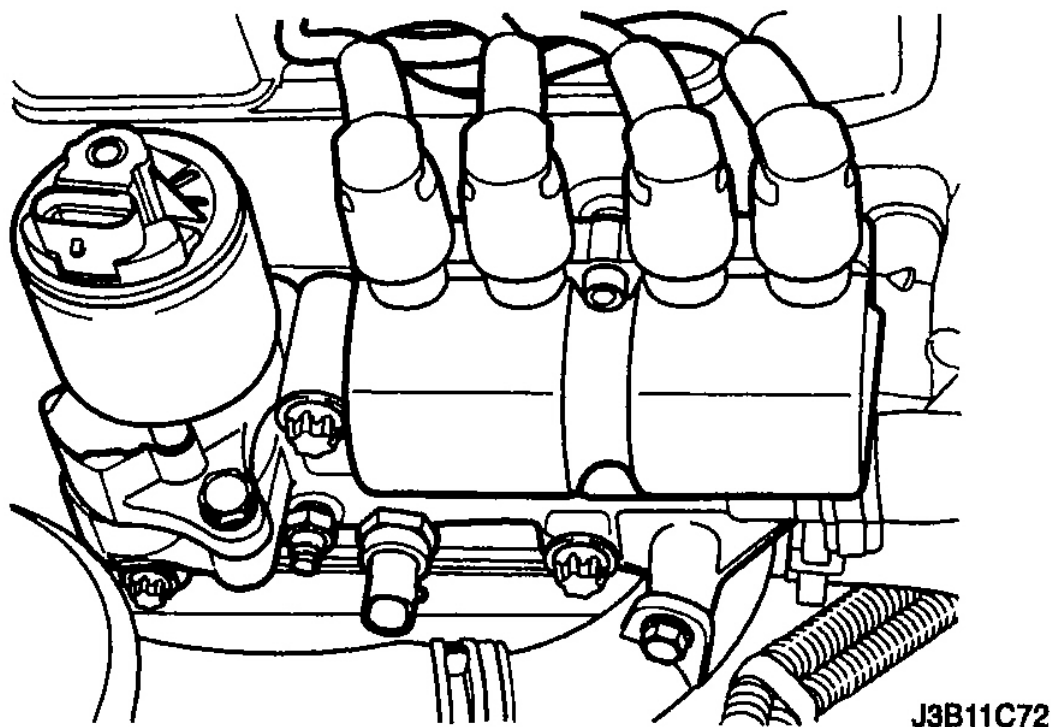


Fig. 136: Removing DIS Ignition Coil
Courtesy of SUZUKI OF AMERICA CORP.

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

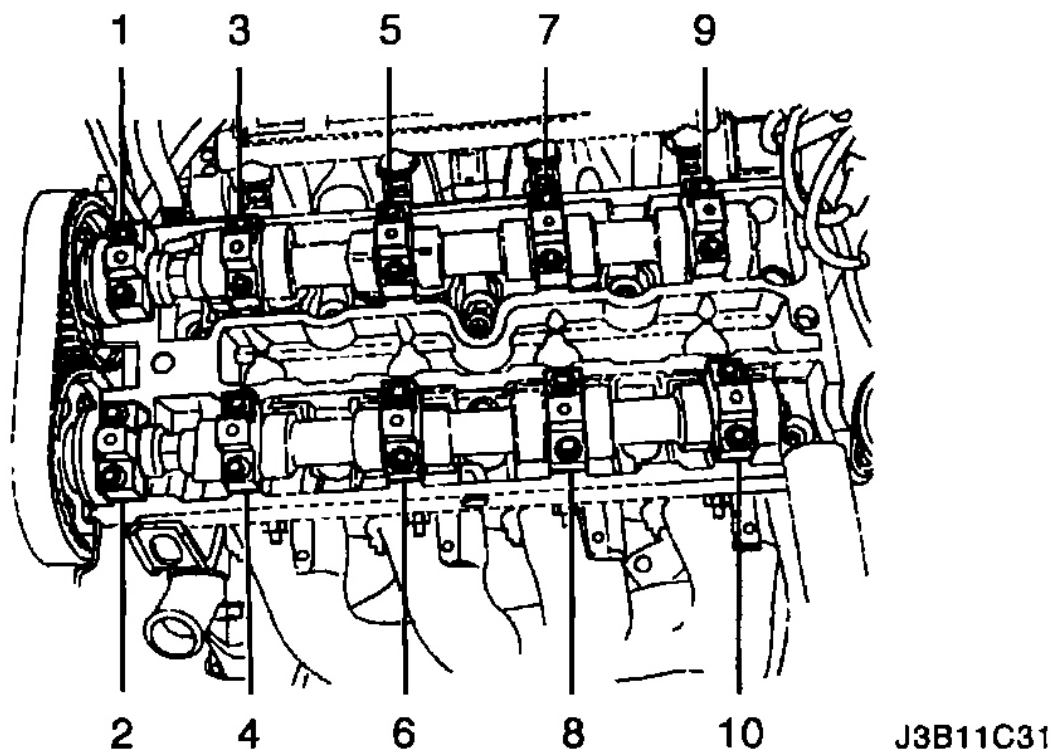
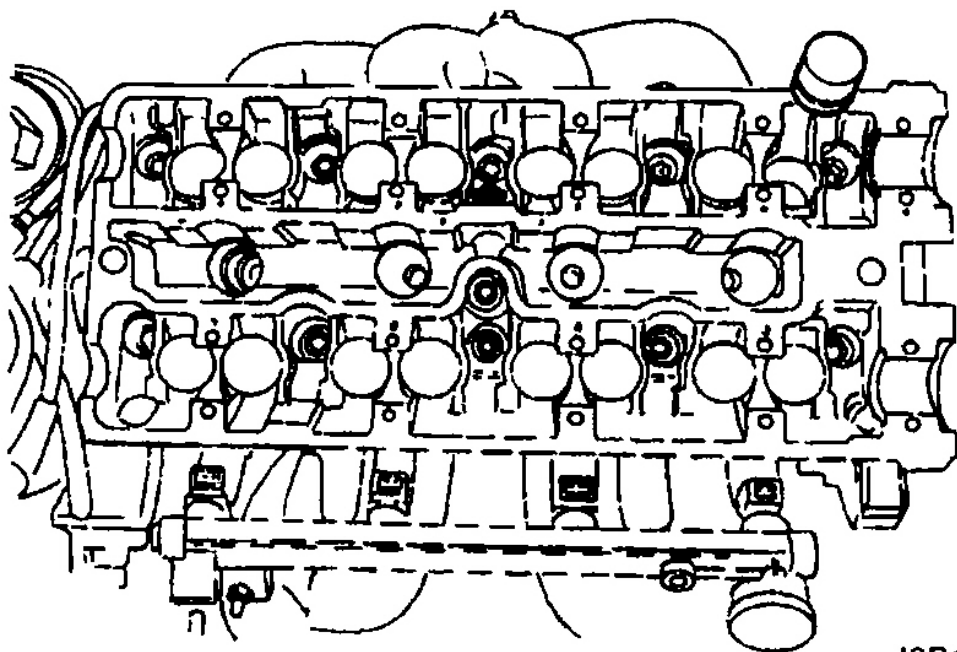


Fig. 137: Removing Camshaft Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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.



J3B11C73

Fig. 138: Removing 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.
27. Remove the valve retainers.
28. Remove the valve spring compressor KM-348 and the adapter KM-653.
29. Remove the valve spring caps.
30. Remove the valve springs. Maintain the original position of the valve springs for installation.

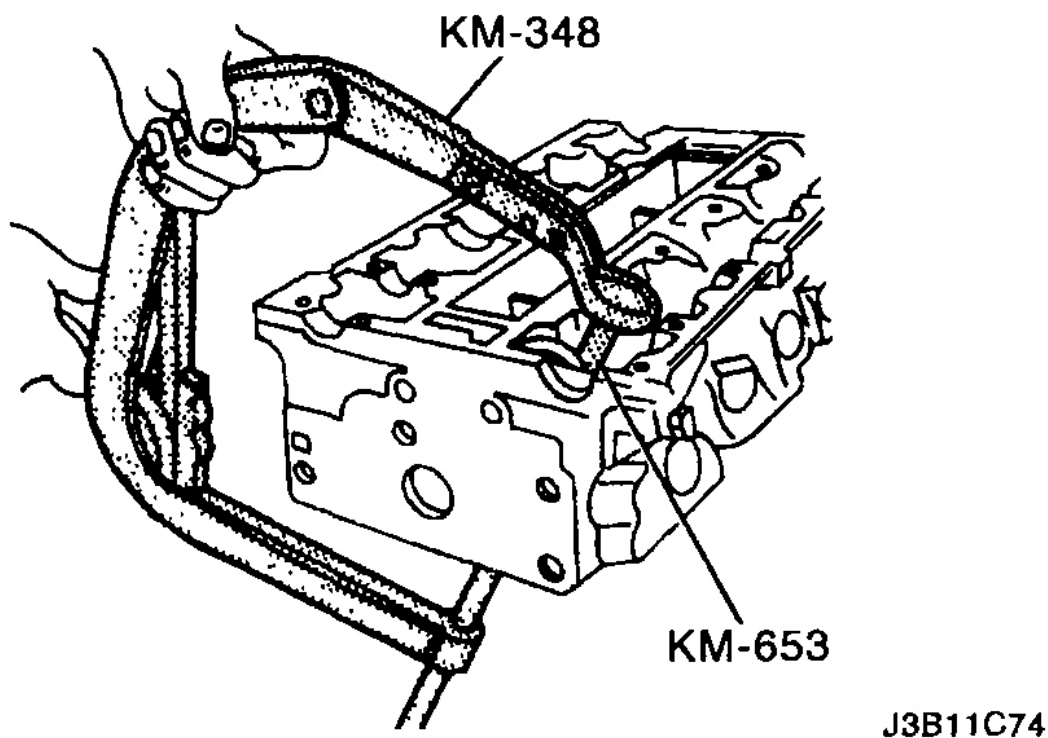
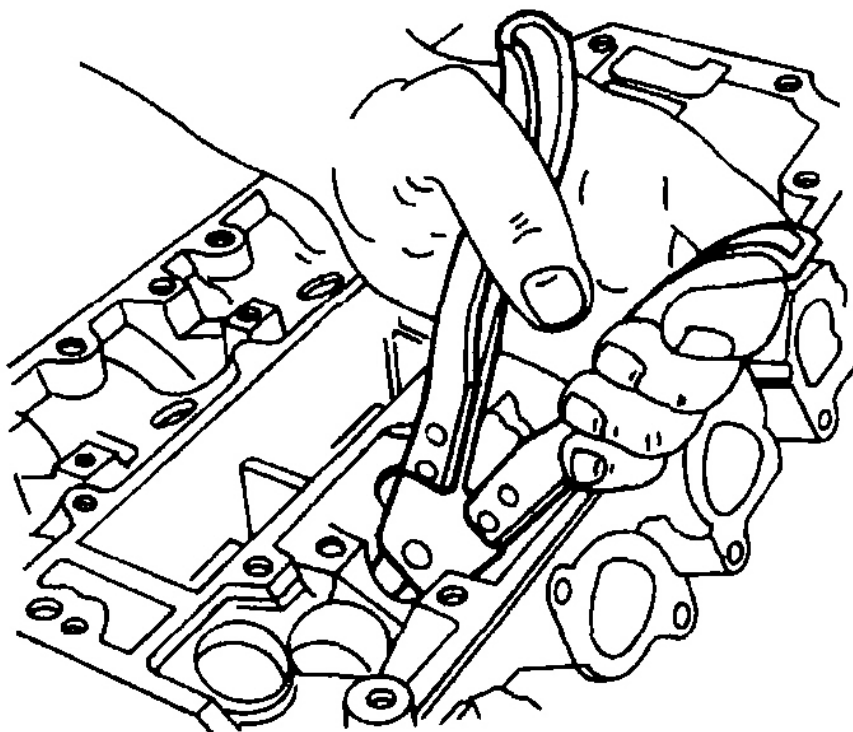


Fig. 139: Using Valve Spring Compressor
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C75

Fig. 140: Removing Valve Stem Seals
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

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

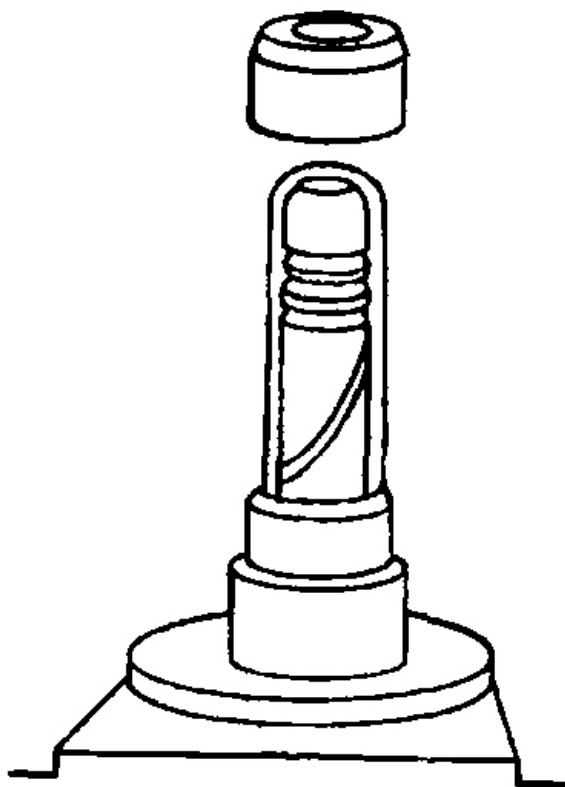
**J3B11C86**

Fig. 141: Installing Valve Components
Courtesy of SUZUKI OF AMERICA CORP.

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

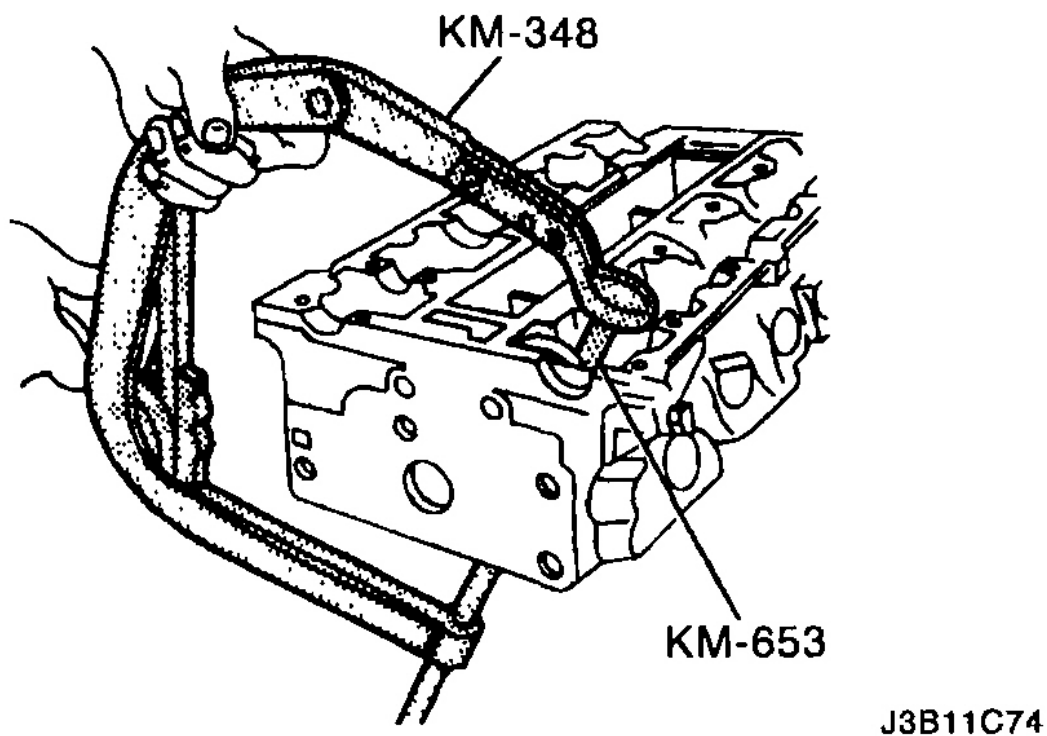
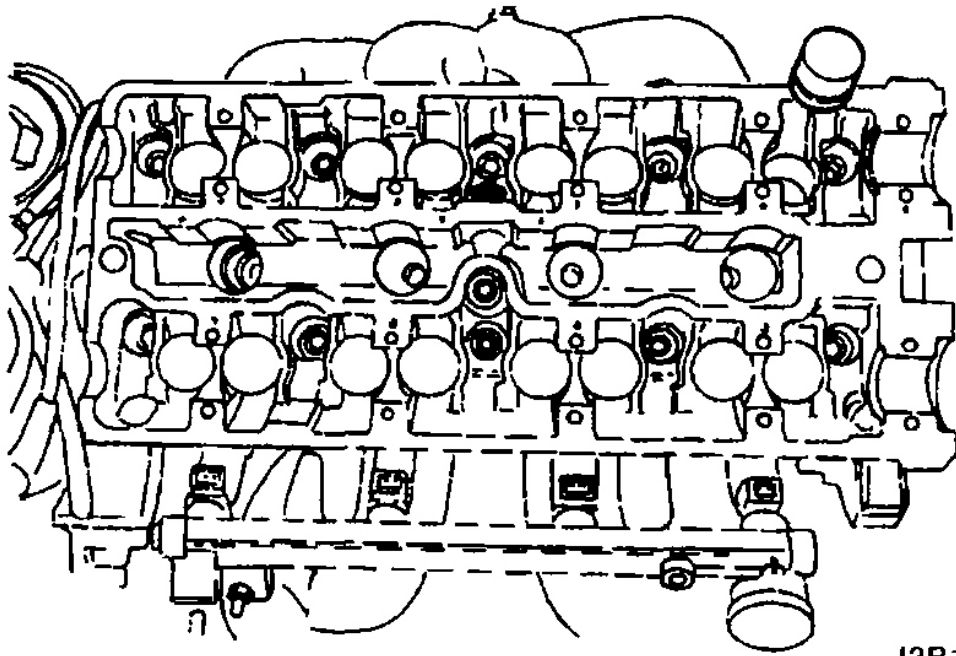


Fig. 142: Removing Valve Spring Compressor
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C73

Fig. 143: Installing 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 in illustration for each camshaft cap.

Tighten

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

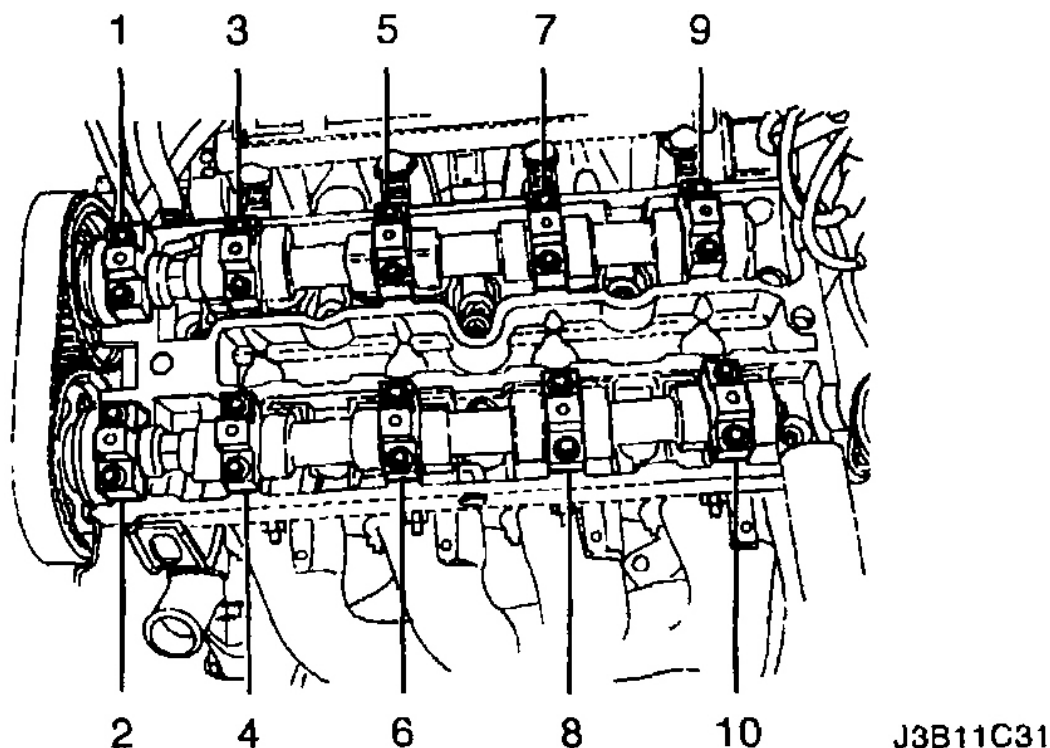


Fig. 144: Tightening Camshaft Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the spark plugs.

Tighten

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

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

Tighten

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

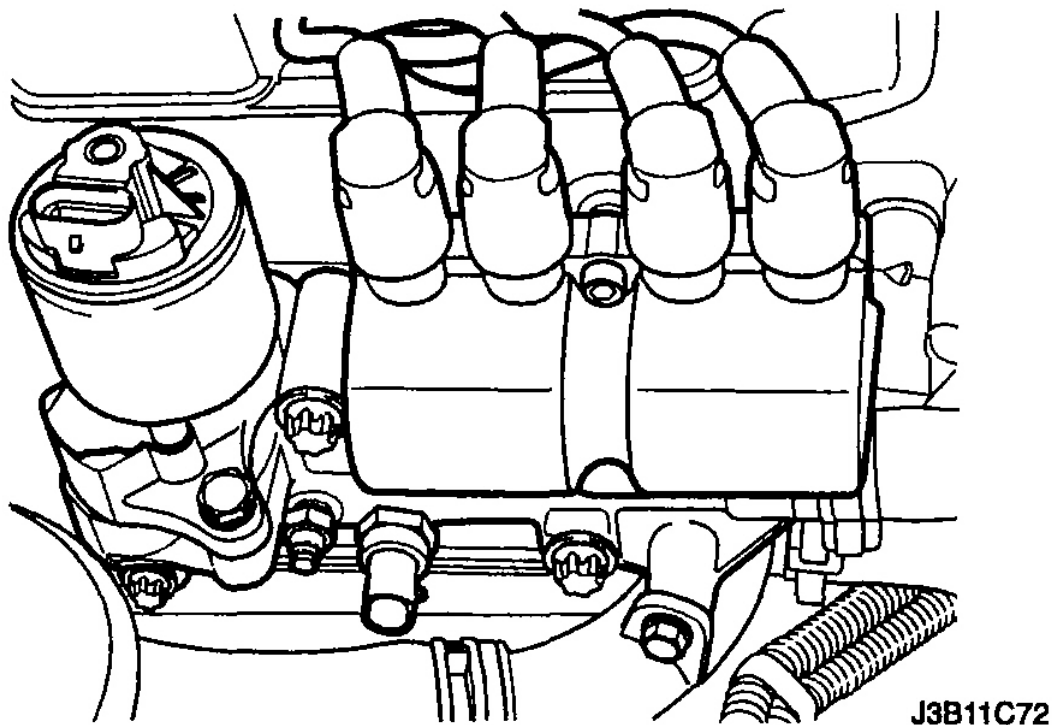


Fig. 145: Installing DIS Coil

Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

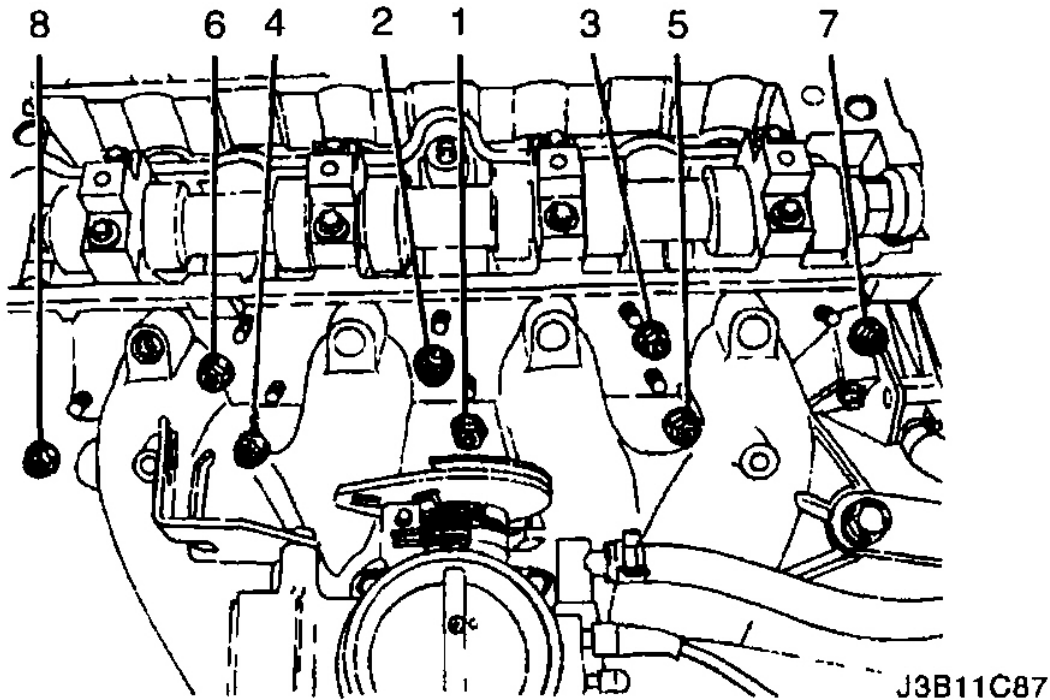


Fig. 146: Installing Intake Manifold Retaining Nuts And Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

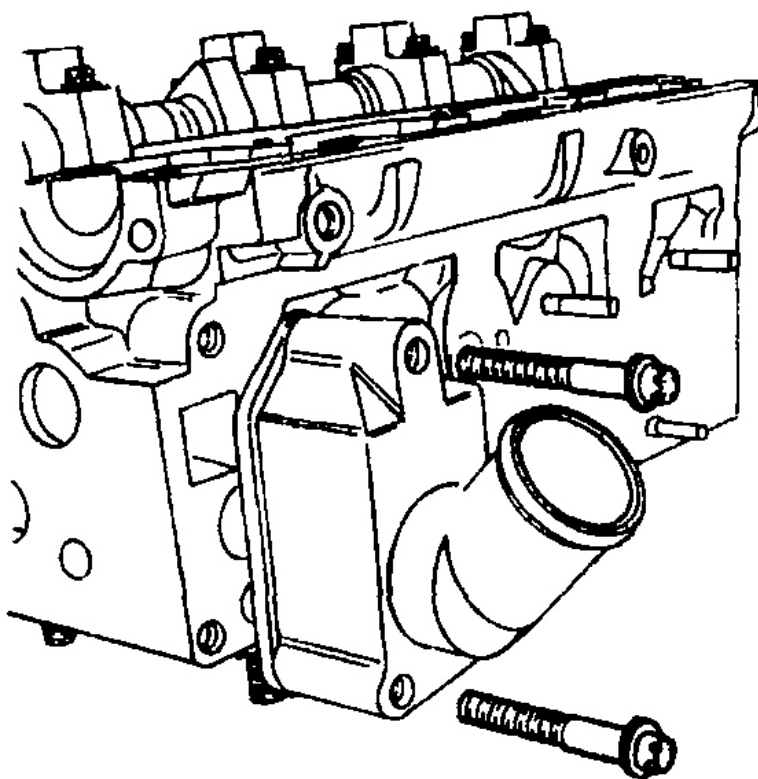
Tighten

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

30. Install the coolant bypass housing and mounting bolts.

Tighten

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



J3B11C71

Fig. 147: Installing Thermostat Housing Mounting Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

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

Tighten

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

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

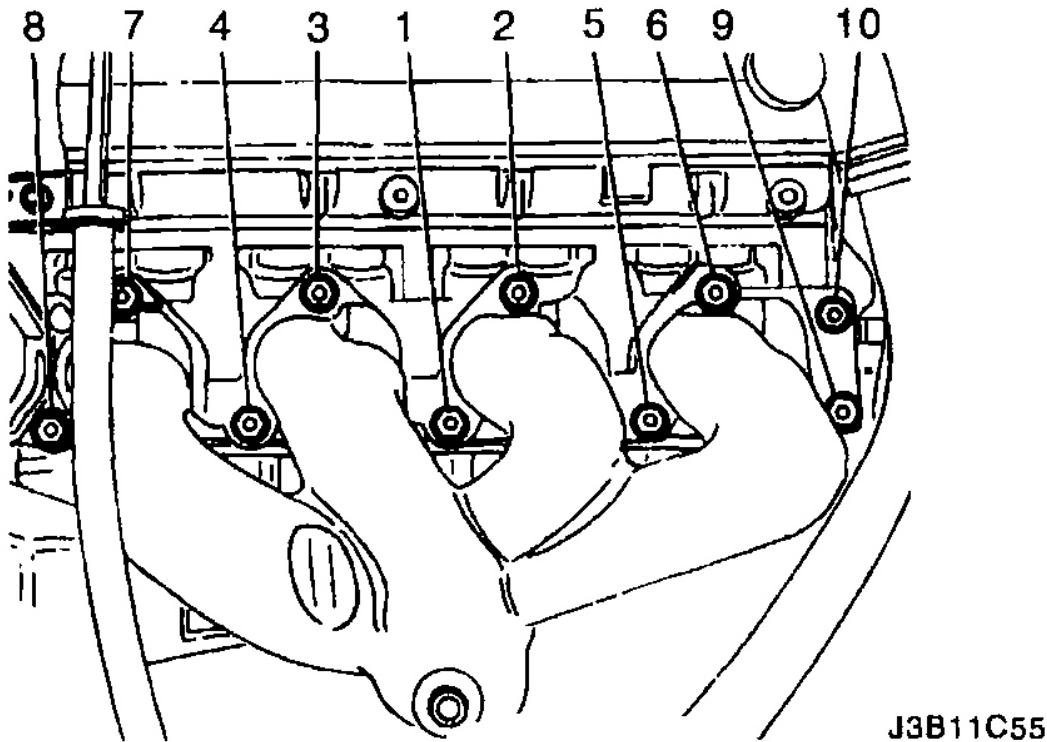
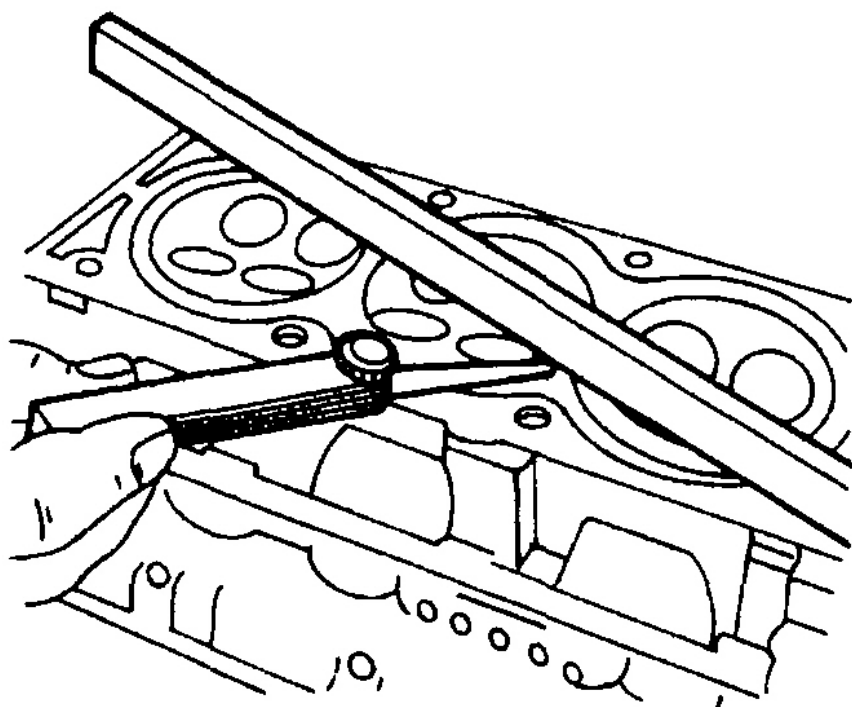


Fig. 148: Tightening Exhaust Manifold Heat Shield Bolts
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD INSPECTION

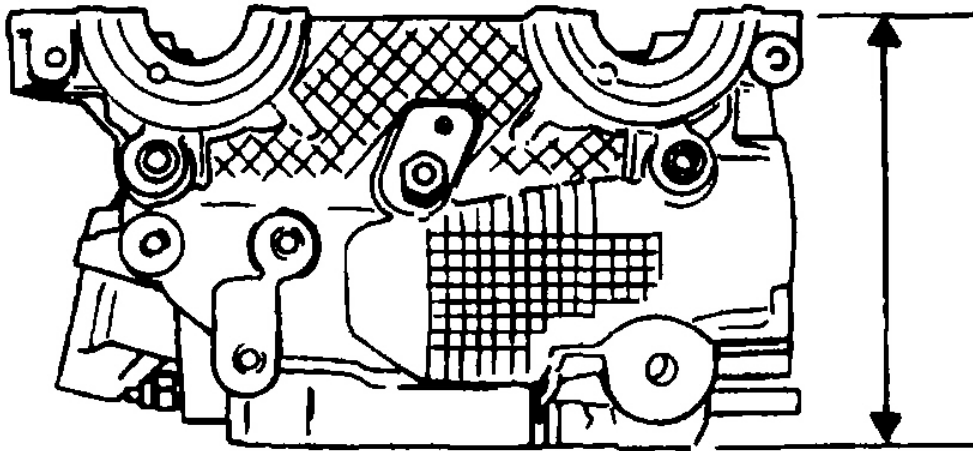
1. Clean the sealing surfaces.
2. Inspect the cylinder head gasket and mating surfaces for leaks, corrosion, and blowby.
3. Inspect the cylinder head for cracks.
4. Inspect the length and the width of the cylinder head using a feeler gauge and a straight edge.
5. Check the sealing surfaces for deformation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



J3B11C76

Fig. 149: Inspecting Cylinder Head For Warpage
Courtesy of SUZUKI OF AMERICA CORP.

6. Measure the height of the cylinder head from sealing surface to sealing surface. The cylinder head height should be 133.975 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.
7. Inspect all threaded holes for damage.
8. Inspect valve seats for excessive wear and burned spots.



J3B11C77

Fig. 150: Measuring Height Of Cylinder Head From Sealing Surface To Sealing Surface
Courtesy of SUZUKI OF AMERICA CORP.

VALVE INSPECTION

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

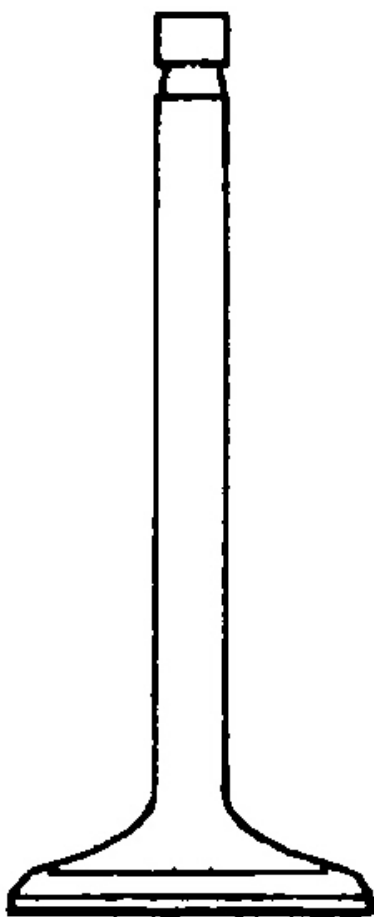
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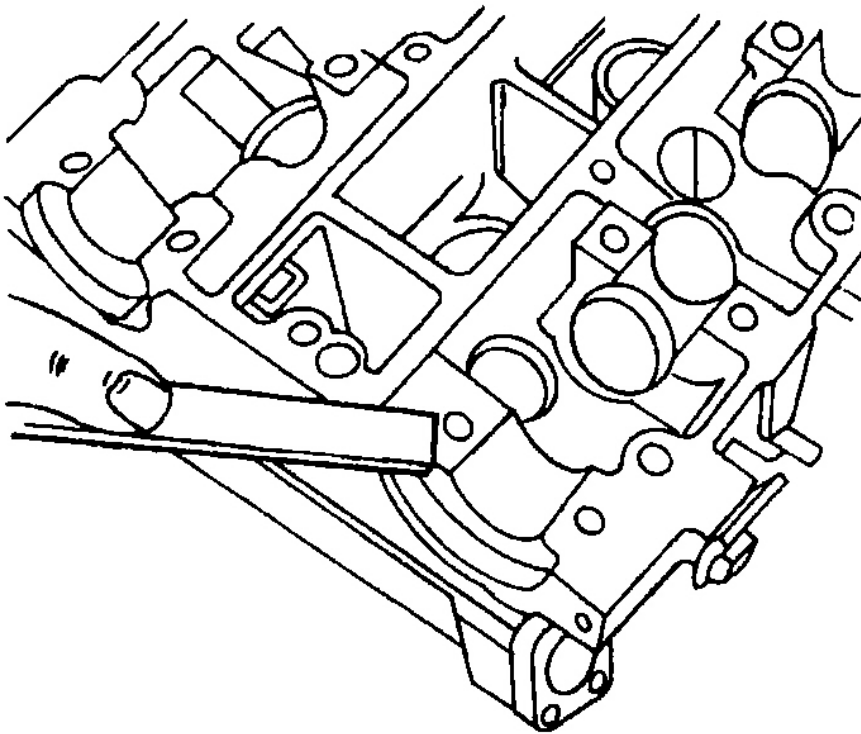
Fig. 151: Inspecting Valve Stem

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



J3B11C79

Fig. 152: Cleaning Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD OVERHAUL

Valve Grind-in

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

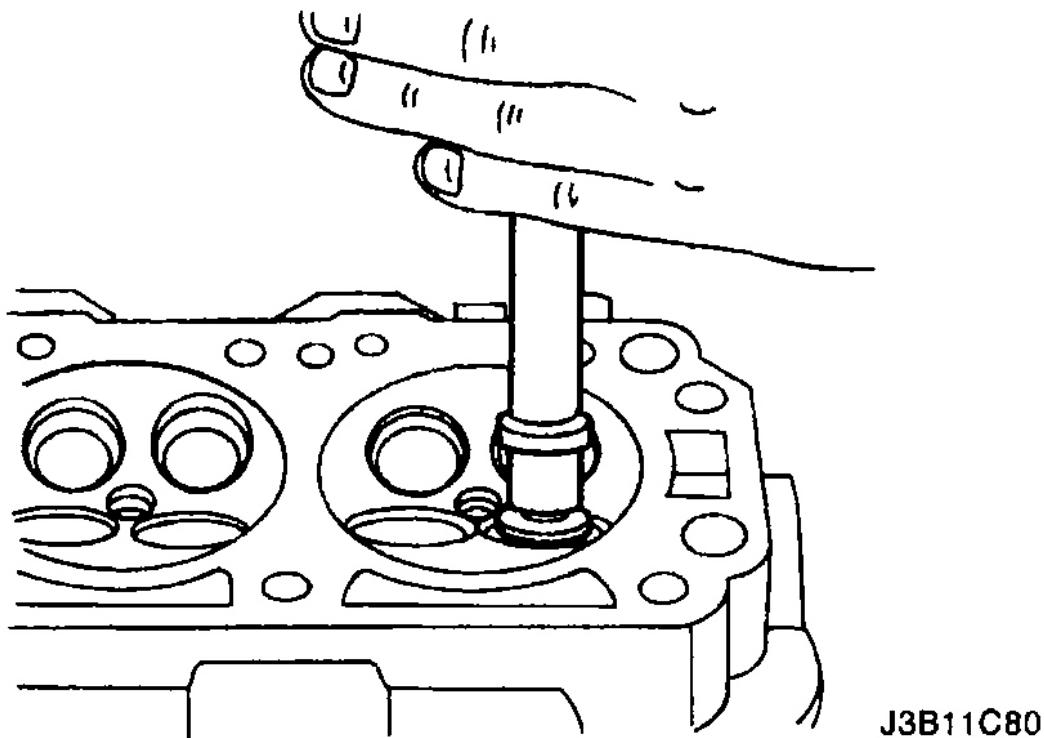
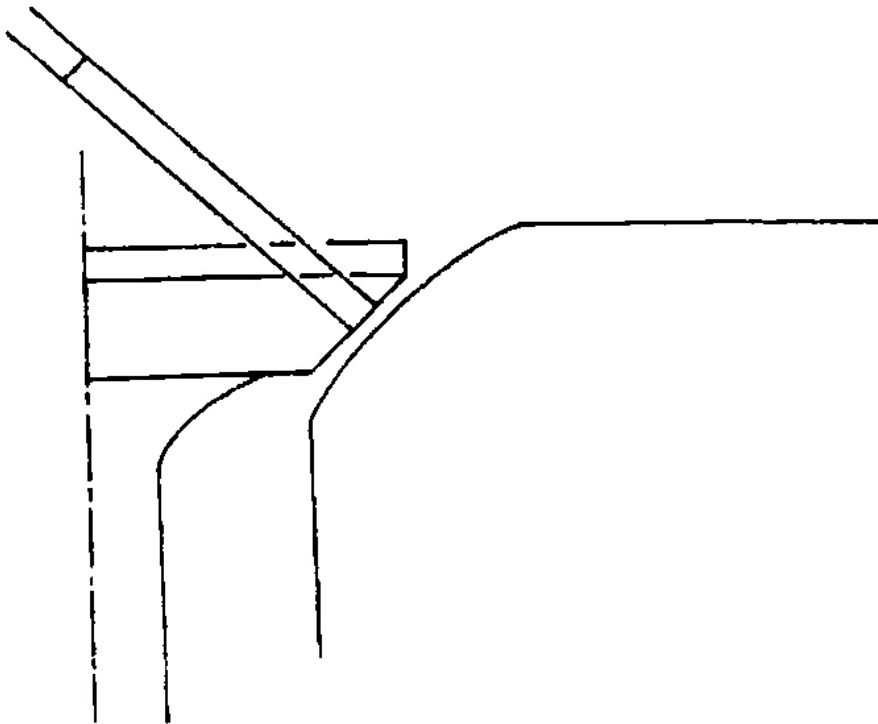


Fig. 153: Checking Valve Contact Pattern
 Courtesy of SUZUKI OF AMERICA CORP.

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.

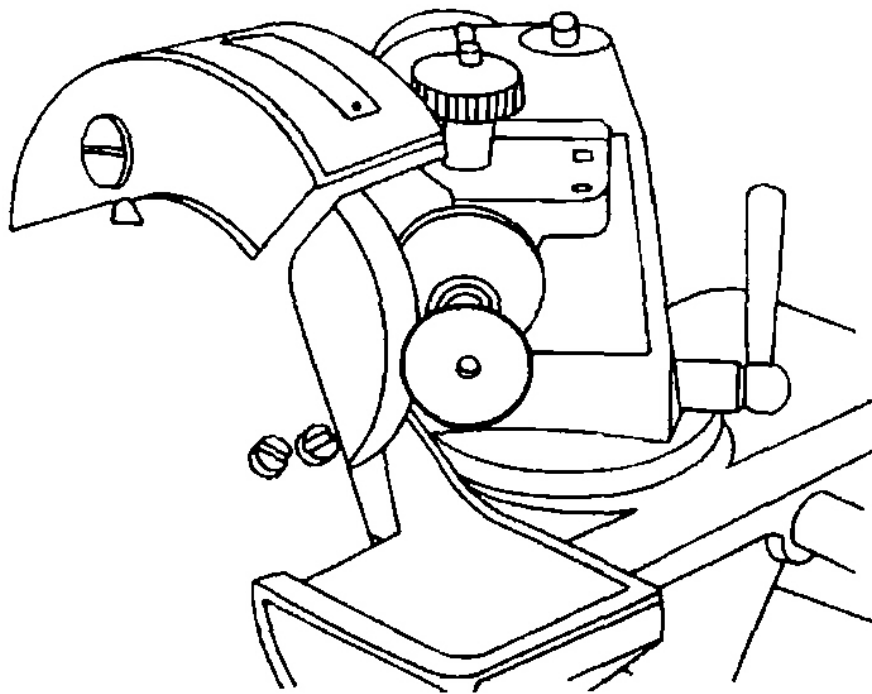
Valve Grind

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.



J3B11C81

Fig. 154: Valve Angle
Courtesy of SUZUKI OF AMERICA CORP.



J3B11C82

Fig. 155: Grinding Valve
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.

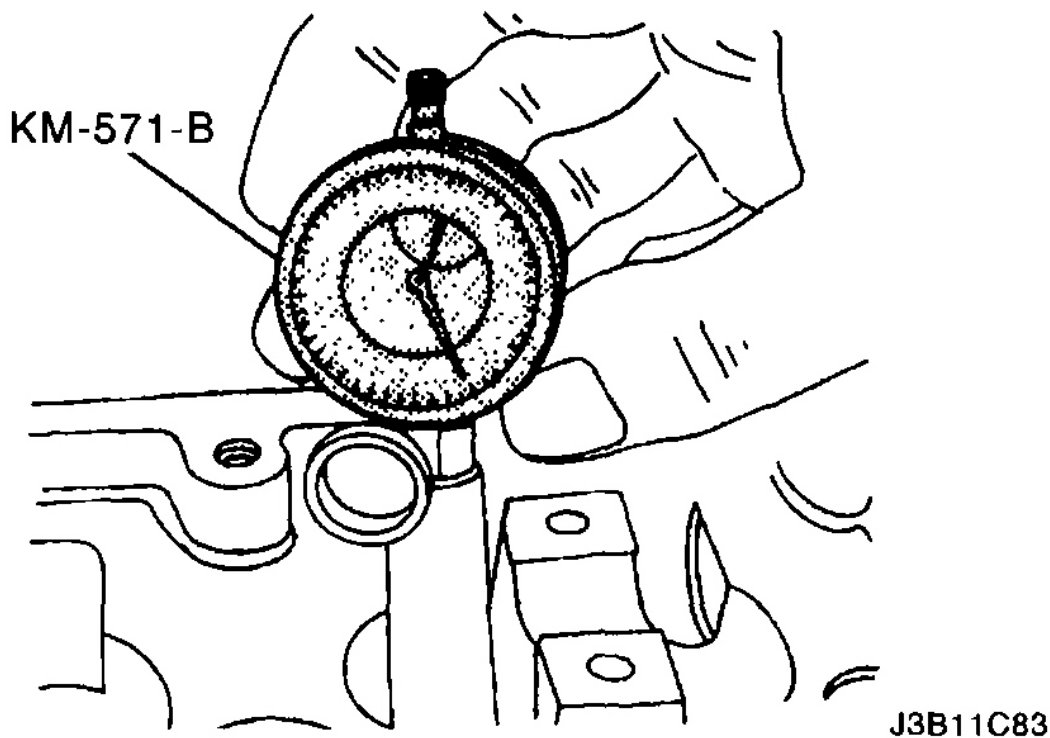


Fig. 156: Measuring Diameter Of Valve Guide
Courtesy of SUZUKI OF AMERICA CORP.

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.

OVERSIZE SERVICE CODE CHART

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

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

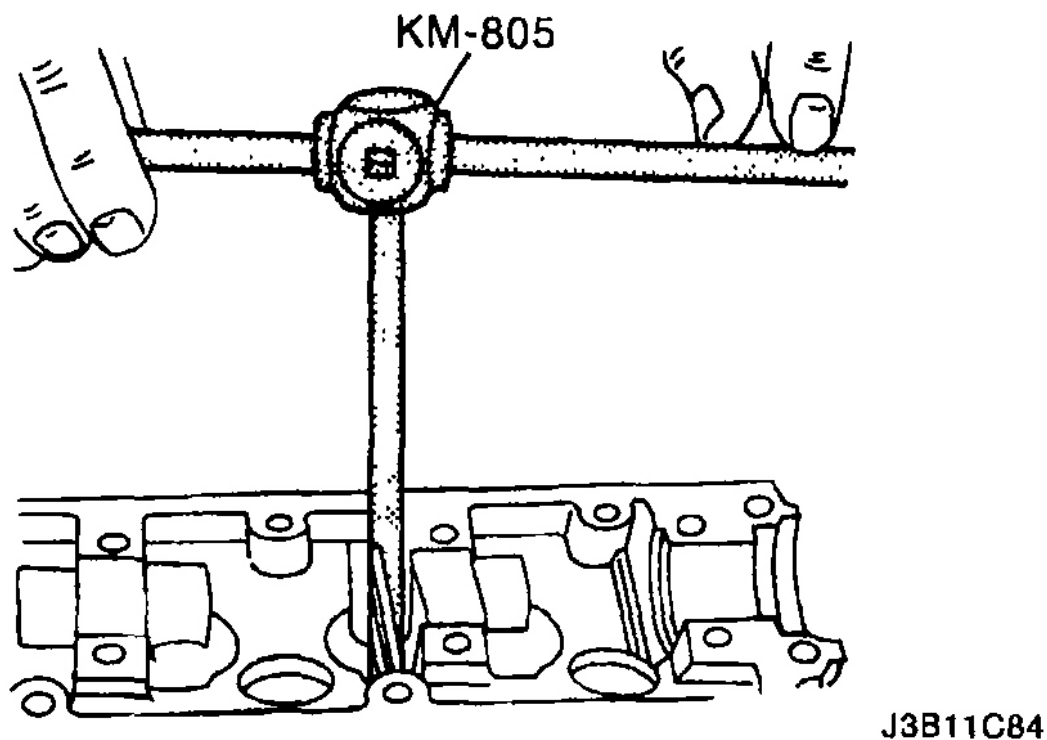


Fig. 157: Reaming Valve Guide

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.
3. Clean the chippings from the cylinder head.

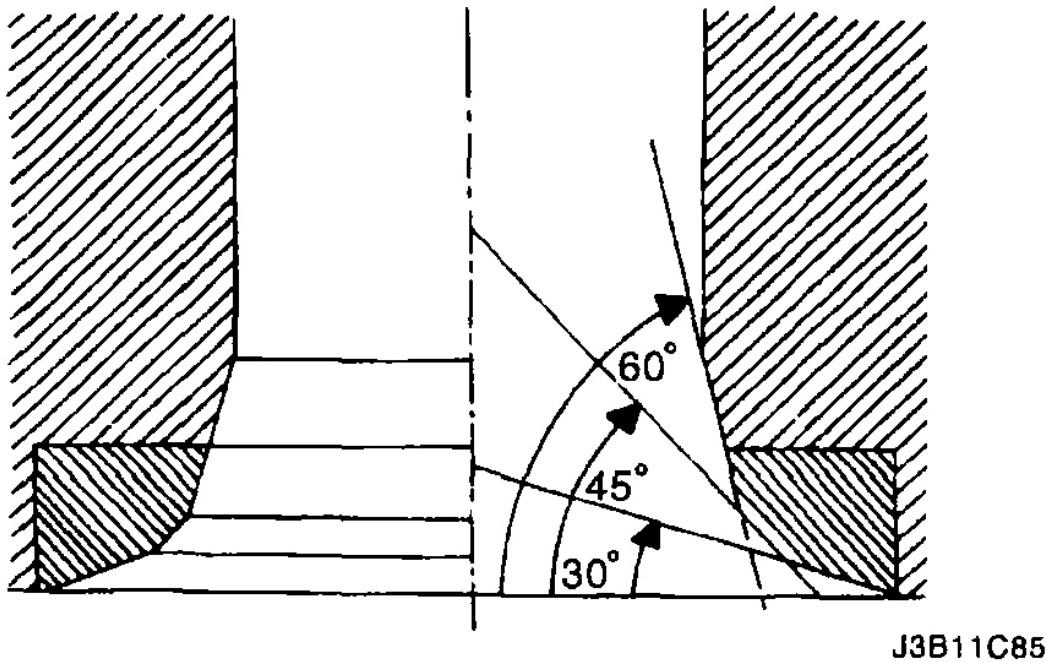


Fig. 158: Identifying Angle Of Valve Seat - Cut
Courtesy of SUZUKI OF AMERICA CORP.

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

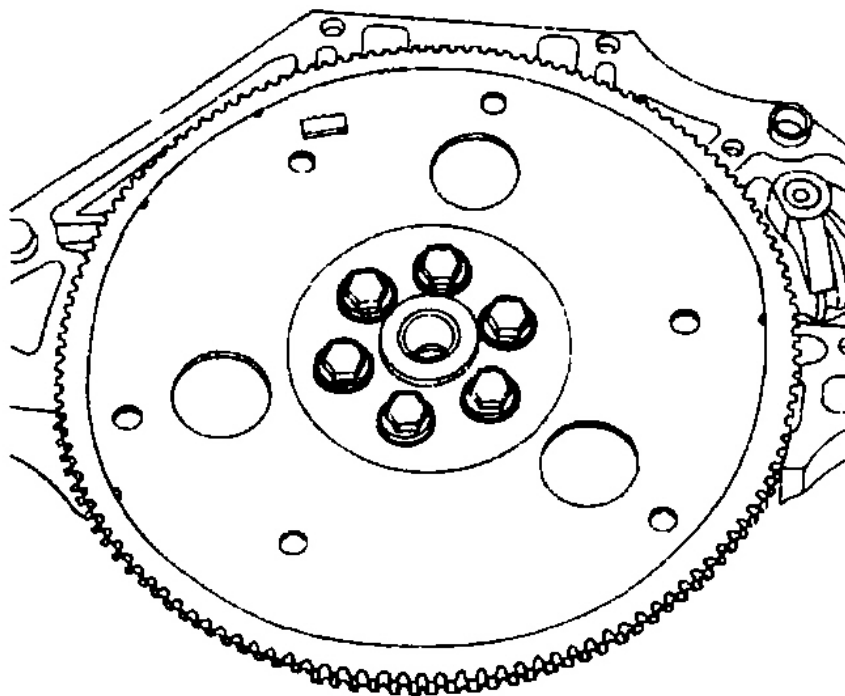
KM-412 Engine Overhaul Stand

KM-470-B Angular Torque Gauge

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

Disassembly

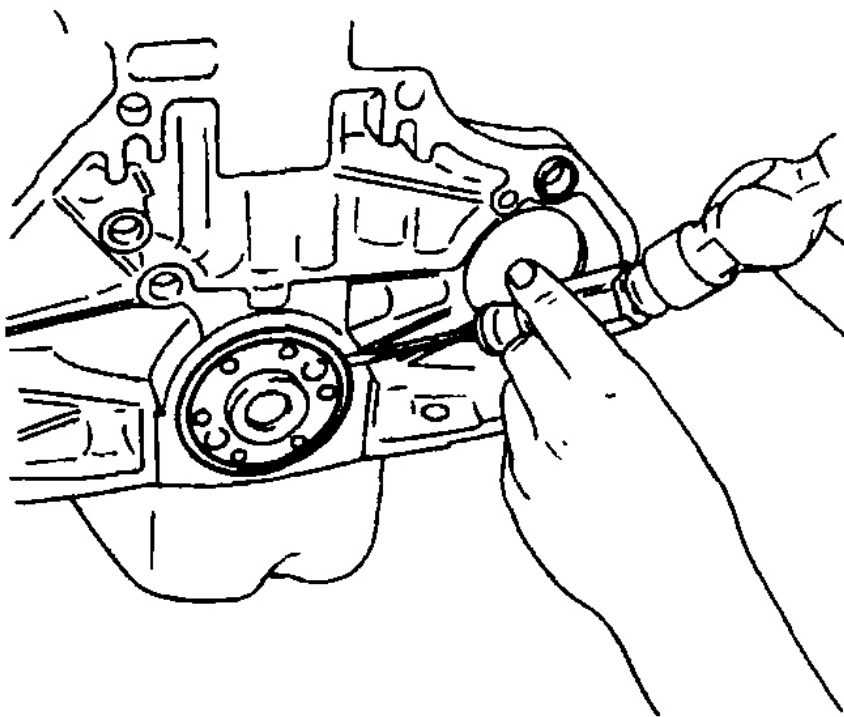
1. Remove the engine. Refer to "**ENGINE REMOVAL AND INSTALLATION:**".
2. Remove the flywheel or flexible plate bolts.
3. Remove the flywheel or the flexible plate.



J3B11C88

Fig. 159: Removing Flywheel Or Flexible Plate
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C89

Fig. 160: Removing Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

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

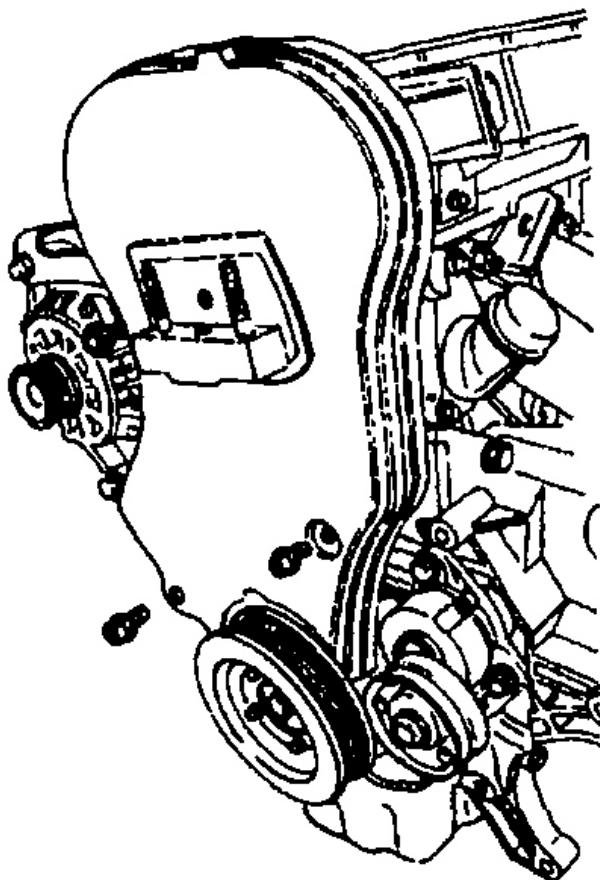
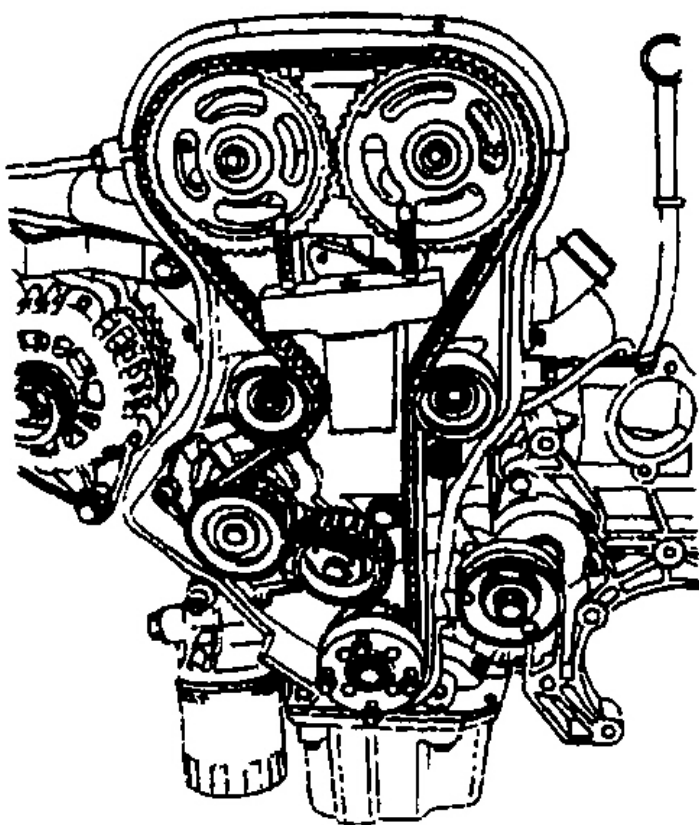
**J3B11C90**

Fig. 161: Removing Crankshaft Pulley Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C91

Fig. 162: Removing Timing Belt
Courtesy of SUZUKI OF AMERICA CORP.

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.

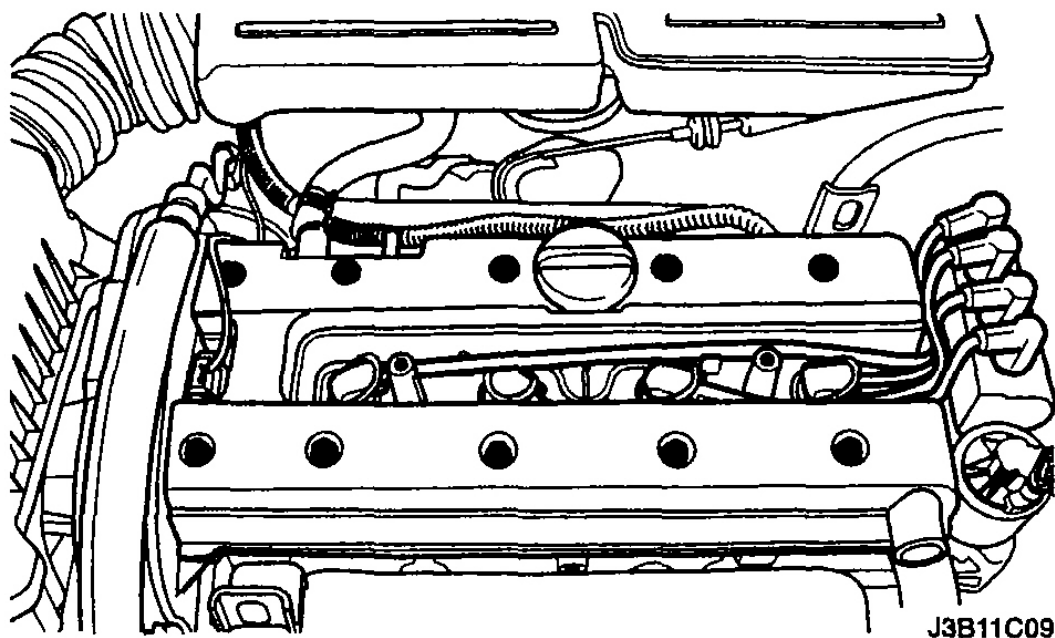
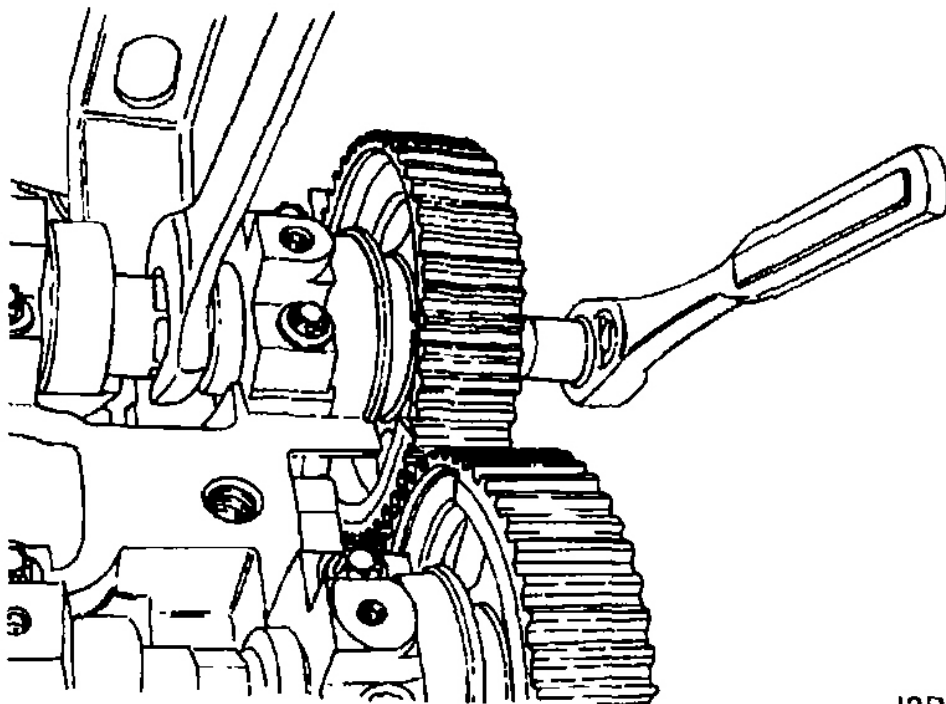


Fig. 163: Removing Camshaft Cover And Camshaft Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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

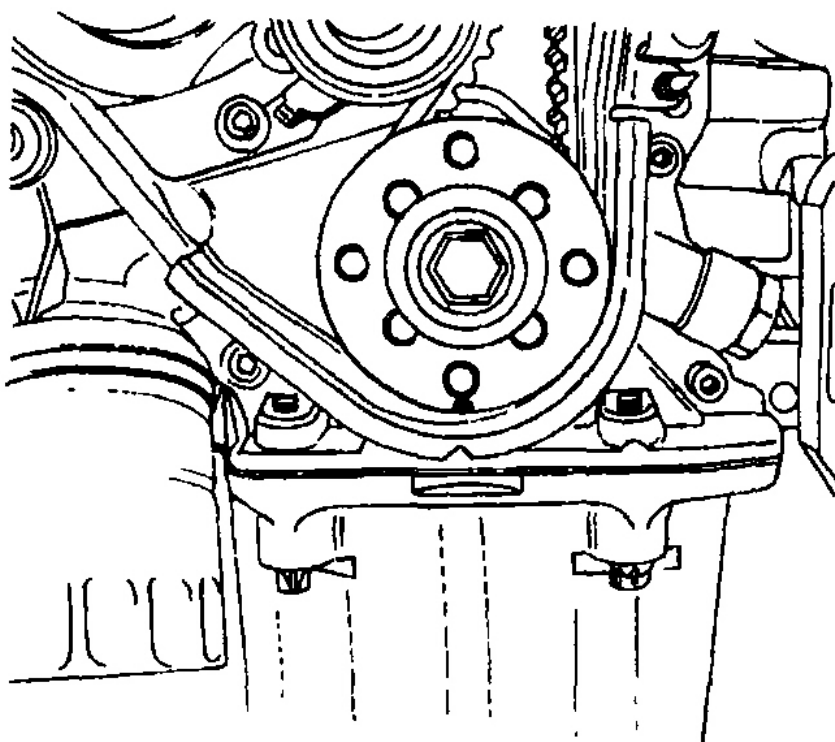
24. While holding the intake camshaft firmly in place, remove the intake camshaft bolt.
25. Remove the intake camshaft gear.
26. While holding the exhaust camshaft firmly in place, remove the exhaust camshaft bolt.
27. Remove the exhaust camshaft gear.



J3B11C17

Fig. 164: Removing Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

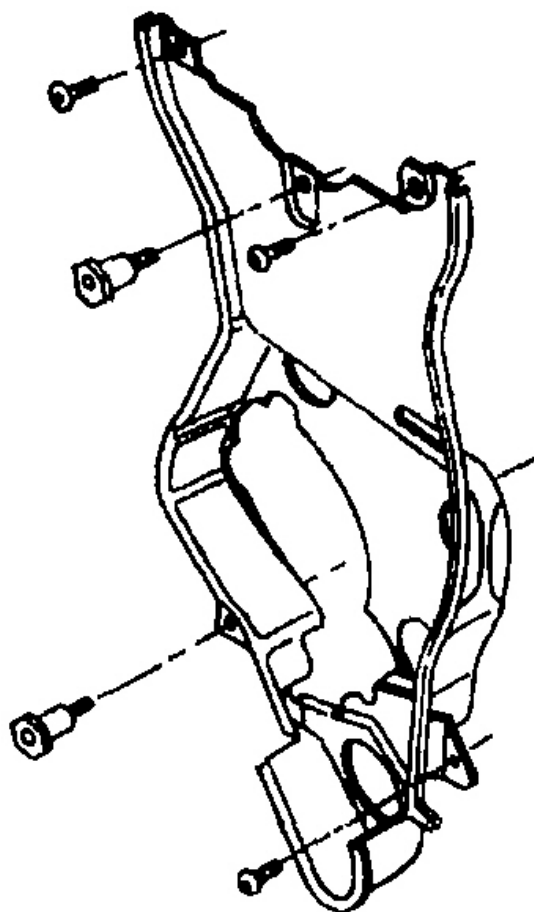
28. Remove the crankshaft timing belt gear.



J3B11C29

Fig. 165: Removing Crankshaft Timing Belt Gear
Courtesy of SUZUKI OF AMERICA CORP.

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



J3B11C20

Fig. 166: Removing Rear Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

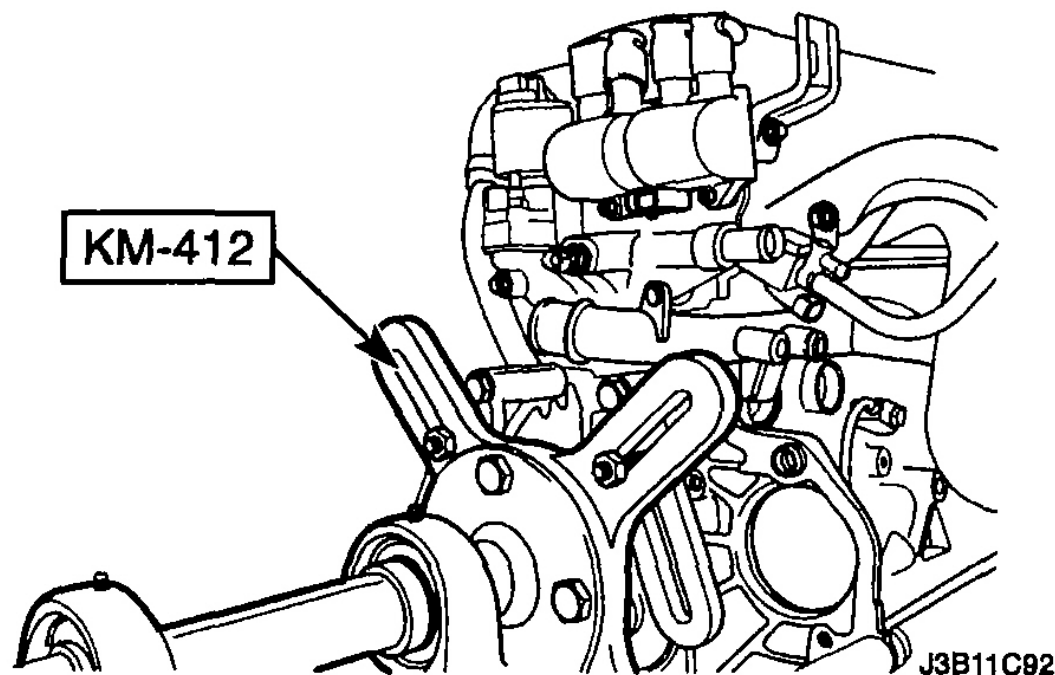
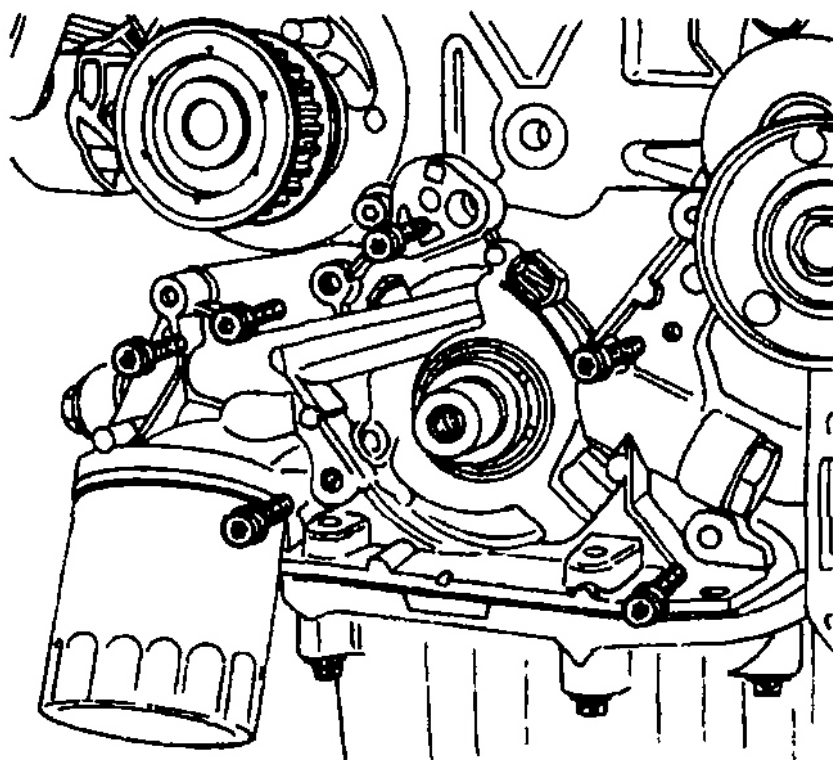


Fig. 167: Rotating Engine On Engine Overhaul Stand
Courtesy of SUZUKI OF AMERICA CORP.

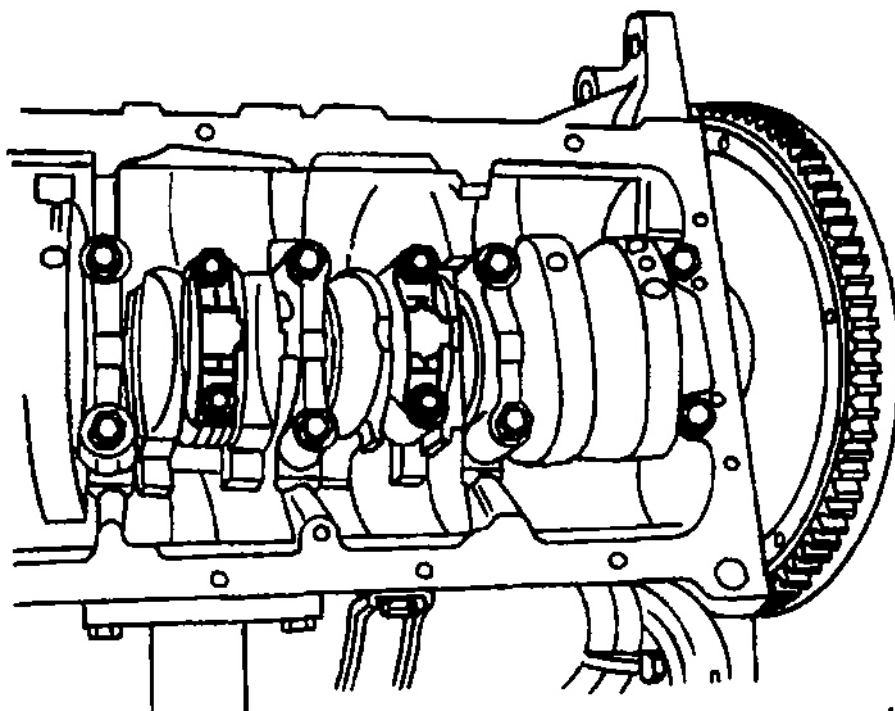
31. Remove the oil pan retaining bolts.
32. Remove the oil pan.
33. Remove the oil suction pipe and support bracket bolts.
34. Remove the oil suction pipe.
35. Remove the crankshaft bearing bridge and oil pan scraper bolts.
36. Remove the oil pan scraper.
37. Remove the crankshaft bearing bridge bolts.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



J3B11C94

Fig. 168: Removing Oil Pump Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

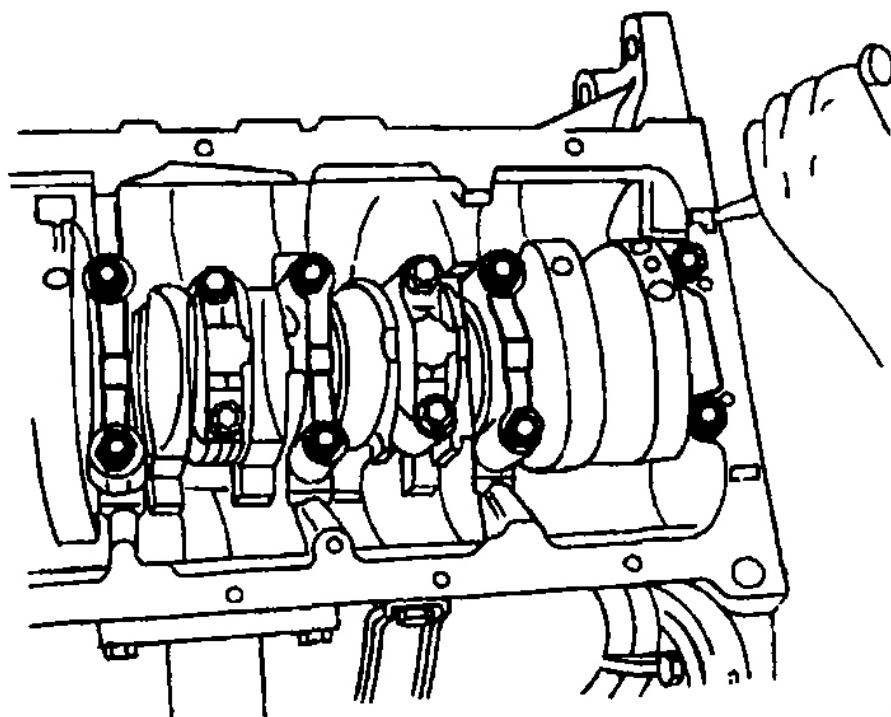
41. Mark the order of the connecting rod bearing caps.
42. Remove the connecting rod bearing cap bolts for all of the pistons.
43. Remove the connecting rod bearing caps and the lower connecting rod bearings.



J3B11C95

Fig. 169: Removing Connecting Rod Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

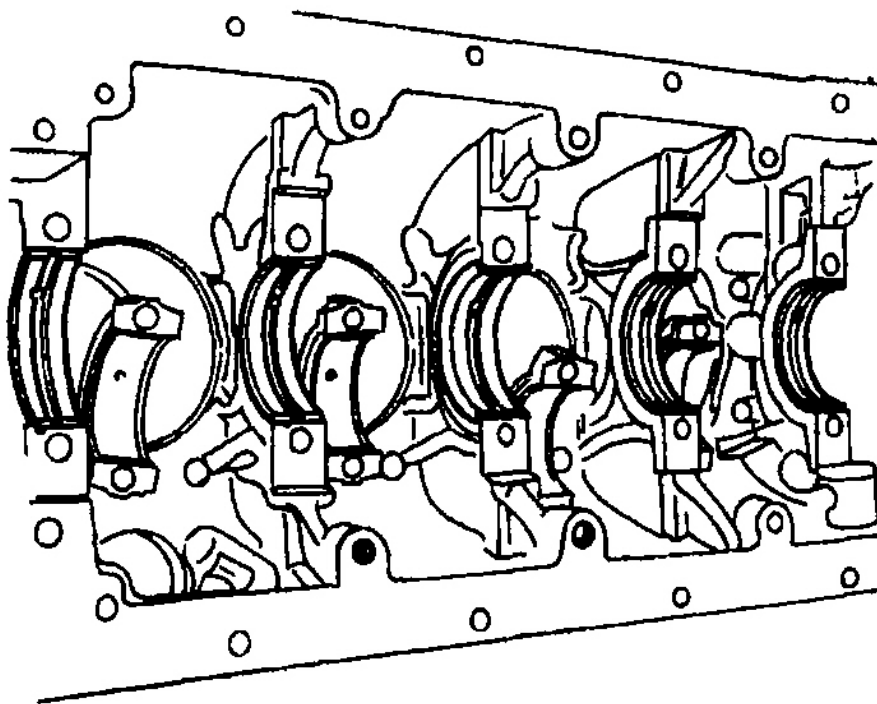


J3B11C96

Fig. 170: Identifying Crankshaft And Bearings
Courtesy of SUZUKI OF AMERICA CORP.

Assembly

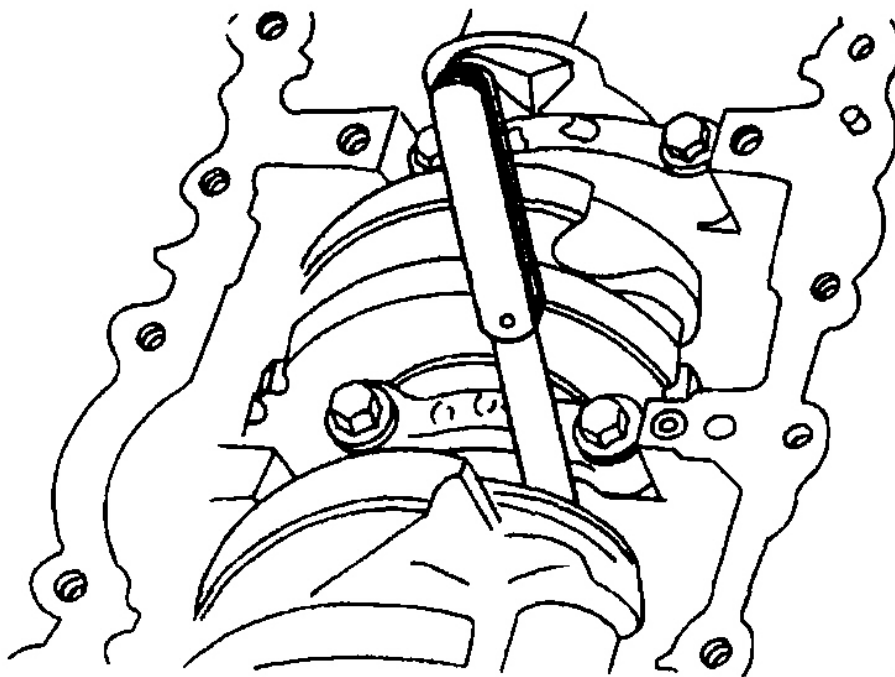
1. Coat the crankshaft bearings with engine oil.
2. If replacing the crankshaft, transfer the pulse pickup sensor disc to the new crankshaft.



J3B11C97

Fig. 171: Coating Crankshaft Bearings With Engine Oil
Courtesy of SUZUKI OF AMERICA CORP.

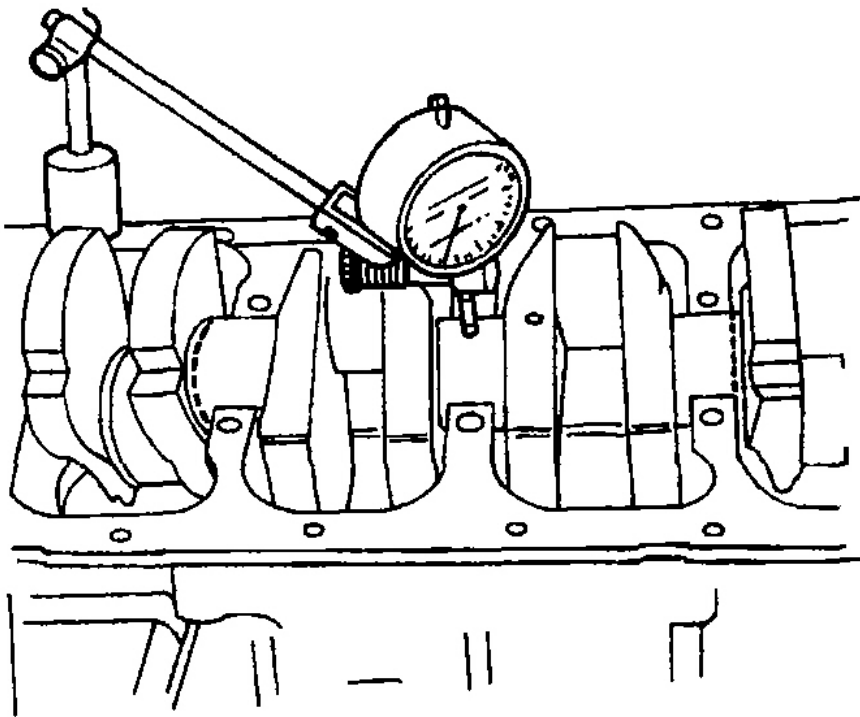
3. Install the crankshaft.
4. Install the lower crankshaft bearings in the bearing caps.
5. Inspect the crankshaft end play with the crankshaft bearings installed.
6. Check for permissible crankshaft end play. Refer to "ENGINE SPECIFICATIONS".



J3B11C98

Fig. 172: 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:**".



J3B11C99

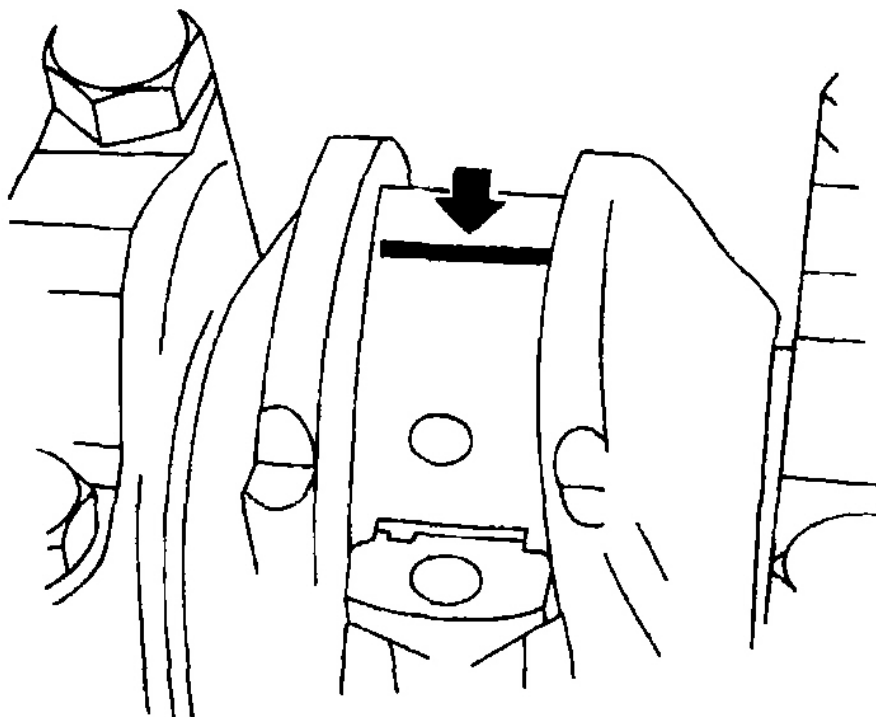
Fig. 173: Checking Middle Crankshaft Journal For Permissible Out-Of-Round
Courtesy of SUZUKI OF AMERICA CORP.

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

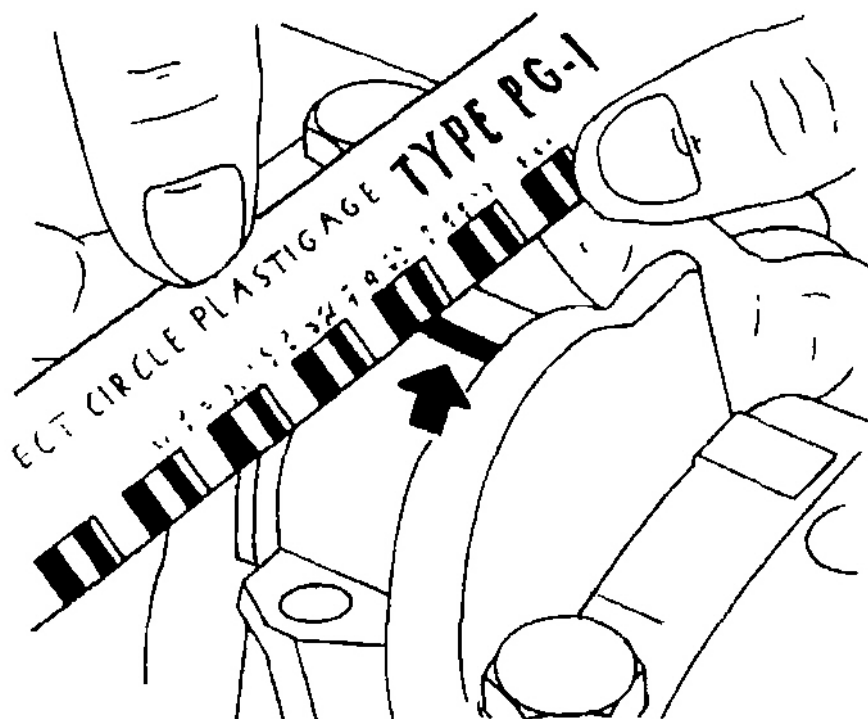
Tighten the crankshaft bearing cap bolts to 50 N.m (37 lb-ft) plus 45 degrees and 15 degrees.



J3B11C0A

Fig. 174: Checking Crankshaft Bearing Oil Clearance
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**".



J3B11C0B

Fig. 175: Inspecting Bearing Clearance For Permissible Tolerance Ranges
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

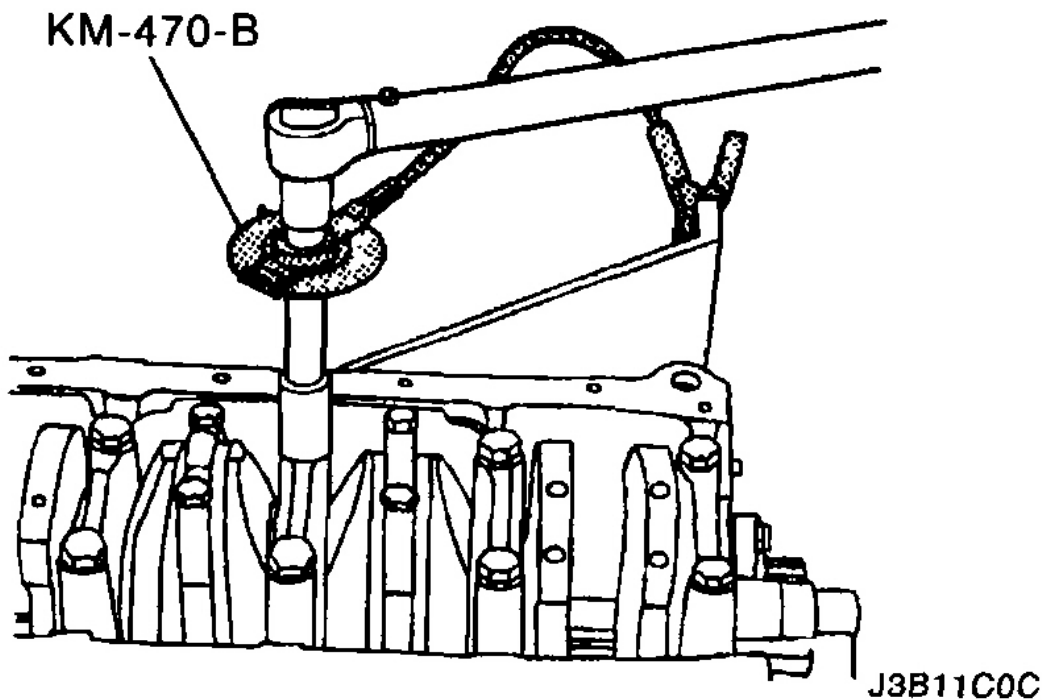


Fig. 176: Tightening Crankshaft Bearing Caps Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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.

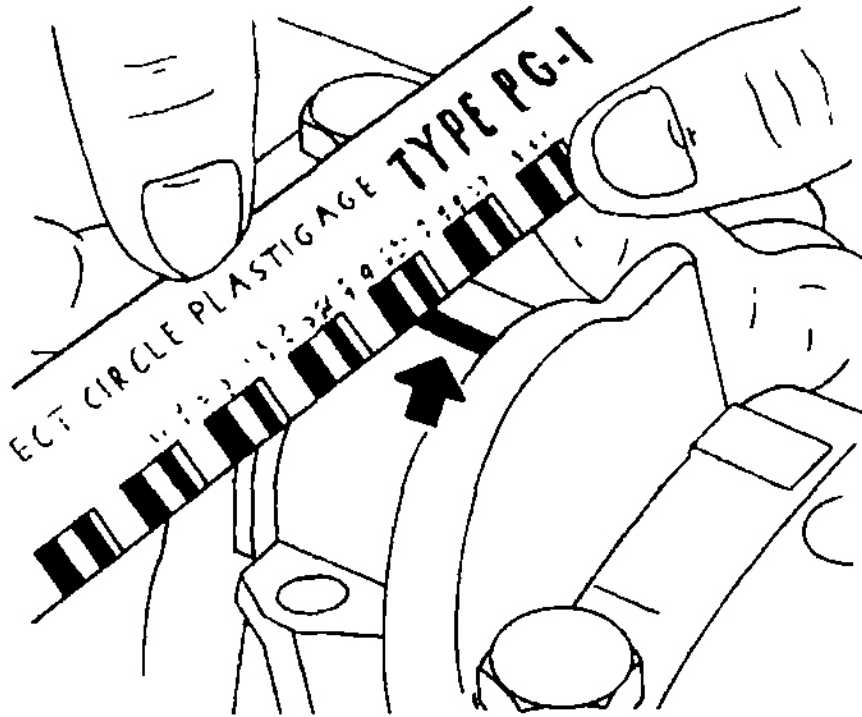
17. Inspect all of the connecting rod bearing clearances using a commercially available plastic gauging (ductile plastic threads).
18. Cut the plastic gauging threads to the length of the connecting rod bearing width. Lay them axially between the connecting rod journals and the connecting rod bearings.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



J3B11C0B

Fig. 177: Inspecting Bearing Clearance For Permissible Tolerance Ranges
Courtesy of SUZUKI OF AMERICA CORP.

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

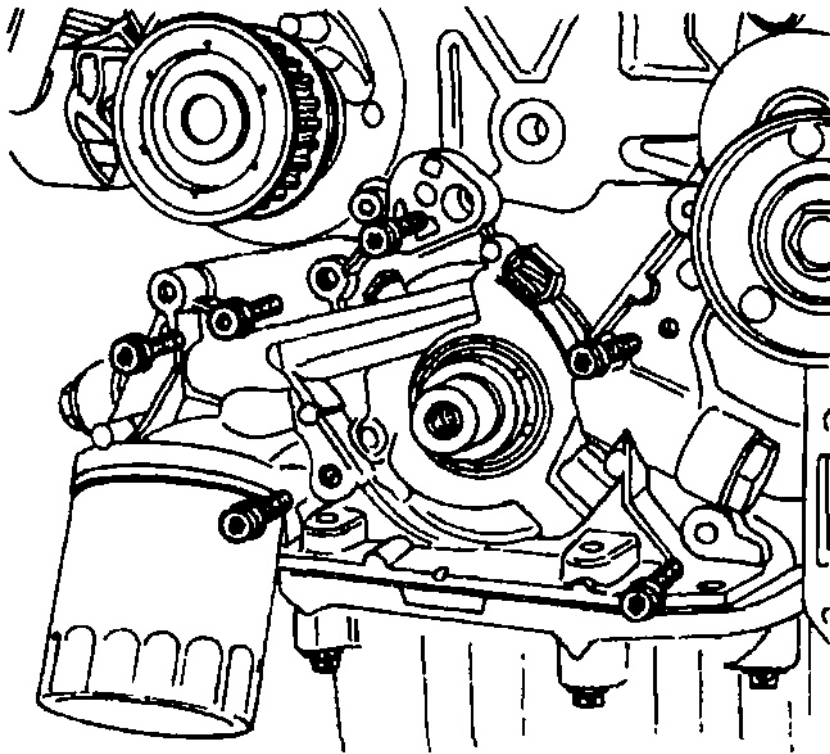
Tighten

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



J3B11C94

Fig. 178: Installing Oil Pump Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

27. Install the crankshaft bearing bridge and bolts.

Tighten

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

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

Tighten

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

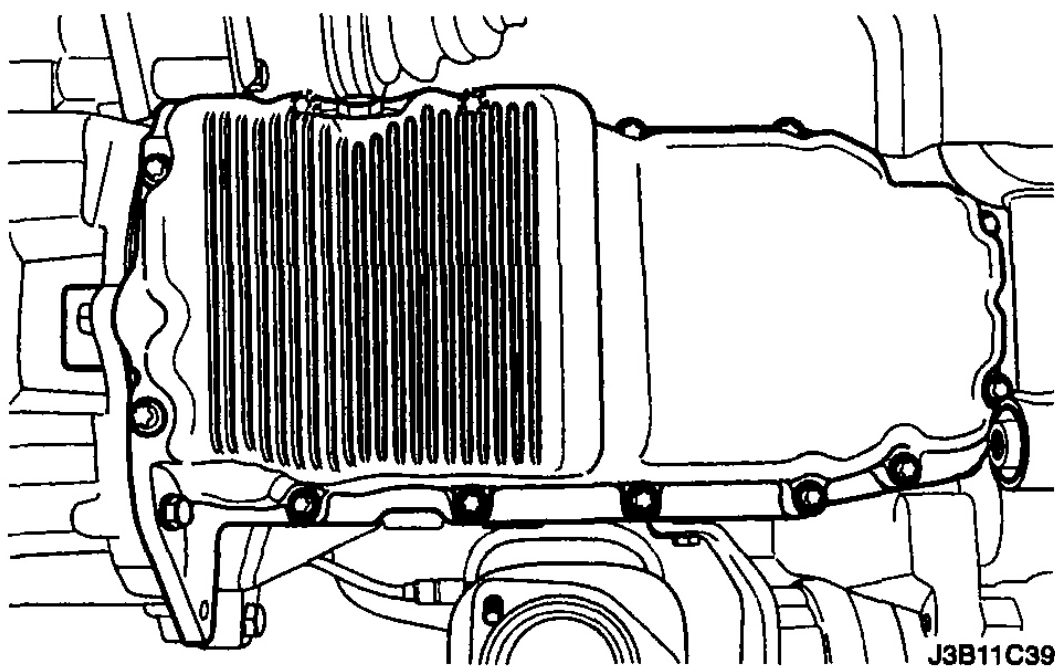


Fig. 179: Installing Oil Pan Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

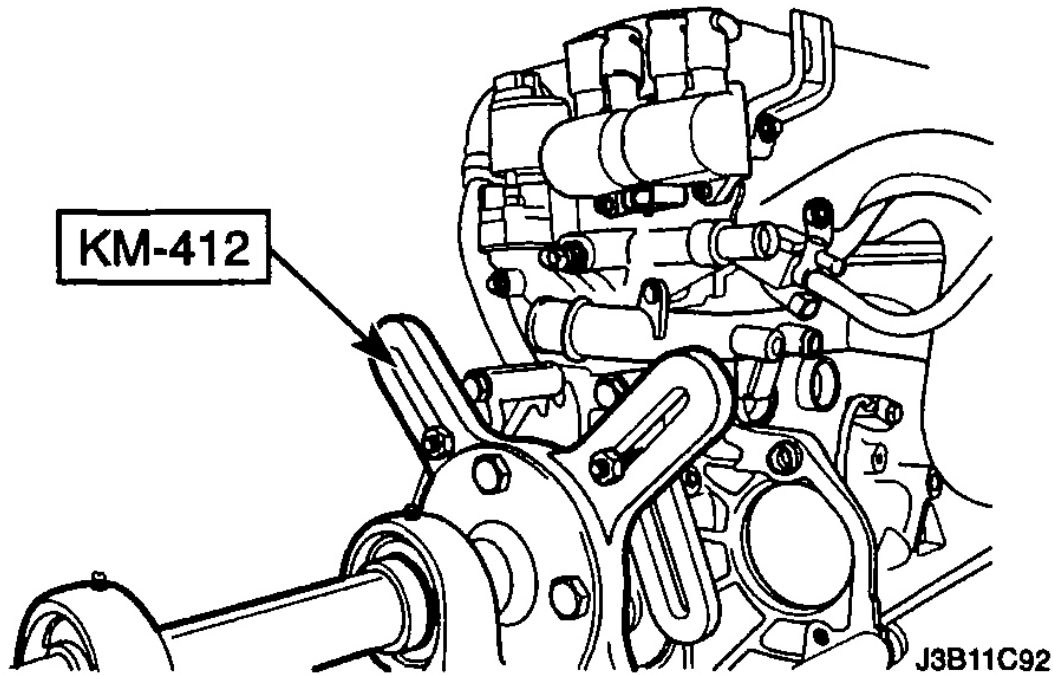


Fig. 180: Rotating Engine On Engine Overhaul Stand
Courtesy of SUZUKI OF AMERICA CORP.

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.

39. Install the engine mount and retaining bolts.

Tighten

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

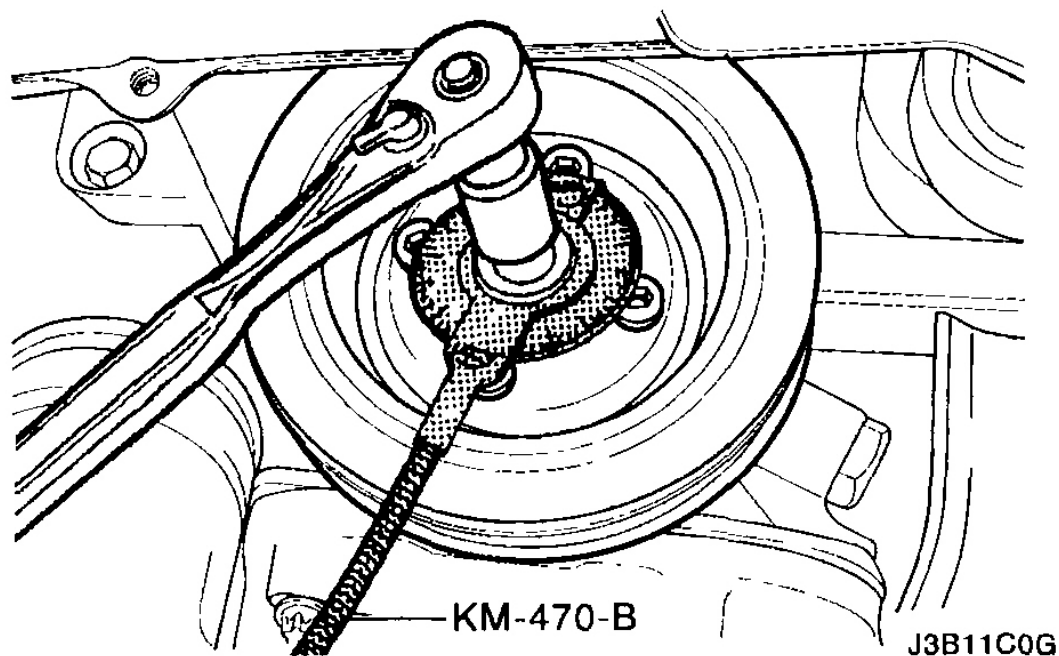


Fig. 181: Tightening Crankshaft Gear Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

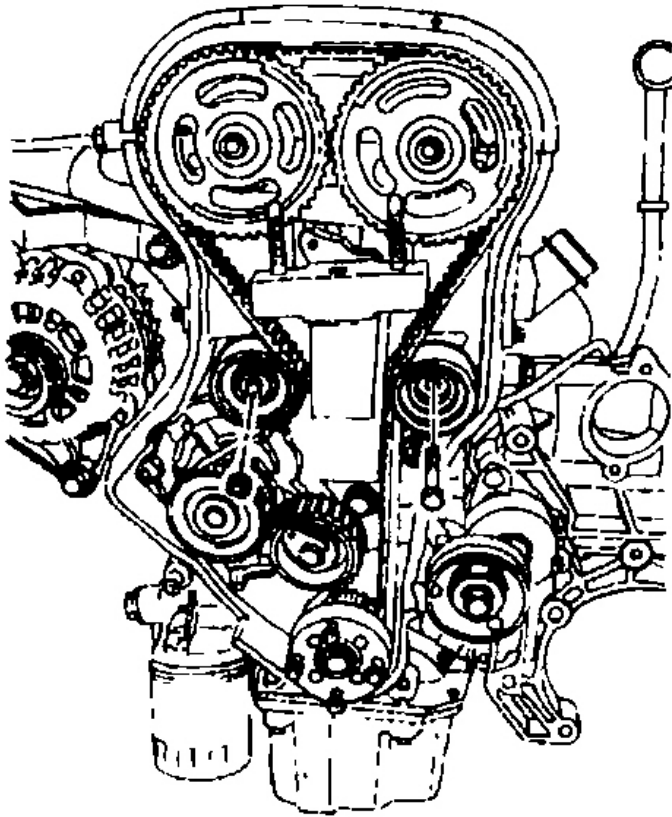
Tighten

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

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

Tighten

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



J3B11C19

Fig. 182: Installing Timing Belt Idler Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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.

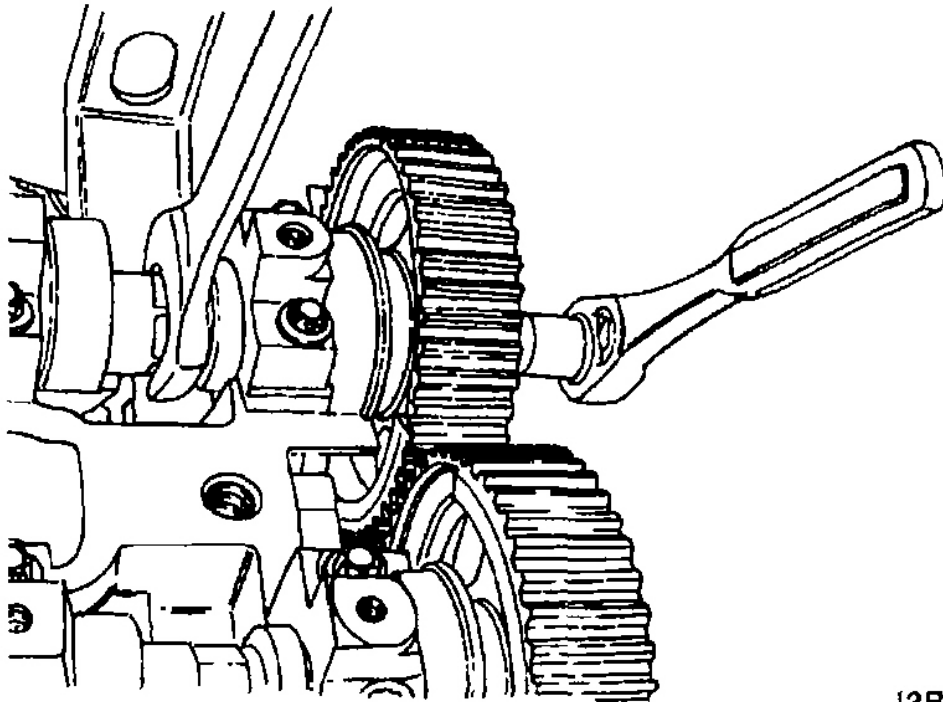
Tighten

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.



J3B11C17

Fig. 183: Installing Exhaust Camshaft Gear
Courtesy of SUZUKI OF AMERICA CORP.

48. Install the timing belt. Refer to "**TIMING BELT REMOVAL AND INSTALLATION:**".
49. Adjust the timing belt tension. Refer to "**TIMING BELT CHECK AND ADJUST:**".
50. Apply a small amount of gasket sealant to the corners of the front camshaft caps and to the top of the rear camshaft cover to cylinder head seal.
51. Install the camshaft cover and the camshaft cover gasket.
52. Install the camshaft cover washers.
53. Install the camshaft cover bolts.

Tighten

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

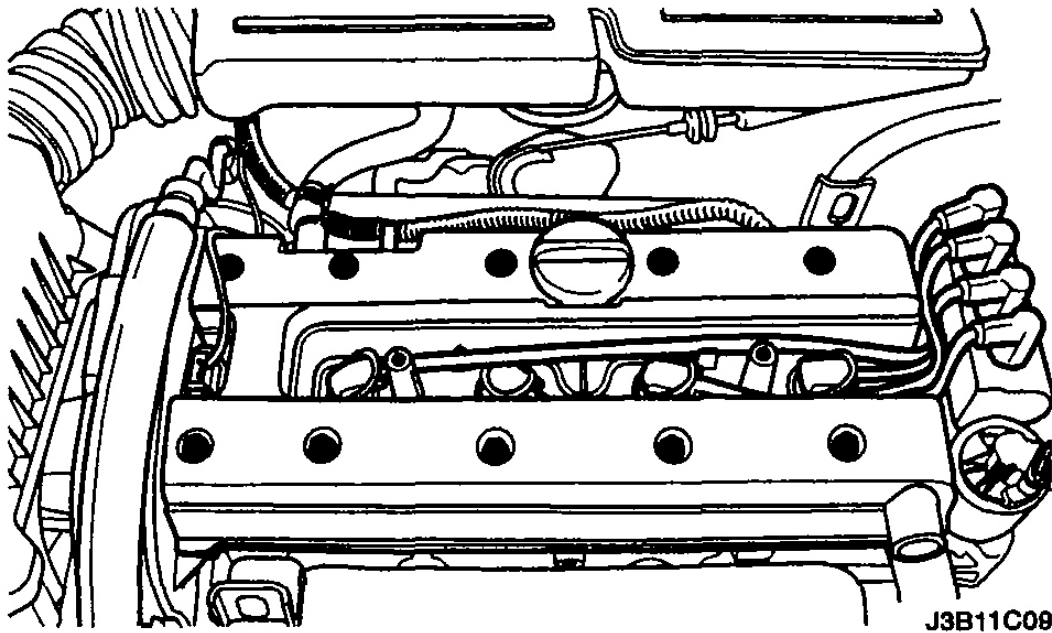


Fig. 184: Installing Camshaft Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

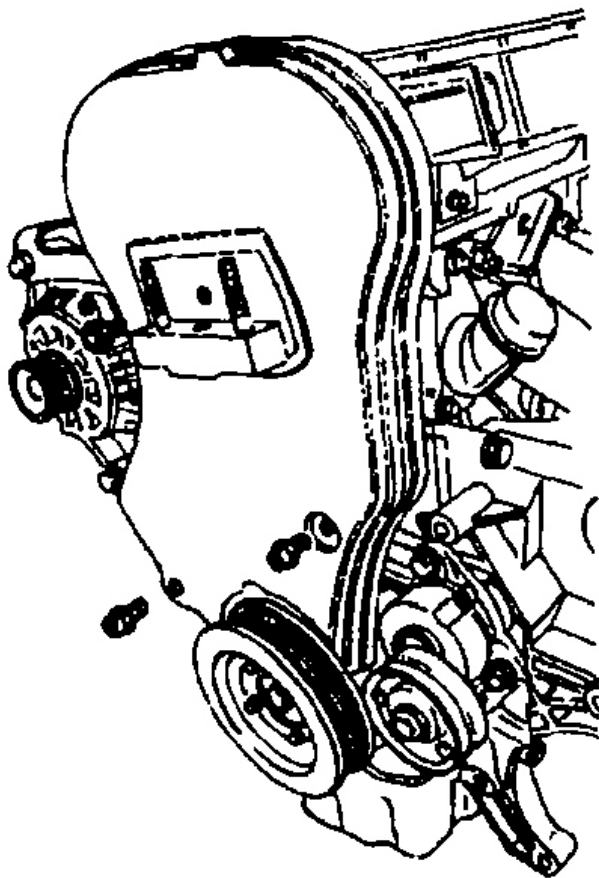
Tighten the spark plug cover bolts to 8 N.m (71 lb-in).

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

Tighten

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

60. Install the engine lifting device.
61. Remove the engine from the engine overhaul stand KM-412.



J3B11C90

Fig. 185: Tightening Front Timing Belt Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

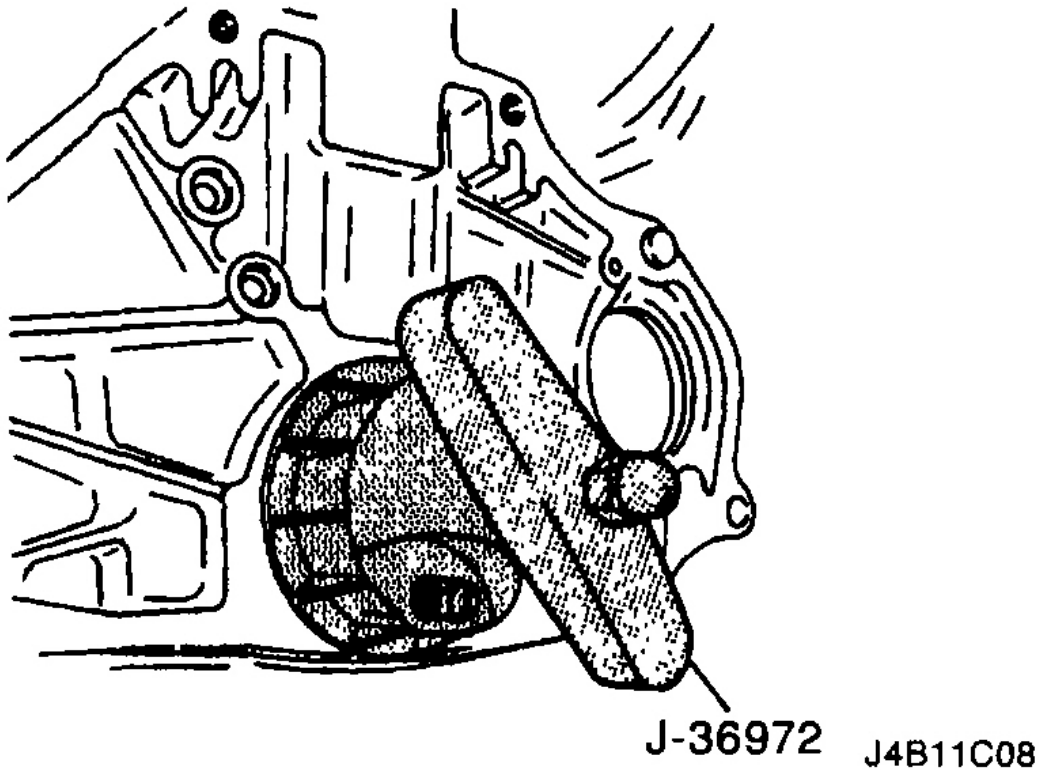


Fig. 186: Installing Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

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).

65. Install the engine. Refer to "**ENGINE REMOVAL AND INSTALLATION:**".

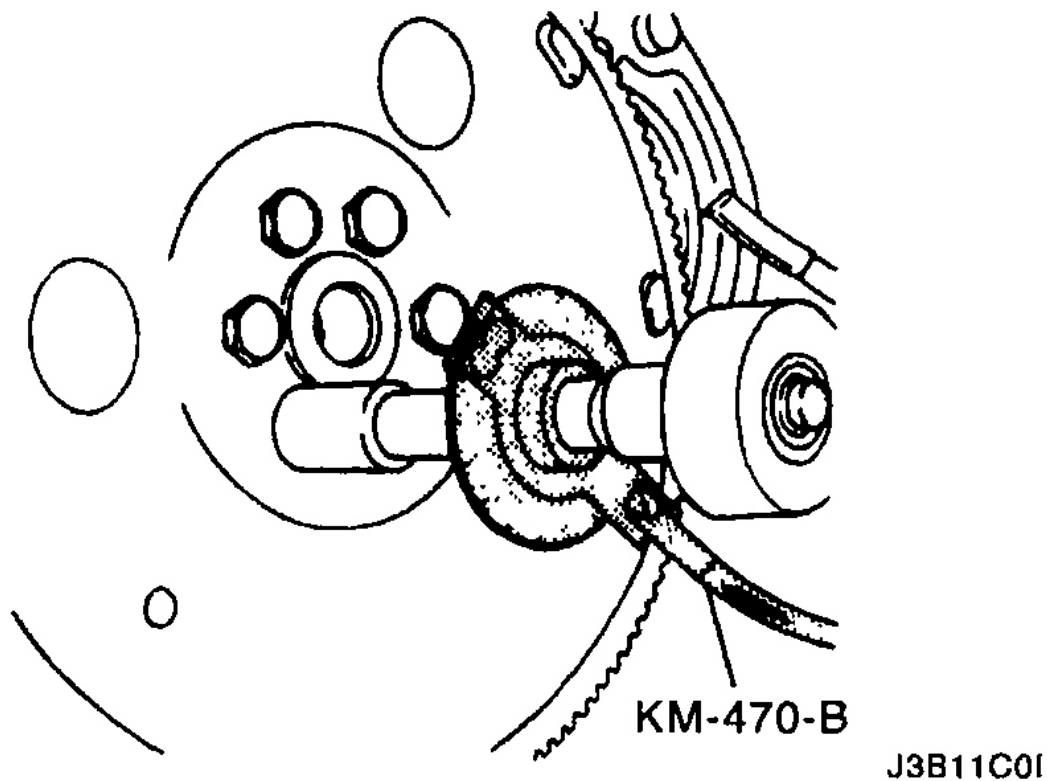


Fig. 187: Installing Flywheel Or Flexible Plate Bolts
Courtesy of SUZUKI OF AMERICA CORP.

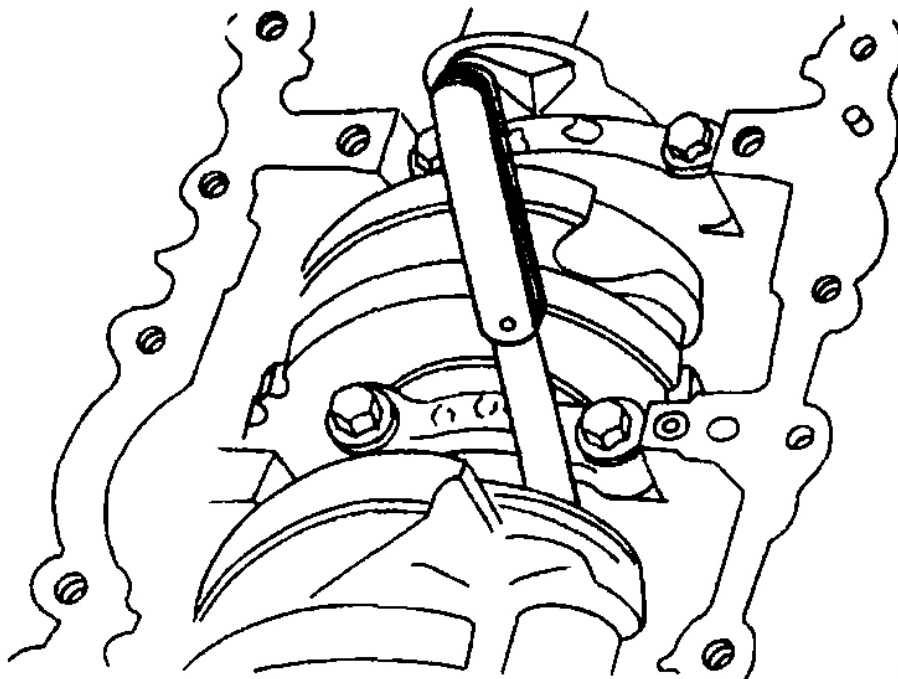
CRANKSHAFT BEARINGS AND CONNECTING ROD BEARINGS - GAUGING PLASTIC INSPECTION

Tools Required

KM-470-B Angular Torque Gauge

Inspection - Crankshaft

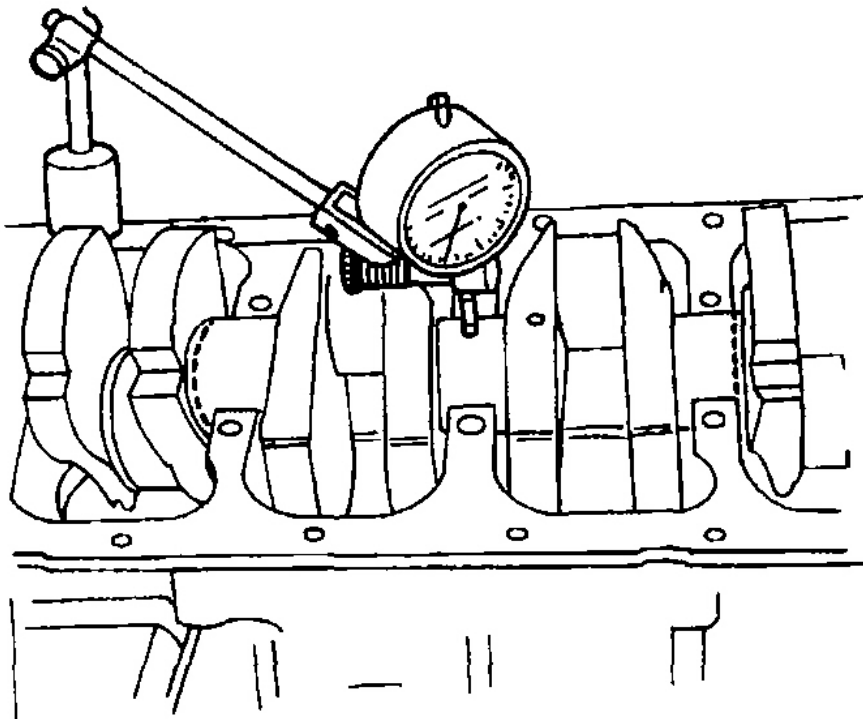
1. Coat the crankshaft bearings with engine oil.
2. Install the upper crankshaft bearings into the engine block crankshaft journals.
3. Install the lower crankshaft bearings into the crankshaft bearing caps.
4. Install the crankshaft.
5. Inspect the crankshaft end play with the crankshaft bearings installed.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



J3B11C98

Fig. 188: 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:**".

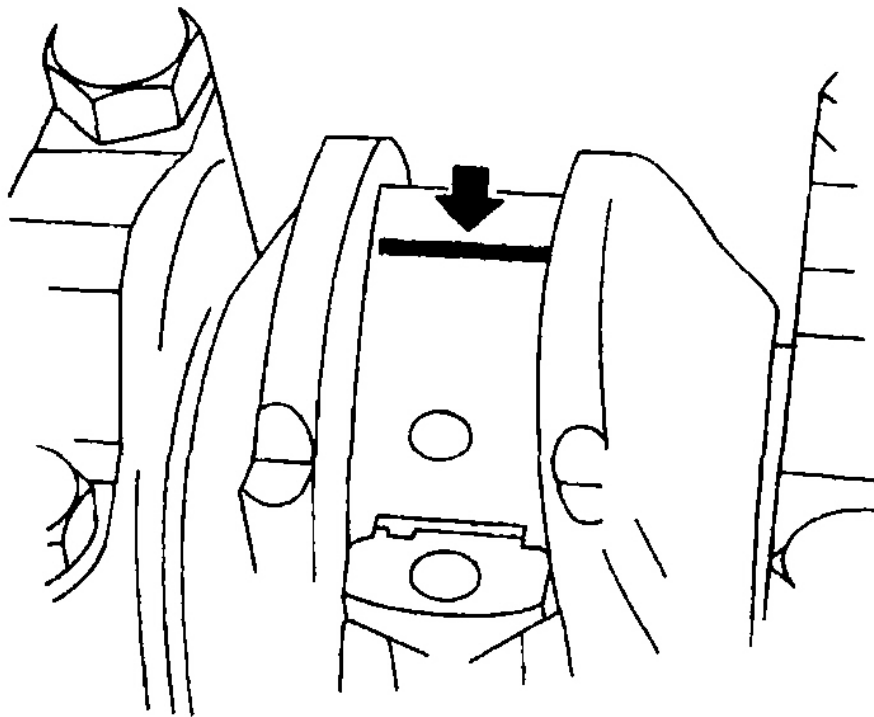


J3B11C99

Fig. 189: Checking Middle Crankshaft Journal For Permissible Out-Of-Round
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.



J3B11C0A

Fig. 190: Checking Crankshaft Bearing Clearance
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.

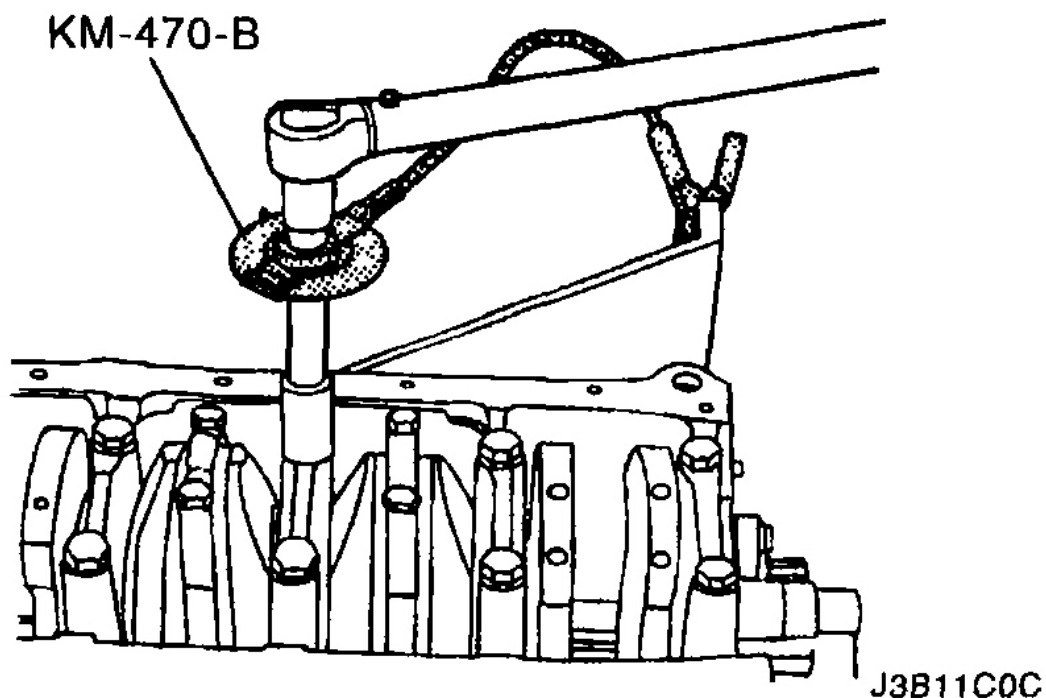
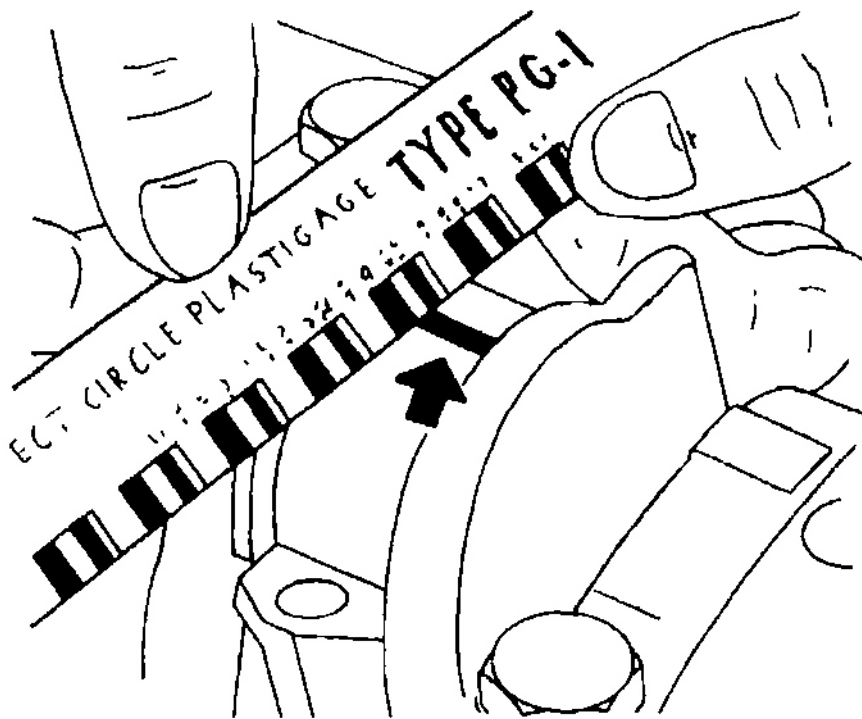


Fig. 191: Tightening Crankshaft Bearing Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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**".



J3B11C0B

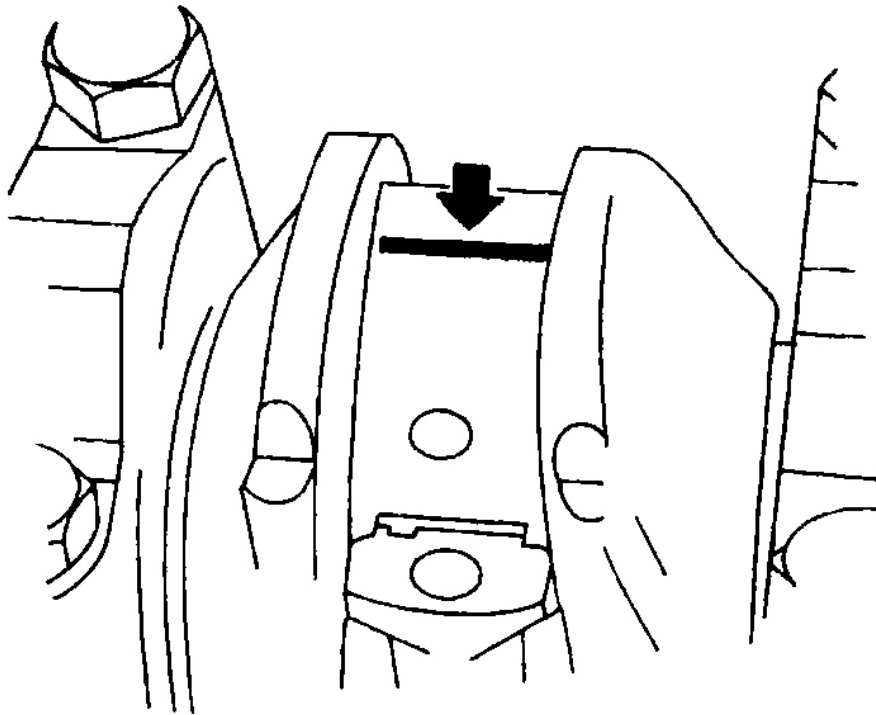
Fig. 192: Inspecting Bearing Clearances For Permissible Tolerance Ranges
Courtesy of SUZUKI OF AMERICA CORP.

Inspection - Connecting Rods

1. Coat the connecting rod bearings with engine oil.
2. Install the upper connecting rod bearings into the connecting rod journals.
3. Install the lower connecting rod bearings into the connecting rod bearing caps.

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.



J3B11C0A

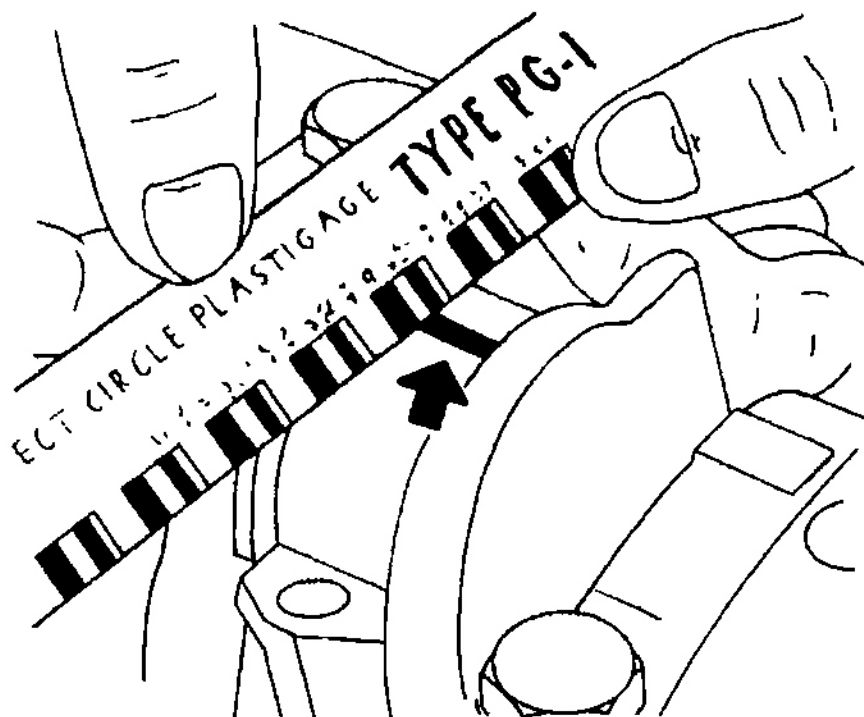
Fig. 193: Checking Connecting Rod Bearing Clearance
Courtesy of SUZUKI OF AMERICA CORP.

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.

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**".



J3B11C0B

Fig. 194: Inspecting Bearing Clearances For Permissible Tolerance Ranges
 Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

ENGINE SPECIFICATIONS

ENGINE SPECIFICATIONS 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 Order	1-3-4-2
Cylinder Bore:	
Diameter	85.975~86.025 mm (3.3848~3.3868 in.)
Out of Round (Maximum)	0.013 mm (0.0005 in.)
Taper (Maximum)	0.013 mm (0.0005 in.)
Piston:	

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Diameter	85.955~86.485 mm (3.384~3.404 in.)
Clearance to Bore	0.0100~0.0300 mm (0.00039~0.00110 in.)
Piston Protrusion	0.5 mm (0.019 in.) Maximum
Piston Taper	0.013 (0.0005 in.)
Piston Rings:	
Ring, End Gap: Top Compression	0.2~0.35 mm (0.008~0.014 in.)
Ring, End Gap: Second Compression	0.3~0.5 mm (0.011~0.019 in.)
Ring, End Gap: Oil	0.25~0.76 mm (0.01~0.03 in.)
Piston Pin:	
Diameter	20.9970~20.9985 mm (0.82665~0.82671 in.)
Pin Offset	1.0 mm (0.04 in.) Towards Thrust Side
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.)
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.)

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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 SPECIFICATIONS

TIGHTENING TORQUE SPECIFICATIONS CHART

Application	N.m	Lb-Ft	Lb-In
Air Cleaner Housing Bolts	10	-	89
Automatic Tensioner Bolt	25	18	-
Camshaft Bearing Bridge and Oil Pan Scraper Bolts	20 + 45°	15 + 45°	-
Camshaft Bearing Cap Bolts	8	-	71
Camshaft Cover Bolts	8	-	71
Charcoal Canister Purge and Exhaust Gas Recirculation Solenoid Bracket Bolt	5	-	44
Connecting Rod Bearing Cap Bolts	35 + 45° + 15°	26 + 45° + 15°	-
Coolant Bypass Housing and Mounting Bolts	15	11	-
Crankshaft Bearing Cap Bolts	50 + 45° + 15°	37 + 45° + 15°	-
Crankshaft Pulley Bolts	20	15	-
Crankshaft Gear Bolt	145 + 30° + 15°	107 + 30° + 15°	-
Cylinder Head Bolts	25 + 90° + 90° + 90°	18 + 90° + 90° + 90°	-
Direct Ignition System Coil and Exhaust Gas Recirculation Mounting Bracket Bolts	25	18	-
Engine Mount Bracket Retaining Bolts and Nuts	55	41	-
Engine Mount Retaining Bolts	45	33	-
Engine-to-Intake Manifold Support Bracket Bolts	20	15	-
Exhaust Camshaft Gear Bolt	50 + 60° + 15°	37 + 60° + 15°	-
Flexible Plate Bolts	45	33	-
Flywheel Bolts	65 + 30° + 15°	48 + 30° + 15°	-
Front Timing Belt Cover Bolts	6	-	53

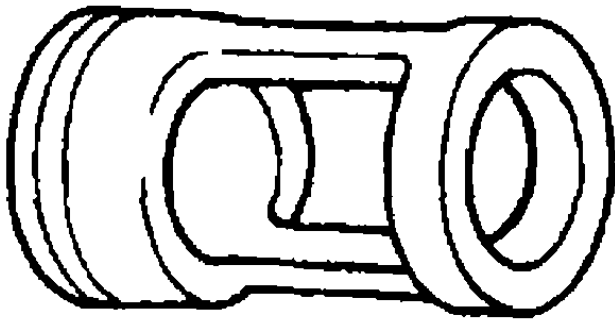
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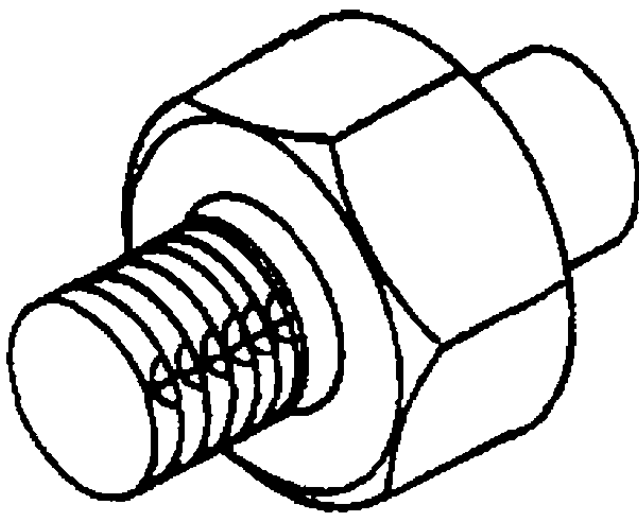
Generator-to-Intake Manifold Strap Bracket Bolt	22	16	-
Generator-to-Intake Manifold Support Bracket Bolts	37	27	-
Intake Camshaft Gear Bolt	50 + 60° + 15°	37 + 60° + 15°	-
Intake Manifold Retaining Bolt and Nuts	22	16	-
Intake Manifold Support Bracket Lower Bolt	25	18	-
Intake Manifold Support Bracket Upper Bolts	25	18	-
Lower Block Support Bracket and Splash Shield Bolts	35	26	-
Pulse Pickup Sensor Disc	13	10	-
Rear Timing Belt Cover Bolts	7	-	62
Safety Relief Valve Bolt	30	22	-
Spark Plug Cover Bolts	8	-	71
Spark Plugs	20	15	-
Thermostat Housing Mounting Bolts	15	11	-
Throttle Cable Bracket Bolts	8	-	71
Timing Belt Automatic Tensioner Bolts	25	18	-
Timing Belt Idler Pulley Bolt	25	18	-
Timing Belt Idler Pulley Nut	25	18	-
Transaxle Bell Housing Bolts	75	55	-
Transaxle Torque Converter Bolts	60	44	-

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

KM-653 Adapter



J3B11C01



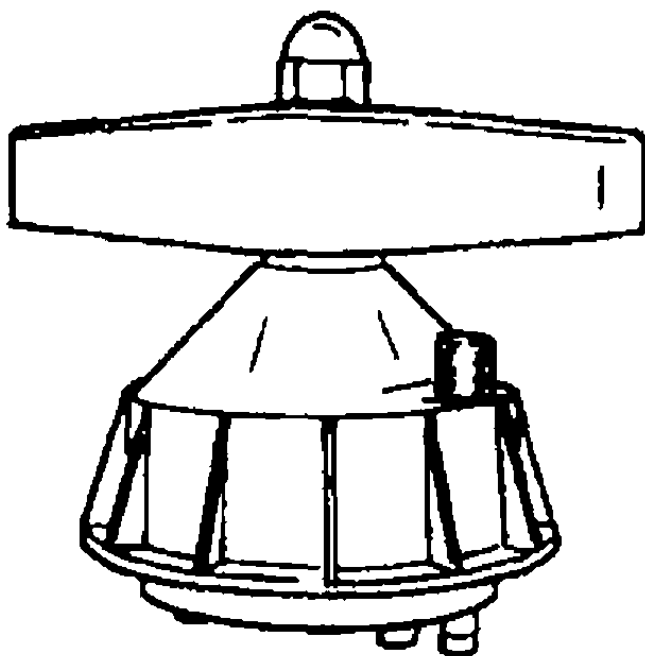
KM-135 Adapter

KM135



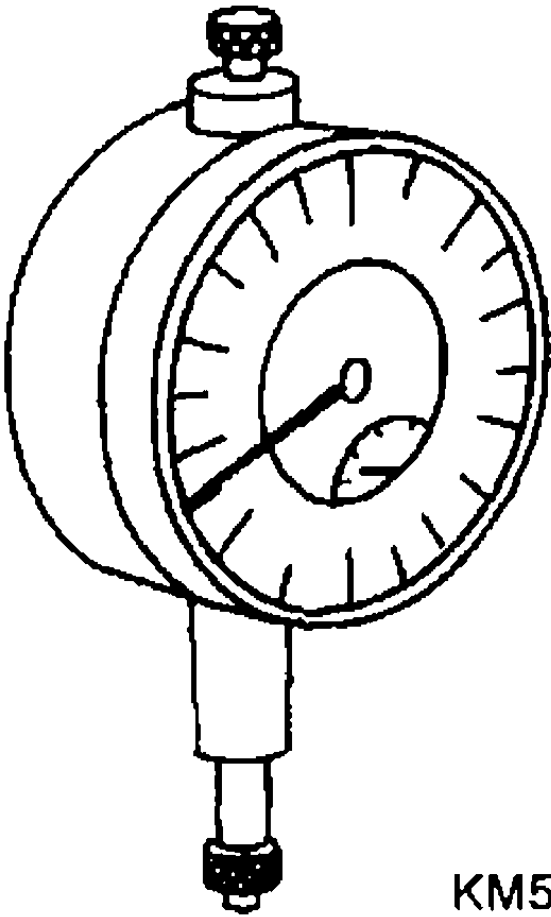
KM-805 Valve Guide Reamer

J3B11C02



J-36792 Crankshaft Rear Oil Seal Installer

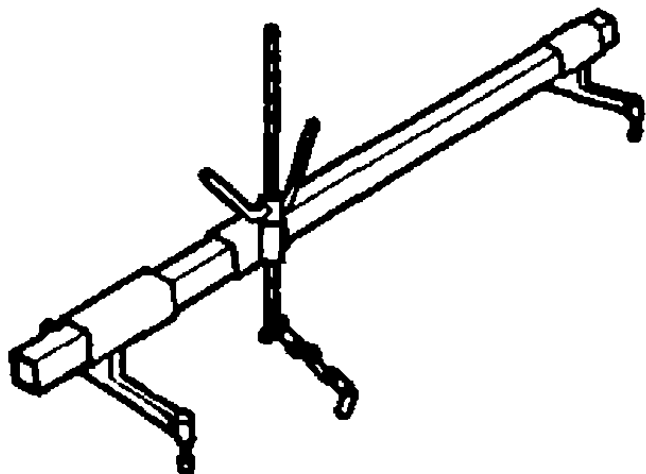
J36972



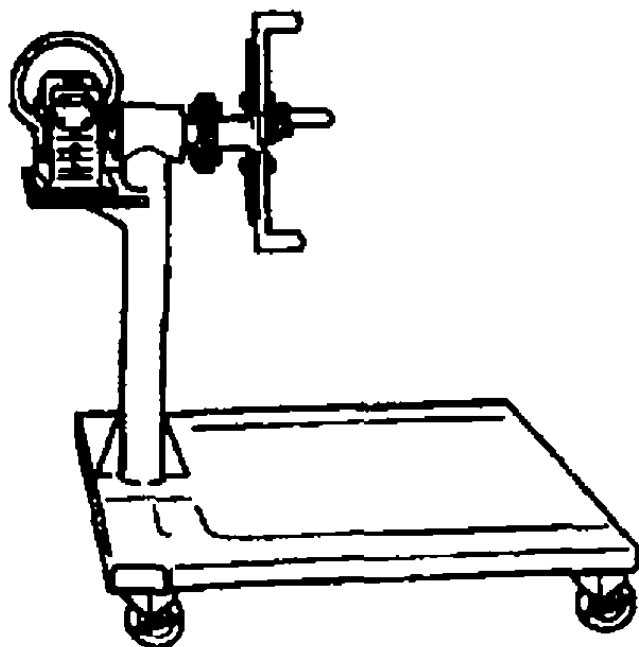
KM571B

KM-571-B Gauge

DW110-060 Engine Assembly Support Fixture

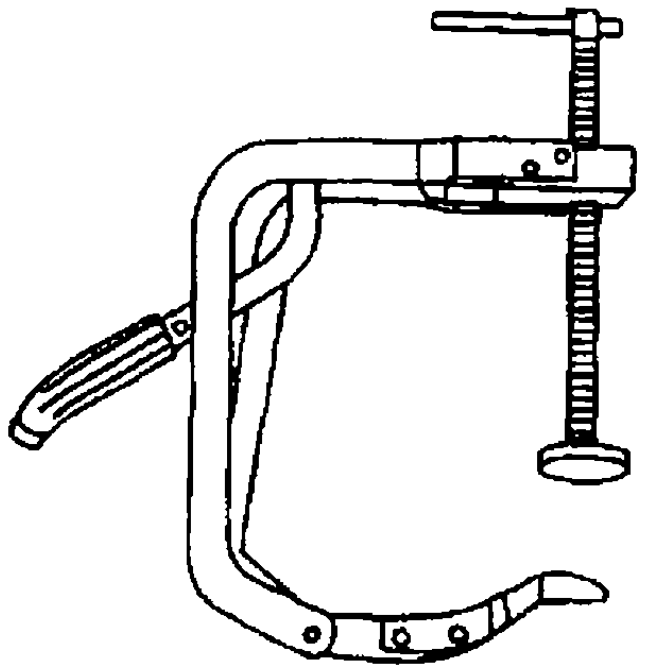


DW110080



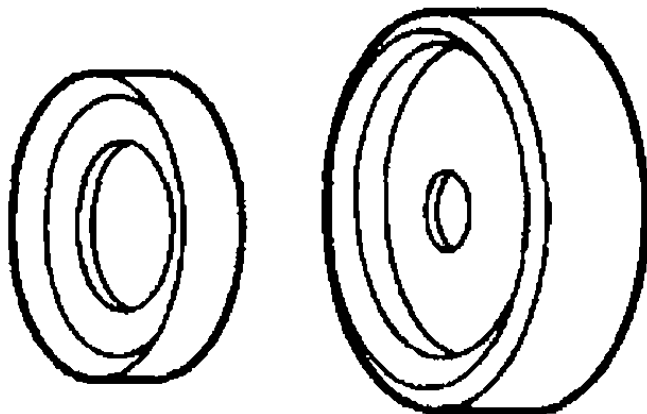
KM412

KM-412 Engine Overhaul Stand



KM348

KM-348 Valve Spring Compressor

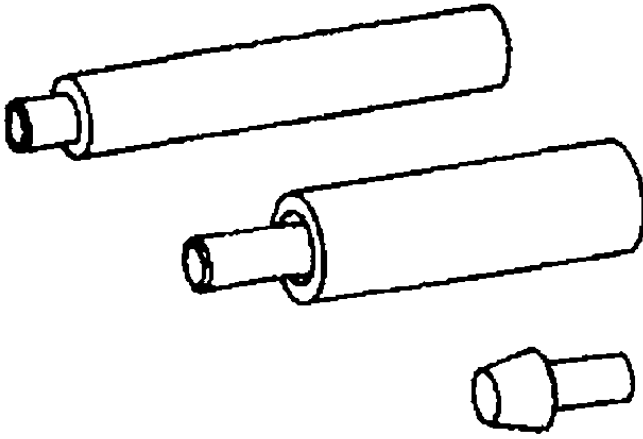


KM635

KM-635 Crankshaft Rear Oil Seal Installer

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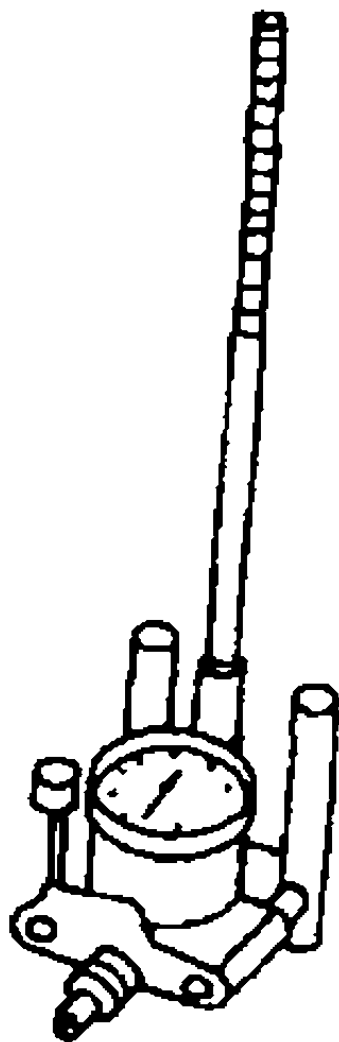
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KM427

KM-427 Piston Pin Service Set

J-8087 Cylinder Bore Check Gauge



J3B11C04

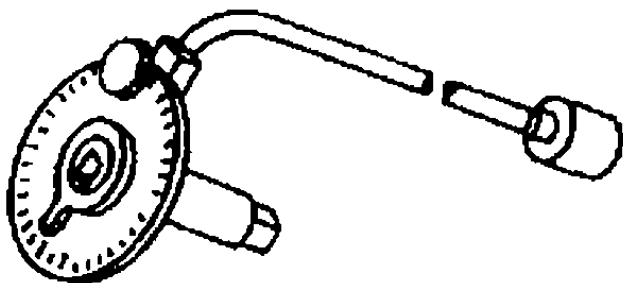


KM-340-0 Cutter Set Includes: KM-340-7 Guide

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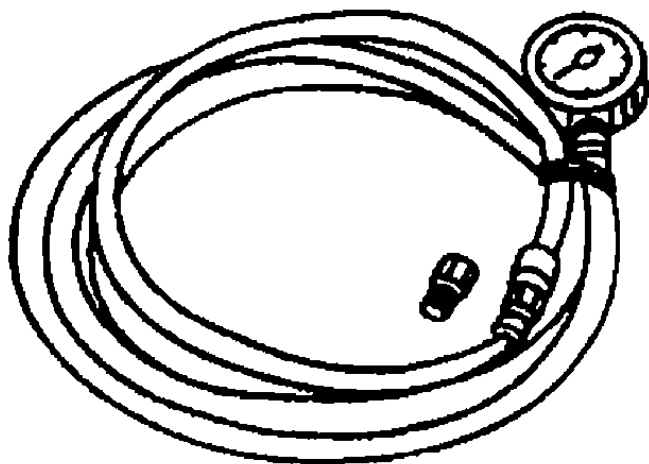
Drift KM-340-13 Cutters KM-340-26 Cutters



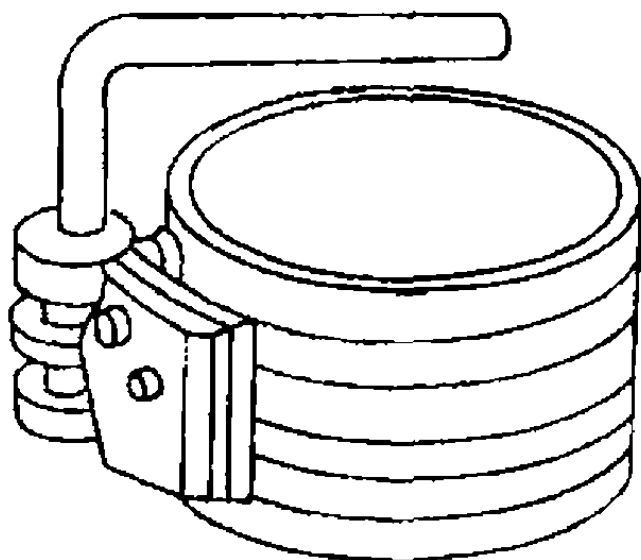
KM-470-B Angular Torque Gauge

KM470B

KM-498-B Pressure Gauge



KM498B



J-8037 Universal Piston Ring Compressor

J3B11C05