

2004 ENGINES**2.5L 6-Cylinder****ENGINE MECHANICAL****GENERAL DESCRIPTION****Intake Manifold Description**

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

Timing Chain Description

The timing chain coordinates the crankshaft and the dual overhead camshafts and keeps them synchronized. The timing chain and the sprockets are toothed so that there is no slippage between them. A timing chain tensioner, a timing chain lever, and a fixed chain guide maintain the timing chain's correct tension. The timing chain is made of steel and under normal operation, virtually no maintenance (replacement of timing chain) is required. The timing chain requires appropriate lubrication.

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 the splash action from pressurized oil escaping from the camshaft journals.

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.

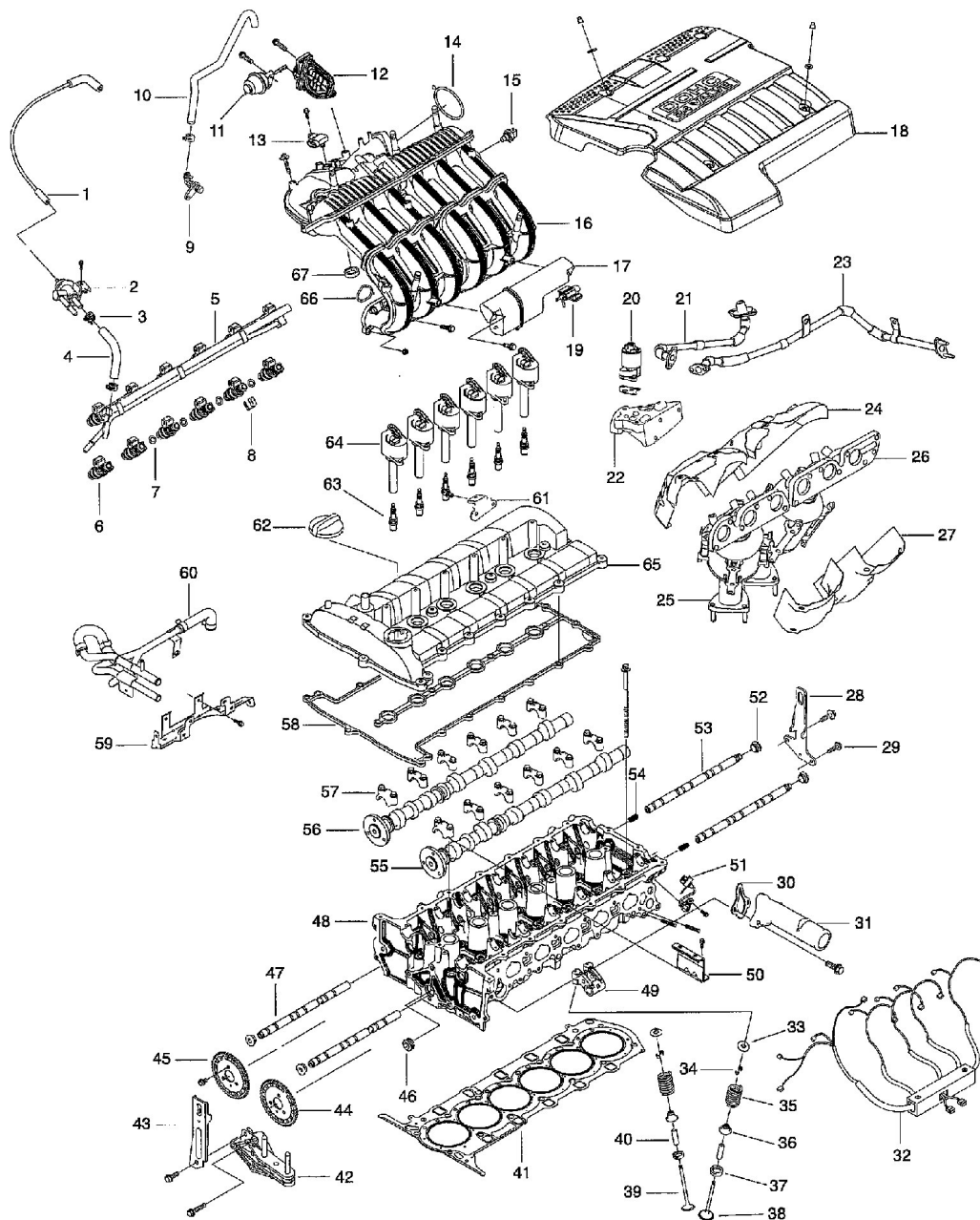
Crankshaft Description

The crankshaft has eleven (11) 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 bearing installed at the fourth (4th) journal.

COMPONENT LOCATION**Upper End Location**

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder



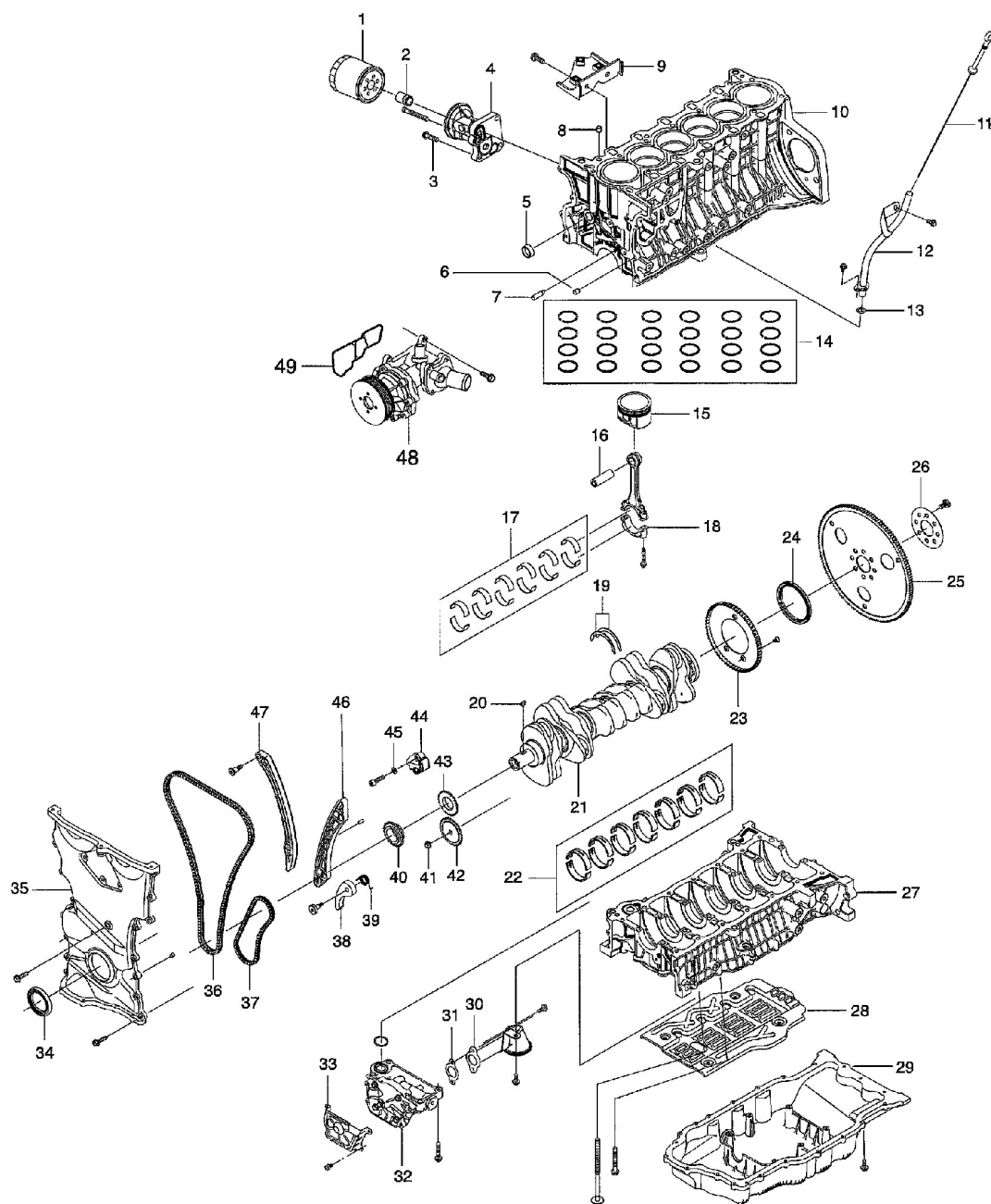
1. Vacuum Pipe	18. Engine Beautification Cover	35. Valve Spring	52. Rocker Arm Shaft Plug
2. Fuel Pressure Regulator	19. VIS Solenoid	36. Valve Stem Seal	53. Rear Rocker Arm Shaft
3. Clip	20. EGR Valve	37. Valve Seat Ring	54. Spring
4. Fuel Rail Hose	21. Intake EGR Pipe	38. Intake Valve	55. Intake Camshaft
5. Fuel Rail	22. EGR Adapter	39. Exhaust Valve	56. Exhaust Camshaft
6. Fuel Injector	23. Exhaust EGR Pipe	40. Valve Guide	57. Camshaft Cap
7. O-Ring	24. Upper Heat Shield	41. Cylinder Head Gasket	58. Cylinder Head Cover Gasket
8. Fuel Injector Clip	25. Exhaust Manifold (1-3)	42. Engine Mount Bracket Support	59. Intake Manifold Bracket
9. PCV Valve	26. Exhaust Manifold (4-6)	43. Front Support Bracket	60. Feeding and Return Heater Pipe
10. PCV Vacuum Hose	27. Lower Heat Shield	44. Intake Cam Sprocket	61. Intake Manifold Support Bracket
11. VIS Actuator	28. Rear Support Bracket	45. Exhaust Cam Sprocket	62. Oil Filler Cap
12. VIS Valve	29. Bolt	46. Plug	63. Spark Plug
13. MAP Sensor	30. Coolant Outlet Port Gasket	47. Front Rocker Arm Shaft	64. Ignition Coil
14. Throttle Body Seal	31. Coolant Outlet Port	48. Cylinder Head	65. Cylinder Head Cover
15. IAT Sensor	32. Wiring Harness	49. Rocker Arm	66. Intake Port Seal
16. Intake Manifold	33. Valve Spring Retainer	50. Top Chain Guide	67. EGR Seal
17. VIS Vacuum Tank	34. Valve Key	51. Camshaft Position Sensor (CMP Sensor)	

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

Lower End Location

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

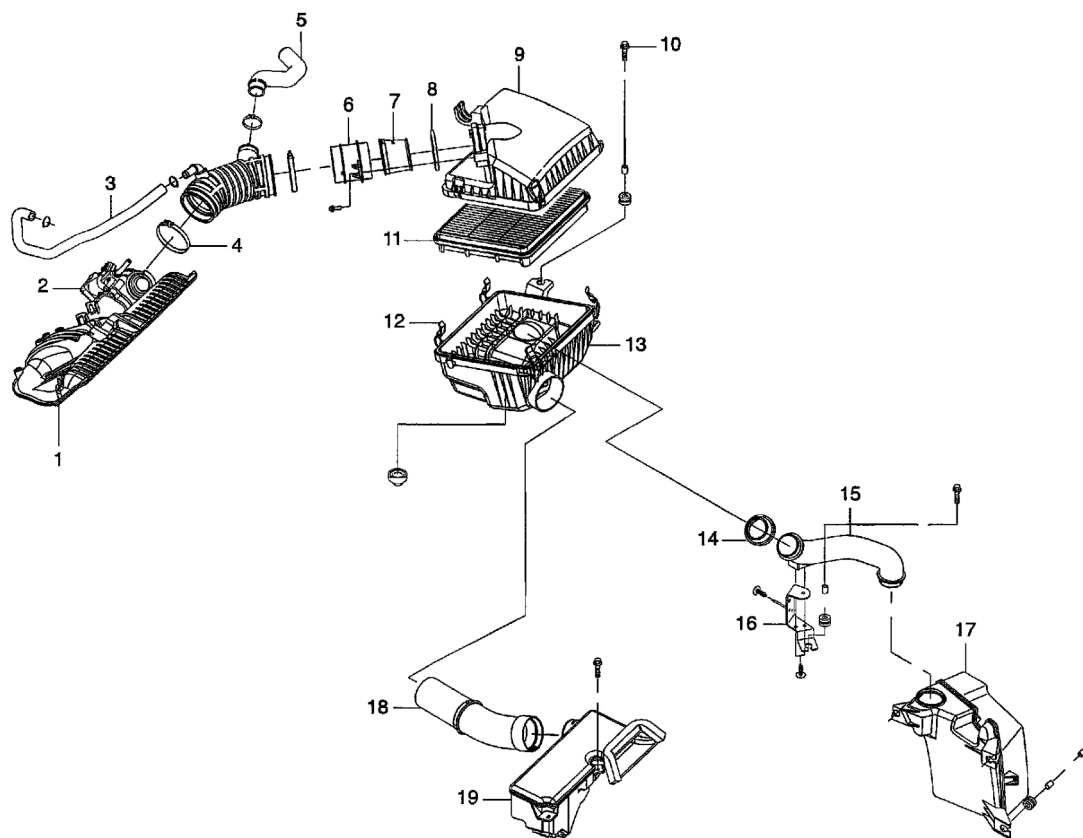


1. Oil Filter	14. Piston Ring	27. Bed Plate	39. Oil Pump Chain Lever Spring
2. Connecting Piece	15. Piston	28. Bed Plate Baffle	40. Crankshaft Sprocket
3. Bolt	16. Piston Pin	29. Oil Pan	41. Nut
4. Oil Filter Adapter	17. Connecting Rod Bearing	30. Oil Suction Pipe	42. Oil Pump Sprocket
5. Oil Gallery Plug	18. Connecting Rod	31. Gasket	43. Crankshaft Oil Pump Sprocket
6. Dowel Ring	19. Thrust Bearing	32. Oil Pump	44. Timing Chain Tensioner
7. Oil Jet Nozzle	20. Woodruff Key	33. Oil Pump Sprocket Cover	45. Spring Washer
8. Dowel Pin	21. Crankshaft	34. Front Oil Seal	46. Fixed Chain Guide
9. Upper Exhaust Bracket	22. Crankshaft Bearing	35. Timing Chain Cover	47. Timing Chain Lever
10. Cylinder Block	23. Target Wheel	36. Timing Chain	48. Water Pump
11. Engine Oil Dipstick	24. Rear Oil Seal	37. Oil Pump Chain	49. Water Pump Gasket
12. Engine Oil Dipstick Tube	25. Flexible Plate	38. Oil Pump Chain Lever	
13. O-Ring	26. Flexible Plate Disk Reinforce		

G01985560

Fig. 2: Exploded View Of Lower Components
Courtesy of SUZUKI OF AMERICA CORP.

Air Intake System Location

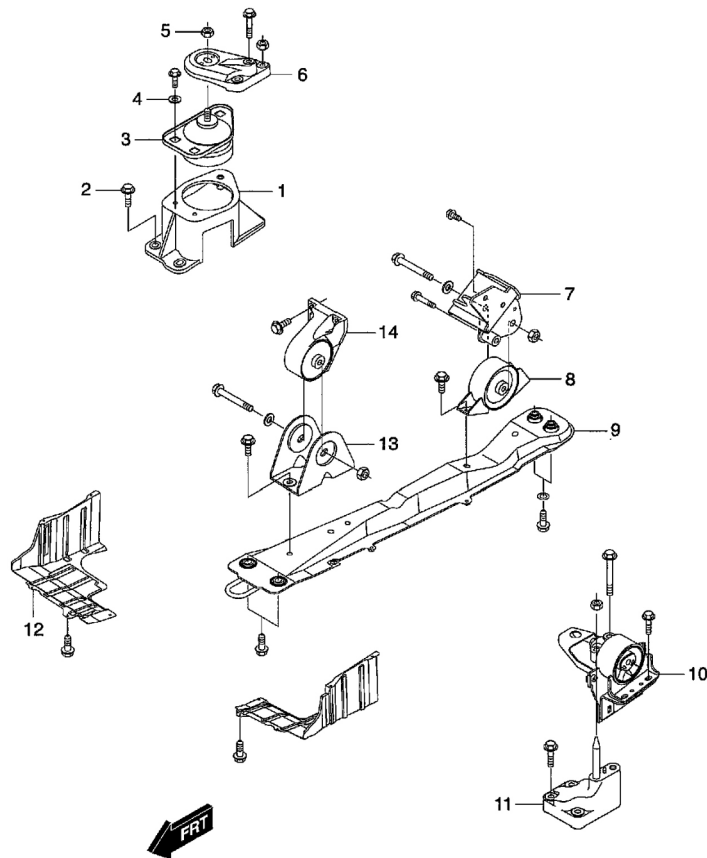


1. Intake Manifold	6. Air Filter Hose Joint	11. Air Filter Element	16. Bracket
2. Throttle Body Assembly	7. Air Filter Diffuser	12. Air Filter Housing Clip	17. Resonator
3. Breather Hose	8. Air Filter Seal	13. Lower Air Filter Housing	18. Air Filter Inlet Hose
4. Clamp	9. Upper Air Filter Housing	14. Resonator Seal	19. Air Filter Snorkel
5. Auxiliary Resonator Neck	10. Bolt	15. Resonator Neck	

G01985561

Fig. 3: Exploded View Of Air Intake
Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount System Location



1. Engine Mount Support Bracket	5. Nut	9. Front Suspension Member	13. Front Engine Mount Bracket
2. Bolt	6. Engine Mount Bracket	10. Transaxle Mount Cage	14. Front Damper Bush Bracket
3. Hydro Mount	7. Rear Transaxle Mount Bracket	11. Transaxle Mount Bracket	
4. Washer	8. Rear Damper Bush Bracket	12. Engine Under Cover	

G01985562

Fig. 4: Identifying Engine Components (Engine Mount System Location)
 Courtesy of SUZUKI OF AMERICA CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

Compression Test

WARNING: Disconnect the Crankshaft Position Sensor (CPS) 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.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

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 value specified?	0.002 - 0.030 mm (0.00008 - 0.00178 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?*	-	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.	-

* 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.

G01985563

Fig. 5: Engine Knock Diagnostic Chart
Courtesy of SUZUKI OF AMERICA CORP.

* 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.

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 value specified?	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.	-

G01985564

Fig. 6: Heavy Knock Hot With Torque Applied Diagnostic Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
6	Inspect the accessory belts. Are the belts too tight or nicked?	-	Go to Step 7.	Step 8.
7	Replace and/or tension the belts to specifications, as necessary. Is the repair complete?	System OK	Go to Step 1.	-
8	Inspect the exhaust system. Is the system grounded?	-	Go to Step 9.	Go to Step 10.
9	Reposition the system, as necessary. Is the repair complete?	-	Go to Step 1.	-
10	Inspect the flywheel. Is the flywheel cracked?	-	Go to Step 11.	Go to Step 12.
11	Replace the flywheel. Is the repair complete?	-	Go to Step 1.	-
12	Inspect the main bearing clearance. Is the clearance more than the value specified?	0.019 - 0.049 mm (0.00075 - 0.00193 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?	0.031 - 0.065 mm (0.00122 - 0.00256 in.)	Go to Step 15.	System OK
15	Replace the rod bearings as necessary. Is the repair complete?	-	Go to Step 1.	-

G01985565

Fig. 7: Heavy Knock Hot With Torque Applied Diagnostic Chart (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

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 loose?	-	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 value specified?	0.031 - 0.065 mm (0.00122 - 0.00256 in.)	Go to Step 9.	System OK
9	Replace the rod bearings, as necessary. Is the repair complete?	-	Go to Step 1.	-

G01985566

Fig. 8: Light Knock When Engine Is Hot Diagnostic Chart
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
1	Does the engine knock during initial start-up but last only a few seconds?	-	Go to Step 2.	System OK
2	Check the engine oil. Is the proper viscosity oil used in the crankcase?	-	Go to Step 4.	Go to Step 3.
3	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	-	Go to Step 1.	-
4	Inspect the hydraulic lifters. Is there evidence of hydraulic lifter bleed-down?	-	Go to Step 5.	Go to Step 6.
5	Clean, test and replace the lifters as necessary. Is the repair complete?*	-	Go to Step 1.	-
6	Inspect the crankshaft end clearance. Is the clearance more than specified value?	0.055 - 0.265 mm (0.002 - 0.010 in.)	Go to Step 7.	Go to Step 8.
7	Replace the crankshaft thrust bearing. Is the repair complete?	-	Go to Step 1.	-

G01985567

Fig. 9: Knocks During Initial Start-Up But Lasts Only A Few Seconds Diagnostic Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Step	Action	Value(s)	Yes	No
8	Inspect the front main bearing clearance. Is the clearance more than the value specified?	0.019 - 0.049 mm (0.00075 - 0.00193 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.	-

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

G01985568

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

Fig. 10: Knocks During Initial Start-Up But Lasts Only A Few Seconds Diagnostic Chart (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
1	Does the engine knock at idle when hot?	-	Go to Step 2.	System OK
2	Inspect the drive belts. Are the belts loose or worn?	-	Go to Step 3.	Go to Step 4.
3	Tension or replace the belts, as necessary. Is the repair complete?	-	Go to Step 1.	-
4	Inspect the A/C compressor and the generator. Is either the compressor or the generator faulty?	-	Go to Step 5.	Go to Step 6.
5	Replace the faulty A/C compressor or the generator. Is the repair complete?	-	Go to Step 1.	-
6	Inspect the valve train. Are valve train components faulty?	-	Go to Step 7.	Go to Step 8.
7	Replace 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?	0.009 - 0.019 mm (0.00035 - 0.00075 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?	0.002 - 0.030 mm (0.00008 - 0.00178 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 value specified?	0.6 mm (0.02362 in.) Toward Thrust Side	Go to Step 19.	System OK
19	Install the correct piston. Is the repair complete?	-	Go to Step 1.	-

G01985569

Fig. 11: Knocks At Idle When Engine Is Hot Diagnostic Chart
Courtesy of SUZUKI OF AMERICA CORP.

Noise Diagnosis

Step	Action	Value(s)	Yes	No
1	Are dull thuds or knocks heard with every engine revolution?	-	Go to Step 2.	System OK
2	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to "Oil Pressure Test: ".	Go to Step 3.

G01985570

Fig. 12: Main Bearing Noise Diagnostic Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
3	Inspect the crankshaft end play. Is there excessive crankshaft end play?	0.055 - 0.265 mm (0.002 - 0.010 in)	Go to "Crankshaft Bearings and Connecting Rod Bearings Removal: " and "Crankshaft Bearings and Connecting Rod Bearings Installation: ".	Go to Step 4.
4	Inspect the crankshaft journals. Are the crankshaft journals out-of-round?	-	Go to "Crankshaft Bearings and Connecting Rod Bearings Removal: " and "Crankshaft Bearings and Connecting Rod Bearings Installation: ".	Go to Step 5.
5	Inspect the crankshaft pulley. Is the crankshaft pulley loose?	-	Go to "Crankshaft Bearings and Connecting Rod Bearings Removal: " and "Crankshaft Bearings and Connecting Rod Bearings Installation: ".	System OK

G01985571

Fig. 13: Main Bearing Noise Diagnostic Chart (2 Of 2)

Courtesy of SUZUKI OF AMERICA CORP.

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

G01985572

Fig. 14: Connecting Rod Bearing Noise Symptom Diagnostic Chart

Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

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 "Cylinder Head and Valve Train Components Removal: " and "Cylinder Head and Valve Train Components Installation: ".	Go to Step 3.
3	Inspect the piston. Is the piston broken or cracked?	-	Go to "Cylinder Head and Valve Train Components Removal: " and "Cylinder Head and Valve Train Components Installation: ".	Go to Step 4.

G01985573

Fig. 15: Piston Noise Diagnostic Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Step	Action	Value(s)	Yes	No
4	Inspect the connecting rods. Is there a misaligned connecting rod?	-	Go to "Cylinder Head and Valve Train Components Removal: " and "Cylinder Head and Valve Train Components Installation: ".	Go to Step 5.
5	Inspect the piston position. Is the piston 180° out of position?	-	Go to "Cylinder Head and Valve Train Components Removal: " and "Cylinder Head and Valve Train Components Installation: ".	System OK

G01985574

Fig. 16: Piston Noise Diagnostic Chart (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

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

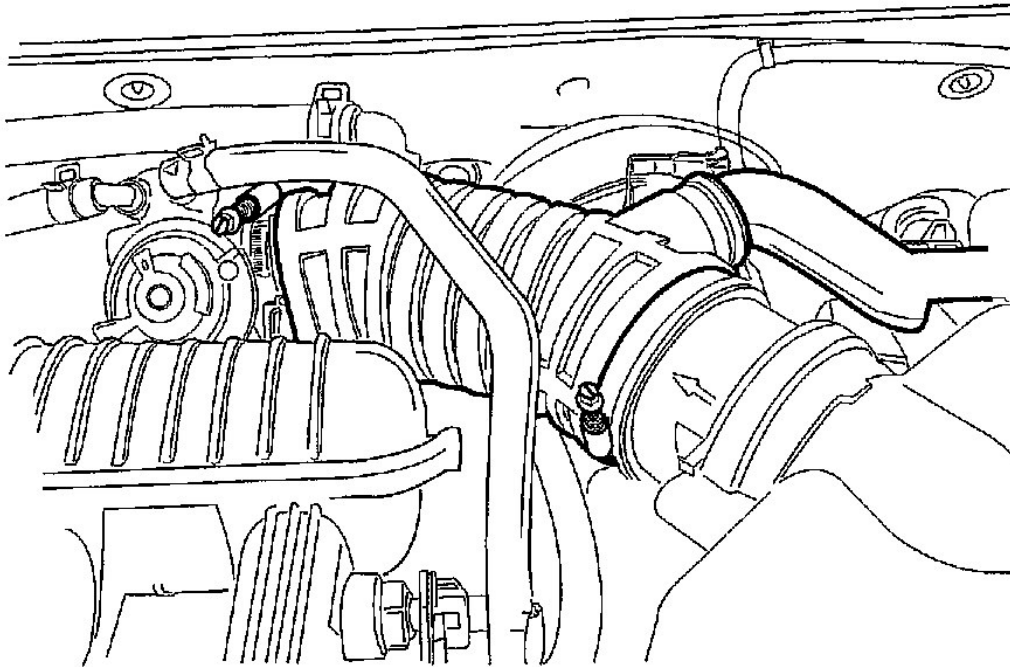
G01985575

Fig. 17: Valve Mechanism Or Valve Train Noise Diagnostic Chart
Courtesy of SUZUKI OF AMERICA CORP.

REPAIR INSTRUCTIONS

Throttle Body Assembly Removal

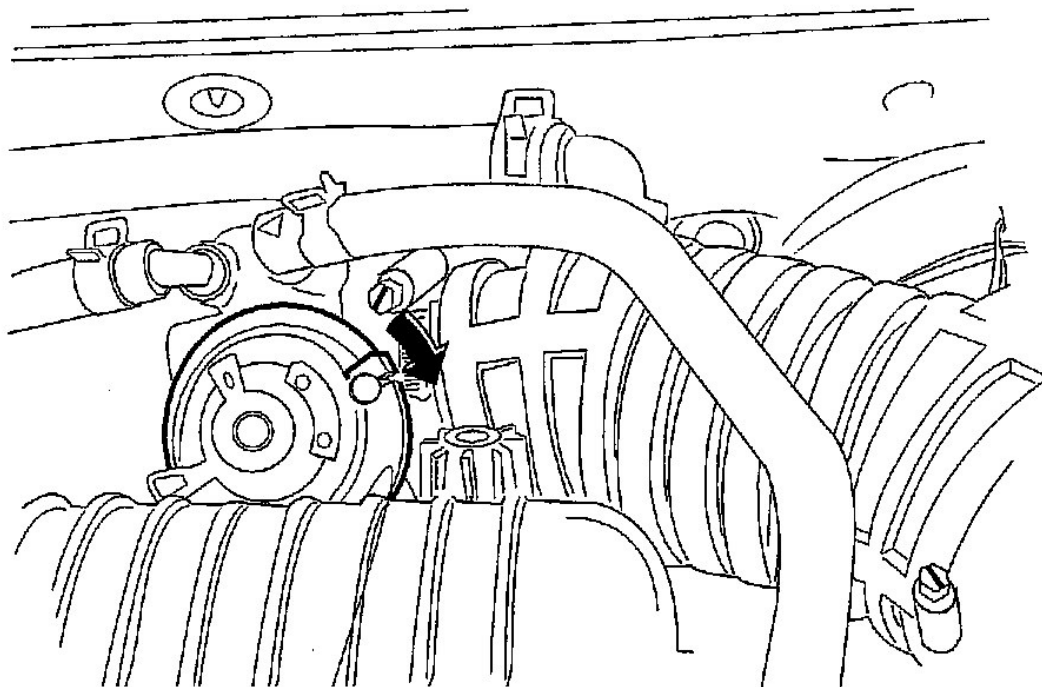
1. Disconnect the negative battery cable.
2. Remove the air filter outlet hose.



G01985576

Fig. 18: Removing Air Filter Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

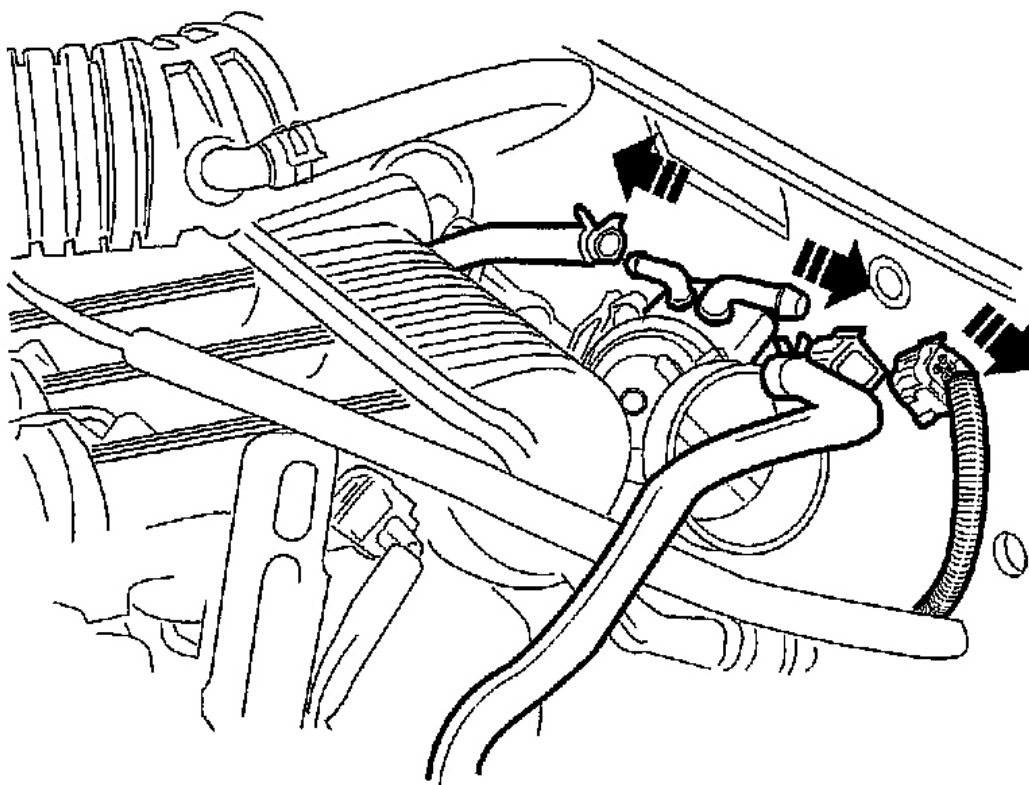
3. Disconnect the throttle cable by opening the throttle and moving the cable through the release slot.



G01985577

Fig. 19: Disconnecting Throttle Cable
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove the coolant inlet and outlet hoses from the throttle body assembly.
5. Disconnect the main throttle idle actuator (MTIA) connector.

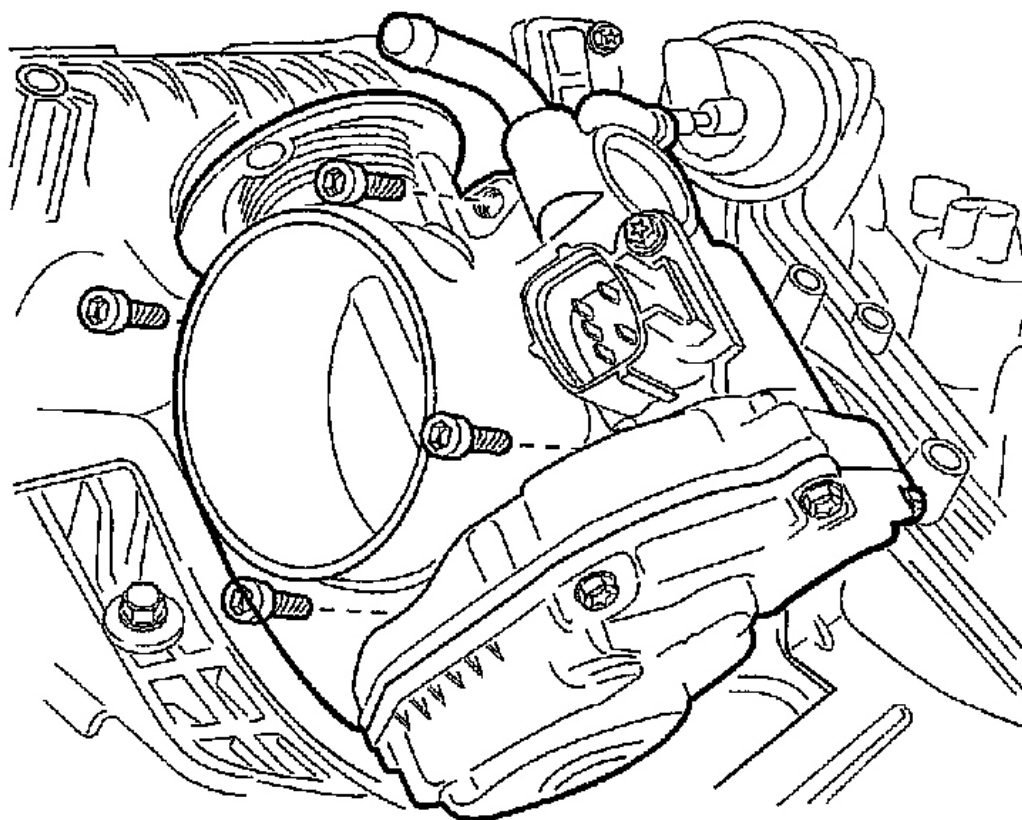


G01985578

Fig. 20: Disconnecting MTIA Connector
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove the throttle body assembly.
7. Remove the throttle body gasket.

NOTE: Inspect the throttle body gasket for a distortion or damage.



G01985579

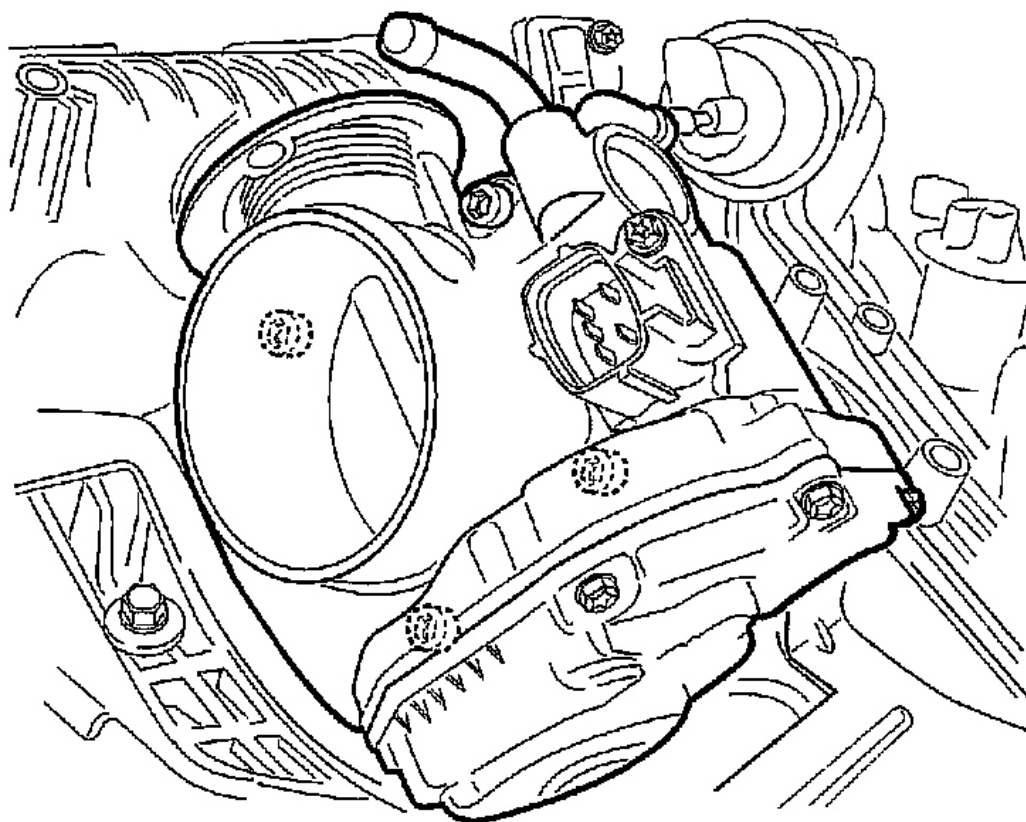
Fig. 21: Removing Throttle Body Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Throttle Body Assembly Installation

1. Installation should follow the removal procedure in the reverse order.
2. Install the throttle body assembly.

Tighten

Tighten the throttle body assembly retaining bolts to 8-18 N.m (71-159 lb-in).

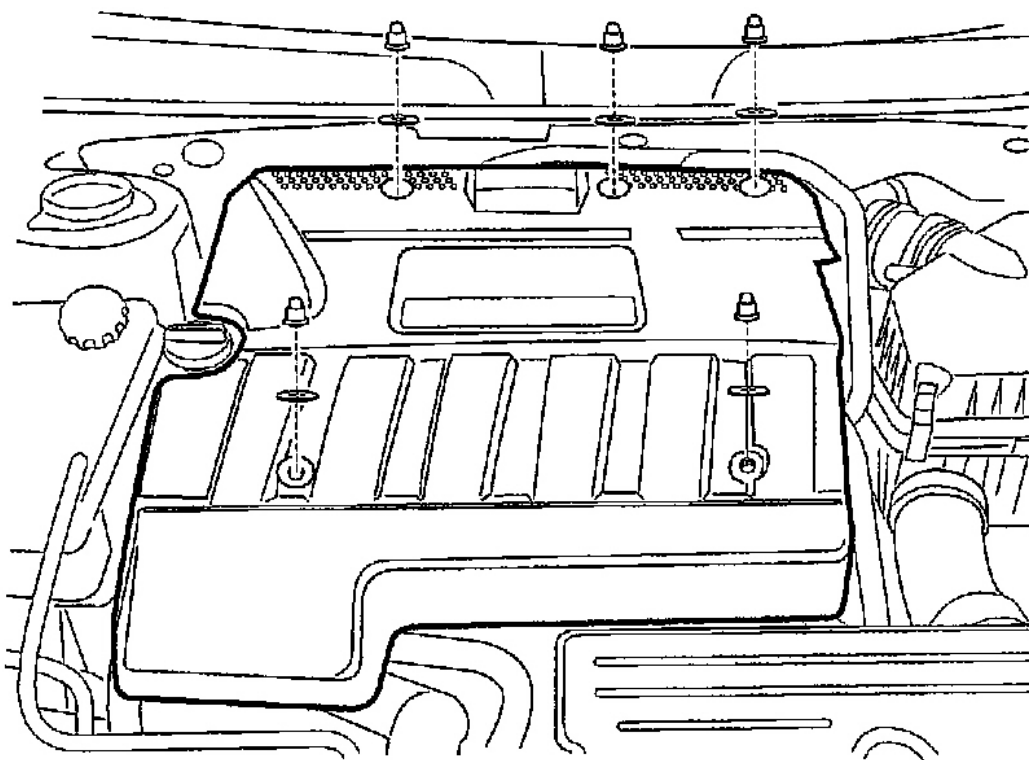


G01985580

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

Intake Manifold Removal

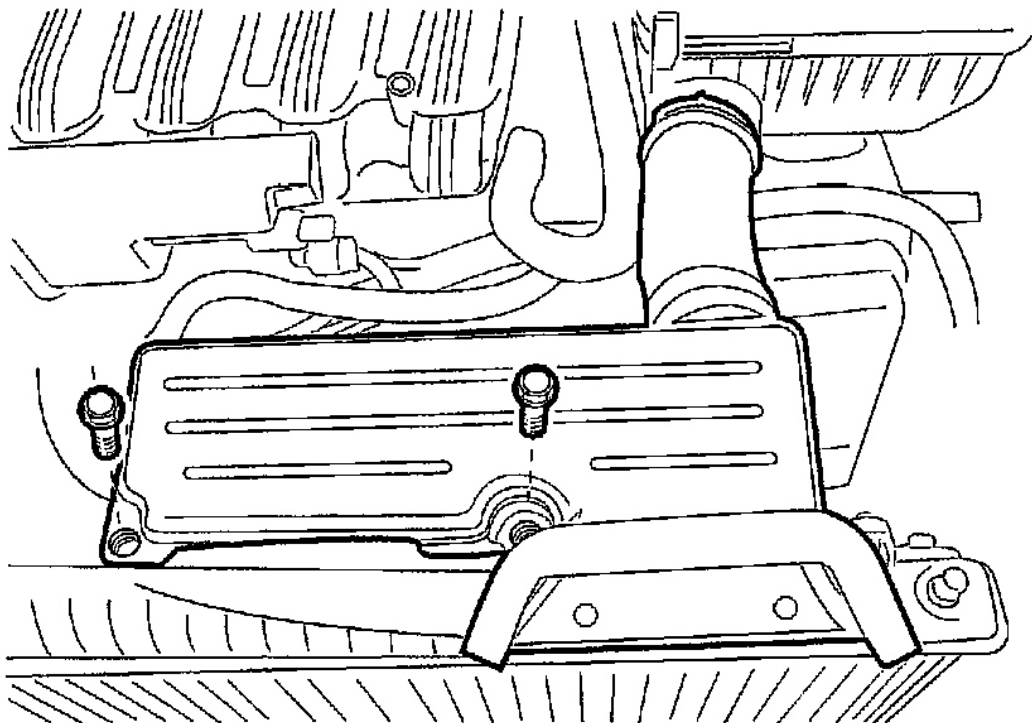
1. Remove the fuel pump fuse.
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .



G01985581

Fig. 23: Draining Engine Coolant
Courtesy of SUZUKI OF AMERICA CORP.

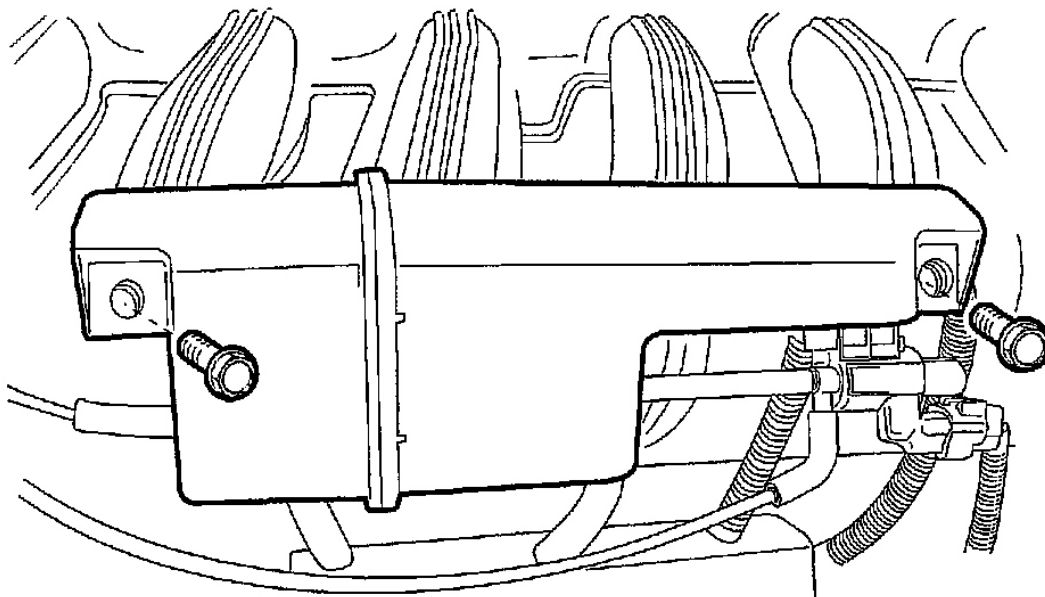
5. Remove the engine beautification cover retaining nut and engine beautification cover.
6. Remove the air filter snorkel.



G01985582

Fig. 24: Removing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

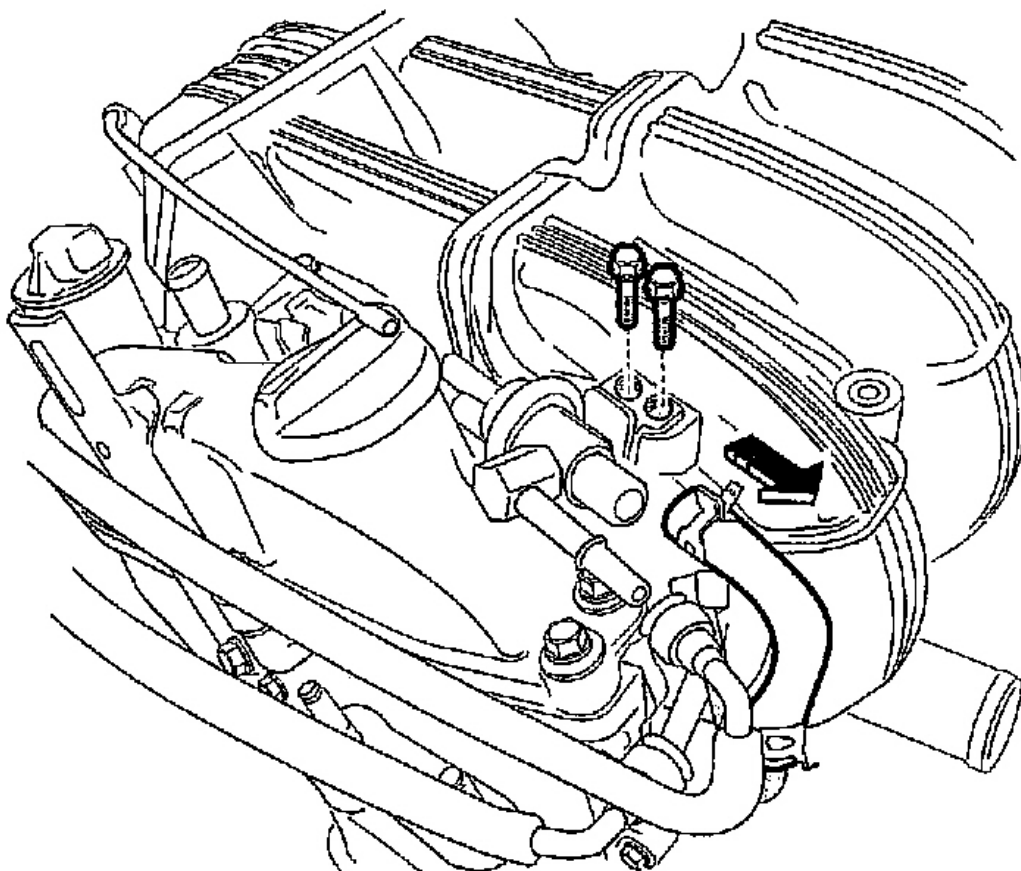
7. Remove the VIS vacuum tank.



G01985583

Fig. 25: Removing VIS Vacuum Tank
Courtesy of SUZUKI OF AMERICA CORP.

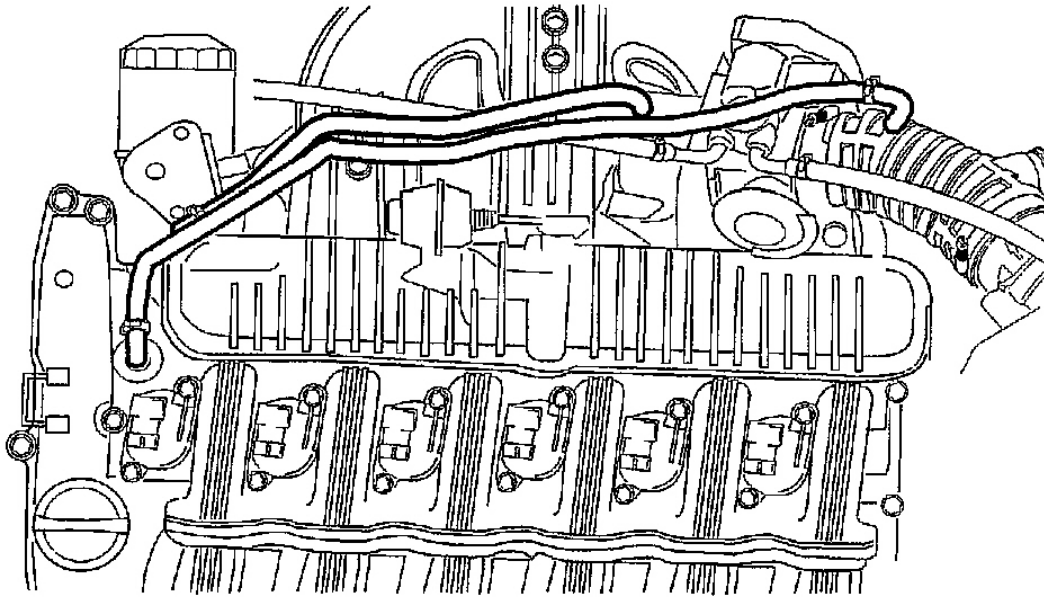
8. Remove the fuel pressure regulator.



G01985584

Fig. 26: Removing Fuel Pressure Regulator
Courtesy of SUZUKI OF AMERICA CORP.

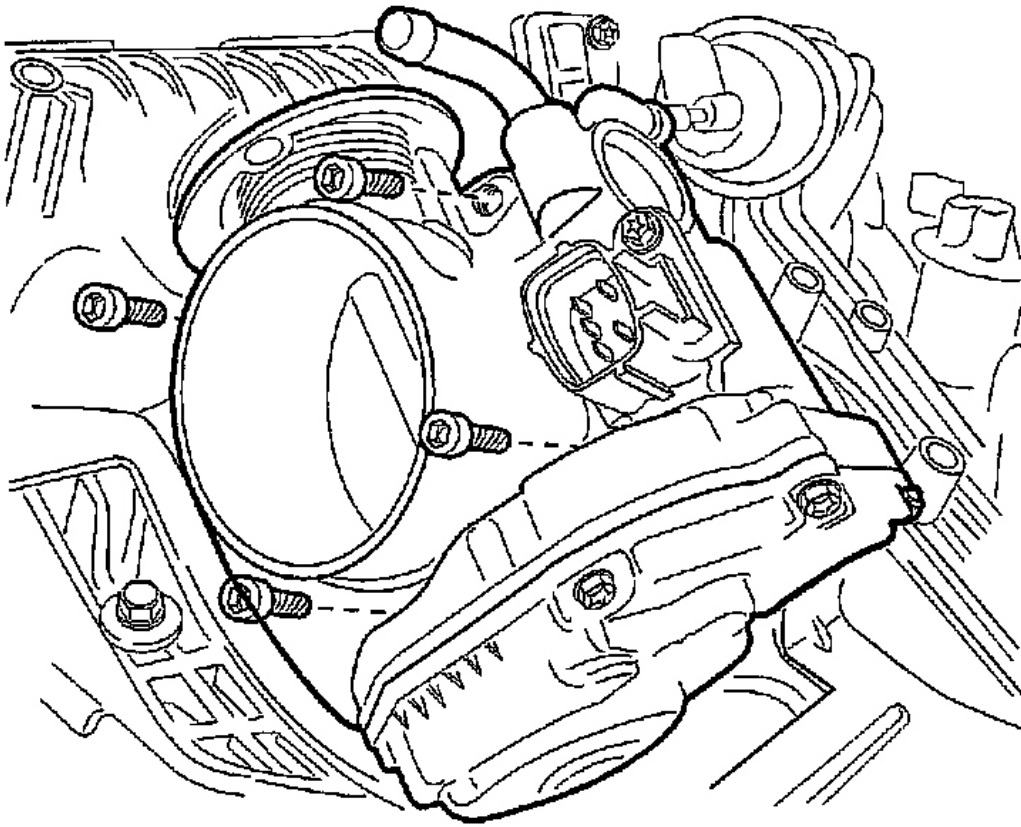
9. Remove the breather hose.
10. Remove the PCV vacuum hose.



G01985585

Fig. 27: Removing PCV Vacuum Hose
Courtesy of SUZUKI OF AMERICA CORP.

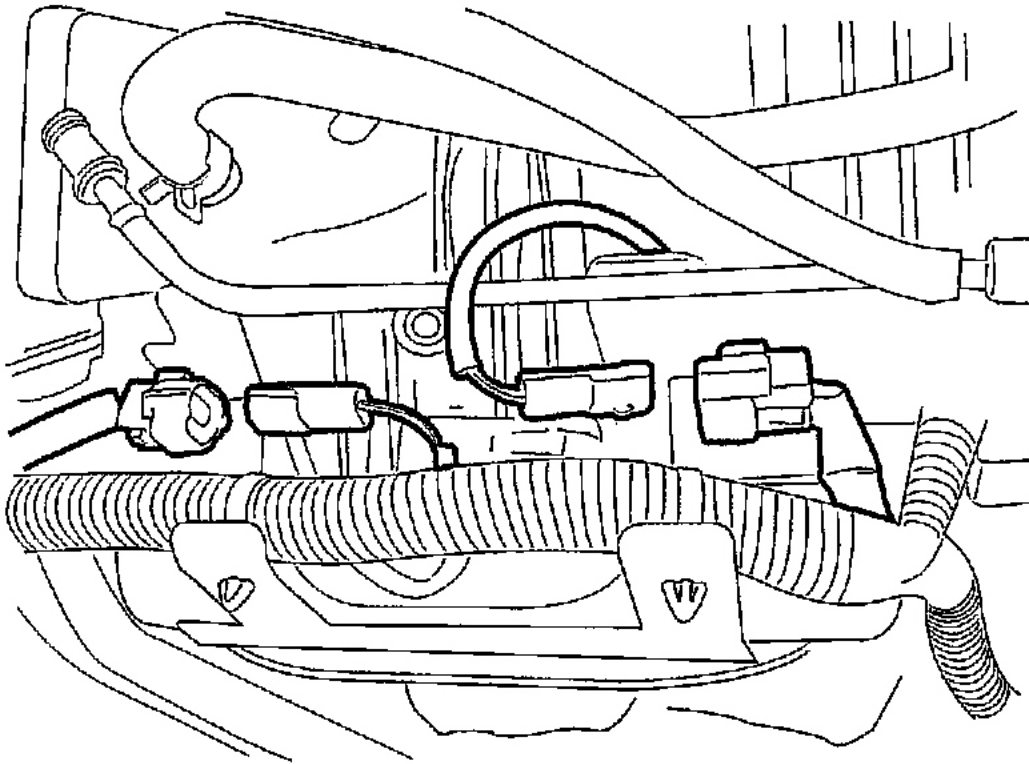
11. Remove the air filter outlet hose. Refer to **Air Intake System Location** .
12. Remove the throttle body assembly. Refer to **Throttle Body Assembly Removal** .



G01985586

Fig. 28: Removing Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

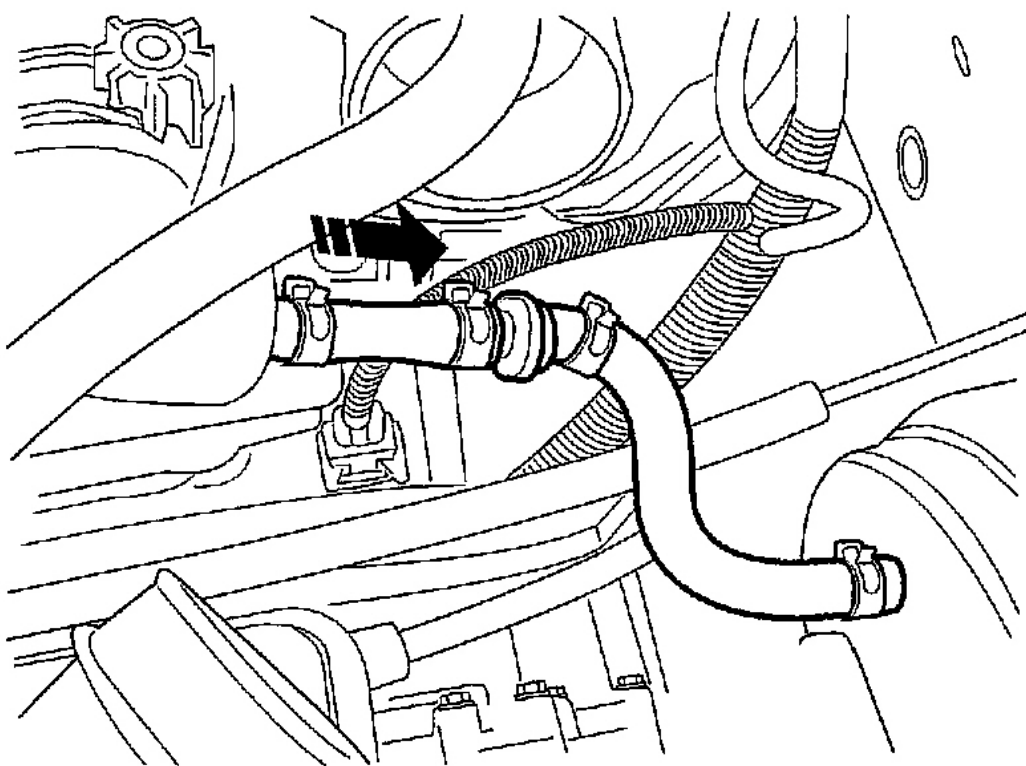
13. Disconnect the charcoal canister purge solenoid connector and hose. Refer to **Air Intake System Location** .
14. Disconnect the O2S (Oxygen Sensor) connector. Refer to **OXYGEN SENSOR (O2S) REMOVAL** .
15. Disconnect the MAP (Manifold Absolute Pressure) sensor connector. Refer to **MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL** .
16. Disconnect the CKP (Crankshaft Position) sensor connector. Refer to **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL** .



G01985587

Fig. 29: Disconnecting CKP Sensor Connector
 Courtesy of SUZUKI OF AMERICA CORP.

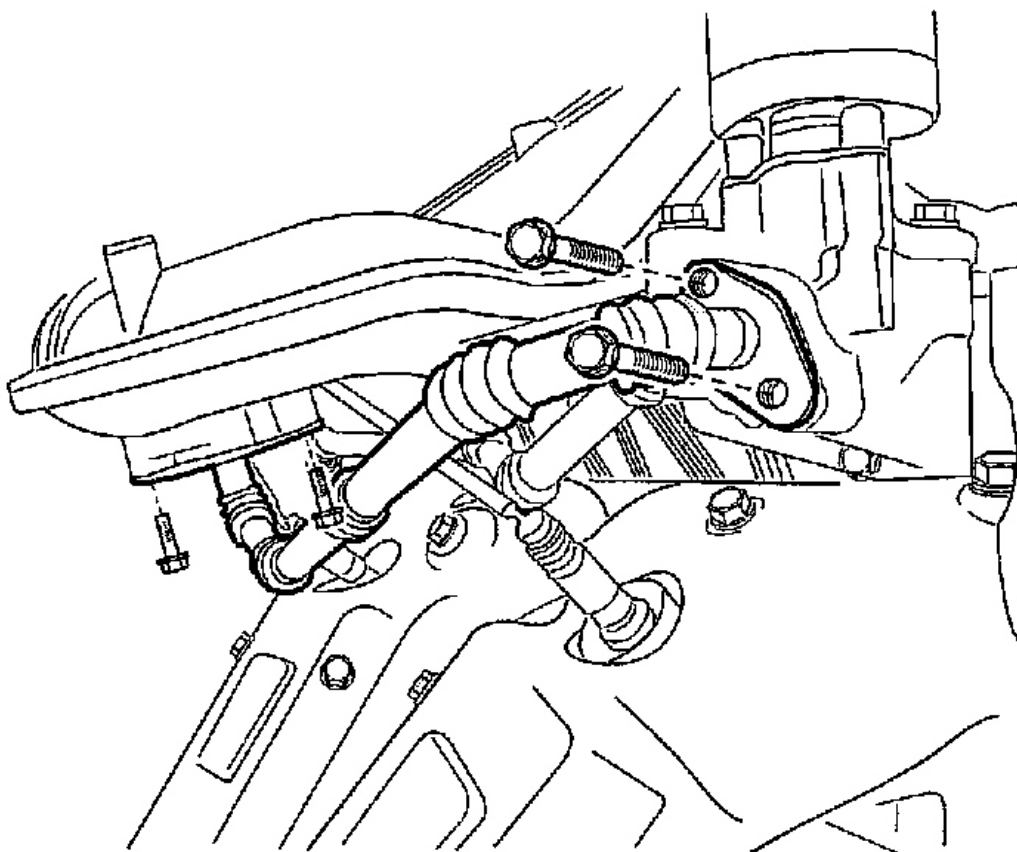
17. Disconnect the EGR (Exhaust Gas Recirculation) solenoid connector. Refer to **EXHAUST GAS RECIRCULATION (EGR) VALVE REMOVAL** .
18. Disconnect the CMP (Camshaft Position) sensor connector. Refer to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL** .
19. Remove the IAT (Intake Air Temperature) sensor. Refer to **INTAKE AIR TEMPERATURE (IAT) SENSOR REMOVAL** .
20. Disconnect the ignition coil connector. Refer to **IGNITION COIL REMOVAL** .
21. Remove the vacuum hose on the brake booster.



G01985588

Fig. 30: Removing Vacuum Hose On Brake Booster
Courtesy of SUZUKI OF AMERICA CORP.

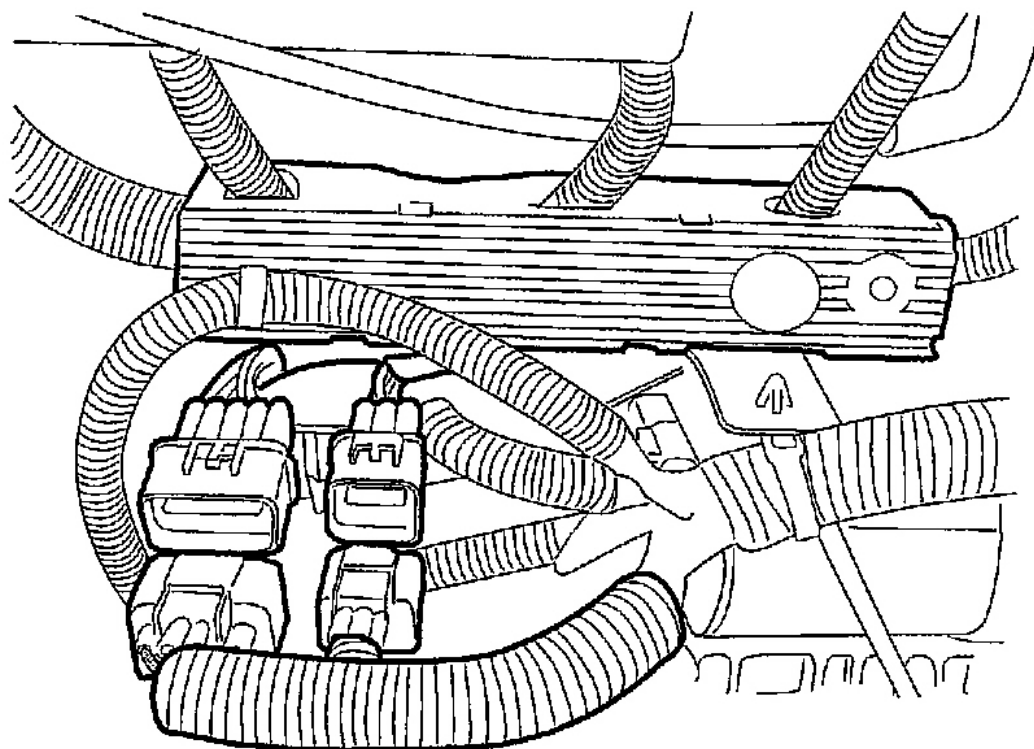
22. Remove the EGR pipe from the intake manifold.
23. Remove the engine coolant temperature sensor.



G01985589

Fig. 31: Removing Engine Coolant Temperature Sensor
Courtesy of SUZUKI OF AMERICA CORP.

24. Remove the wiring harness from the support bracket on the cylinder block.

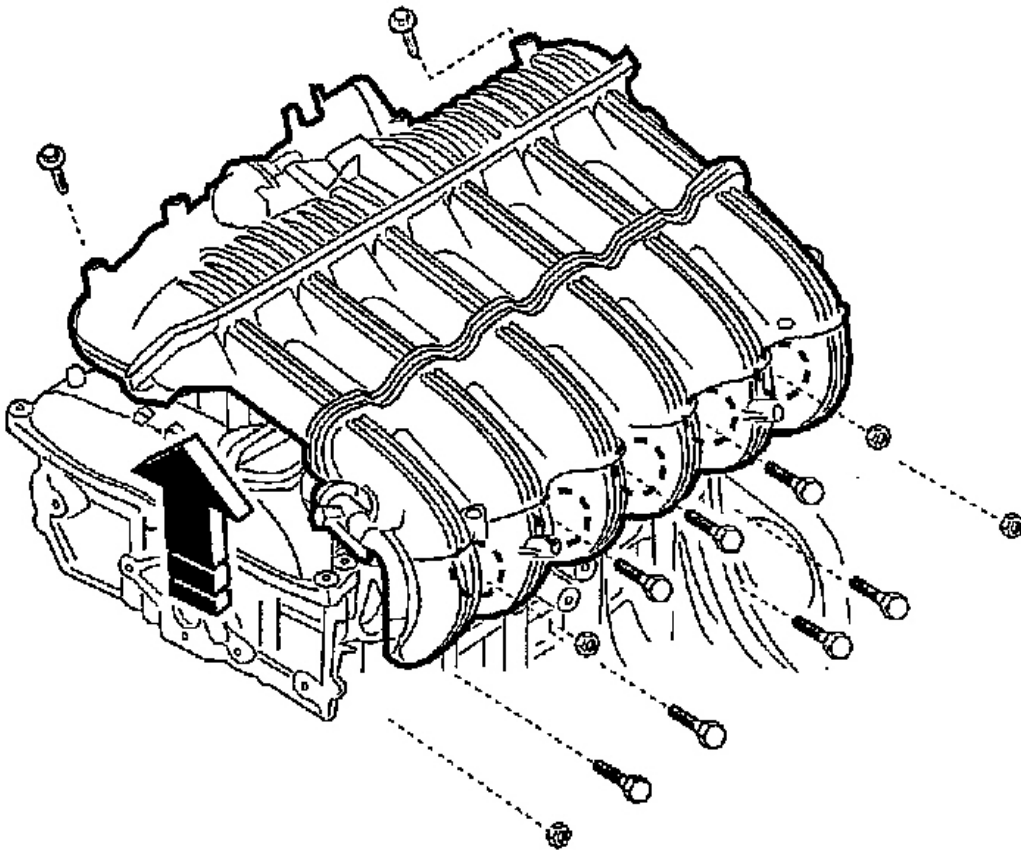


G01985590

Fig. 32: Removing Wiring Harness From Support Bracket On Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

25. Remove the intake manifold retaining nuts/bolts and the intake manifold.
26. Remove the bolts on the intake manifold support bracket.
27. Remove the intake manifold gaskets.
28. Clean the contact surfaces between intake manifold and the cylinder head.

NOTE: Remove the fuel rail after removing the intake manifold.



G01985591

Fig. 33: Cleaning Contact Surfaces Between Intake Manifold & Cylinder Head
Courtesy of SUZUKI OF AMERICA CORP.

Intake Manifold Installation

1. Installation should follow the removal procedure in the reverse order.
2. Discard used intake manifold gaskets and install new ones.
3. Tighten the intake manifold retaining nuts and bolts.

NOTE: Install the intake manifold after installing the fuel rail.

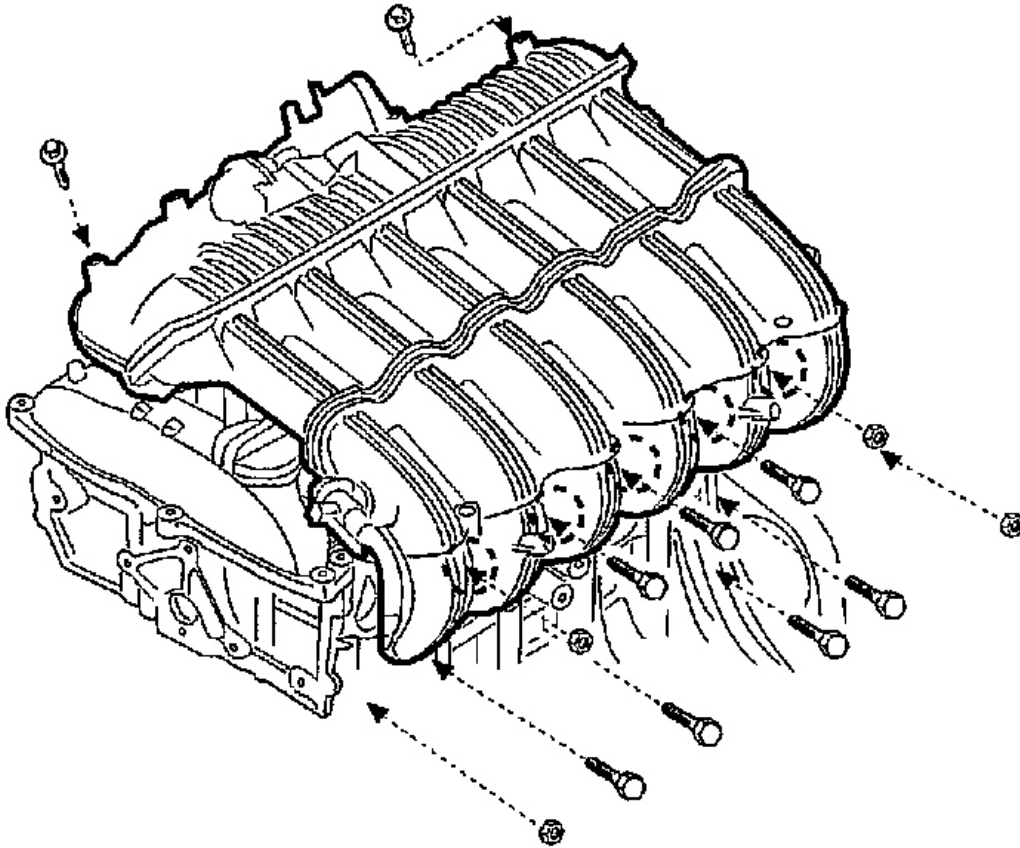
CAUTION: Genuine intake manifold retaining bolts within the specifications should be used to prevent damaged intake manifold from impairing the airflow to the cylinder.

Tighten

Tighten the seven (7) intake manifold retaining bolts to 10-14 N.m (89-124 lb-in).

Tighten the four (4) intake manifold retaining nuts to 10-14 N.m (89-124 lb-in).

Tighten the two (2) bolts on the intake manifold support bracket to 10-14 N.m (89-124 lb-in).



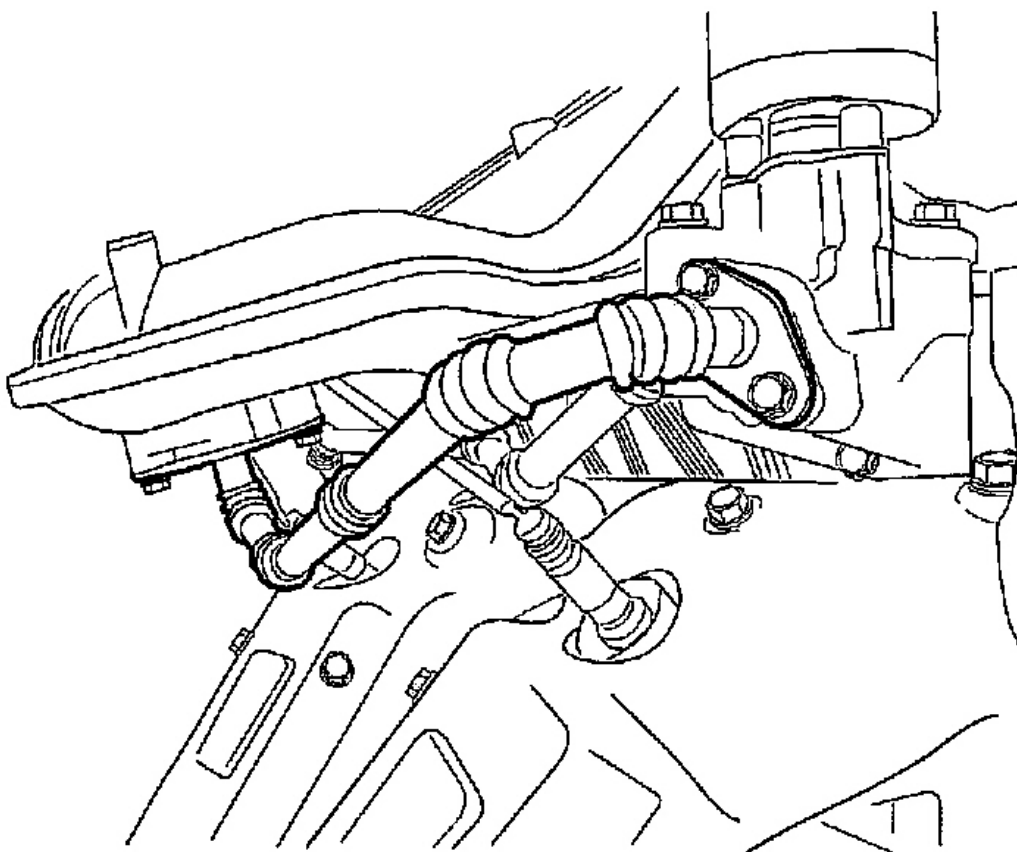
G01985592

Fig. 34: Tightening Intake Manifold Retaining Nuts & Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Tighten the intake EGR pipe retaining bolts on the intake manifold. Refer to **EXHAUST GAS RECIRCULATION (EGR) VALVE INSTALLATION**.

Tighten

Tighten the intake EGR pipe retaining bolts to 8-12 N.m (71-106 lb-in).



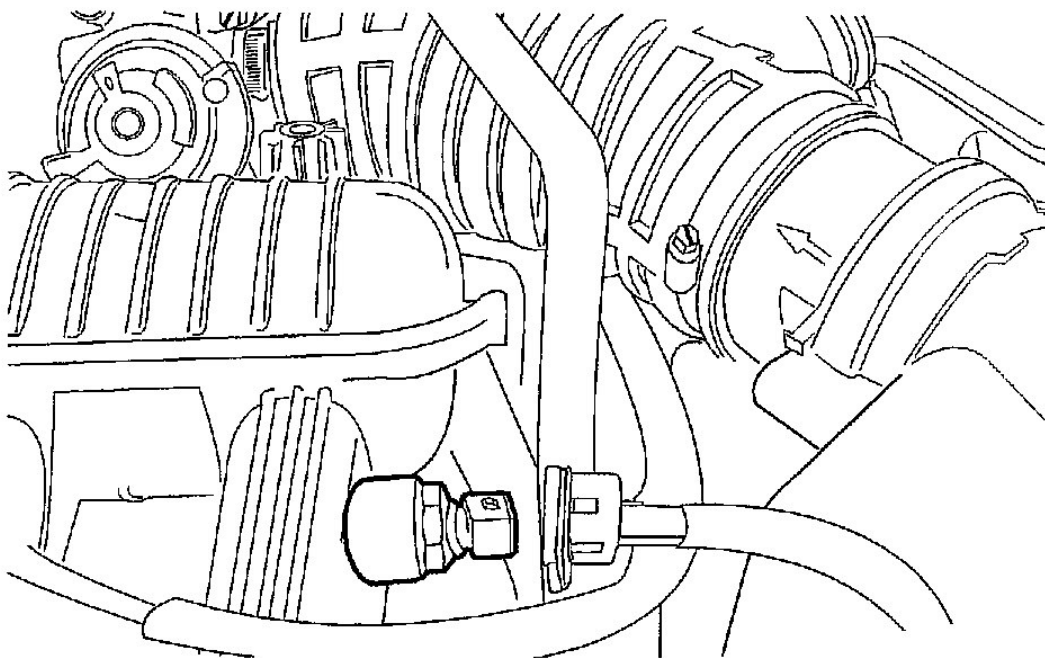
G01985593

Fig. 35: Tightening Intake EGR Pipe Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the IAT (Intake Air Temperature) sensor. Refer to **INTAKE AIR TEMPERATURE (IAT) SENSOR INSTALLATION** .

Tighten

Tighten the IAT sensor to 20-30 N.m (15-22 lb-ft).



G01985594

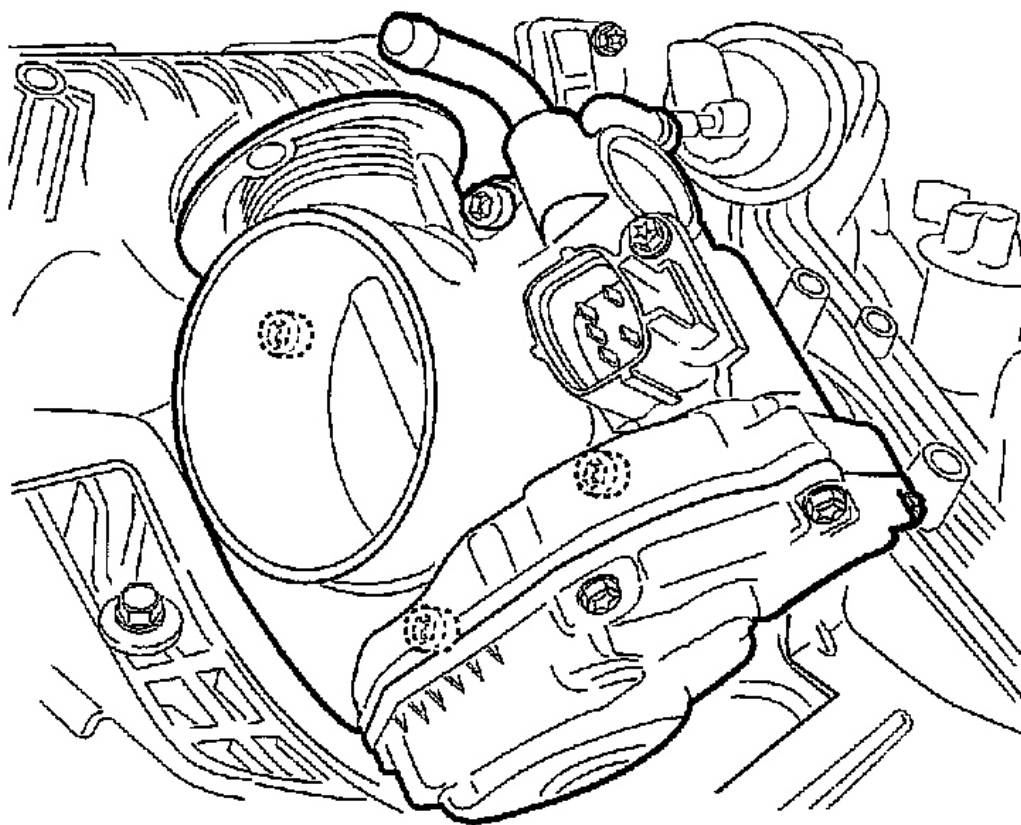
Fig. 36: Installing IAT Sensor

Courtesy of SUZUKI OF AMERICA CORP.

6. Install the throttle body assembly. Refer to **Throttle Body Assembly Installation** .

Tighten

Tighten the throttle body assembly retaining bolts to 8-18 N.m (6-13 lb-ft).



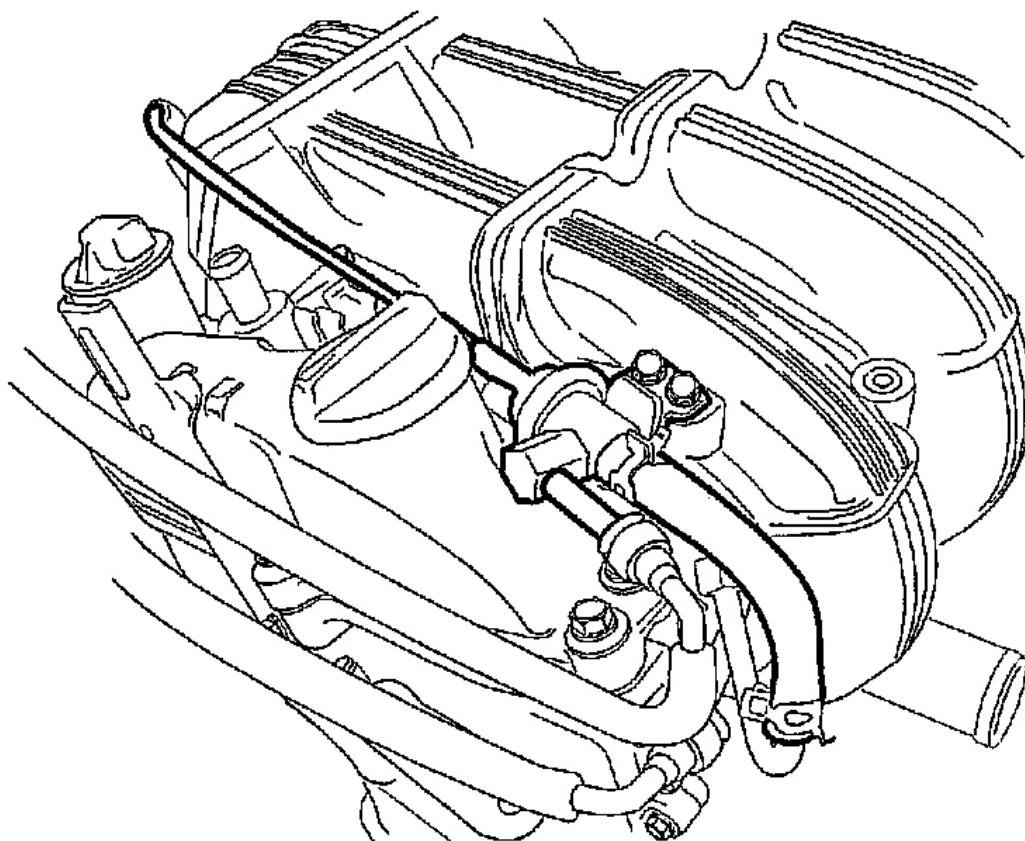
G01985595

Fig. 37: Installing Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the fuel pressure regulator. Refer to **FUEL PRESSURE REGULATOR INSTALLATION** .

Tighten

Tighten the fuel pressure regulator retaining bolts to 10-13 N.m (89-115 lb-in).



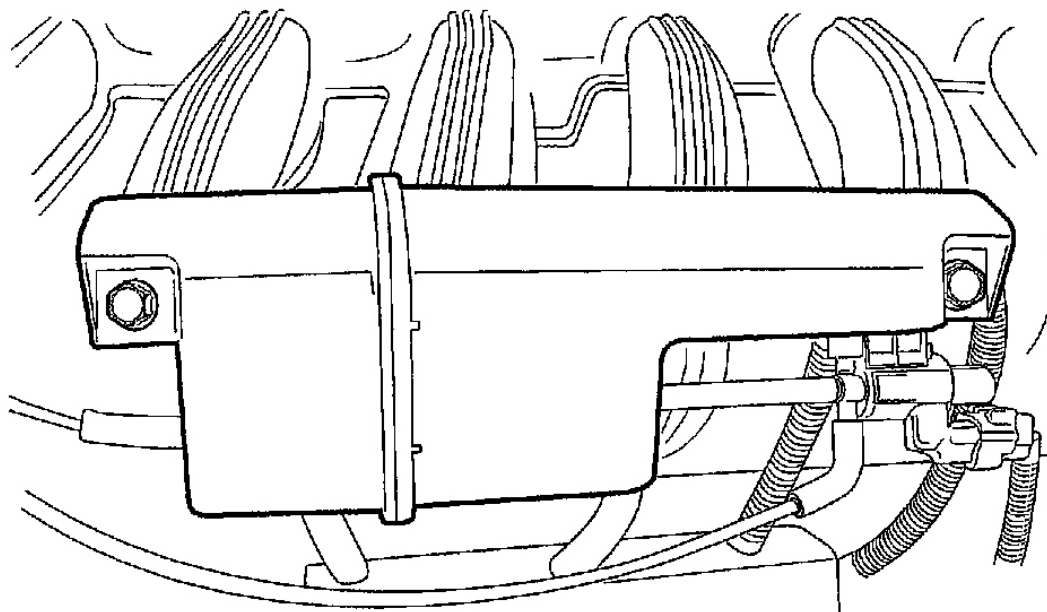
G01985596

Fig. 38: Installing Fuel Pressure Regulator
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the VIS vacuum tank. Refer to **VIS VACUUM TANK INSTALLATION** .

Tighten

Tighten the VIS vacuum tank retaining bolts to 7-9 N.m (62-80 lb-in).



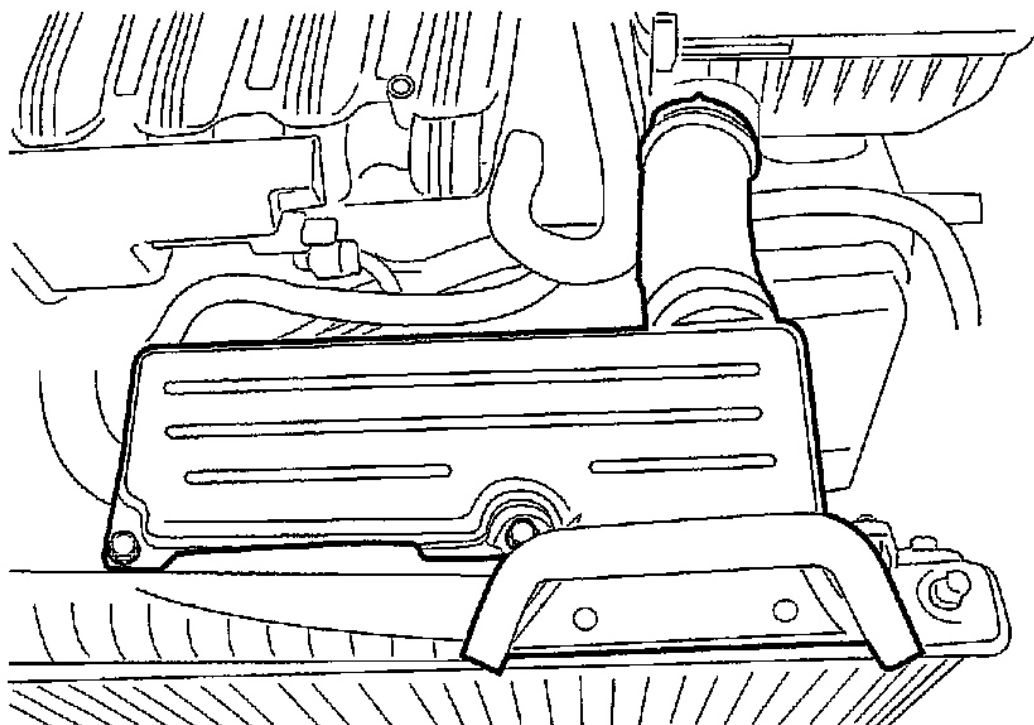
G01985597

Fig. 39: Installing VIS Vacuum Tank
Courtesy of SUZUKI OF AMERICA CORP.

9. Install the air filter snorkel. Refer to **Air Intake System Location** .

Tighten

Tighten the air filter snorkel retaining bolts to 5-7 N.m (44-62 lb-in).



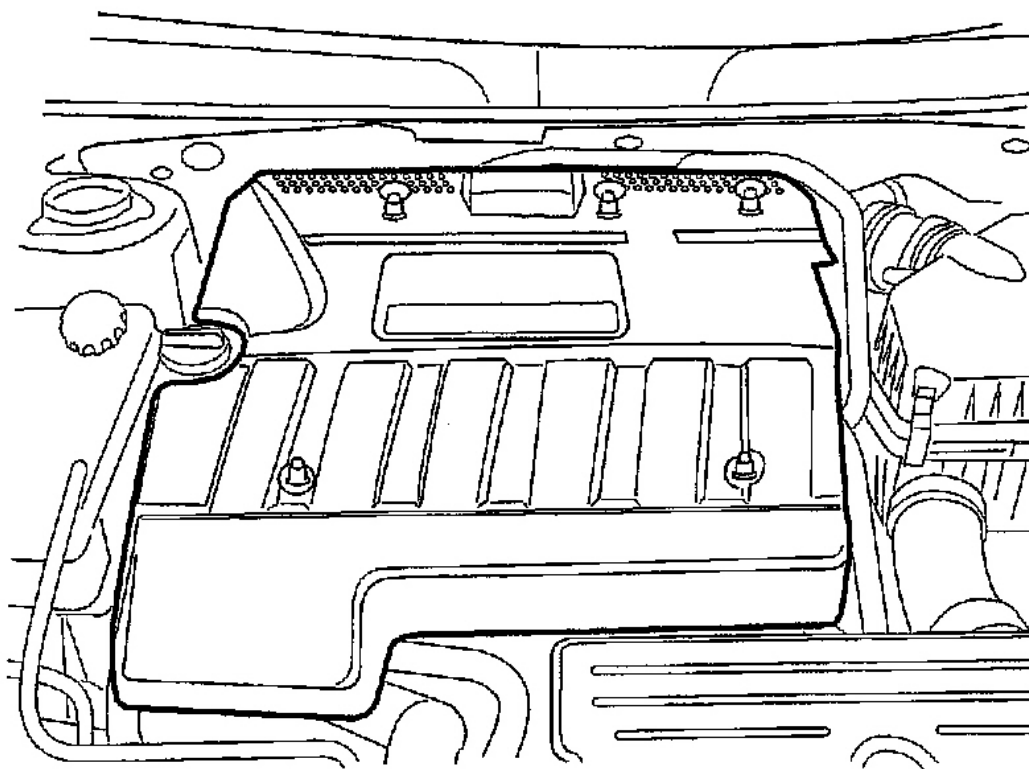
G01985598

Fig. 40: Installing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the engine beautification cover.

Tighten

Tighten the engine beautification retaining bolts to 8-12 N.m (71-106 lb-in).

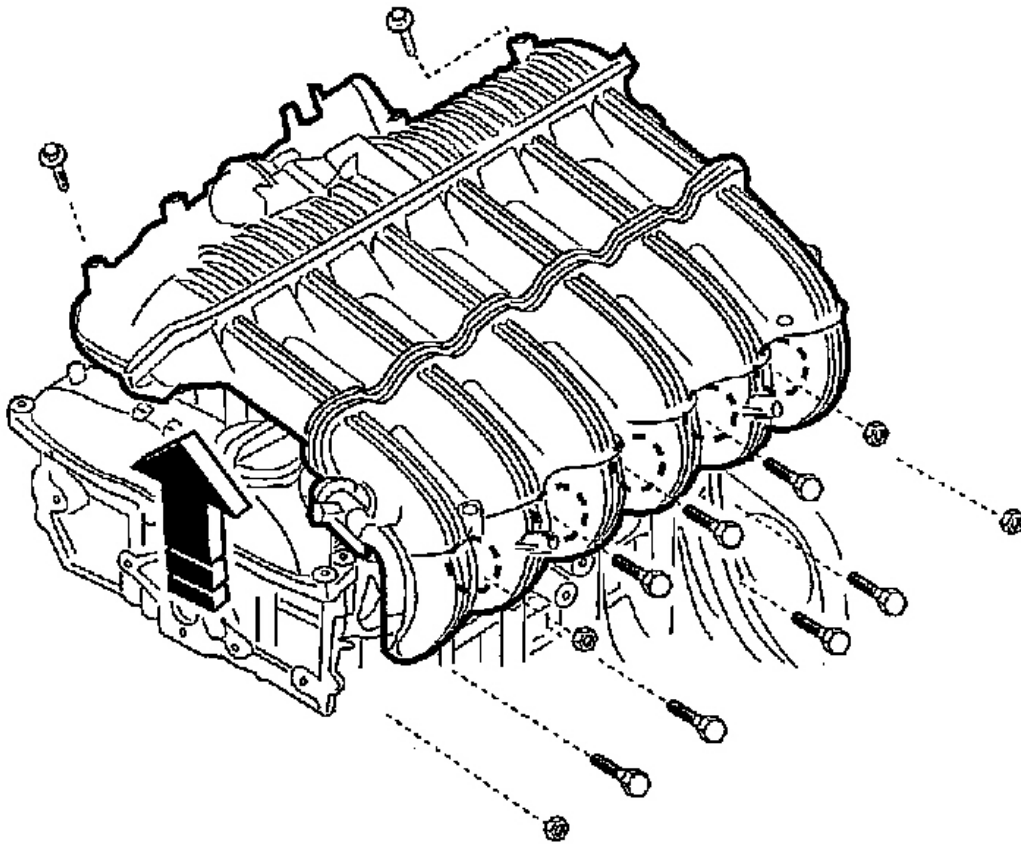


G01985599

Fig. 41: Installing Engine Beautification Cover
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head Cover Removal

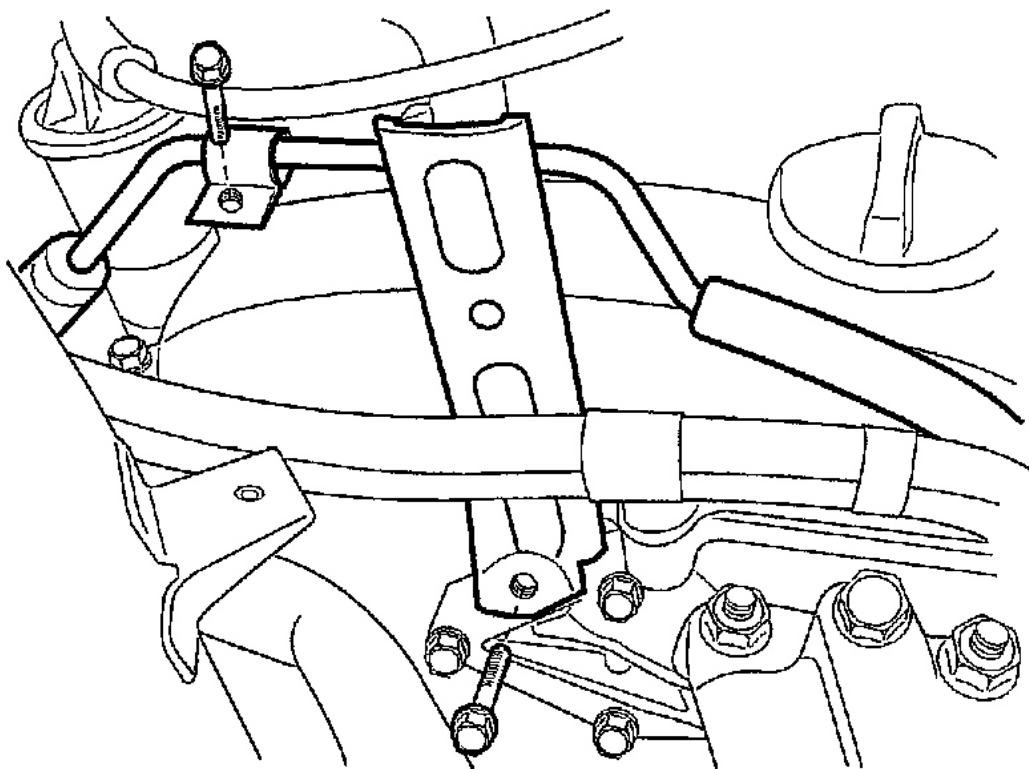
1. Remove the fuel pump fuse.
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
5. Remove the intake manifold. Refer to **Intake Manifold Removal** .



G01985600

Fig. 42: Removing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

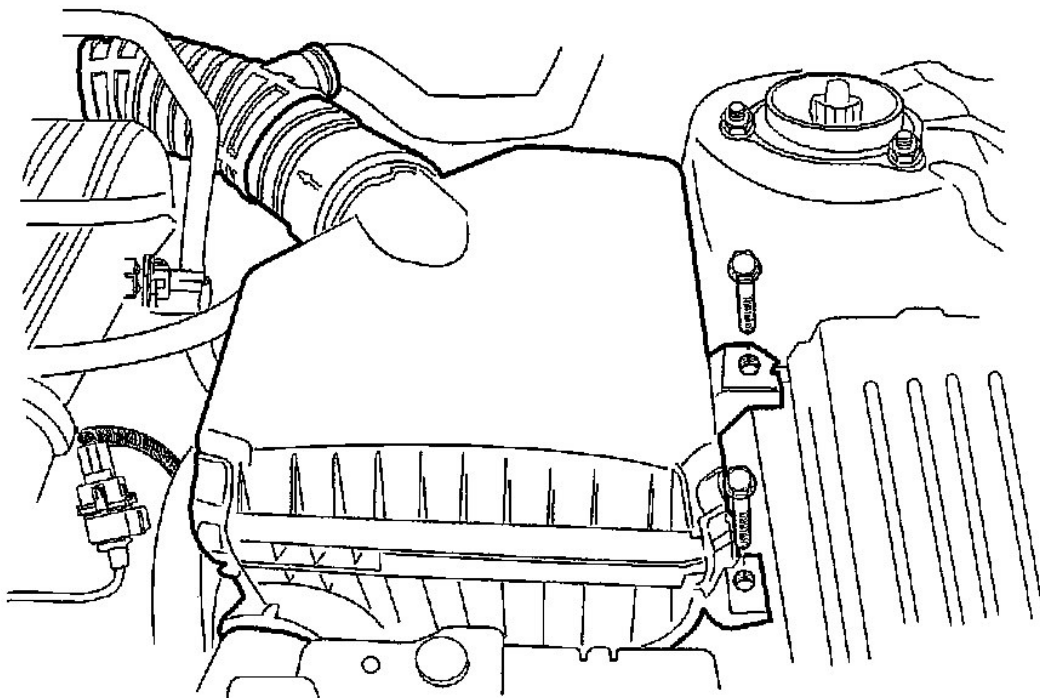
6. Remove the coolant reservoir. Refer to **SURGE TANK REMOVAL** .
7. Remove the front support bracket retaining bolt and the front support bracket.



G01985601

Fig. 43: Removing Front Support Bracket Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

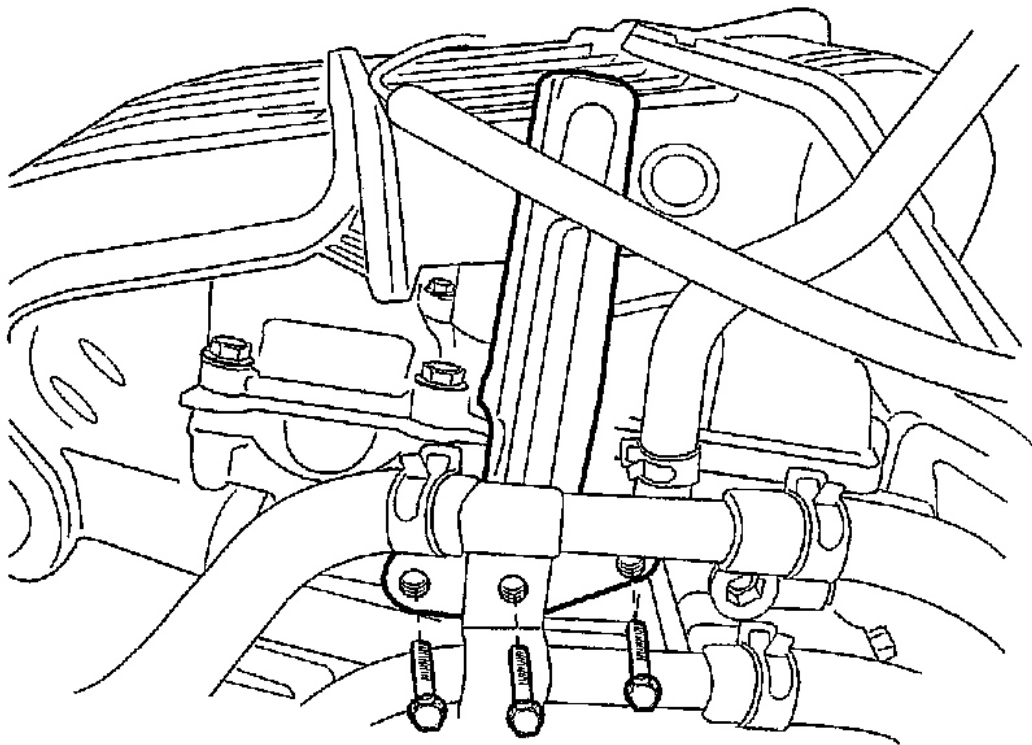
8. Remove the air filter housing.



G01985602

Fig. 44: Removing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

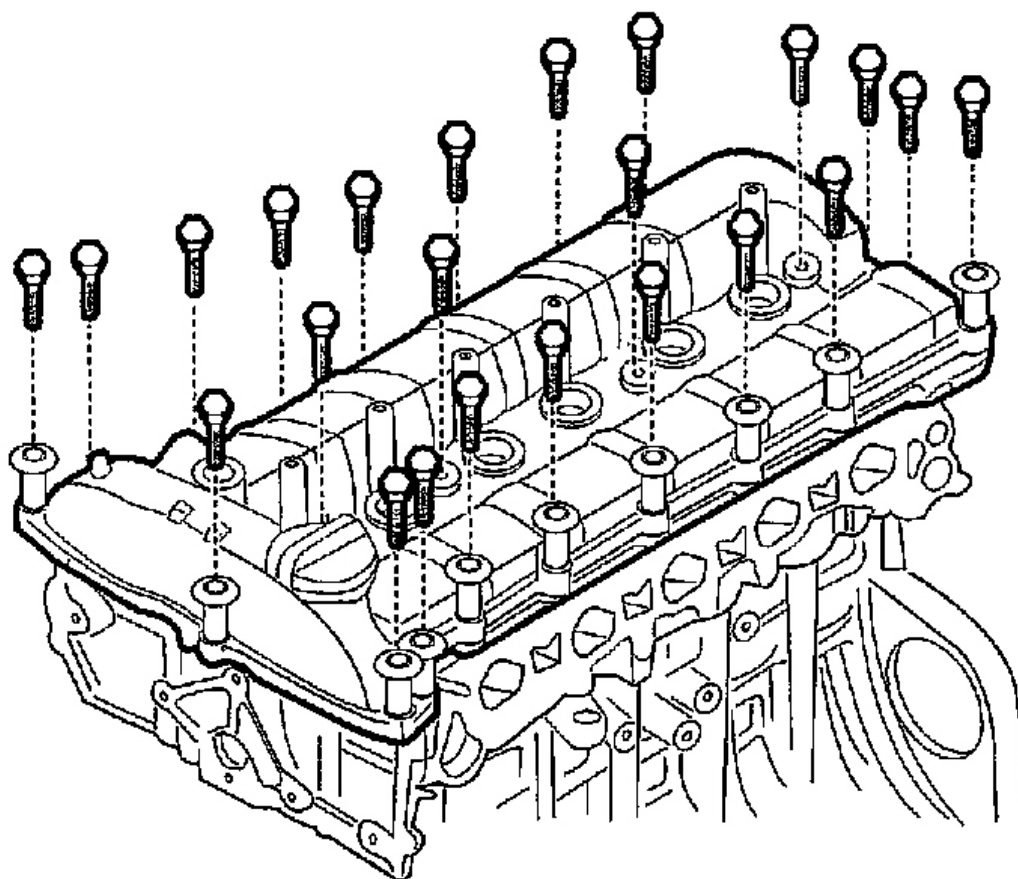
9. Remove the rear support bracket retaining bolts and the rear support bracket.
10. Remove the ignition coils. Refer to **IGNITION COIL REMOVAL** .



G01985603

Fig. 45: Removing Ignition Coils
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove the cylinder head cover bolts and the cylinder head cover.
12. Remove the cylinder head cover gasket.



G01985604

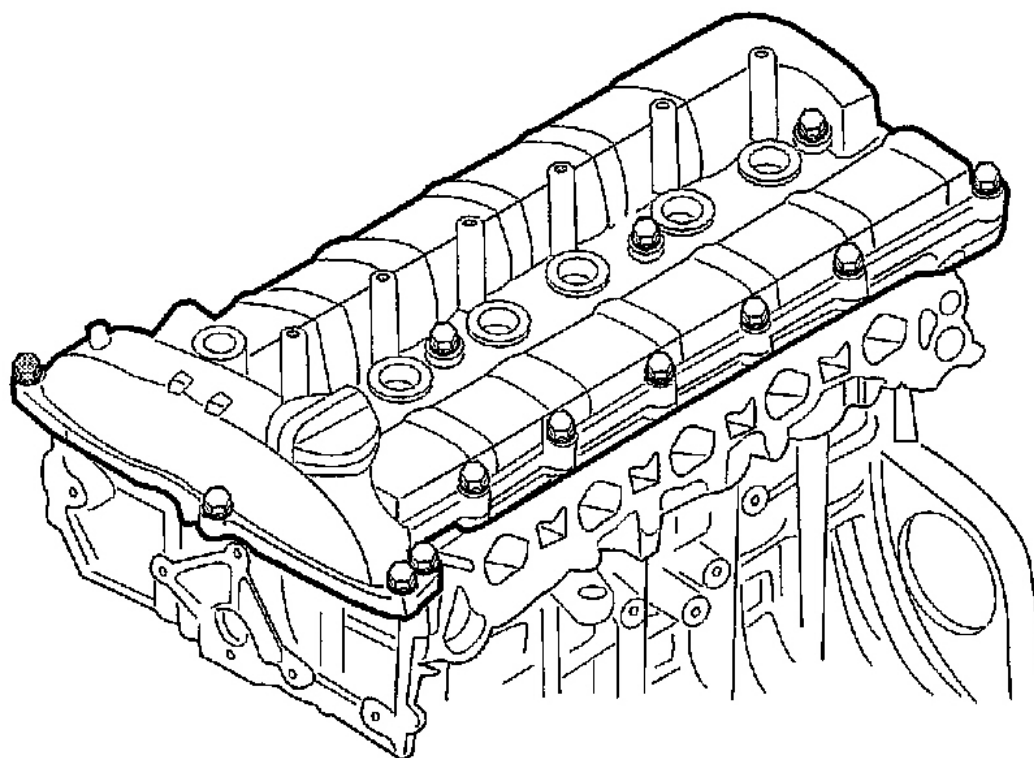
Fig. 46: Removing Cylinder Head Cover Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head Cover Installation

1. Installation should follow the removal procedure in the reverse order.
2. Discard used cylinder head gasket and install new one.
3. Tighten the cylinder head cover bolts.

Tighten

Tighten the cylinder head cover bolts to 12-14 N.m (106-124 lb-in).



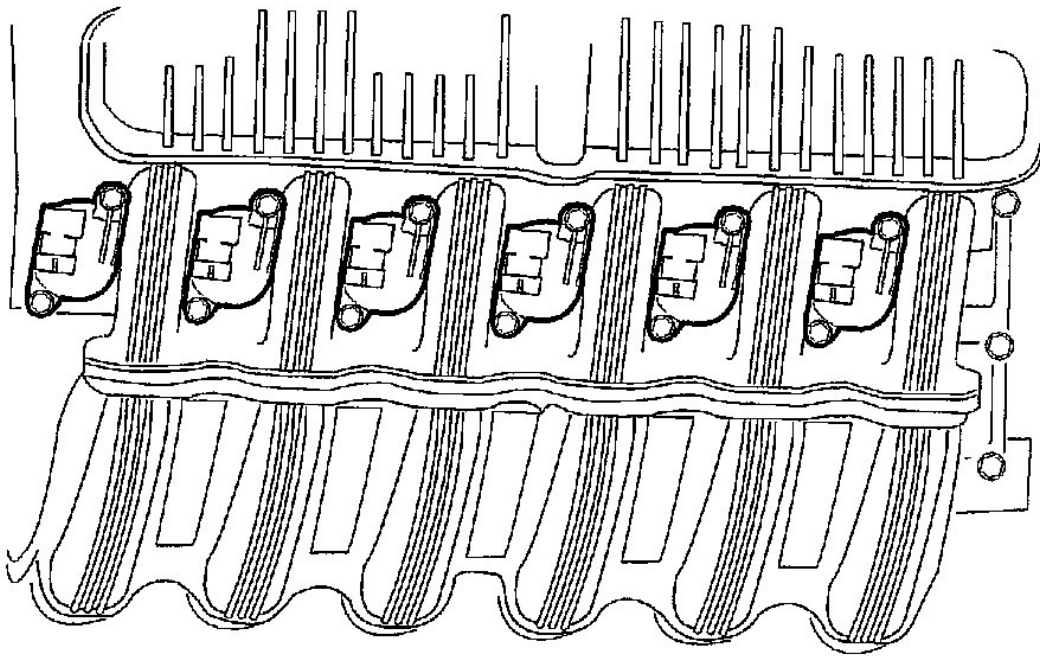
G01985605

Fig. 47: Tightening Cylinder Head Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Install the ignition coils.

Tighten

Tighten the ignition coil retaining bolts to 6-8 N.m (53-71 lb-in).



G01985606

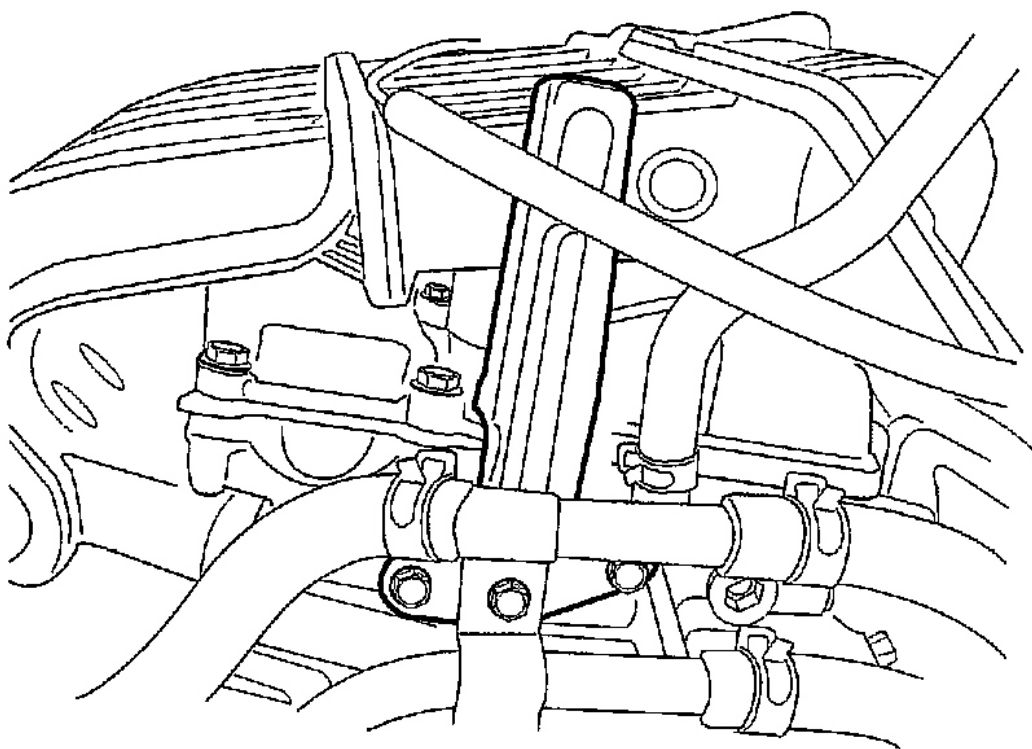
Fig. 48: Installing Ignition Coils
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the rear support bracket.

Tighten

Tighten the rear support bracket retaining bolt (Intake-side) to 8-12 N.m (71-106 lb-in).

Tighten the rear support bracket retaining bolt (Exhaust-side) to 18-25 N.m (13-18 lb-ft).



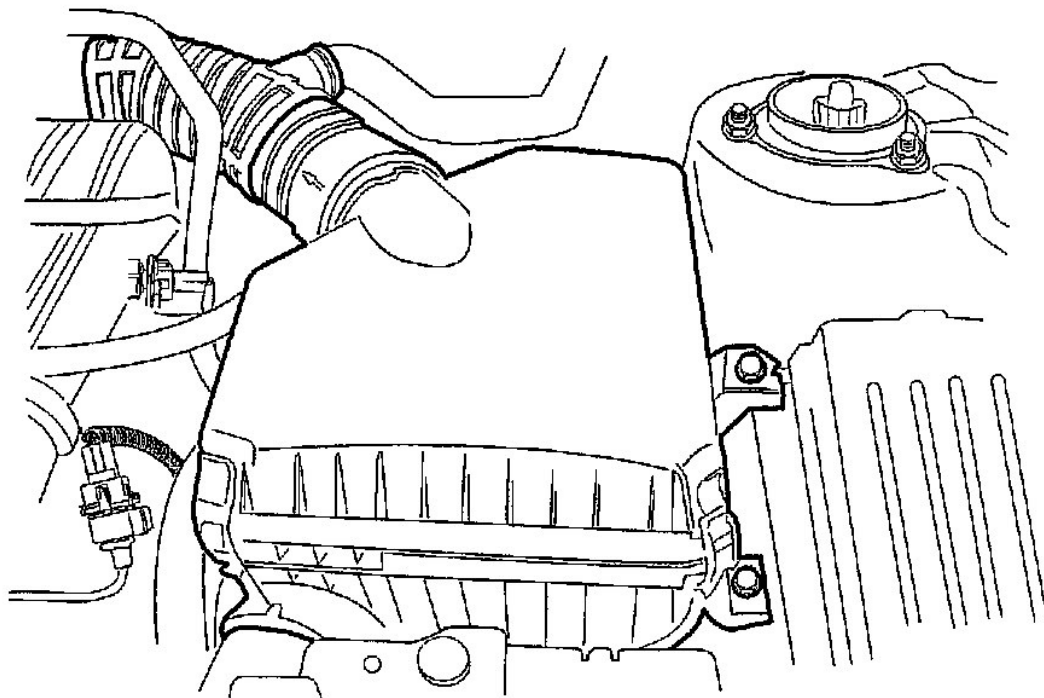
G01985607

Fig. 49: Installing Rear Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the air filter housing.

Tighten

Tighten the air filter housing bolt to 8-12 N.m (71-106 lb-in).



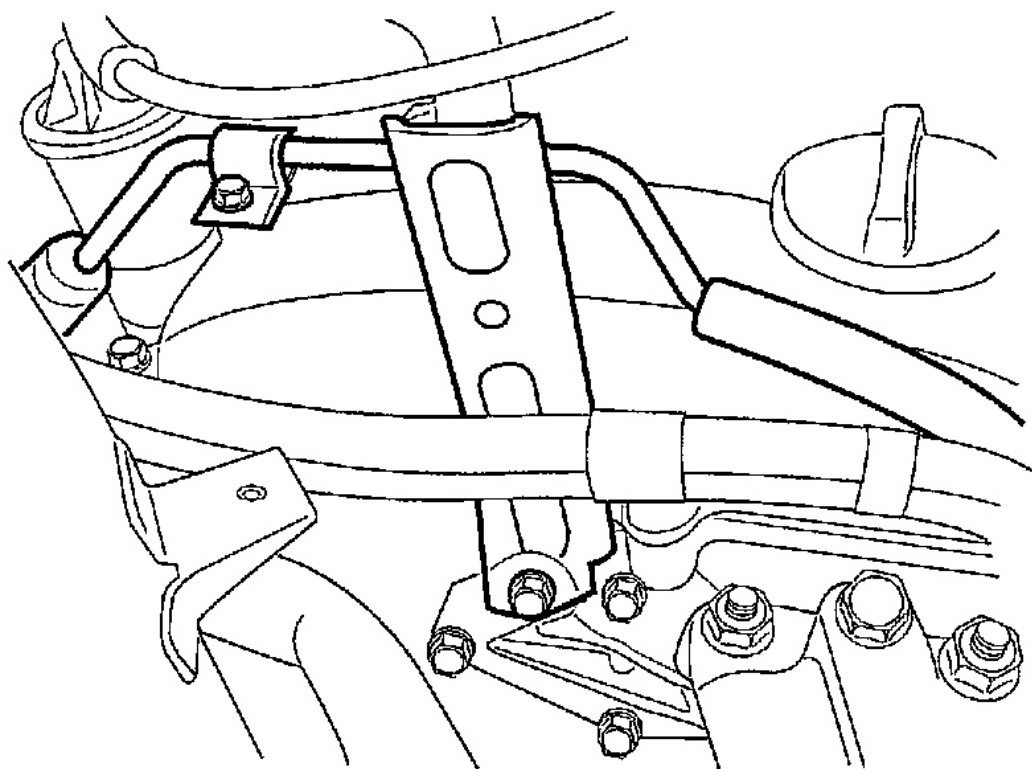
G01985608

Fig. 50: Installing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the front support bracket.

Tighten

Tighten the front support bracket retaining bolt to 15-25 N.m (11-18 lb-ft).



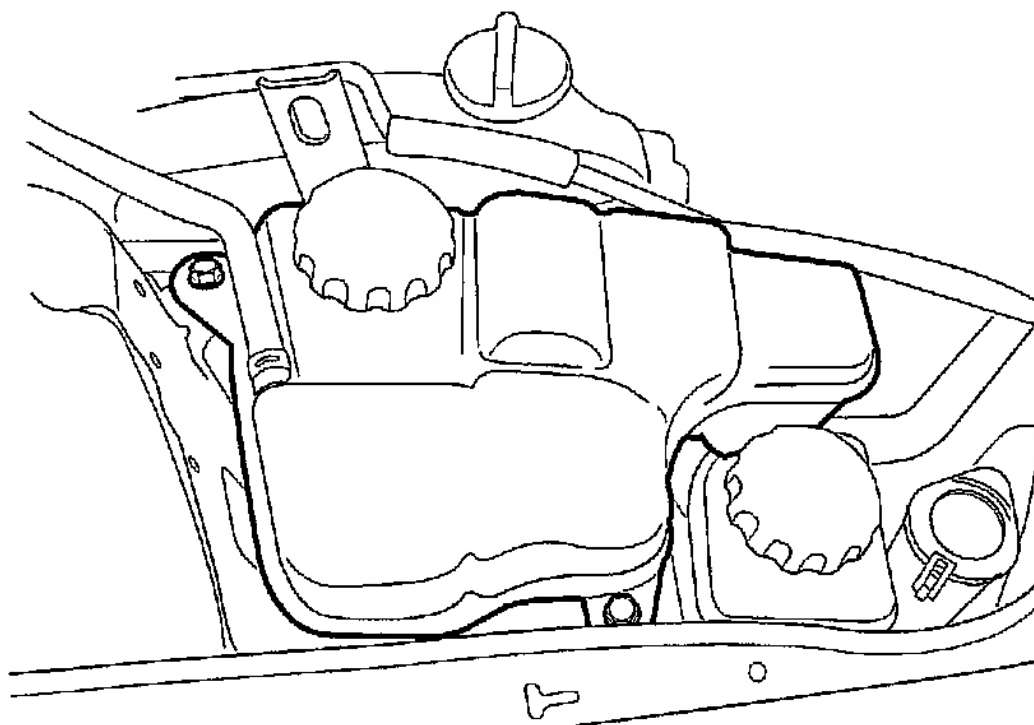
G01985609

Fig. 51: Installing Front Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the coolant reservoir. Refer to **SURGE TANK INSTALLATION** .

Tighten

Tighten the coolant reservoir retaining bolts to 35-45 N.m (26-33 lb-ft).



G01985610

Fig. 52: Installing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

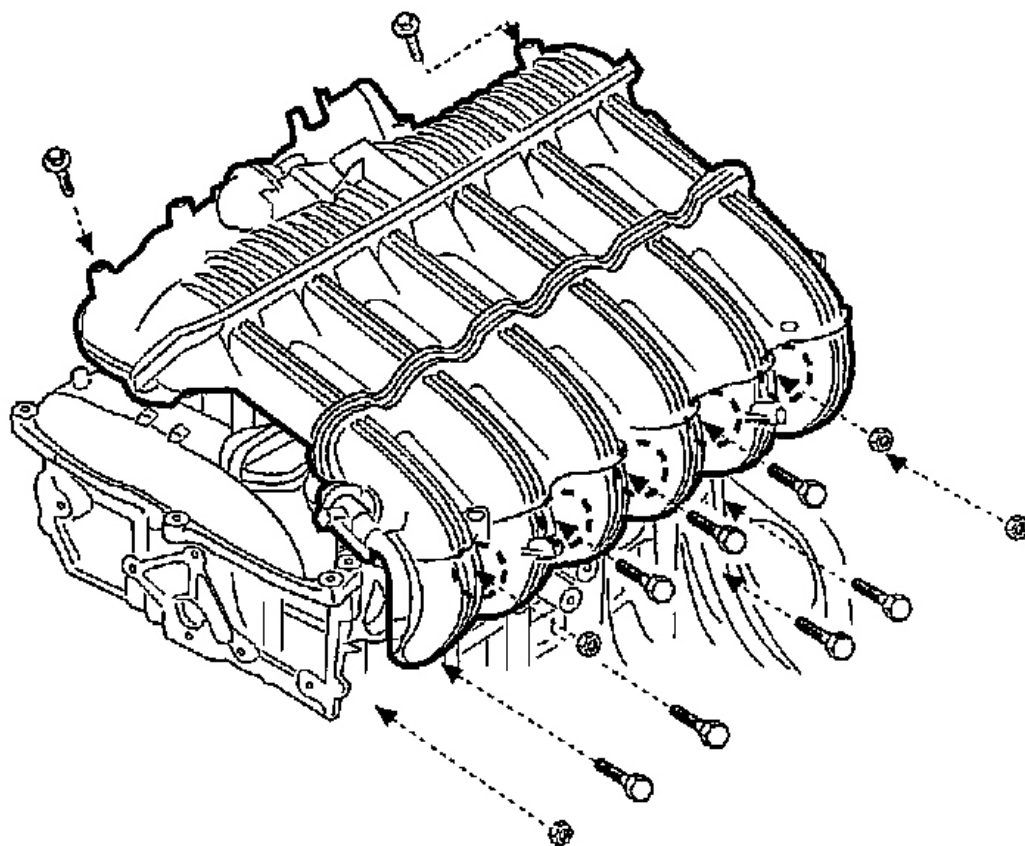
9. Discard used intake manifold gaskets and install new ones.
10. Tighten the intake manifold retaining nuts and bolts. Refer to **Intake Manifold Installation** .

Tighten

Tighten the seven (7) intake manifold retaining bolts to 10-14 N.m (89-124 lb-in).

Tighten the four (4) intake manifold retaining nuts to 10-14 N.m (89-124 lb-in).

Tighten the two (2) bolts on the intake manifold support bracket to 10-14 N.m (89-124 lb-in).

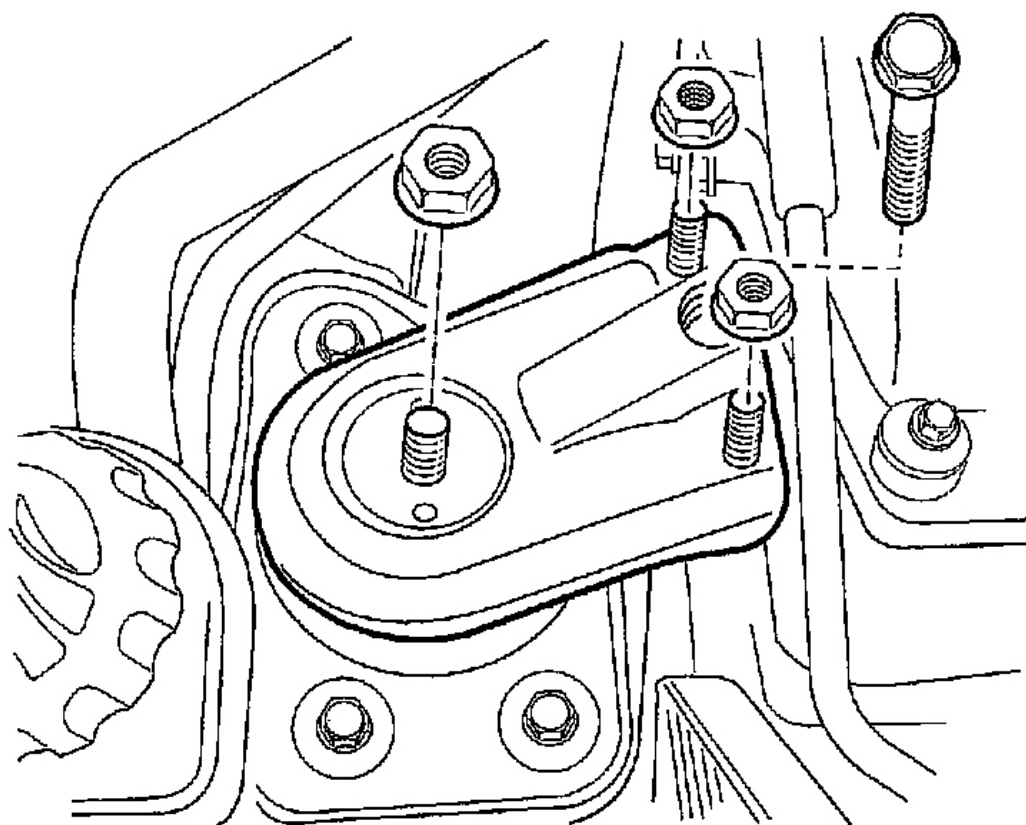


G01985611

Fig. 53: Tightening Intake Manifold Retaining Nuts & Bolts
Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount (RH) Removal

1. Disconnect the negative battery cable.
2. Remove the engine mount bracket-to-hydro mount nut and engine mount bracket nuts/bolt.



G01985612

Fig. 54: Removing Engine Mount Bracket-To-Hydro Mount Nut
Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount (RH) Installation

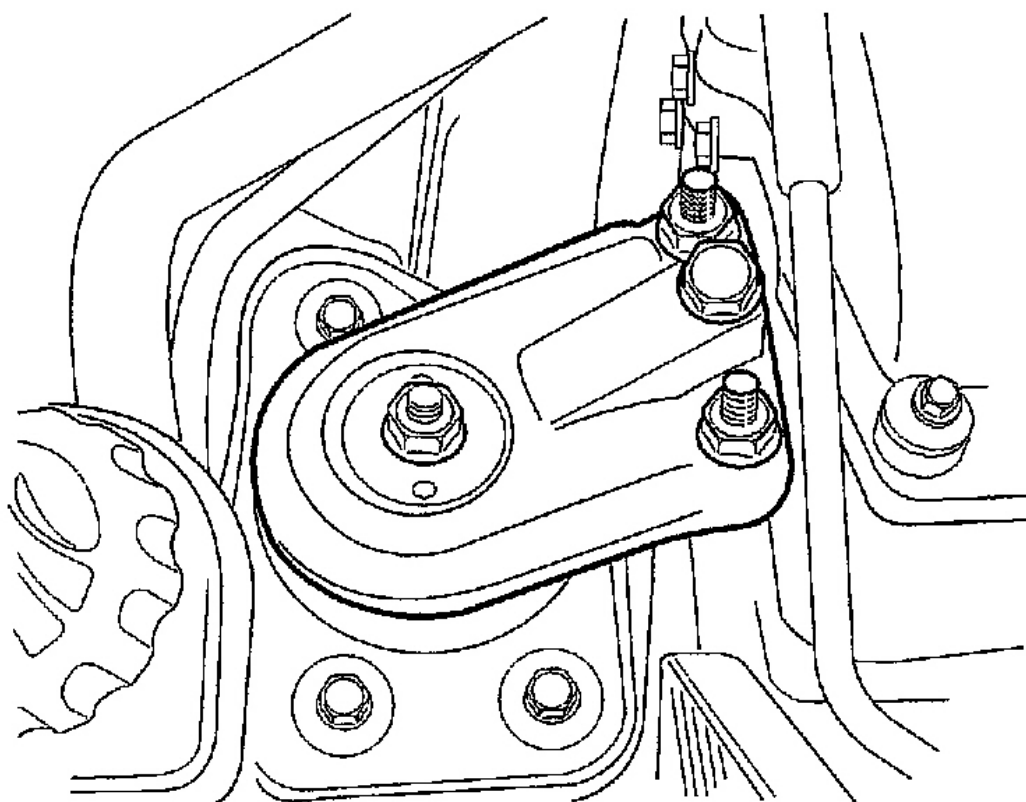
1. Installation should follow the removal procedure in the reverse order.
2. Install the engine mount (RH).

Tighten

Tighten the engine mount bracket-to-hydro mount nut to 55-70 N.m (41-52 lb-ft).

Tighten the engine mount bracket bolt to 42-60 N.m (31-44 lb-ft).

Tighten the two (2) engine mount bracket nuts to 42-60 N.m (31-44 lb-ft).

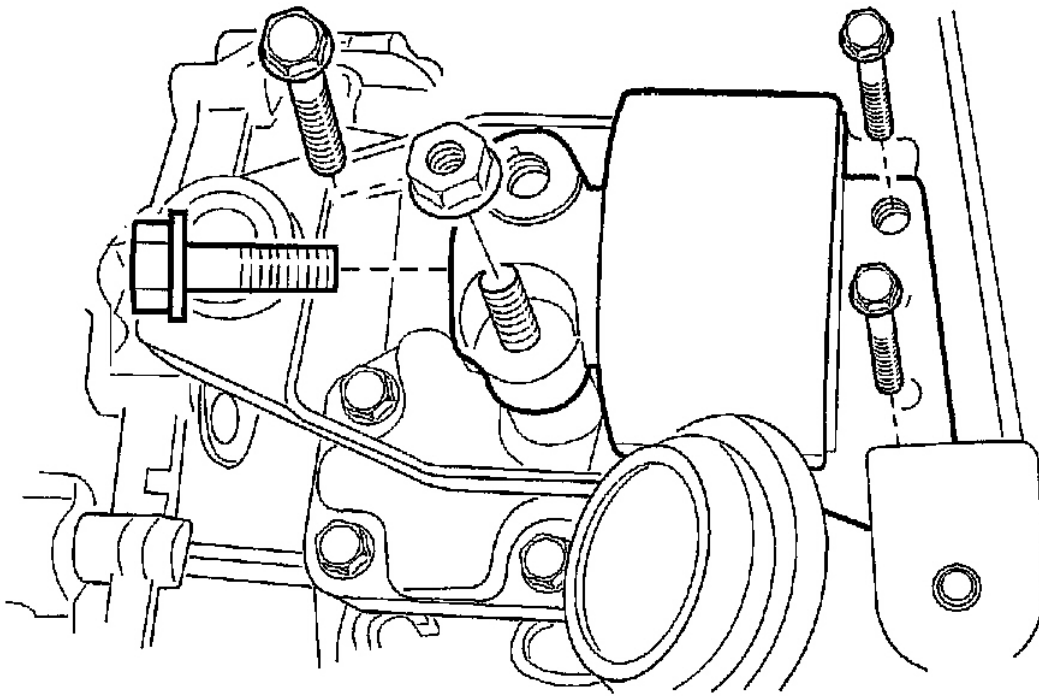


G01985613

Fig. 55: Installing Engine Mount (RH)
Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount (LH) Removal

1. Disconnect the negative battery cable.
2. Remove the transaxle mount cage nut / bolts.



G01985614

Fig. 56: Removing Transaxle Mount Cage Nut/Bolts
 Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount (LH) Installation

1. Installation should follow the removal procedure in the reverse order.
2. Install the engine mount (LH).

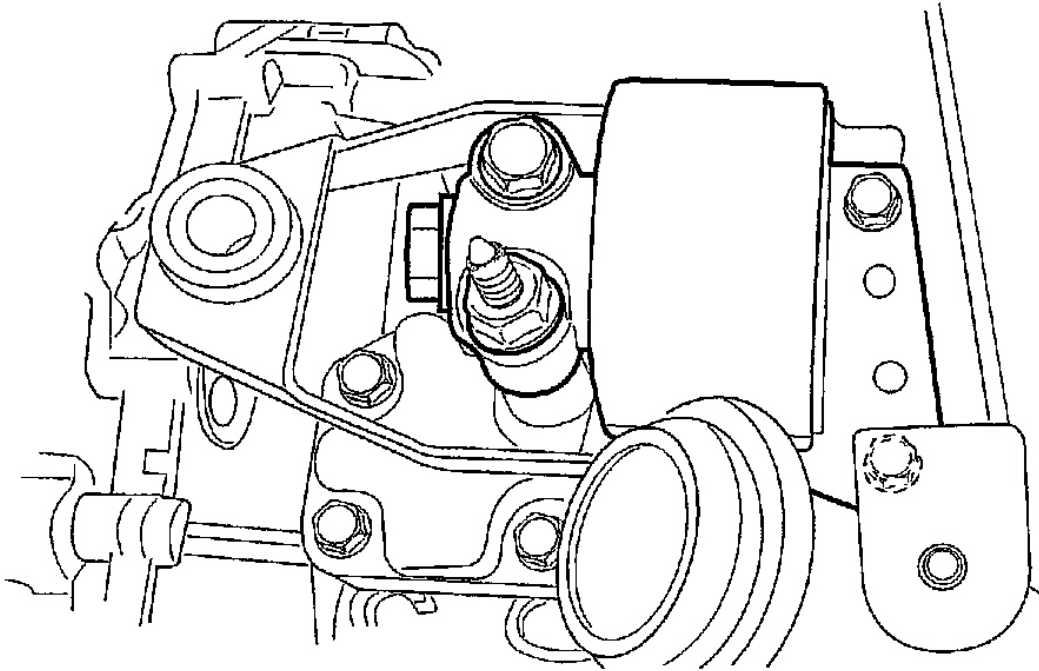
Tighten

Tighten the four (4) transaxle mount cage-to-longitudinal member bolts to 55-75 N.m (41-55 lb-ft).

Tighten the transaxle mount cage-to-transaxle mount bracket bolt to 55-75 N.m (41-55 lb-ft).

Tighten the transaxle mount cage-to-transaxle mount bracket nut to 55-75 N.m (41-55 lb-ft).

Tighten the transaxle mount cage through bolt to 100-120 N.m (74-89 lb-ft).



G01985615

Fig. 57: Installing Engine Mount (LH)
Courtesy of SUZUKI OF AMERICA CORP.

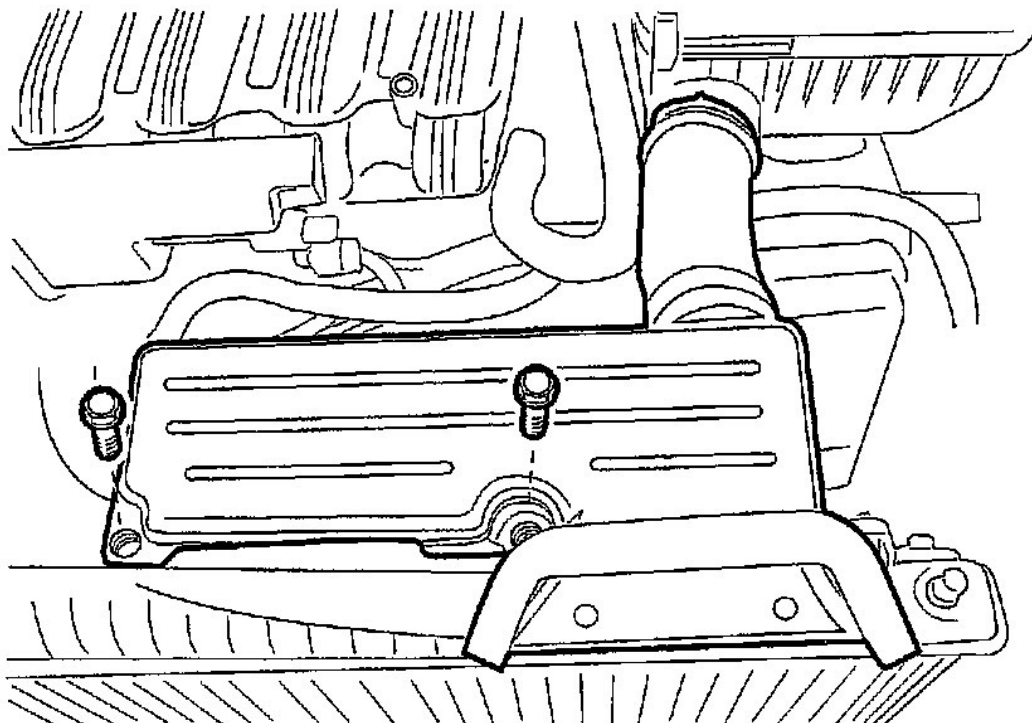
Engine Assembly Removal

Tools Required

DW110-060 Engine Assembly Lift Support

DW010-010 Power Pack Stand

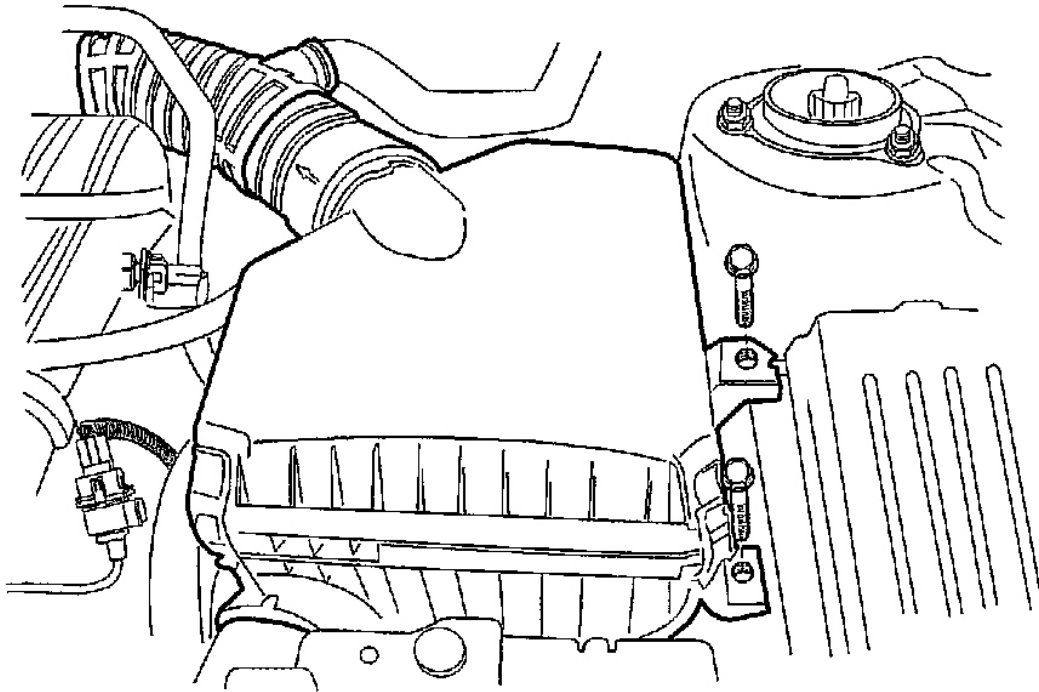
1. Remove the fuel pump fuse.
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
5. Drain the engine oil.
6. Drain the transaxle oil.
7. Drain the power steering oil.
8. Recover the refrigerant. Refer to **MANUAL HVAC SYSTEM** .
9. Remove the engine beautification cover.
10. Remove the air filter snorkel.



G01985616

Fig. 58: Removing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

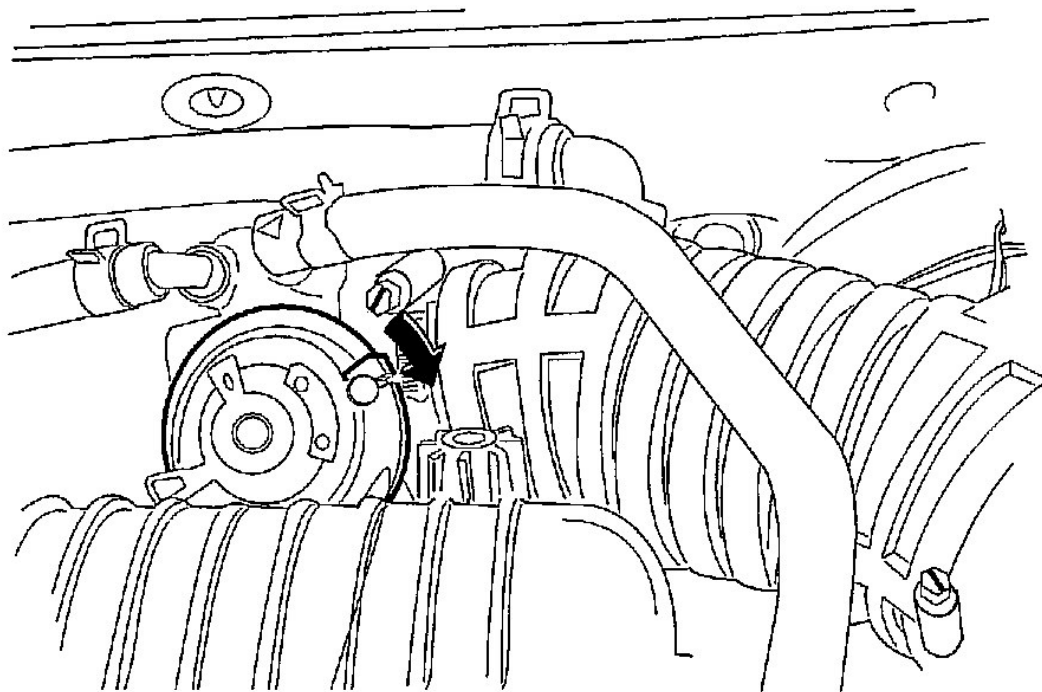
11. Remove the air filter housing assembly.



G01985617

Fig. 59: Removing Air Filter Housing Assembly
Courtesy of SUZUKI OF AMERICA CORP.

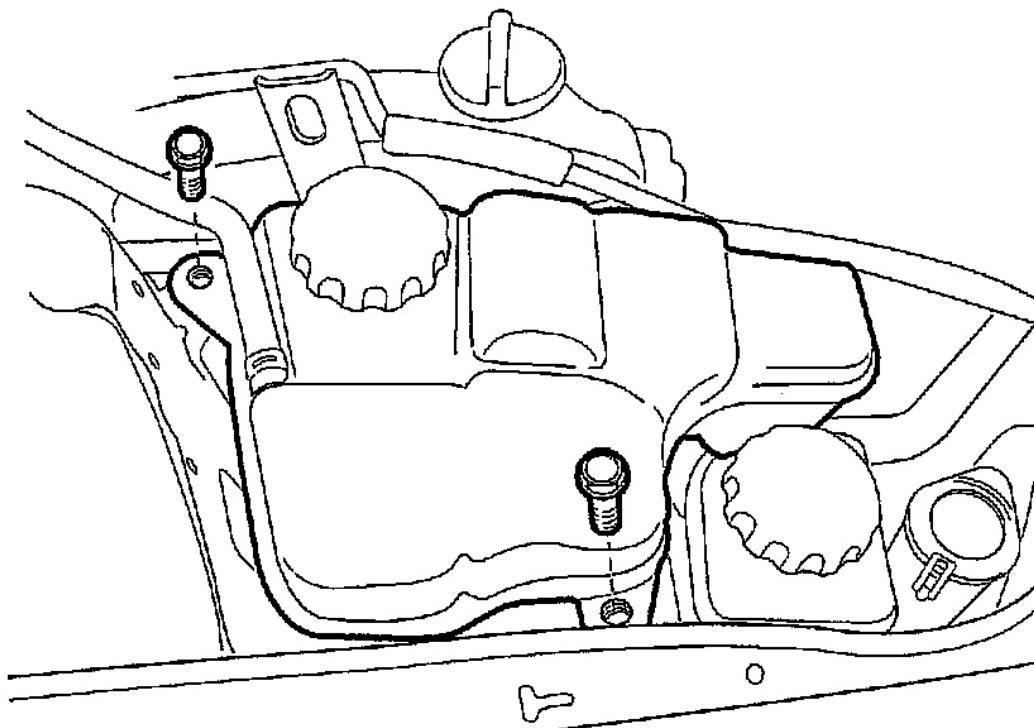
12. Remove the breather hose.
13. Disconnect the throttle cable from the throttle body assembly.



G01985618

Fig. 60: Disconnecting Throttle Cable From Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

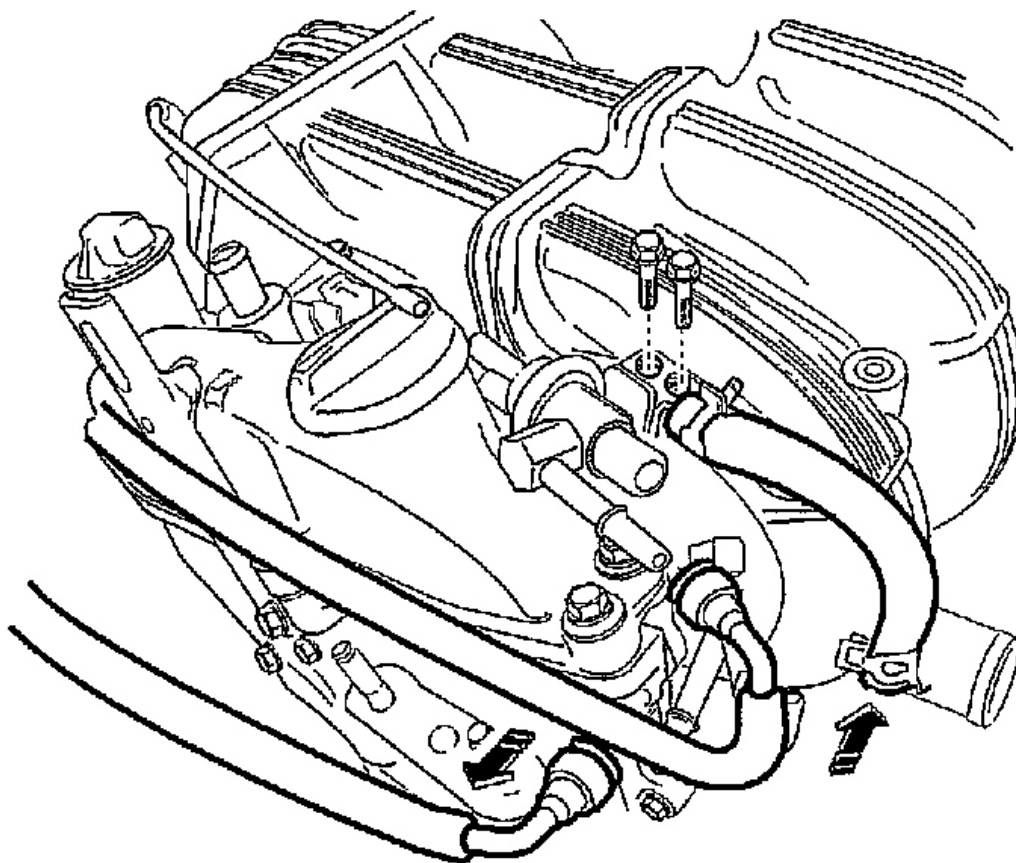
14. Disconnect the coolant reservoir hoses.
15. Remove the coolant reservoir. Refer to **SURGE TANK REMOVAL** .



G01985619

Fig. 61: Removing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

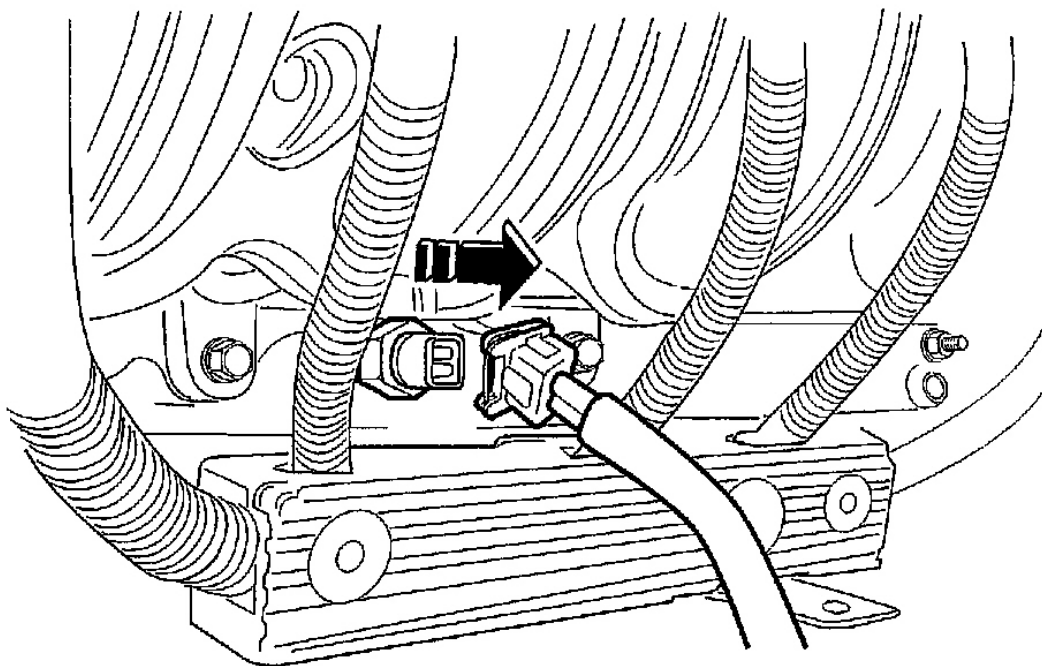
16. Disconnect the power steering pump outlet pipe.
17. Disconnect the fuel rail hose and fuel feeding/return pipe.



G01985620

Fig. 62: Disconnecting Fuel Rail Hose & Fuel Feeding/Return Pipe
Courtesy of SUZUKI OF AMERICA CORP.

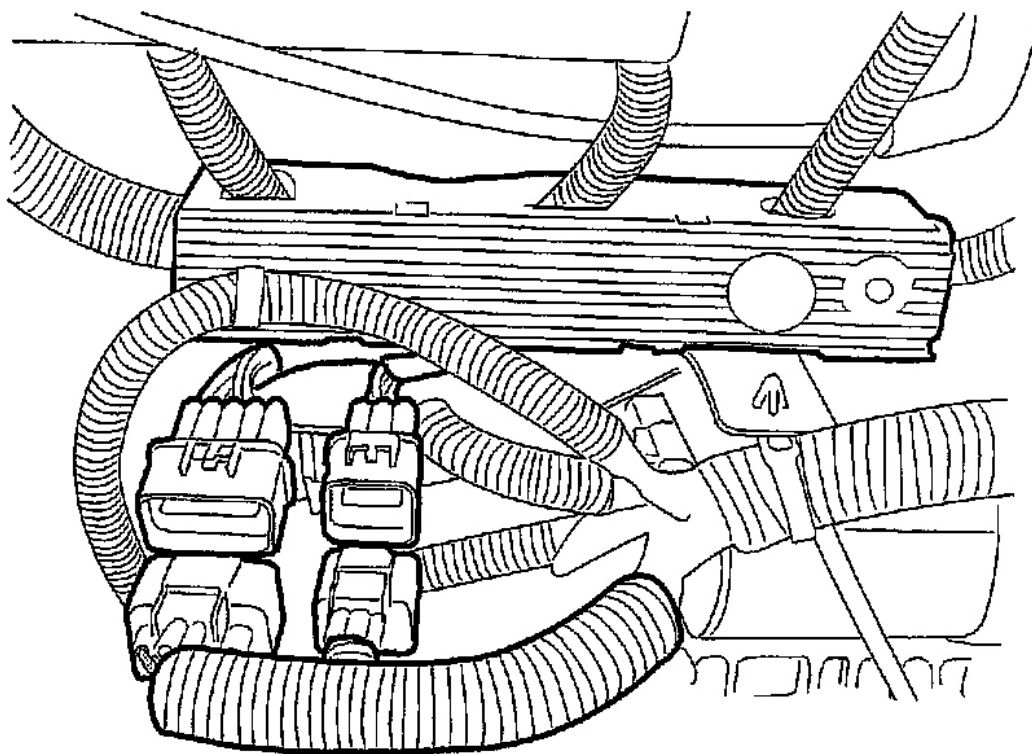
18. Disconnect the connectors on the O2S, EGR, charcoal canister purge solenoid valve, MAP sensor, Throttle body, engine oil pressure sensor, CMP sensor, knock sensor, VIS, and the engine coolant temperature sensor.



G01985621

Fig. 63: Disconnecting Connectors
Courtesy of SUZUKI OF AMERICA CORP.

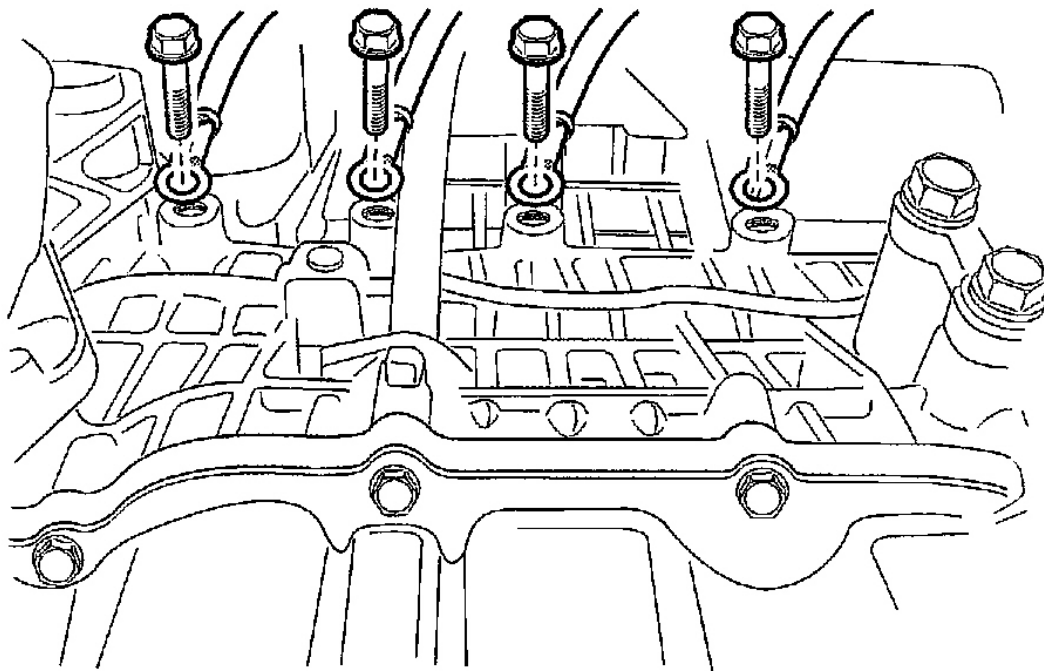
19. Detach wiring harness from the wiring harness bracket on the cylinder block.



G01985622

Fig. 64: Detaching Wiring Harness From Wiring Harness Bracket On Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

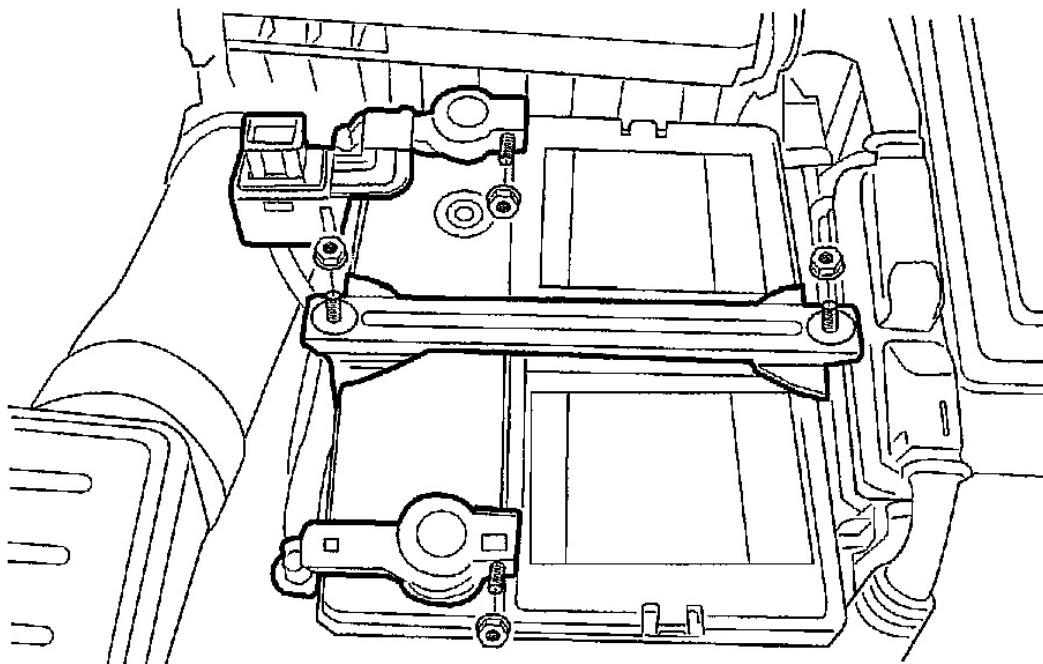
20. Disconnect the engine block ground by removing the engine block ground bolts.



G01985623

Fig. 65: Disconnecting Engine Block Ground
Courtesy of SUZUKI OF AMERICA CORP.

21. Remove the battery.

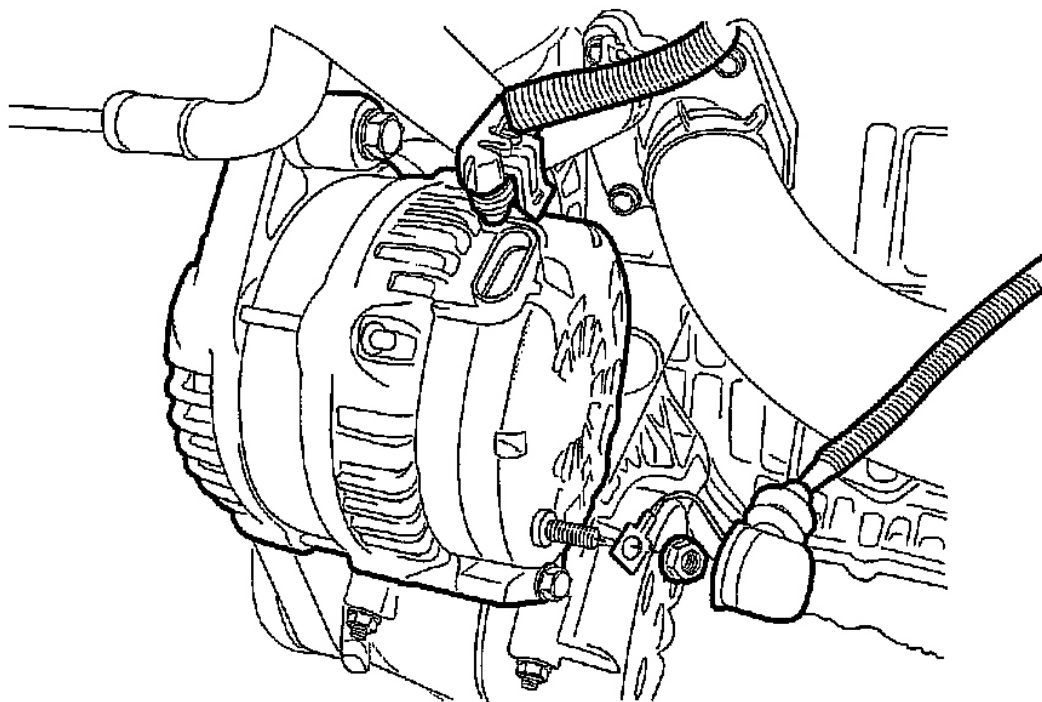


G01985624

Fig. 66: Removing Battery

Courtesy of SUZUKI OF AMERICA CORP.

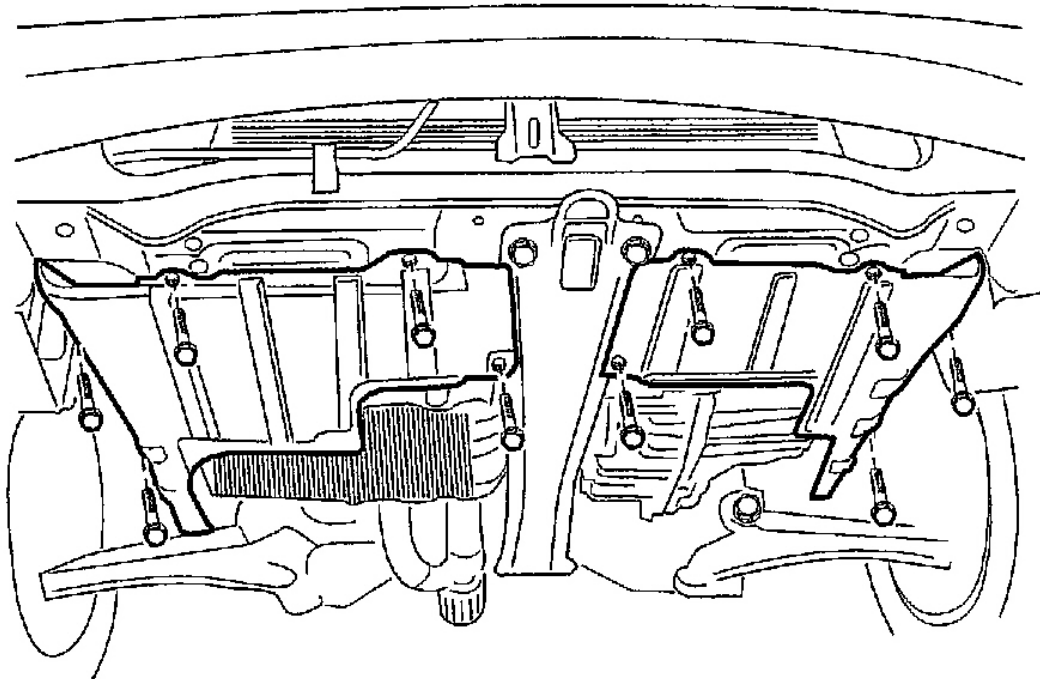
22. Disconnect the automatic transaxle cable.
23. Disconnect the inhibit switch connector.
24. Disconnect the connectors on the transaxle. Refer to **AXLE SHAFTS** .
25. Disconnect the alternator connector and wiring harness. Refer to **GENERATOR** .



G01985625

Fig. 67: Disconnecting Alternator Connector & Wiring Harness
Courtesy of SUZUKI OF AMERICA CORP.

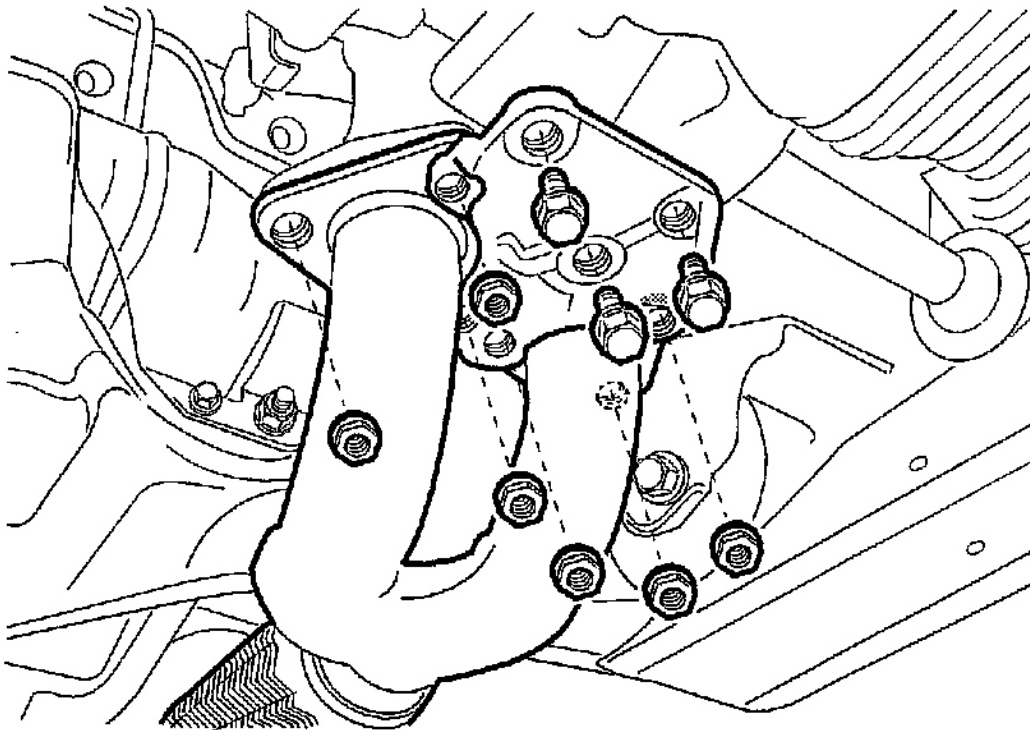
26. Remove the upper and lower radiator hoses. Refer to **RADIATOR REMOVAL** .
27. Remove the front wheels.
28. Remove the engine under covers.



G01985626

Fig. 68: Removing Engine Under Covers
Courtesy of SUZUKI OF AMERICA CORP.

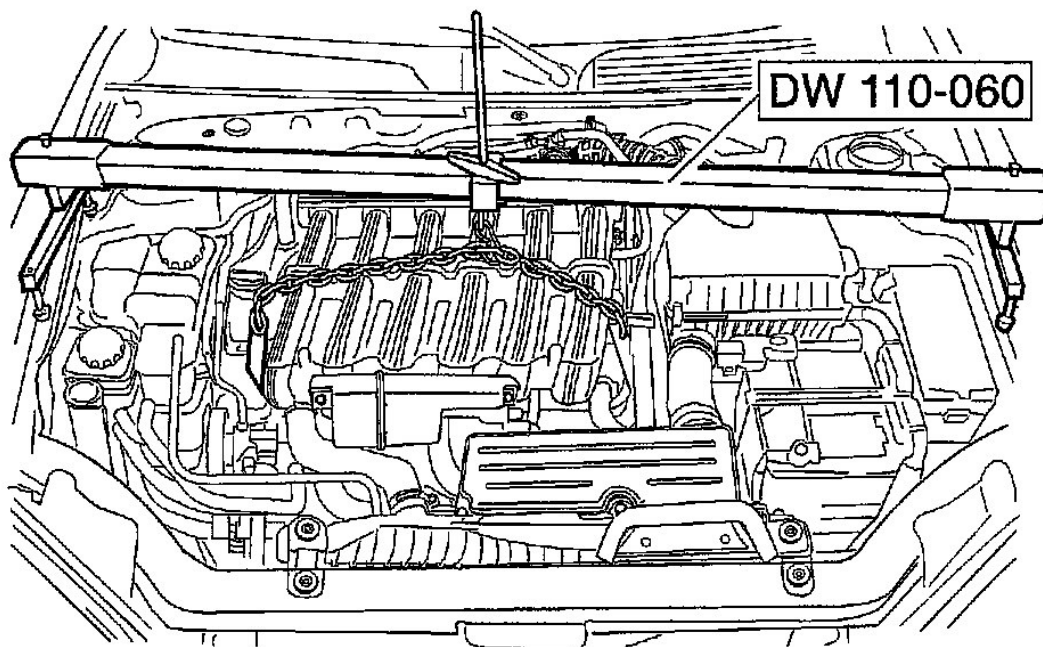
29. Remove the front axle shaft. Refer to AXLE SHAFTS .
30. Remove the front muffler. Refer to MUFFLER -- FRONT REMOVAL .



G01985627

Fig. 69: Removing Front Muffler
Courtesy of SUZUKI OF AMERICA CORP.

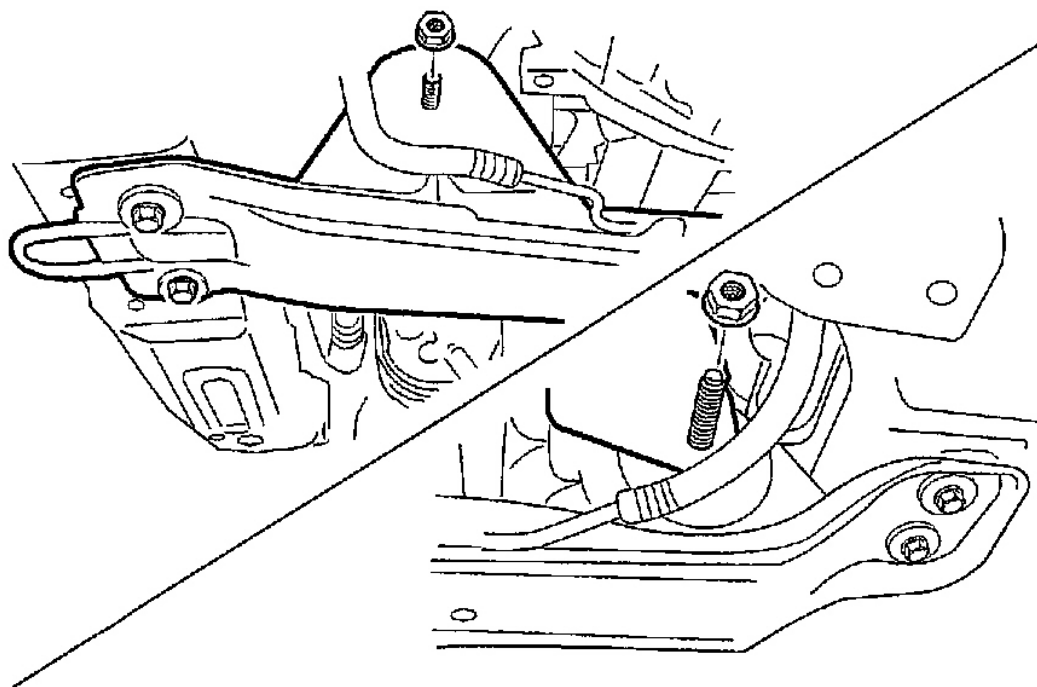
31. Support the engine assembly using the engine assembly lift support DW110-060.



G01985628

Fig. 70: Supporting Engine Assembly Using Lift Support
Courtesy of SUZUKI OF AMERICA CORP.

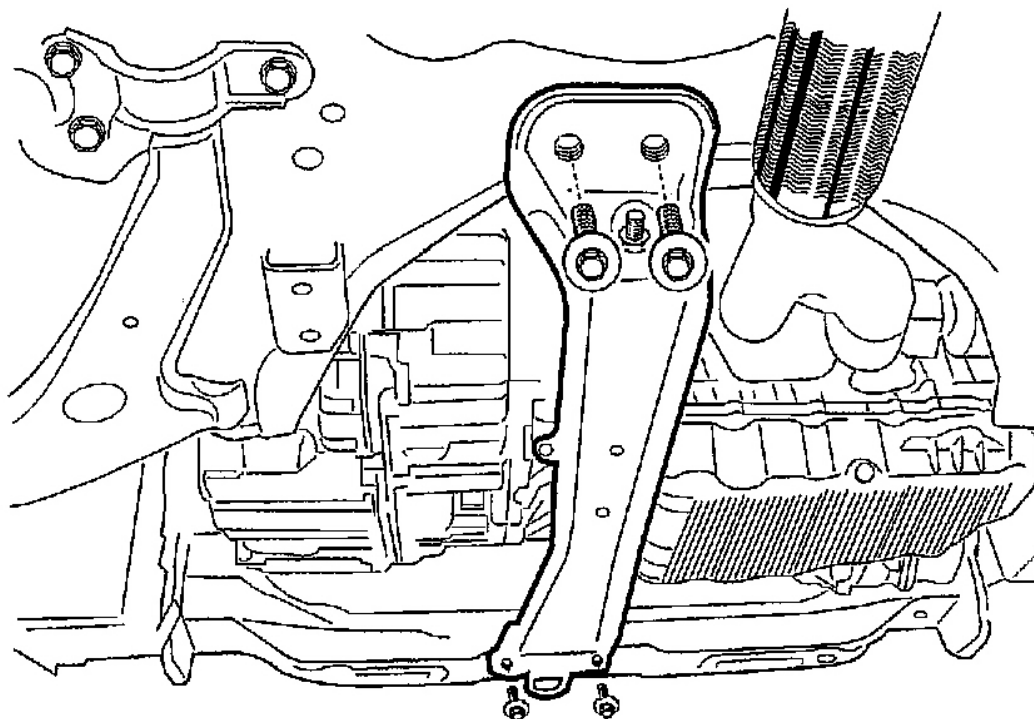
32. Remove the front engine mount bracket-to-damper bush bolt/nut and the rear transaxle mount bracket-to-damper bush bolt/nut.



G01985629

Fig. 71: Removing Front Engine Mount Bracket-To-Damper Bush Bolt/Nut
Courtesy of SUZUKI OF AMERICA CORP.

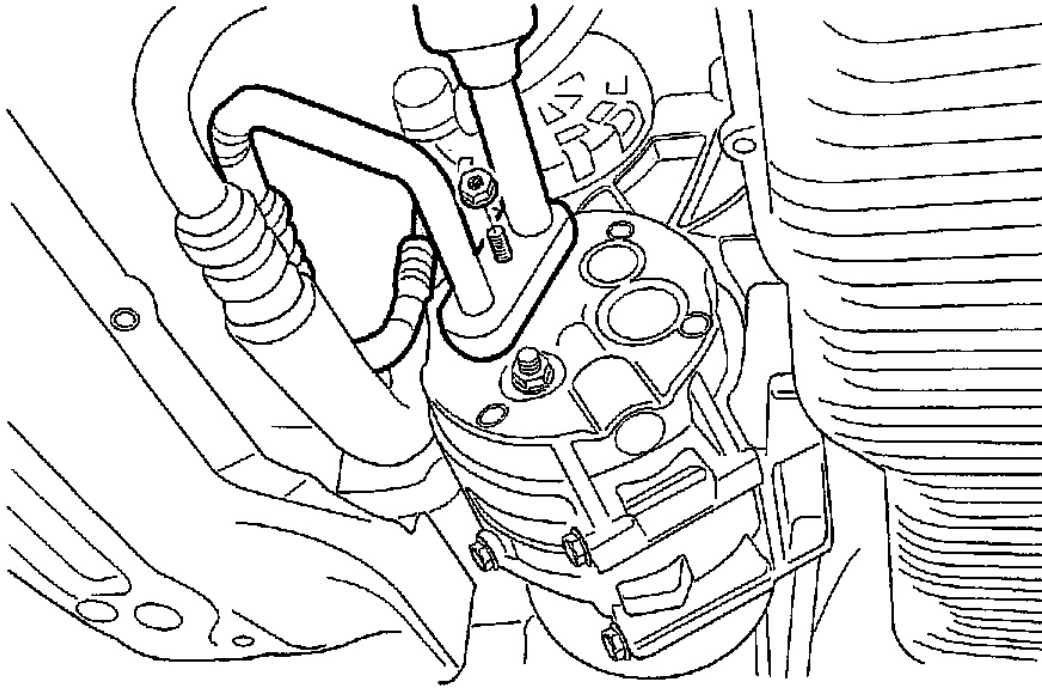
33. Remove the center front suspension member bolts and the center front suspension member.



G01985630

Fig. 72: Removing Center Front Suspension Member Bolts
Courtesy of SUZUKI OF AMERICA CORP.

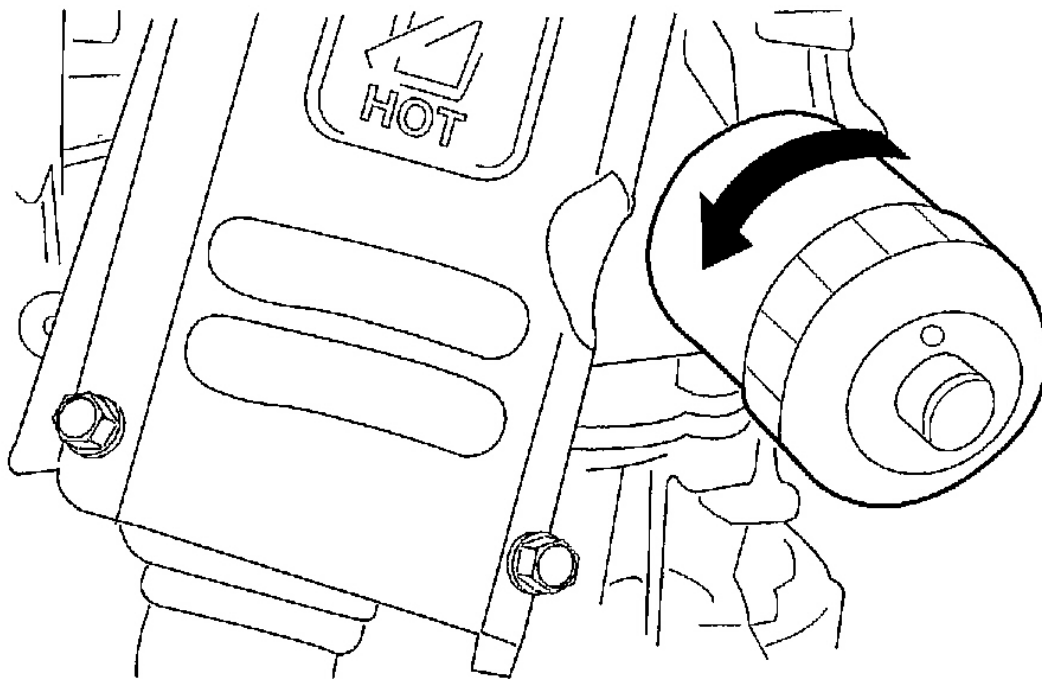
34. Disconnect the connector on the compressor.
35. Disconnect the refrigerant suction and discharge pipe block from the compressor.



G01985631

Fig. 73: Disconnecting Refrigerant Suction
Courtesy of SUZUKI OF AMERICA CORP.

36. Remove the oil filter.

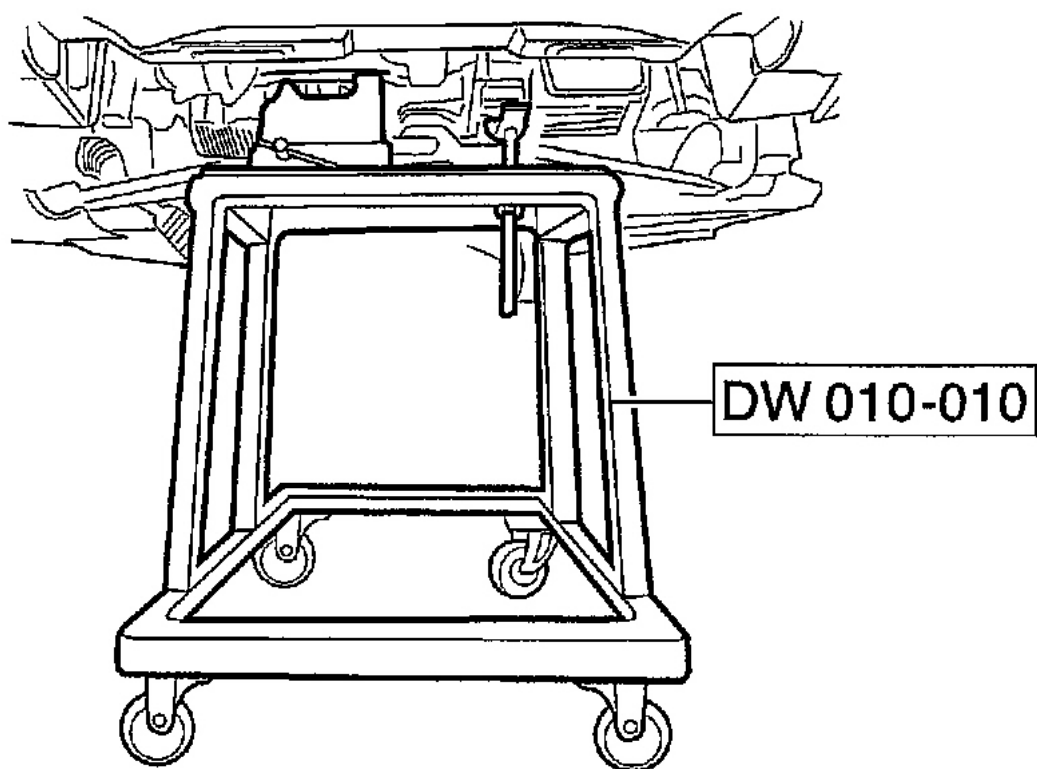


G01985632

Fig. 74: Removing Oil Filter

Courtesy of SUZUKI OF AMERICA CORP.

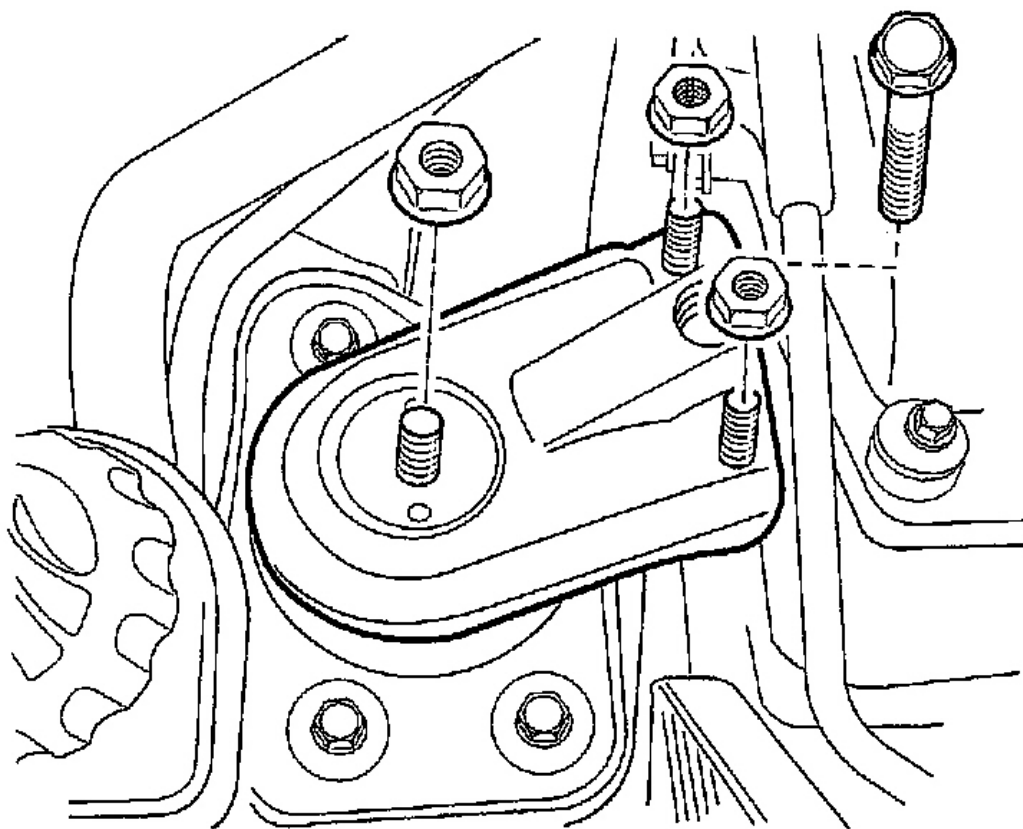
37. Support the engine and transaxle with the power pack stand DW010-010.



G01985633

Fig. 75: Supporting Engine & Transaxle With Power Pack Stand
Courtesy of SUZUKI OF AMERICA CORP.

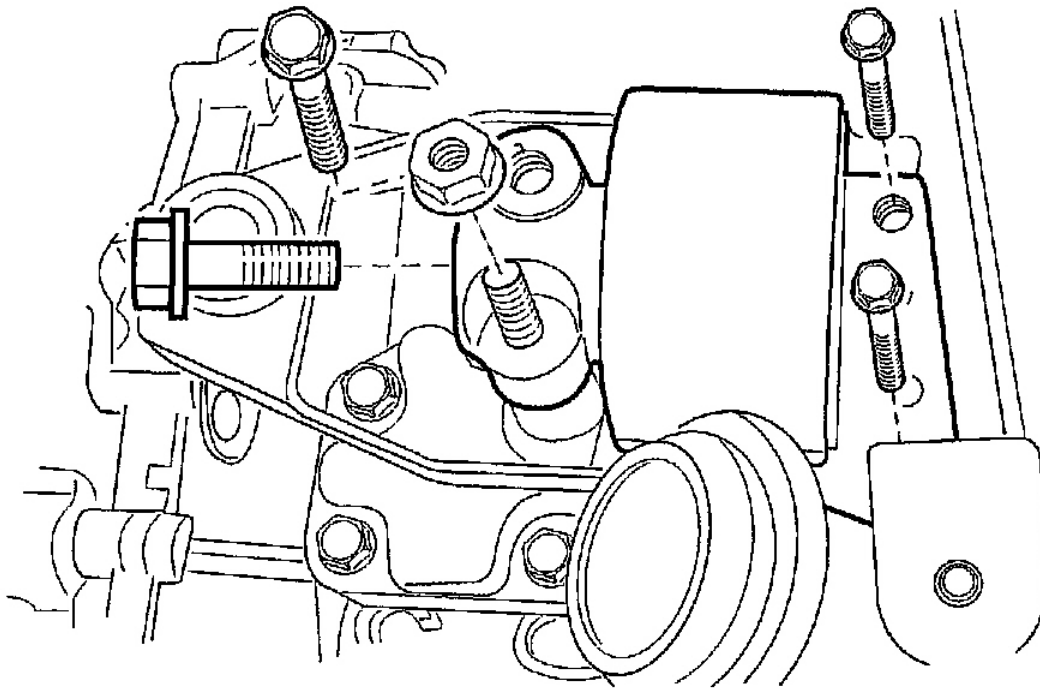
38. Remove the engine mount bracket (RH). Refer to **Engine Mount (RH) Removal** .



G01985634

Fig. 76: Removing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

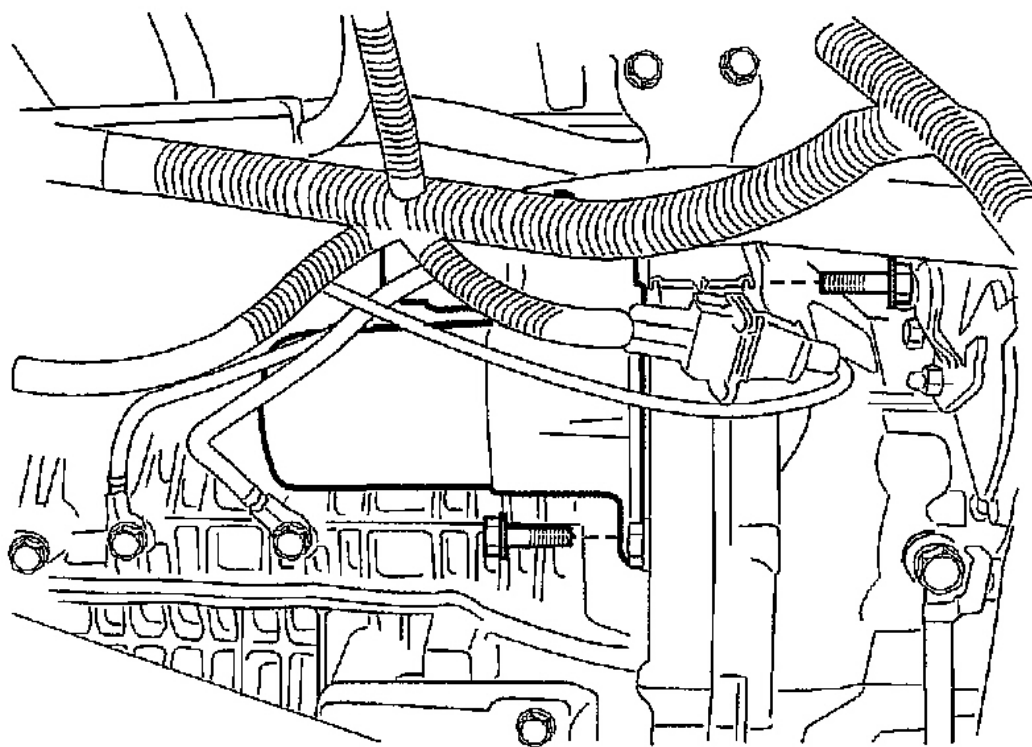
39. Remove the engine mount bracket (LH). Refer to **Engine Mount (LH) Removal**
40. Separate the engine and transaxle assembly from the engine compartment.



G01985635

Fig. 77: Separating Engine & Transaxle Assembly
Courtesy of SUZUKI OF AMERICA CORP.

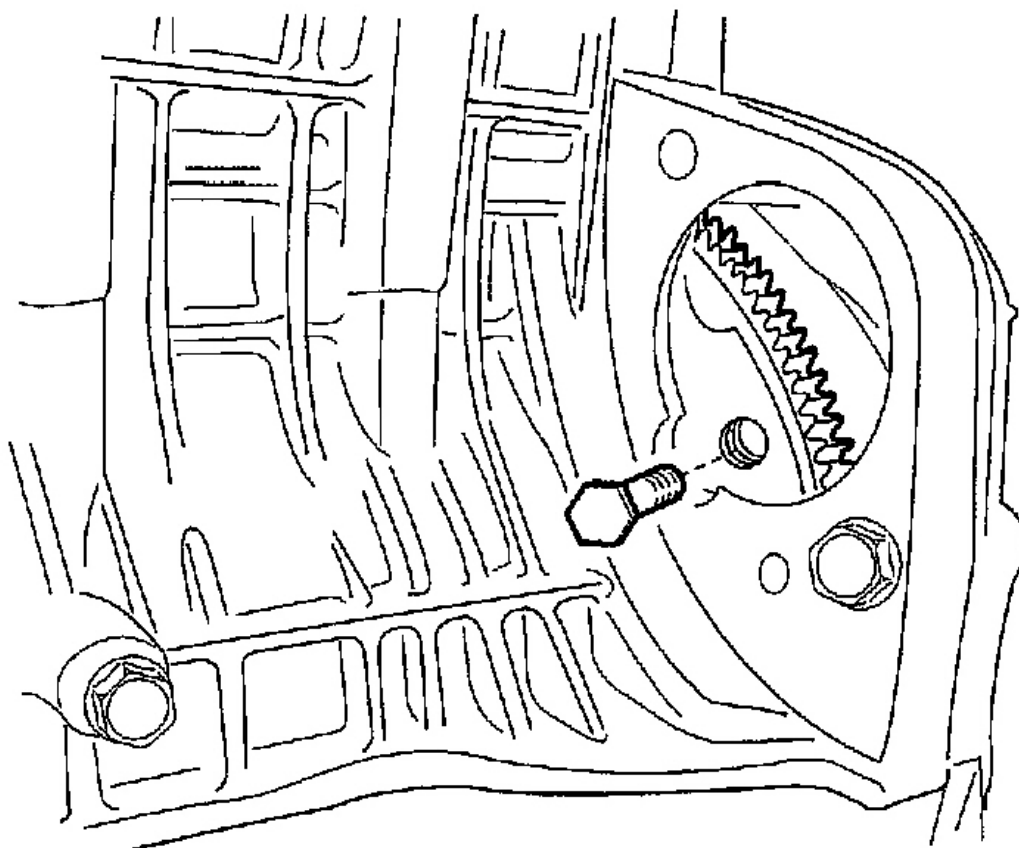
41. Remove the starter. Refer to **STARTER** .



G01985636

Fig. 78: Removing Starter
Courtesy of SUZUKI OF AMERICA CORP.

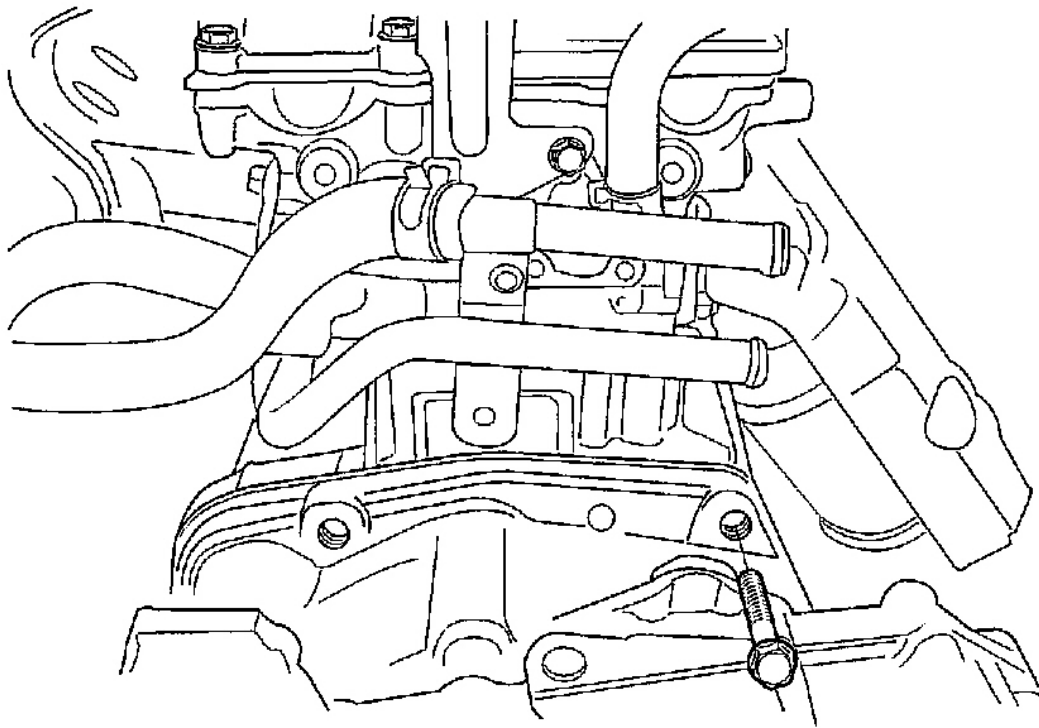
42. Remove three (3) transaxle torque converter bolts.



G01985637

Fig. 79: Removing Transaxle Torque Converter Bolts
Courtesy of SUZUKI OF AMERICA CORP.

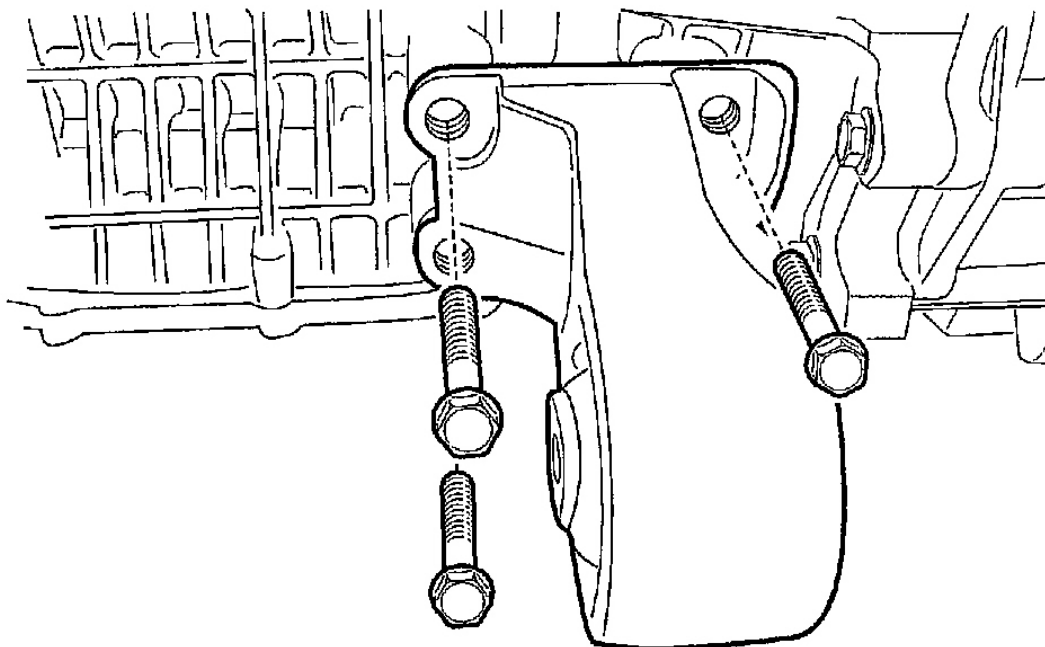
43. Remove the transaxle-to-engine block bolts.



G01985638

Fig. 80: Removing Transaxle-To-Engine Block Bolts
Courtesy of SUZUKI OF AMERICA CORP.

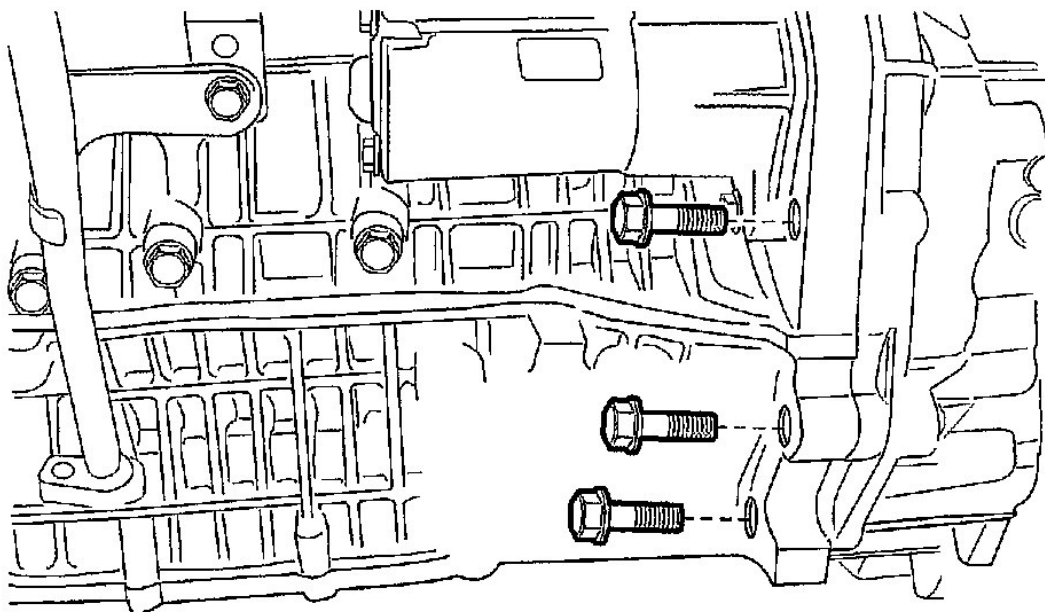
44. Remove the rear transaxle mount bracket.
45. Remove the front damper bush bracket.



G01985639

Fig. 81: Removing Front Damper Bush Bracket
Courtesy of SUZUKI OF AMERICA CORP.

46. Remove the engine block-to-transaxle bolts.

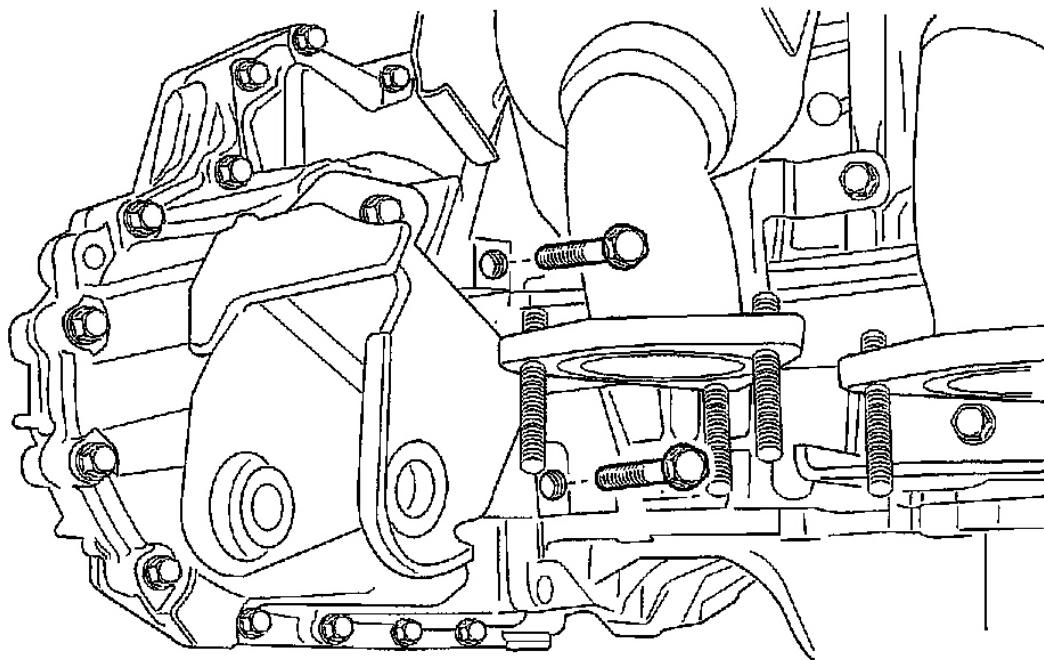


G01985640

Fig. 82: Removing Engine Block-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

47. Remove the engine block-to-transaxle bolts.
48. Remove the engine assembly from the transaxle.

CAUTION: Be careful not to damage the torque converter when removing the transaxle.



G01985641

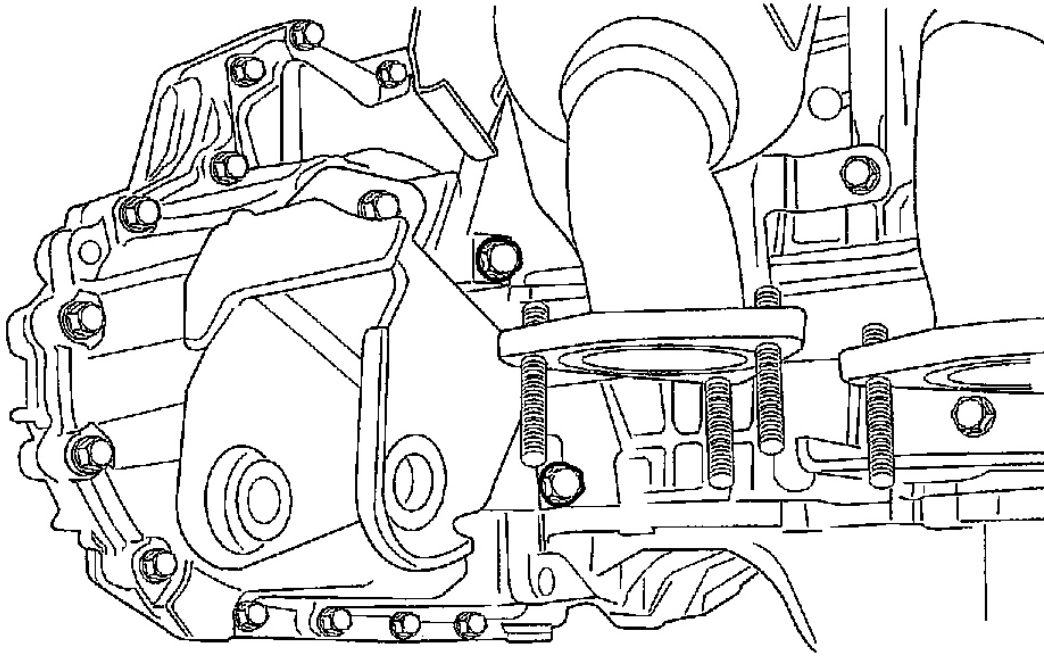
Fig. 83: Removing Engine Assembly From Transaxle
Courtesy of SUZUKI OF AMERICA CORP.

Engine Assembly Installation

1. Installation should follow the removal procedure in the reverse order.
2. Tighten the engine block-to-transaxle bolts near the rear transaxle bracket.

Tighten

Tighten the engine block-to-transaxle bolts to 60-85 N.m (44-63 lb-ft).



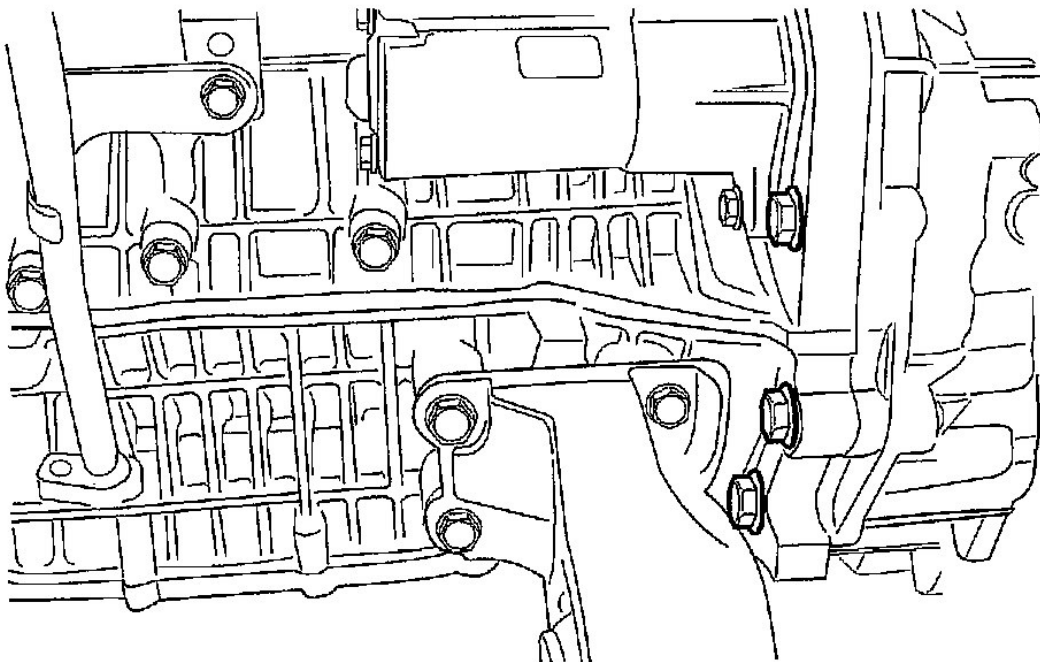
G01985642

Fig. 84: Tightening Engine Block-To-Transaxle
Courtesy of SUZUKI OF AMERICA CORP.

3. Tighten the engine block-to-transaxle bolts near the front engine mount bracket.

Tighten

Tighten the engine block-to-transaxle bolts to 60-85 N.m (44-63 lb-ft).



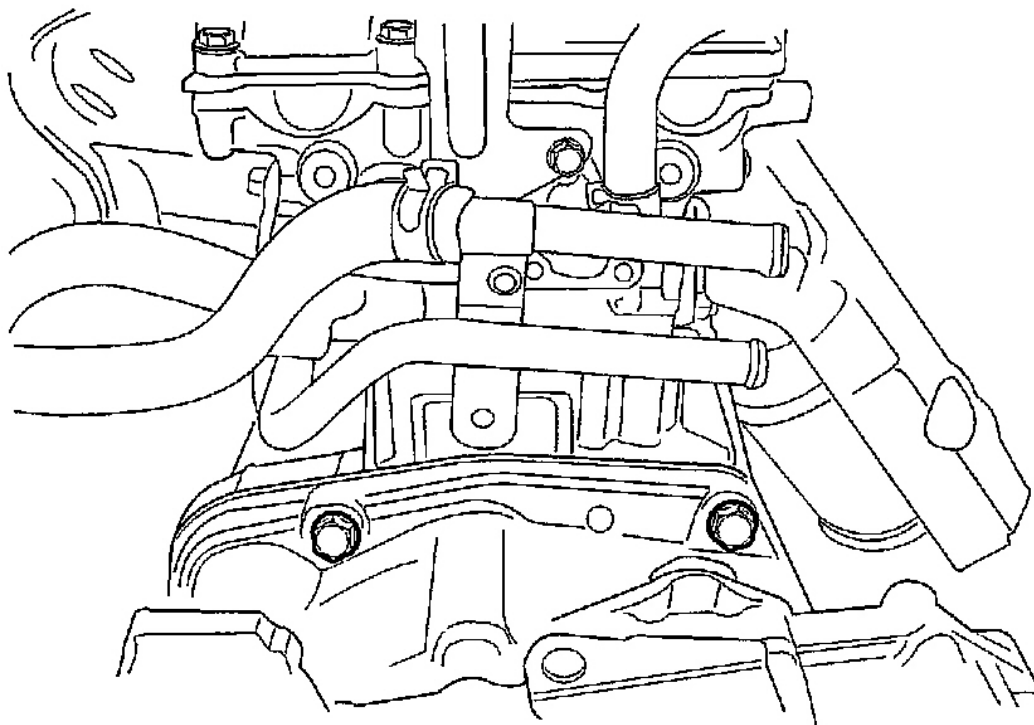
G01985643

Fig. 85: Tightening Engine Block-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Tighten the transaxle-to-engine block bolts near the rear support bracket.

Tighten

Tighten the transaxle-to-engine block bolts to 60-85 N.m (44-63 lb-ft).



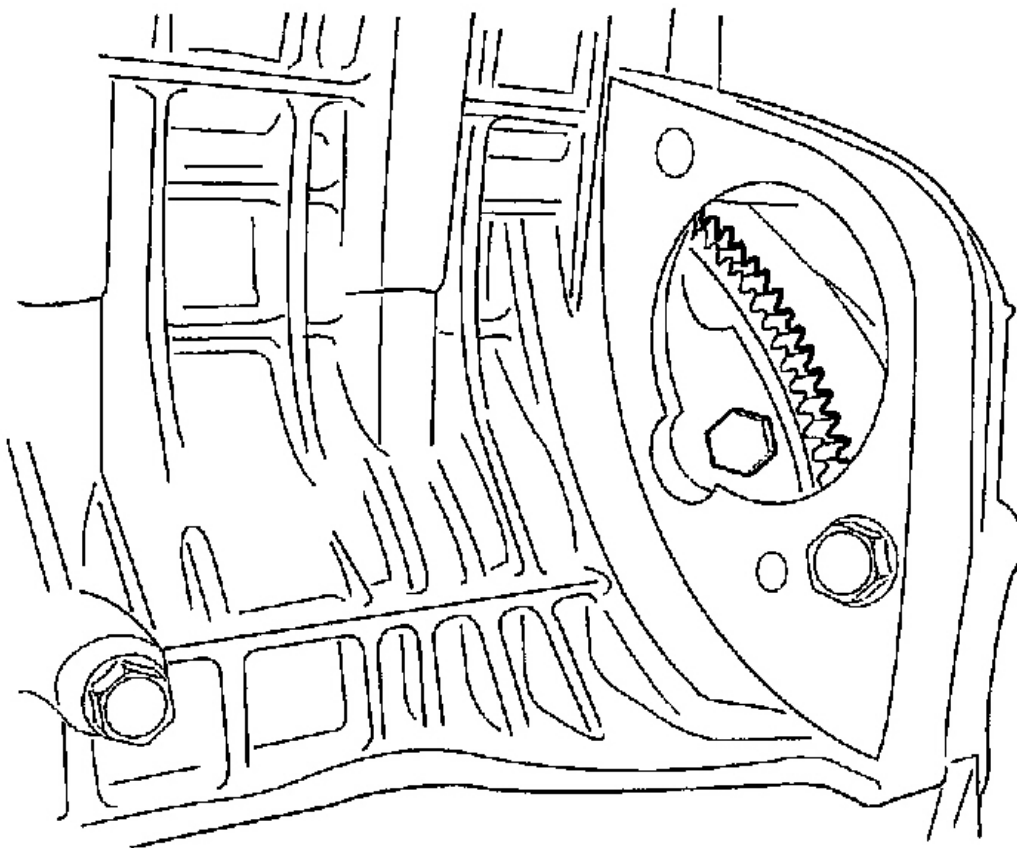
G01985644

Fig. 86: Tightening Transaxle-To-Engine Block Bolts
Courtesy of SUZUKI OF AMERICA CORP.

5. Tighten the three (3) flexible plate-to-torque converter retaining bolts.

Tighten

Tighten the transaxle torque converter bolts to 40-50 N.m (30-37 lb-ft).



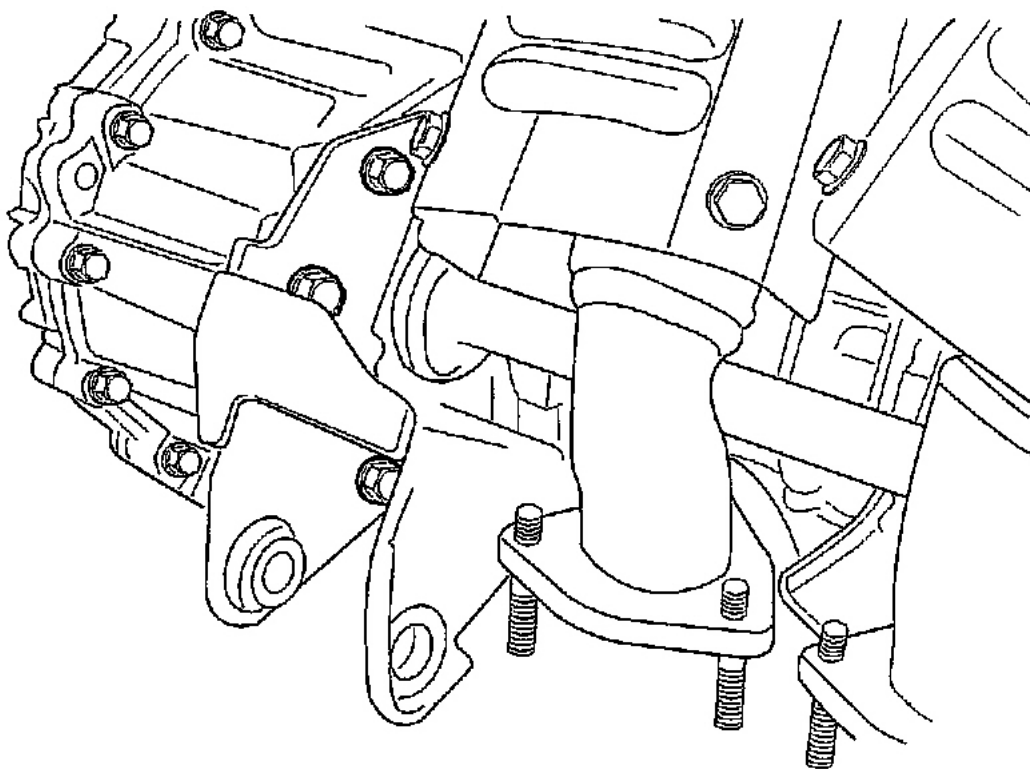
G01985645

Fig. 87: Tightening Flexible Plate-To-Torque Converter Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the rear transaxle mount bracket.

Tighten

Tighten the rear transaxle mount bracket bolts to 55-75 N.m (26-55 lb-ft).



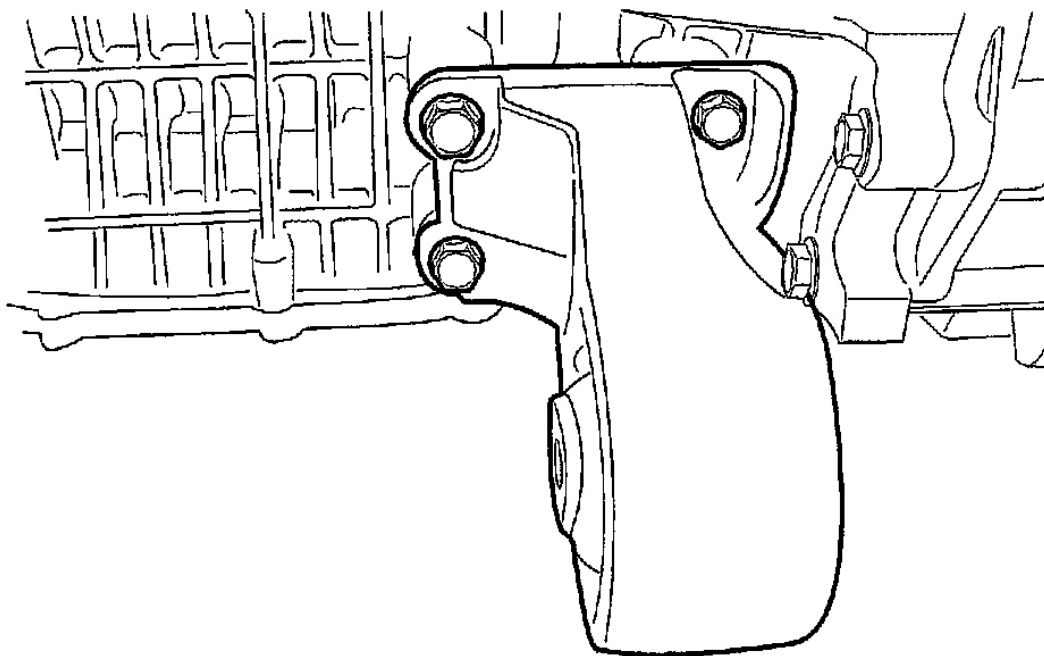
G01985646

Fig. 88: Installing Rear Transaxle Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the front damper bush bracket.

Tighten

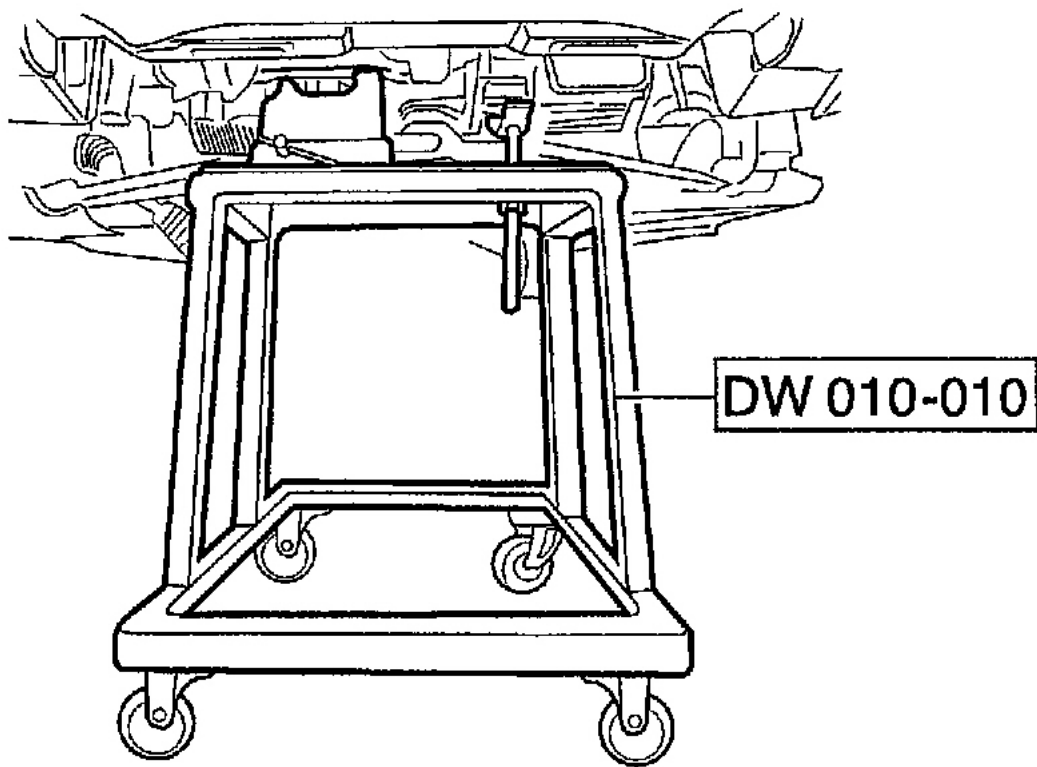
Tighten the front damper bush bracket bolts to 55-75 N.m (26-55 lb-ft).



G01985647

Fig. 89: Installing Front Damper Bush Bracket
Courtesy of SUZUKI OF AMERICA CORP.

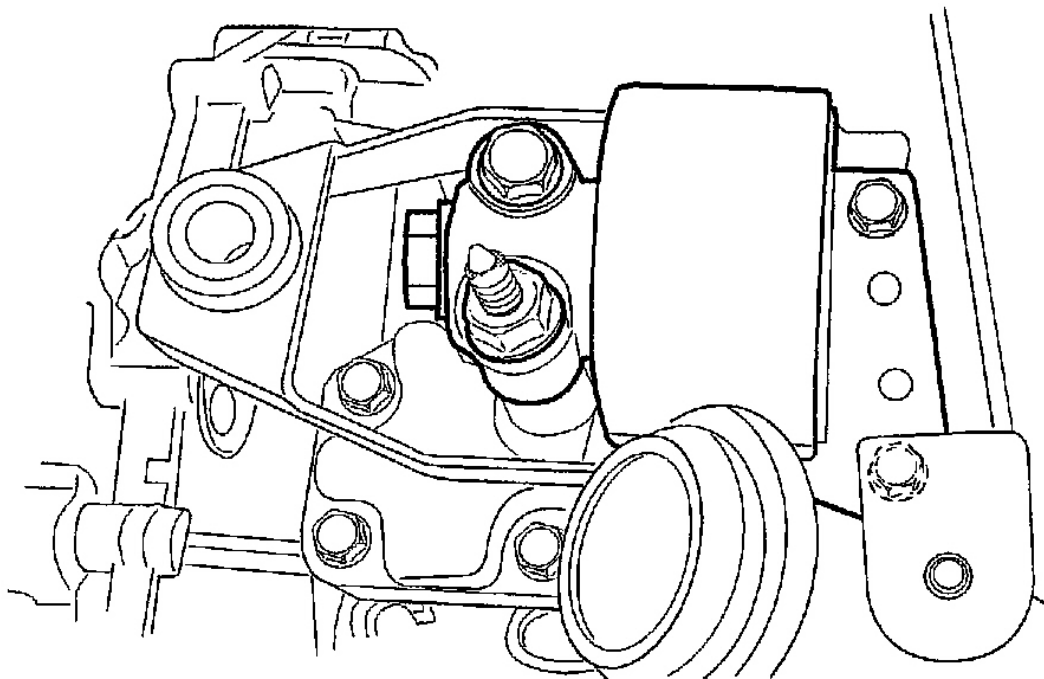
8. Install the starter. Refer to **STARTER** .
9. Install the engine and transaxle assembly using the power pack stand DW010-010.



G01985648

Fig. 90: Installing Engine & Transaxle Assembly
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the engine mount bracket (LH). Refer to **Engine Mount (LH) Removal** .

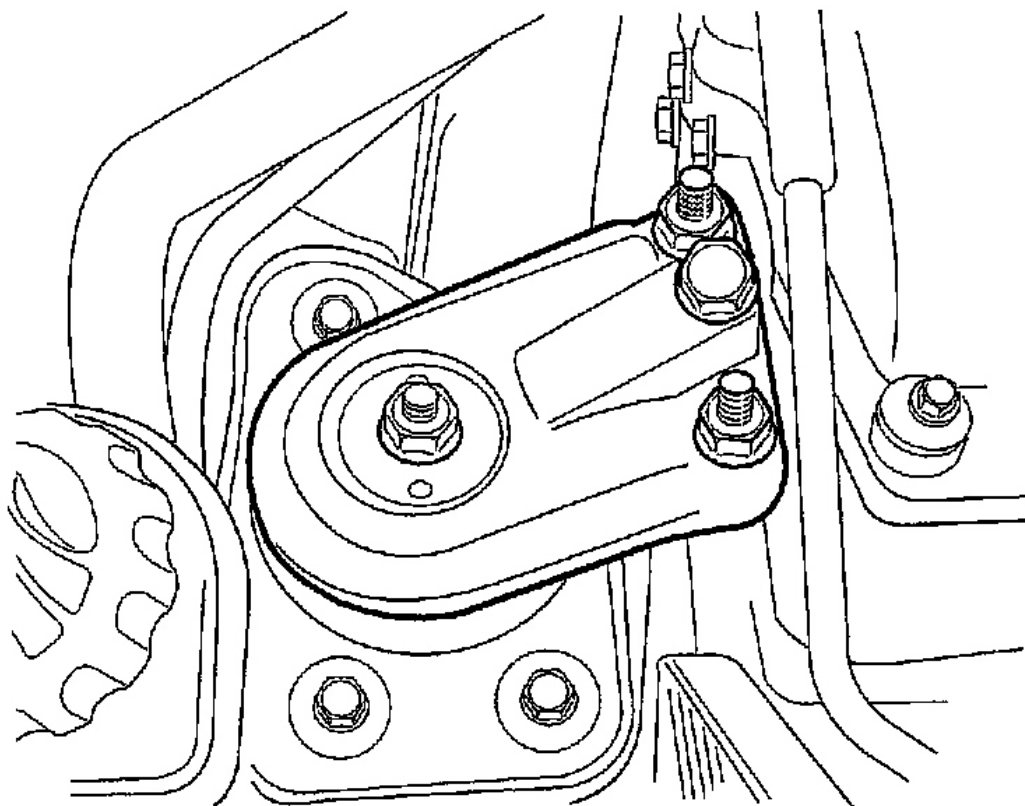


G01985649

Fig. 91: Installing Engine Mount Bracket (LH)

Courtesy of SUZUKI OF AMERICA CORP.

11. Install the engine mount bracket (RH). Refer to **Engine Mount (RH) Installation** .



G01985650

Fig. 92: Installing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

12. Support the engine and transaxle assembly using the engine assembly lift support DW110-060.
13. Remove the power pack stand DW010-010.

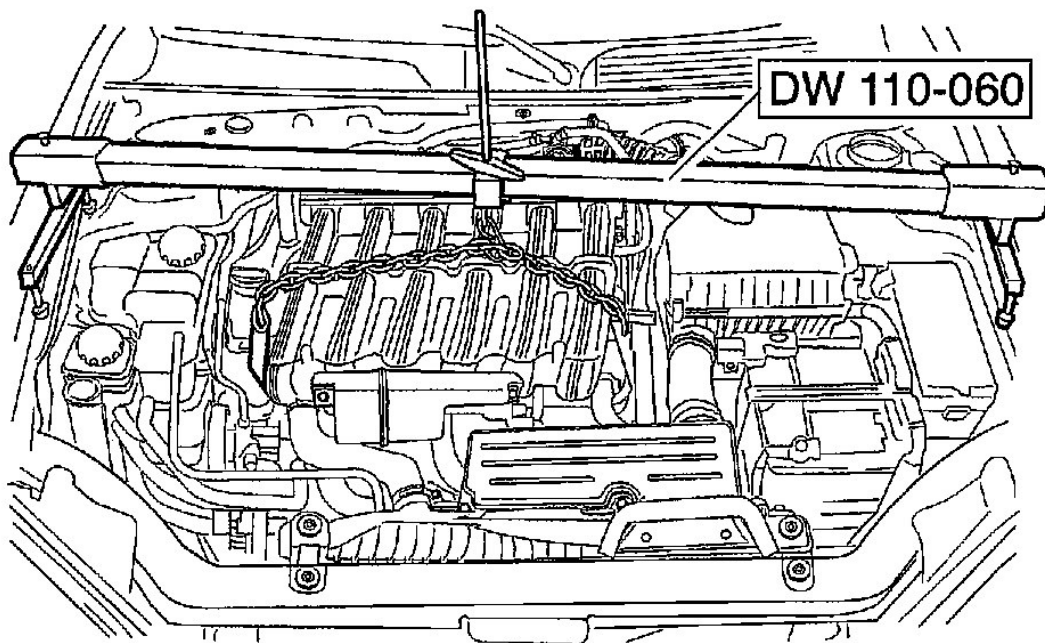
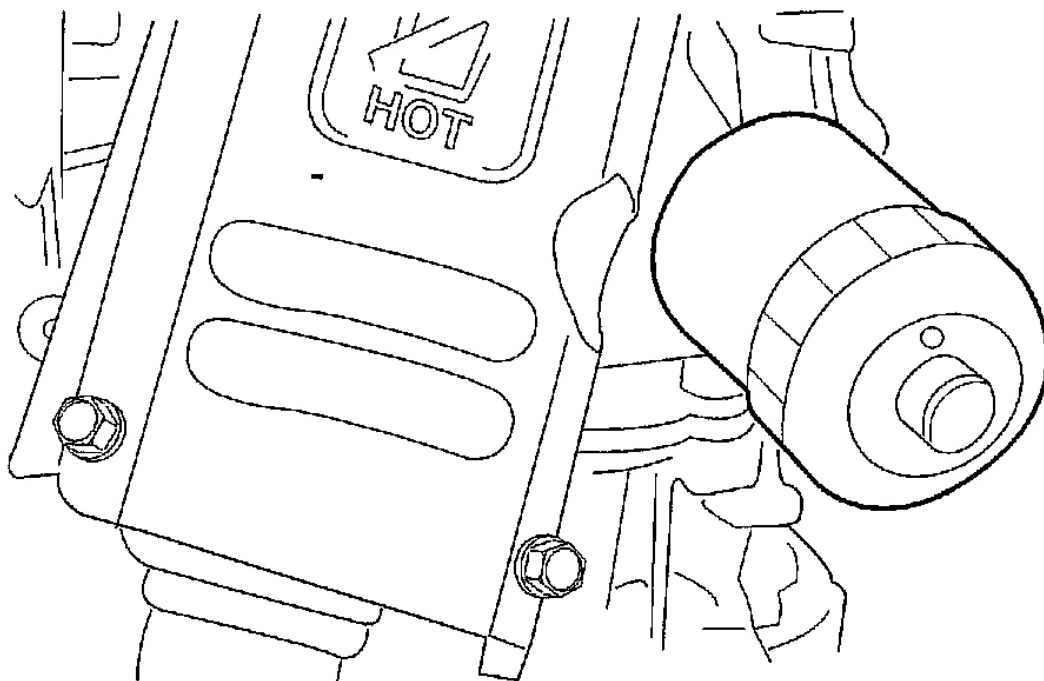


Fig. 93: Removing Power Pack Stand
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the oil filter.

Tighten

Tighten the oil filter to 12-16 N.m (9-12 lb-in).



G01985652

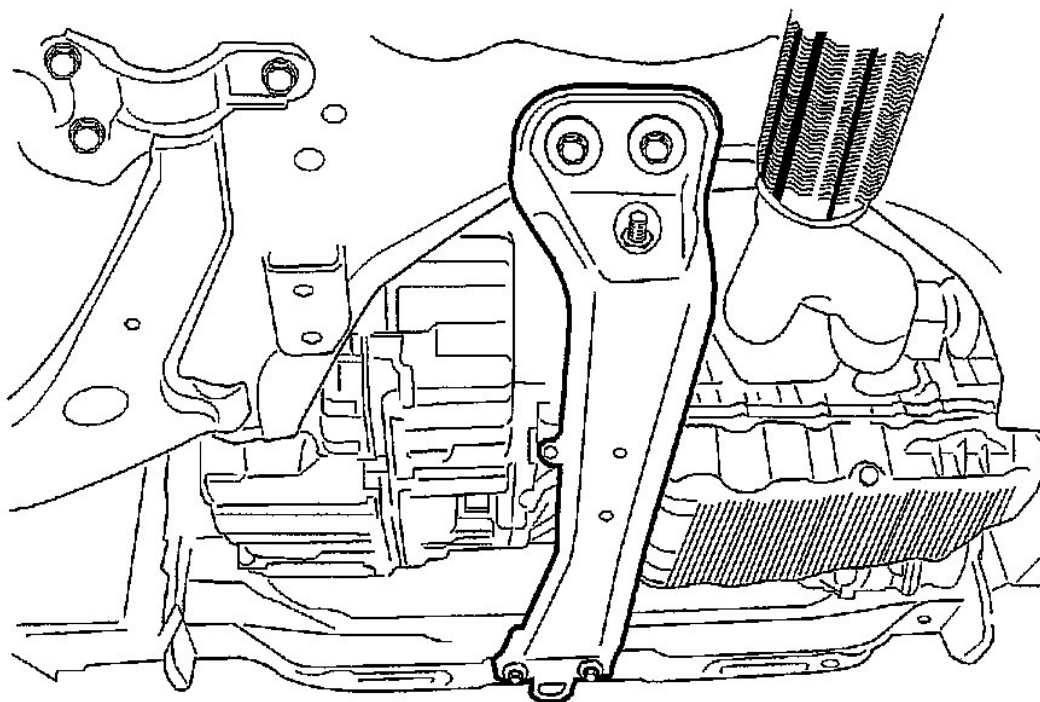
Fig. 94: Installing Oil Filter

Courtesy of SUZUKI OF AMERICA CORP.

15. Install the center front suspension member.

Tighten

Tighten the center front suspension member bolts to 80-100 N.m (59-74 lb-ft).



G01985653

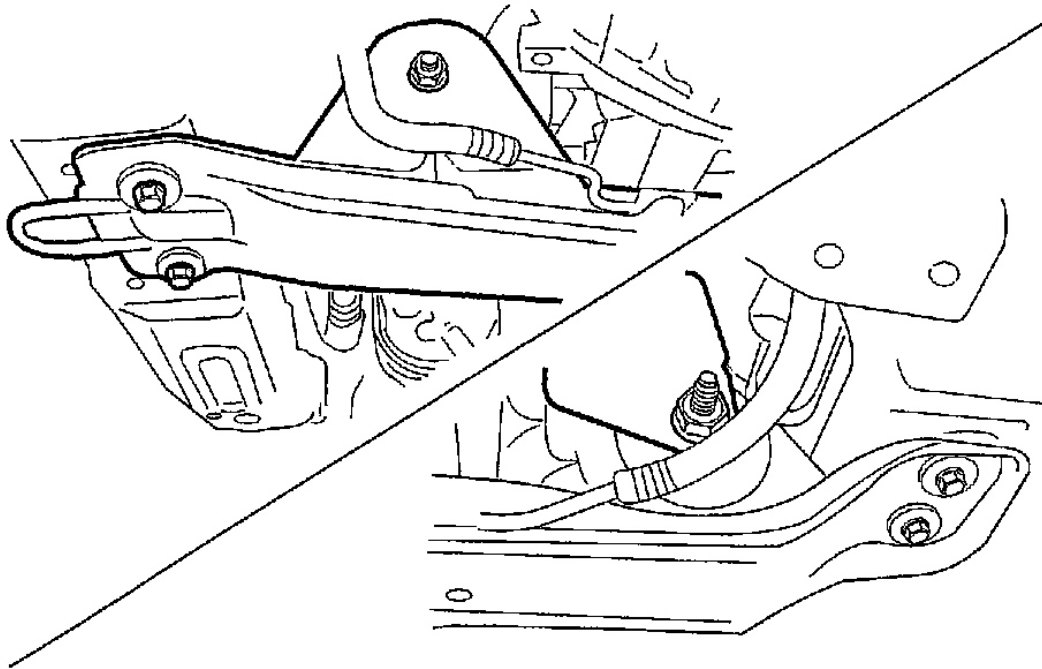
Fig. 95: Installing Center Front Suspension Member
Courtesy of SUZUKI OF AMERICA CORP.

16. Tighten the front engine mount bracket-to-damper bush bolt/nut and the rear transaxle mount bracket-to-damper bush bolt/nut.

Tighten

Tighten the front engine mount bracket-to-damper bush bolt/nut to 70-90 N.m (52-66 lb-ft).

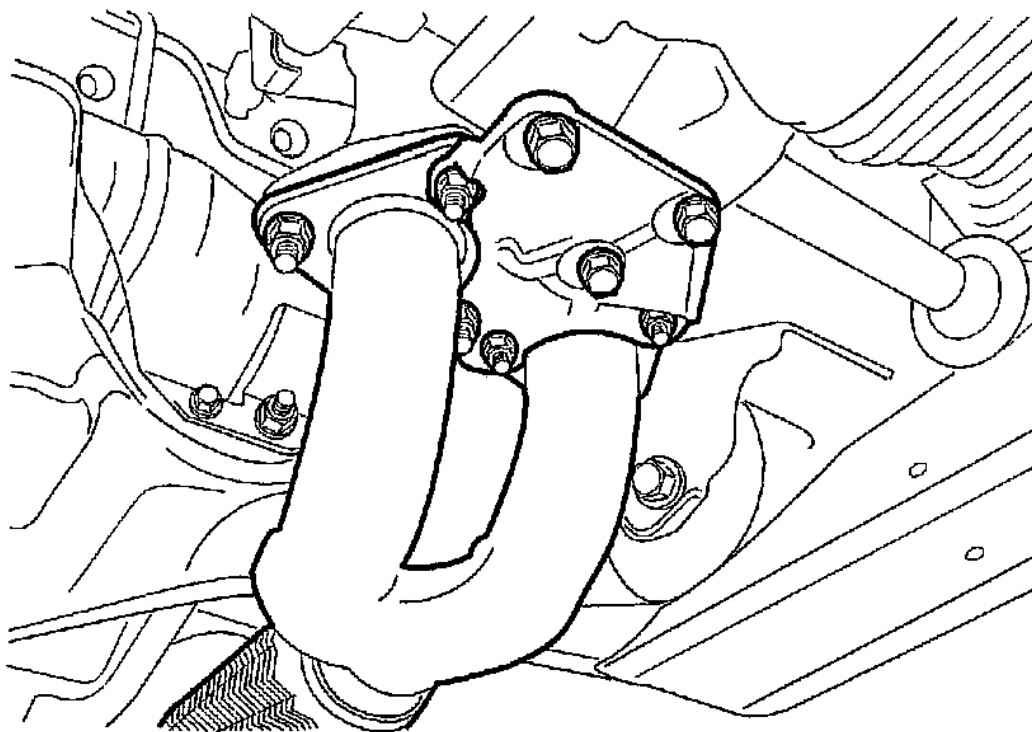
Tighten the rear transaxle mount bracket-to-damper bush bolt/nut to 70-90 N.m (52-66 lb-ft).



G01985654

Fig. 96: Tightening Front Engine Mount Bracket-To-Damper
Courtesy of SUZUKI OF AMERICA CORP.

17. Install the front muffler. Refer to **MUFFLER -- FRONT INSTALLATION** .



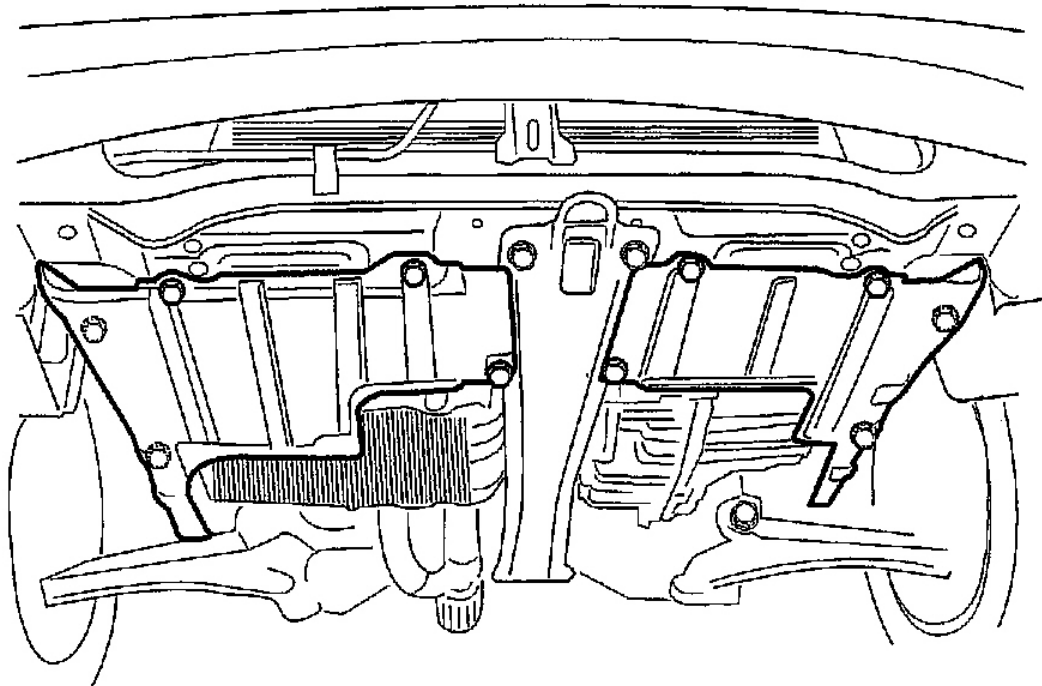
G01985655

Fig. 97: Installing Front Muffler
Courtesy of SUZUKI OF AMERICA CORP.

18. Install the axle shaft. Refer to **AXLE SHAFTS** .
19. Install the engine under cover.

Tighten

Tighten the engine under cover bolts to 17-27 N.m (13-20 lb-ft).



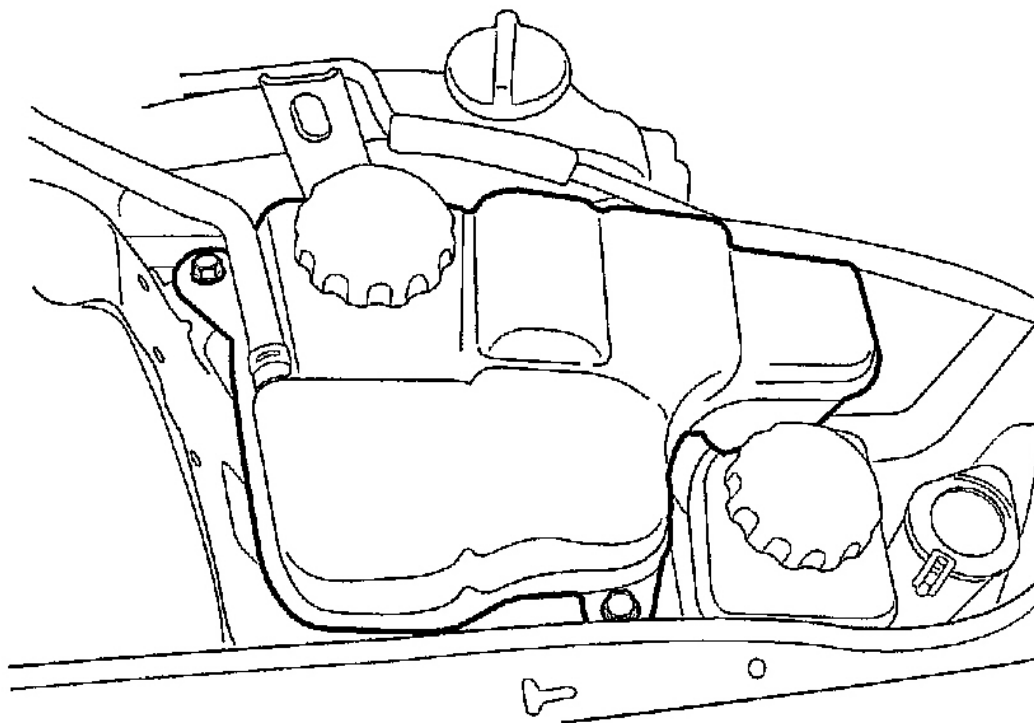
G01985656

Fig. 98: Installing Engine Under Cover
Courtesy of SUZUKI OF AMERICA CORP.

20. Connect the connectors and cables on the transaxle. Refer to **AXLE SHAFTS** .
21. Connect the wiring harness, hoses, pipes, and connectors to the engine assembly.
22. Install the coolant reservoir. Refer to **SURGE TANK INSTALLATION** .

Tighten

Tighten the coolant reservoir bolts to 3.5-4.5 N.m (31-40 lb-in).



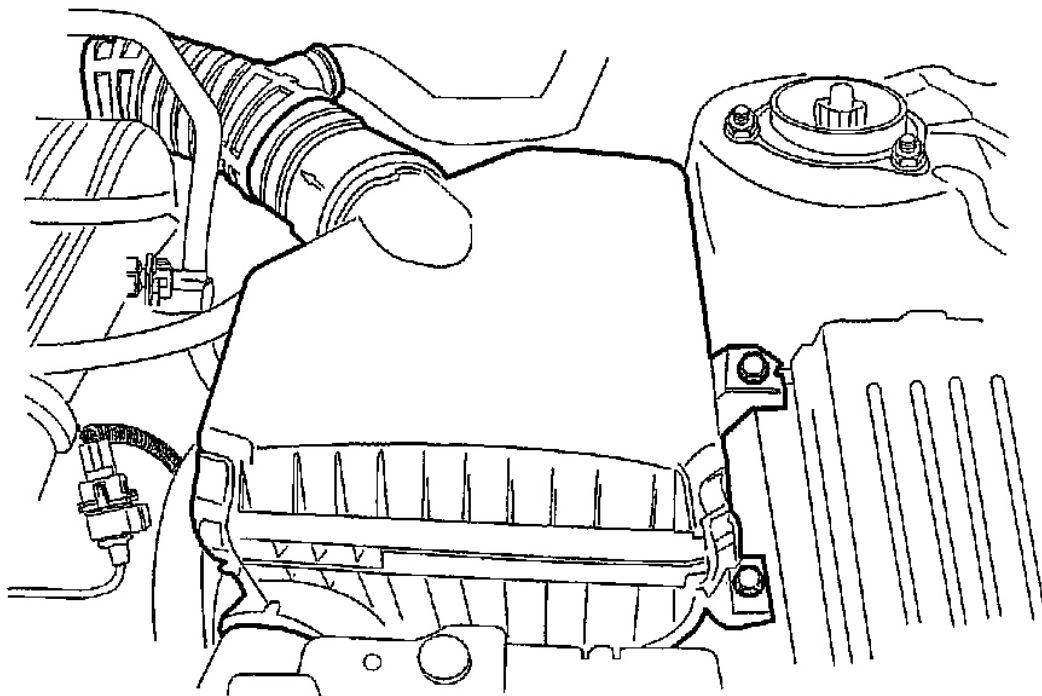
G01985657

Fig. 99: Installing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the air filter housing.

Tighten

Tighten the air filter housing bolt to 8-12 N.m (71-106 lb-in).



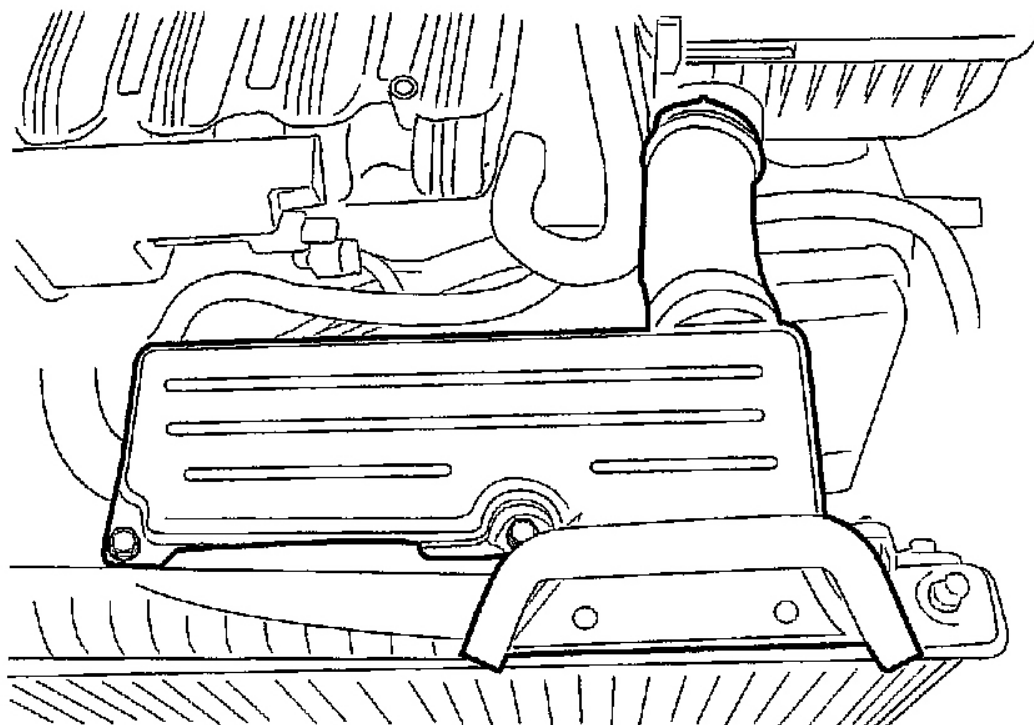
G01985658

Fig. 100: Installing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

24. Install the air filter snorkel.

Tighten

Tighten the air filter snorkel retaining bolt to 5-7 N.m (44-62 lb-in).



G01985659

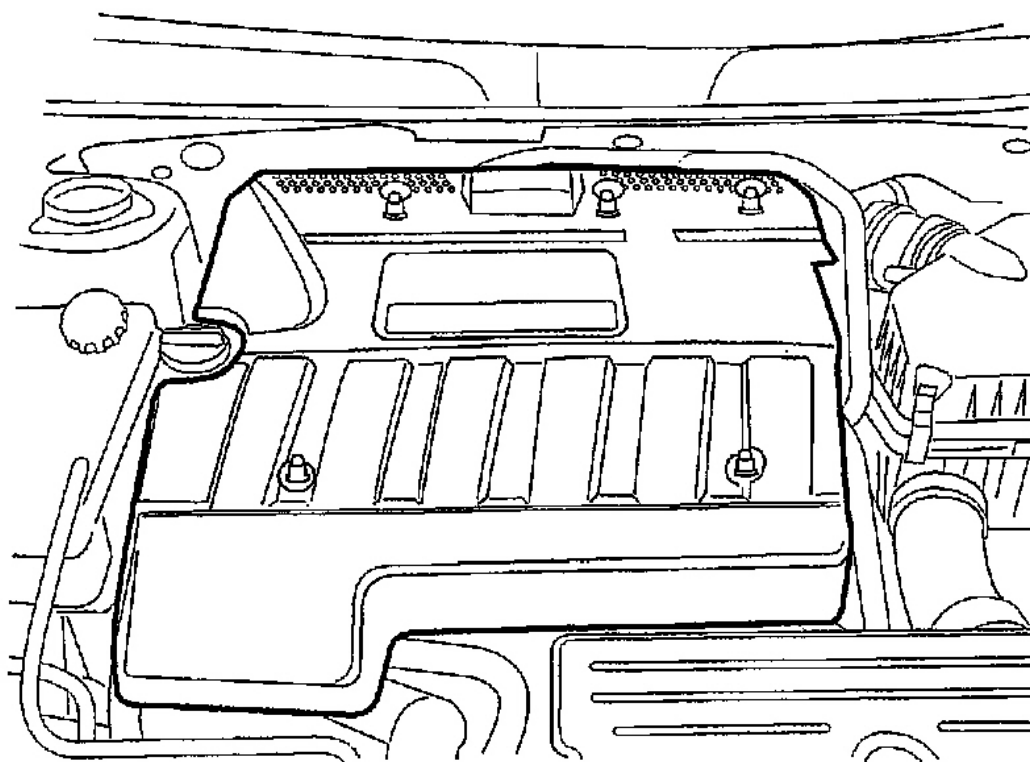
Fig. 101: Installing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

25. Install the engine beautification cover.

Tighten

Tighten the engine beautification cover bolts to 8-12 N.m (71-106 lb-in).

26. Connect the connectors and hoses.
27. Recharge the refrigerant. Refer to **MANUAL HVAC SYSTEM**.
28. Fill the power steering oil.
29. Fill the transaxle oil.
30. Fill the engine oil.



G01985660

Fig. 102: Filling Engine Oil

Courtesy of SUZUKI OF AMERICA CORP.

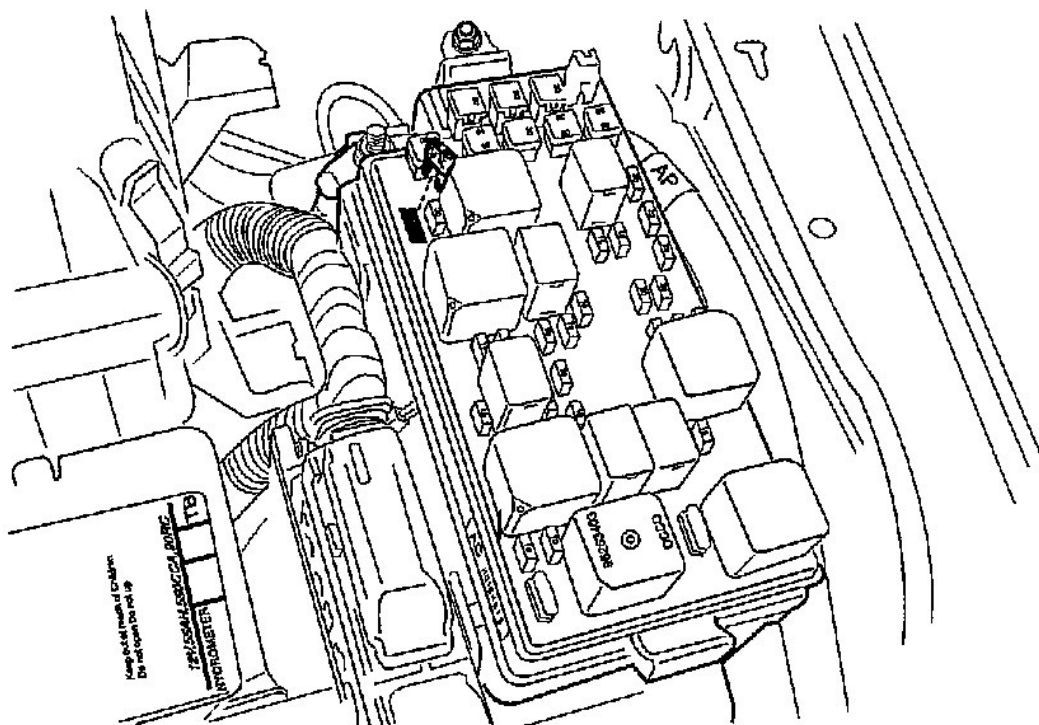
Timing Chain Removal

Tools Required

- DW110-060 Engine Assembly Lift Support
- DW010-010 Power Pack Stand
- DW110-030 Engine Overhaul Stand
- DW110-130-01 Crankshaft Pulley Holder
- DW110-130-02 Crankshaft Pulley Installer/Remover
- DW110-150 Camshaft Sprocket Holder
- DW110-190 Crankshaft Adjuster
- DW110-140 Timing Chain Cover Install Guide Pin

1. Remove the fuel pump fuse.

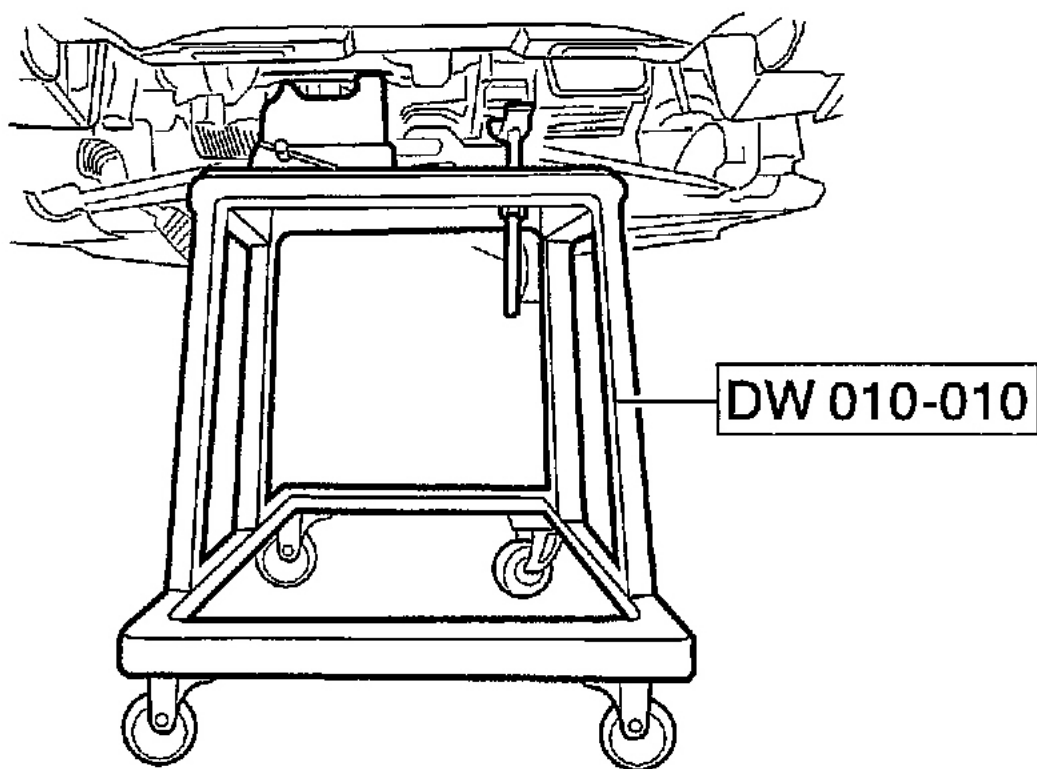
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM**.
5. Drain the engine oil.
6. Drain the transaxle oil.



G01985661

Fig. 103: Draining Transaxle Oil
Courtesy of SUZUKI OF AMERICA CORP.

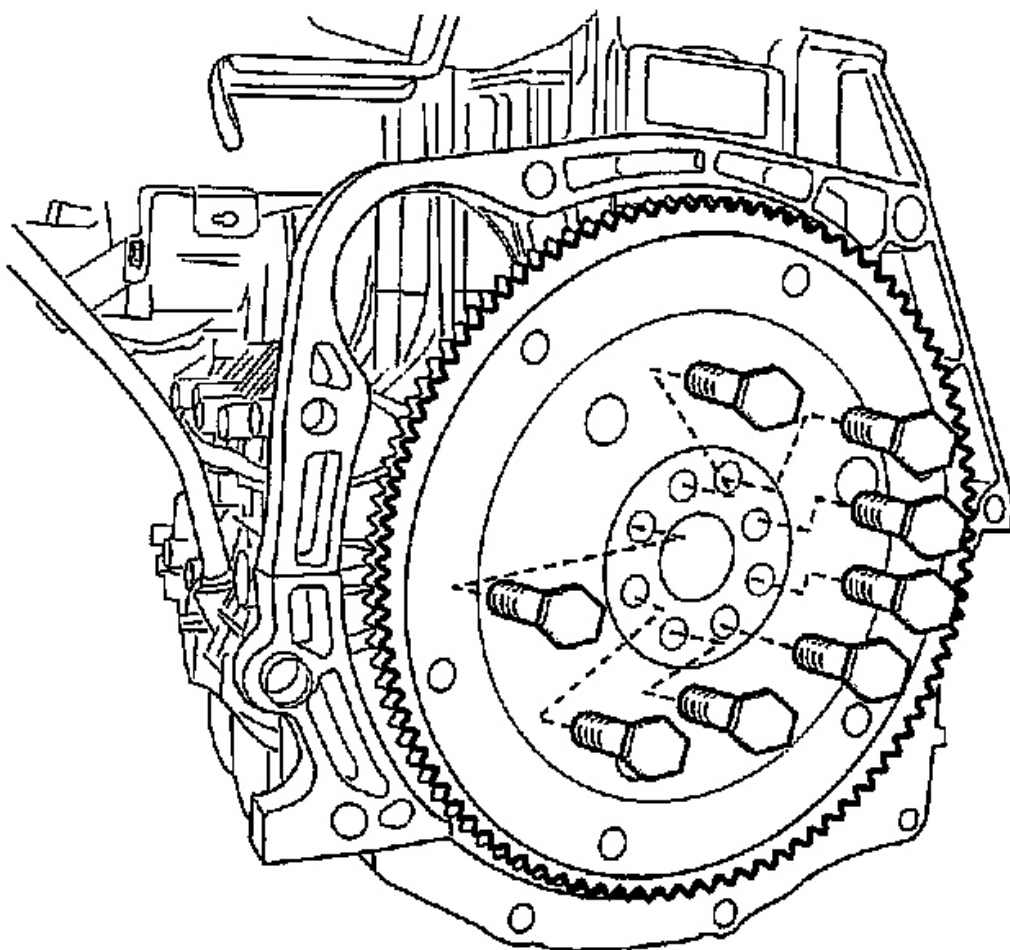
7. Drain the power steering oil.
8. Recover the refrigerant.
9. Remove the engine assembly. Refer to **Engine Assembly Removal**.



G01985662

Fig. 104: Removing Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

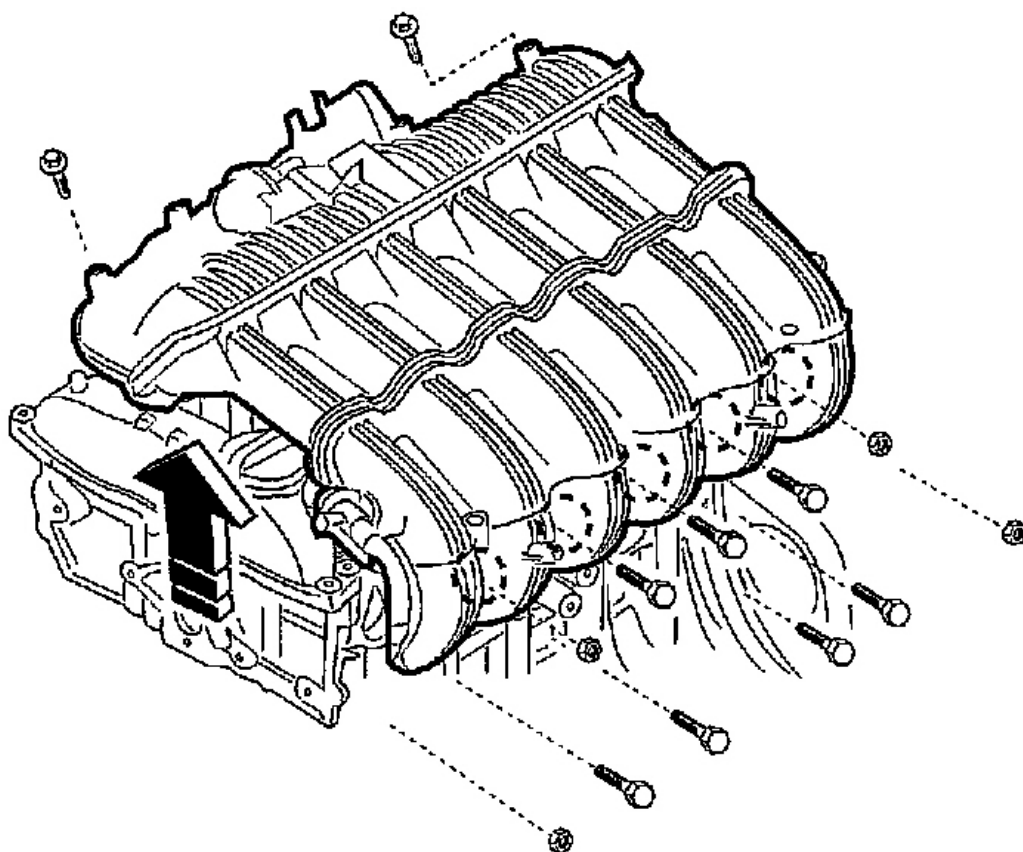
10. Remove the flexible plate bolts and the flexible plate.
11. Support the engine assembly with the engine overhaul stand DW110-030.



G01985663

Fig. 105: Supporting Engine Assembly With Engine Overhaul Stand
Courtesy of SUZUKI OF AMERICA CORP.

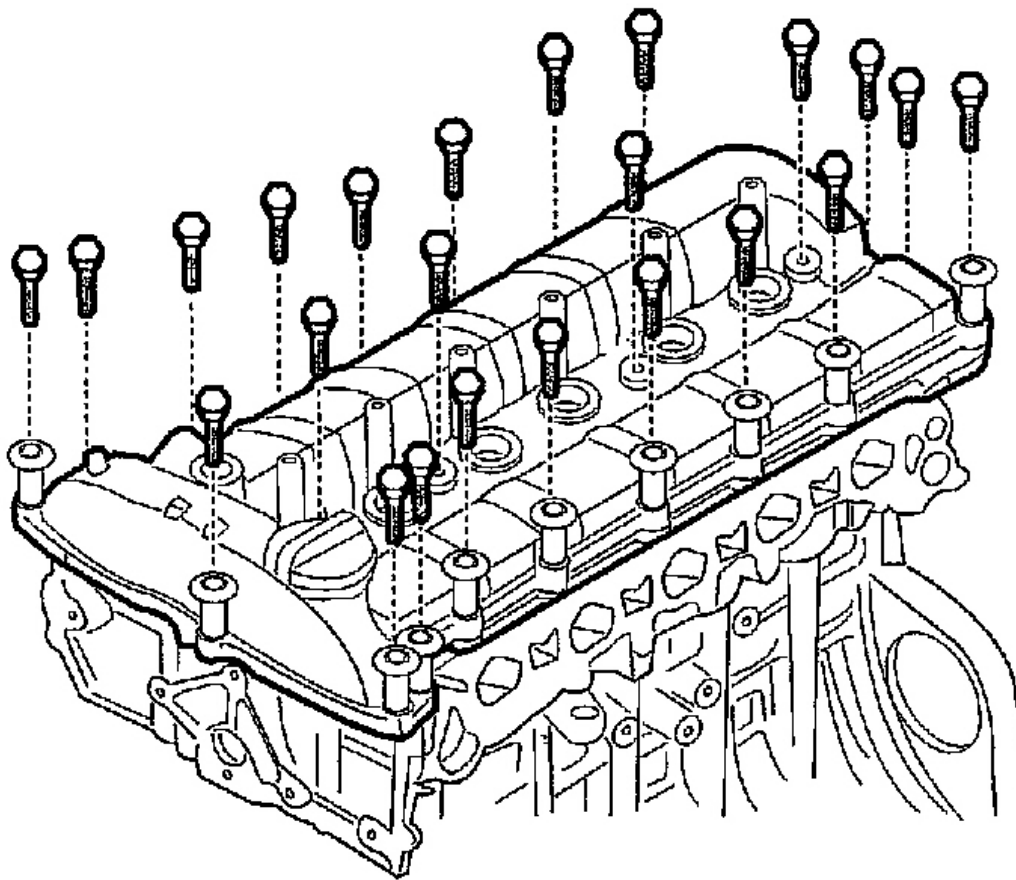
12. Remove the intake manifold. Refer to **Throttle Body Assembly Removal** .



G01985664

Fig. 106: Removing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

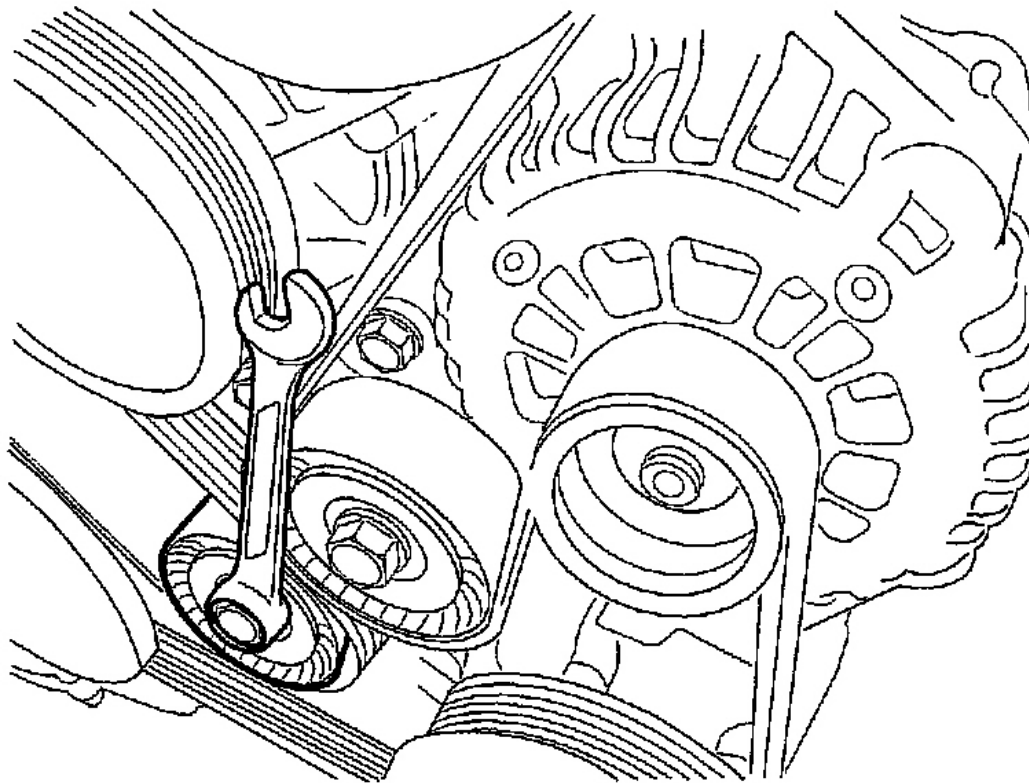
13. Remove the cylinder head cover. Refer to Cylinder Head Cover Removal .



G01985665

Fig. 107: Removing Cylinder Head Cover
Courtesy of SUZUKI OF AMERICA CORP.

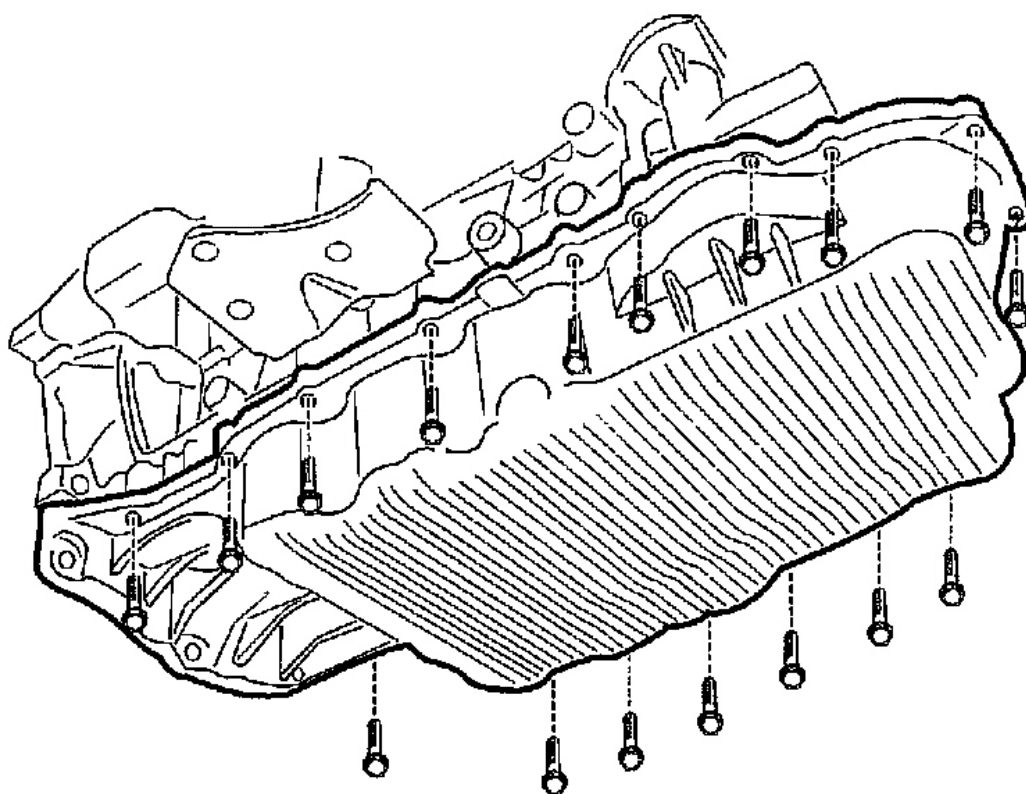
14. Remove the drive belt.



G01985666

Fig. 108: Removing Drive Belt
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove the oil pan. Refer to Oil Pan / Oil Pump Removal .



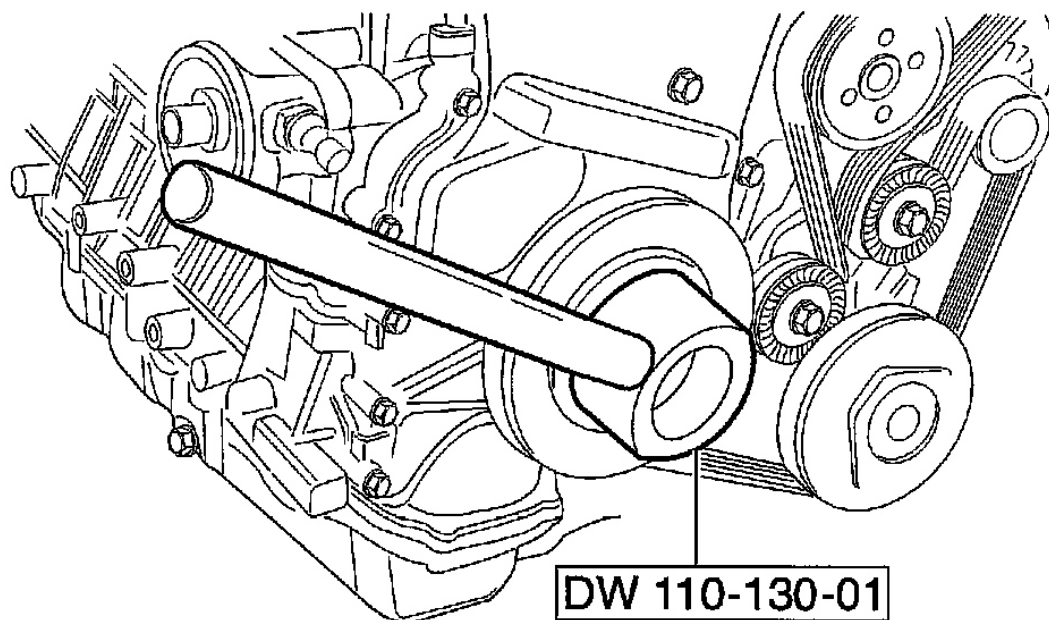
G01985667

Fig. 109: Removing Oil Pan

Courtesy of SUZUKI OF AMERICA CORP.

16. Install the crankshaft pulley holder DW110-130-01 to the crankshaft pulley bolt.

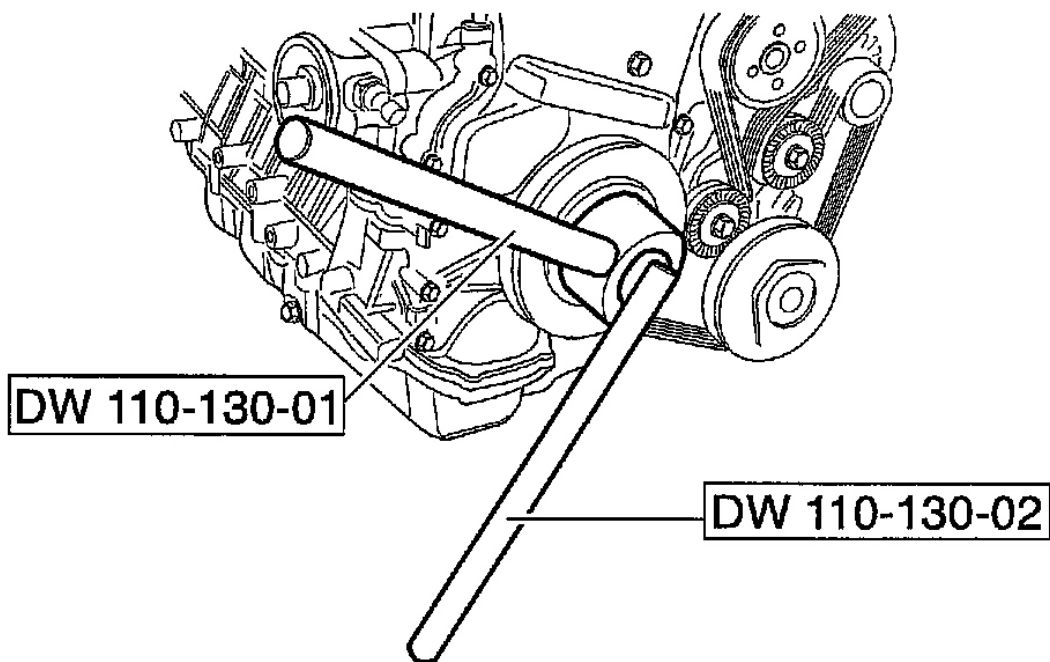
CAUTION: Very high torque is required to remove or to install the crankshaft pulley. Never remove the crankshaft pulley when the vehicle is hung on the lift.



G01985668

Fig. 110: Installing Crankshaft Pulley Holder
Courtesy of SUZUKI OF AMERICA CORP.

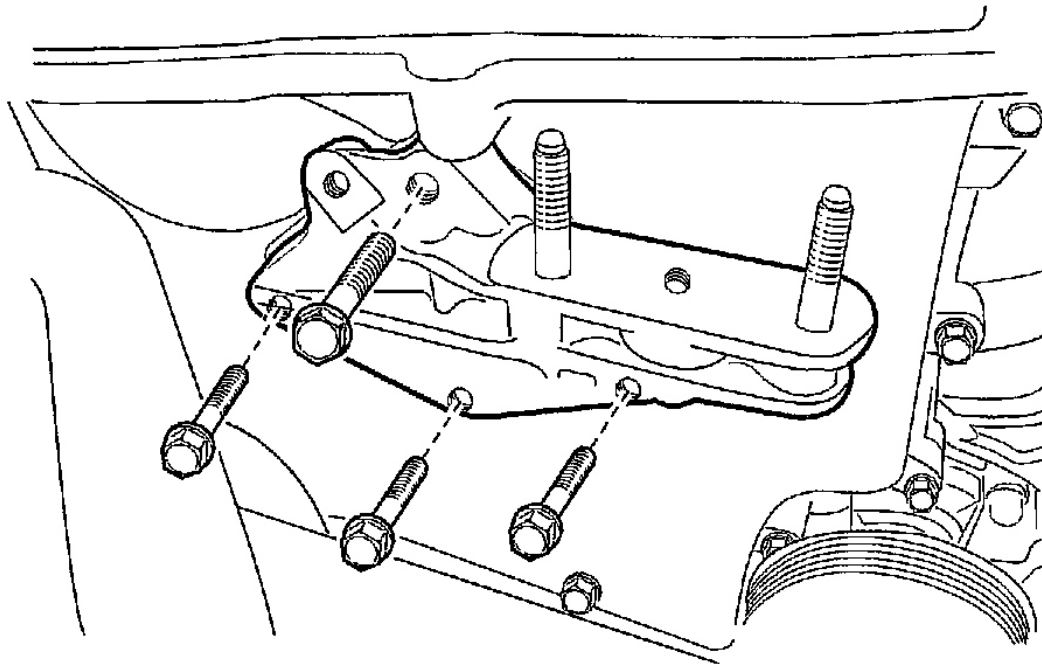
17. Remove the crankshaft pulley bolt using the crankshaft pulley installer/remover DW110-130-02.



G01985669

Fig. 111: Removing Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

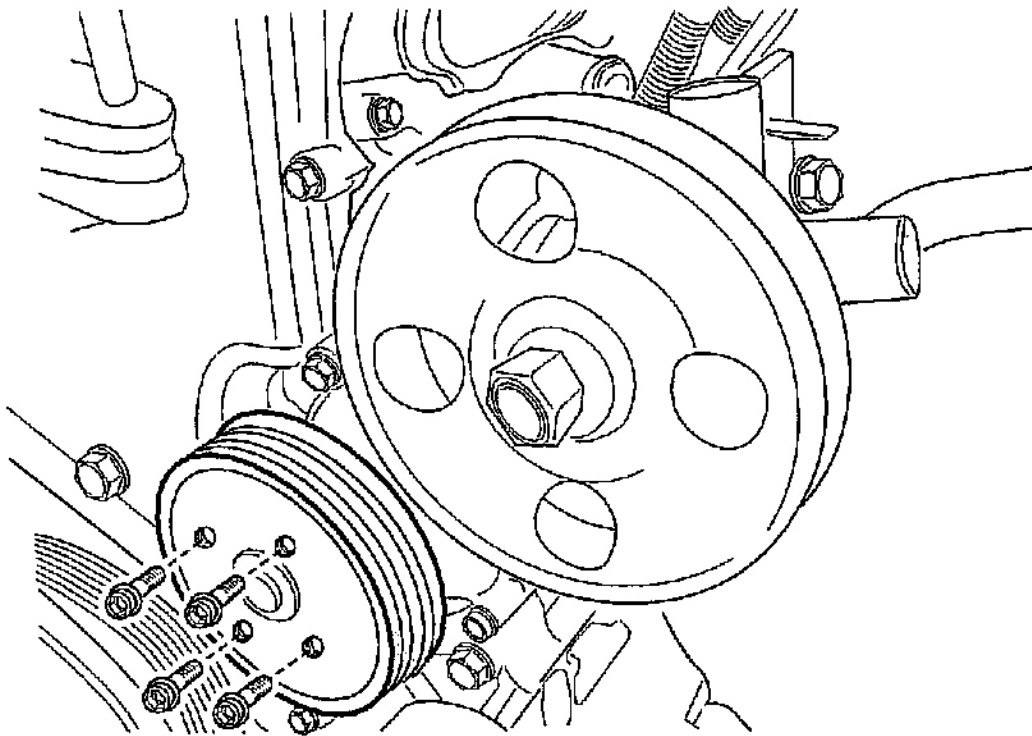
18. Remove the engine mount bracket support.



G01985670

Fig. 112: Removing Engine Mount Bracket Support
Courtesy of SUZUKI OF AMERICA CORP.

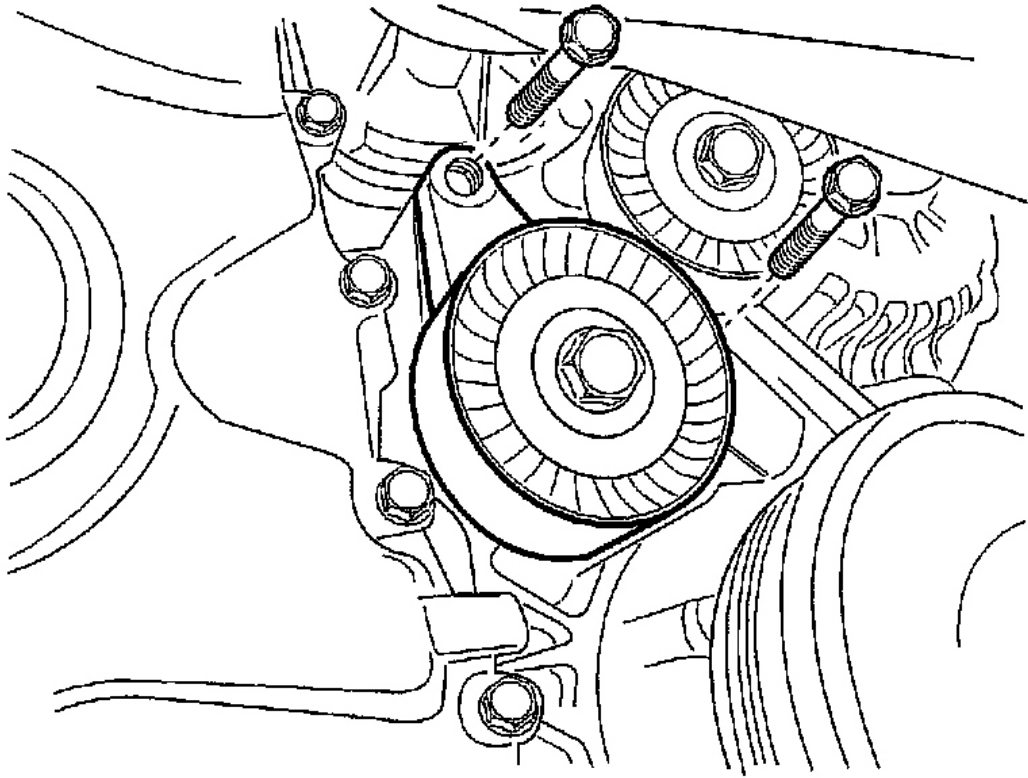
19. Remove the water pump pulley.



G01985671

Fig. 113: Removing Water Pump Pulley
Courtesy of SUZUKI OF AMERICA CORP.

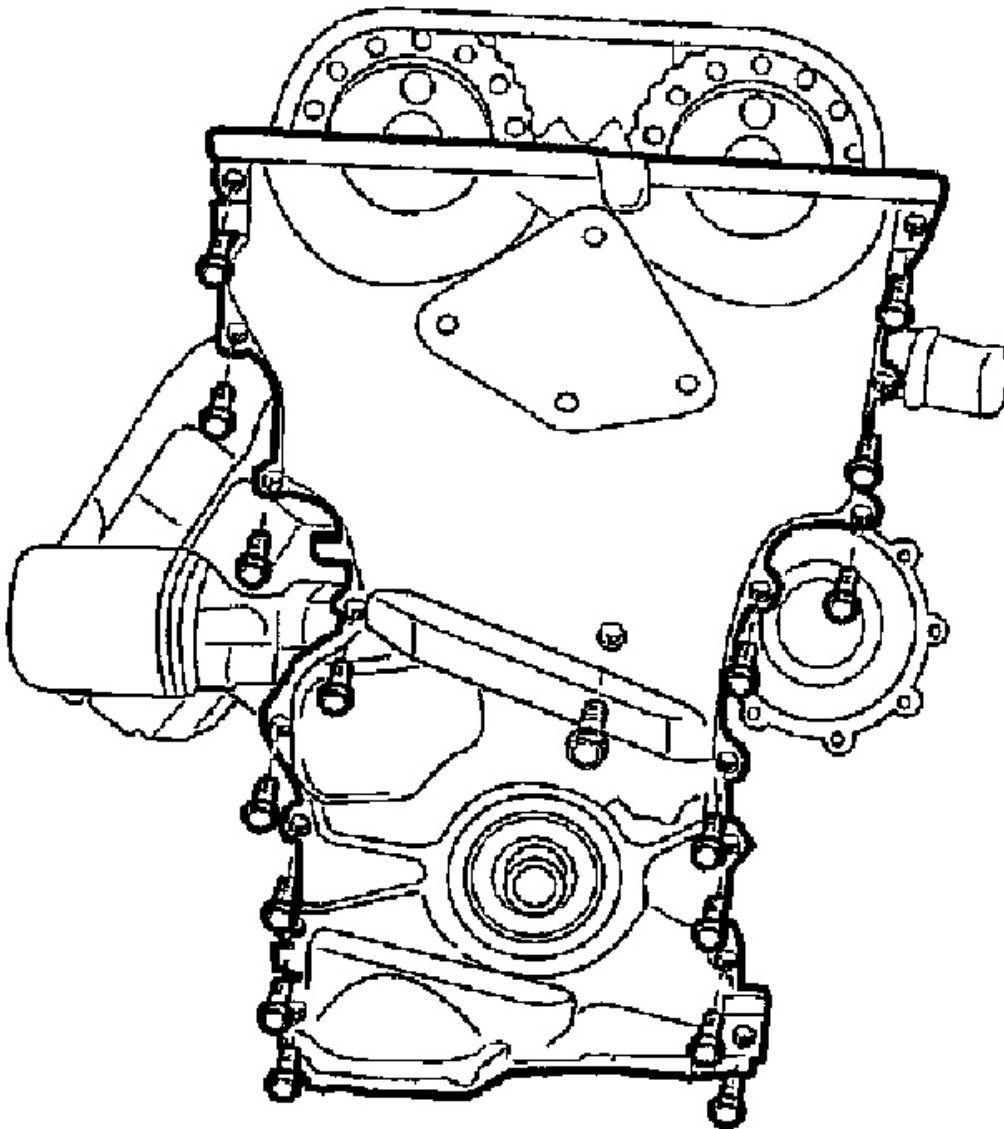
20. Remove the drive belt automatic tensioner retaining bolts and the tensioner.



G01985672

Fig. 114: Removing Drive Belt Automatic Tensioner Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

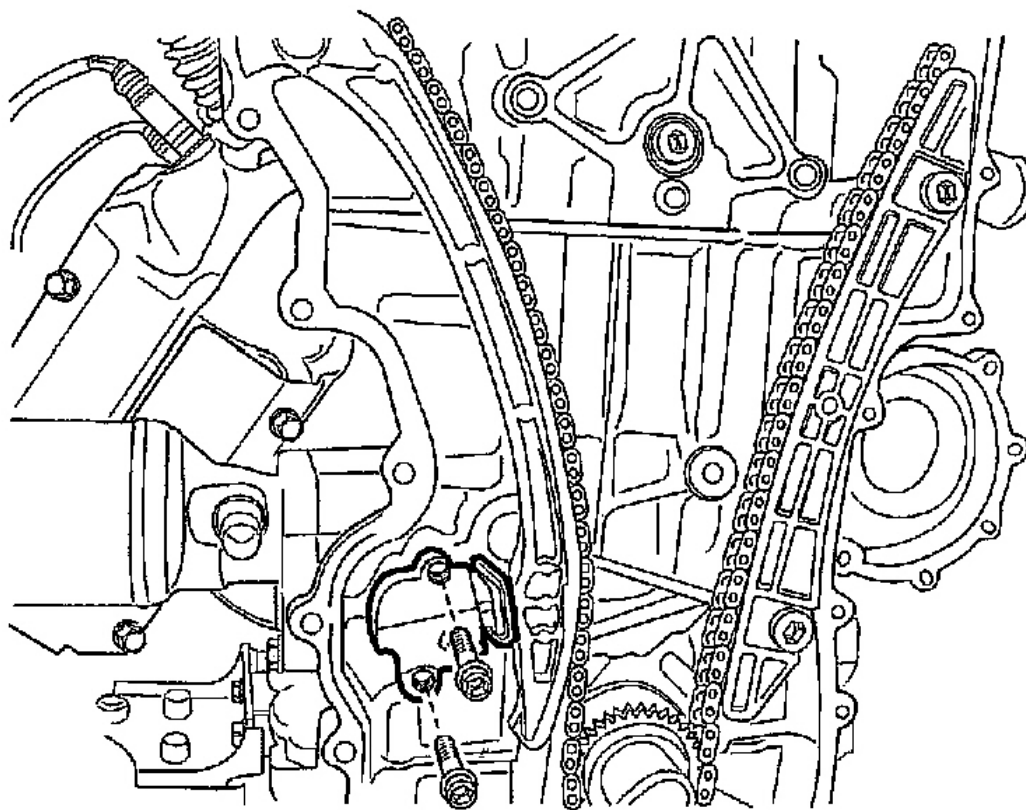
21. Remove the timing chain cover.
22. Remove two dowel rings for timing cover.



G01985673

Fig. 115: Removing Dowel Rings For Timing Cover
Courtesy of SUZUKI OF AMERICA CORP.

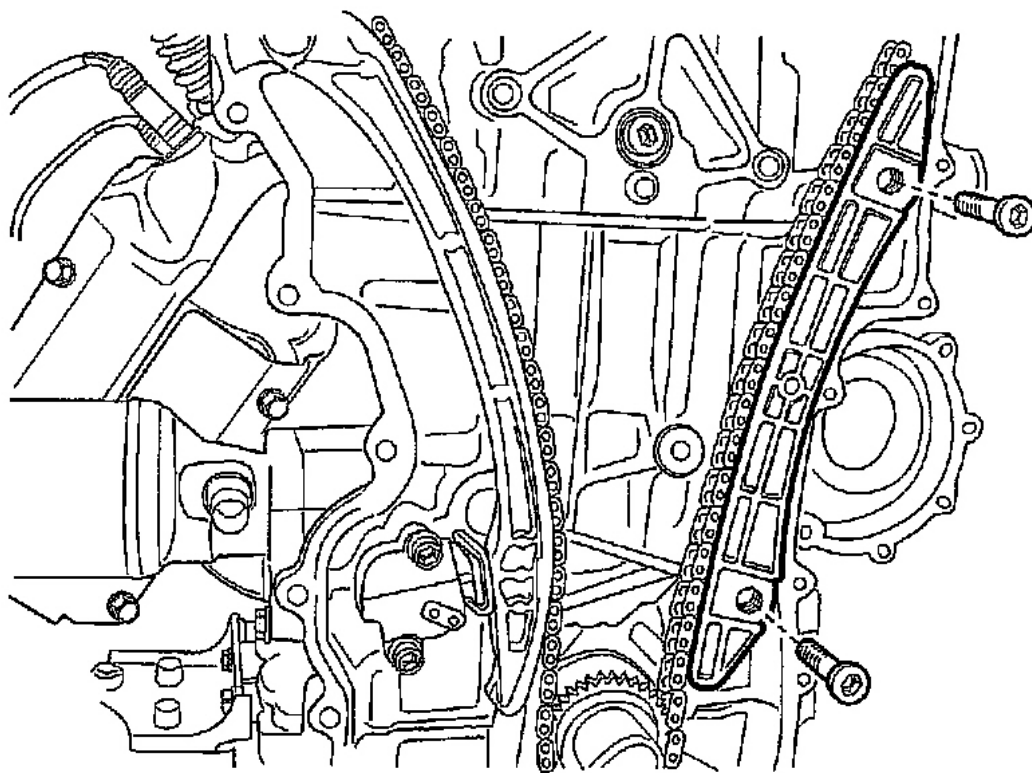
23. Remove the timing chain tensioner.



G01985674

Fig. 116: Removing Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

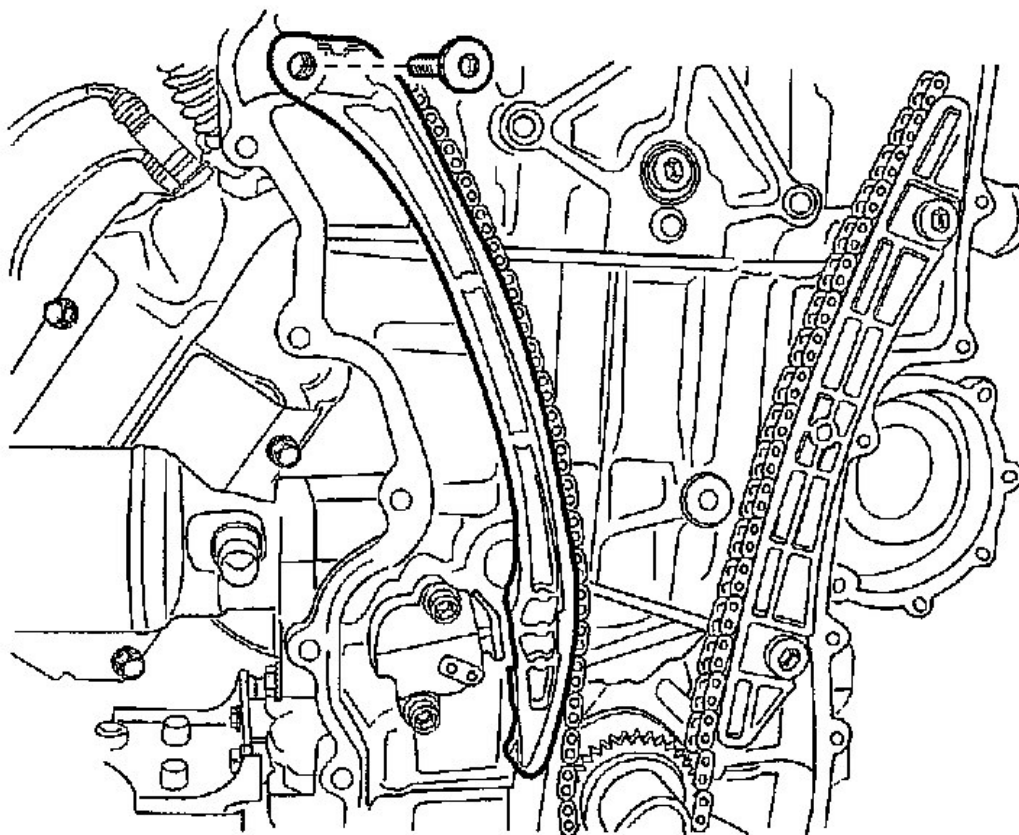
24. Remove the fixed timing chain guide.



G01985675

Fig. 117: Removing Fixed Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

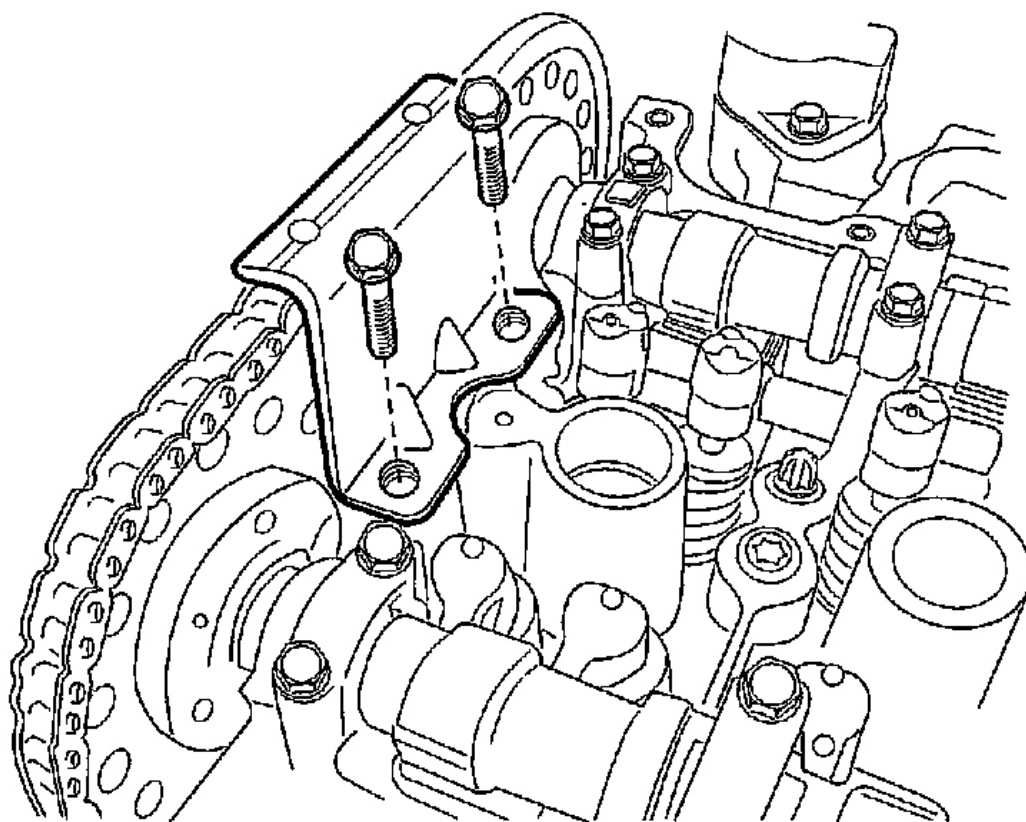
25. Remove the timing chain lever.



G01985676

Fig. 118: Removing Timing Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

26. Remove the top chain guide.
27. Remove the timing chain.
28. Remove the crankshaft sprocket and the woodruff key.

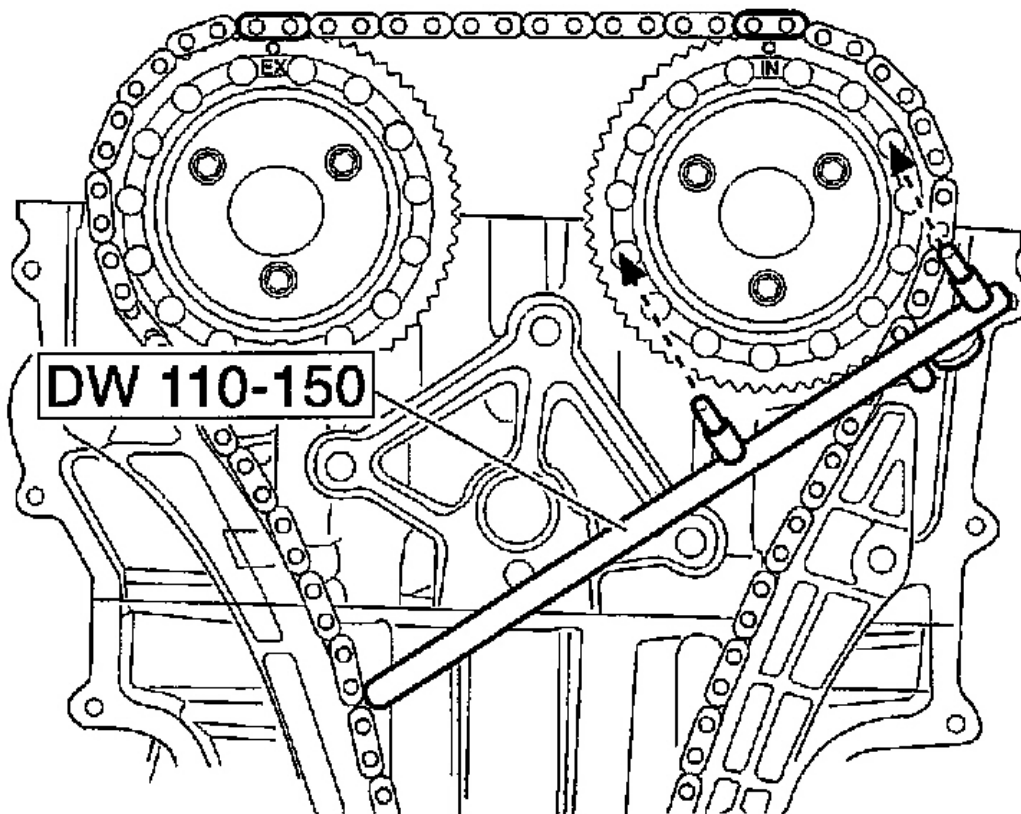


G01985677

Fig. 119: Removing Crankshaft Sprocket & Woodruff Key
Courtesy of SUZUKI OF AMERICA CORP.

Timing Chain Installation

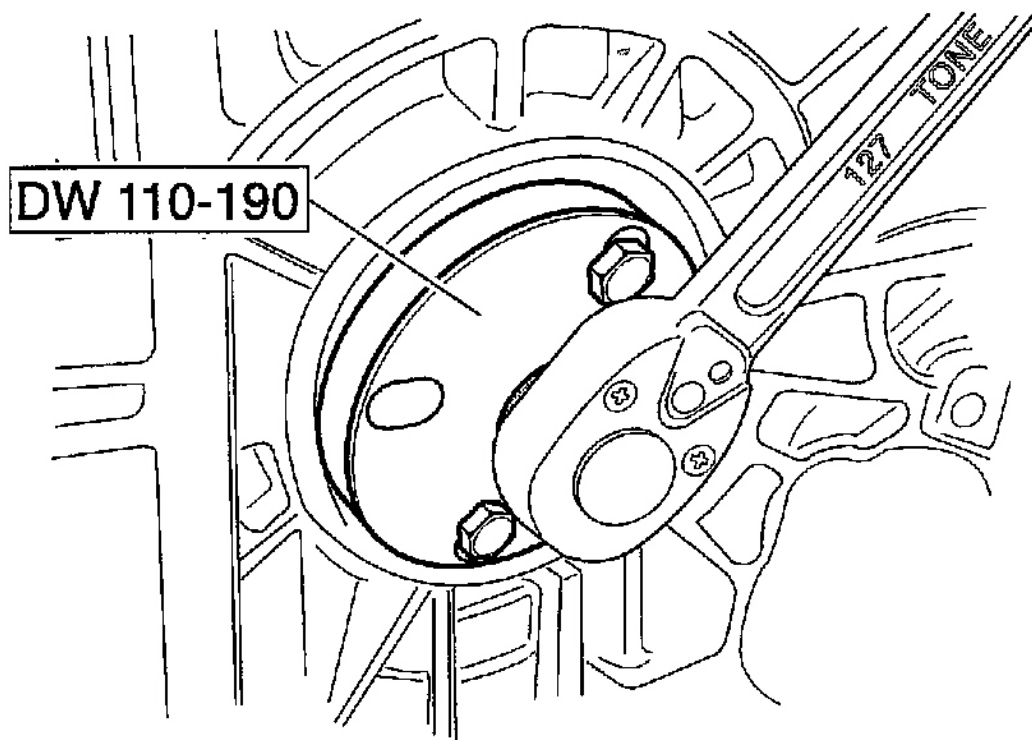
1. Installation should follow the removal procedure in the reverse order.
2. Install the timing chain after aligning both the mark on the camshaft sprocket and on the timing chain using camshaft sprocket holder DW110-150.



G01985678

Fig. 120: Installing Timing Chain After Aligning Both Mark On Camshaft Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

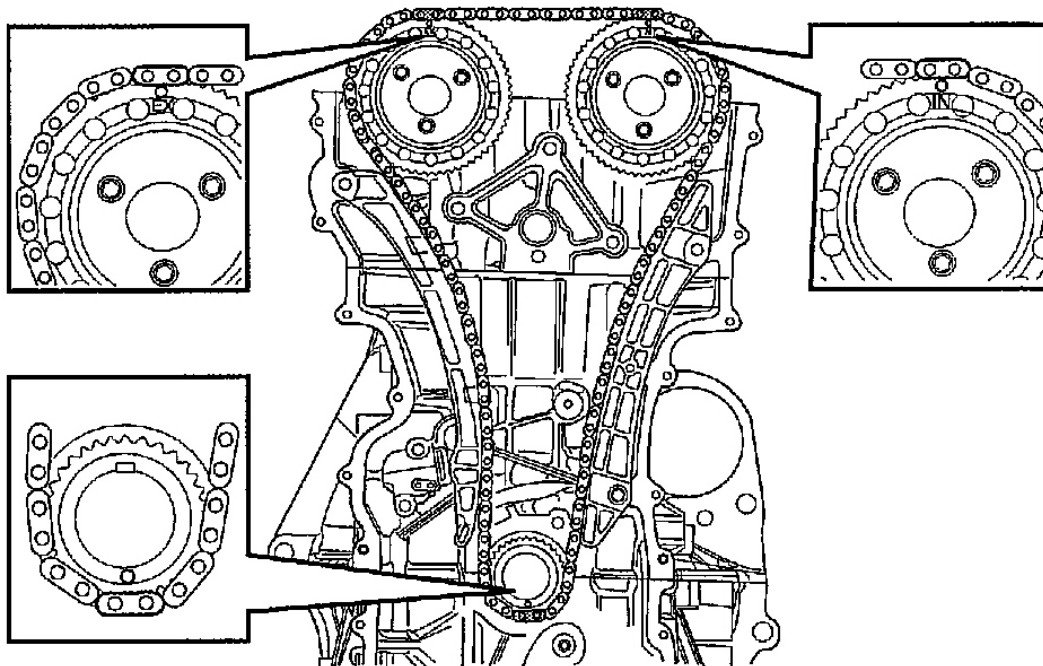
3. Align both the timing mark on the crankshaft sprocket and on the timing chain.
4. Adjust the crankshaft using the crankshaft adjuster DW110-190.



G01985679

Fig. 121: Adjusting Crankshaft Using Crankshaft Adjuster
Courtesy of SUZUKI OF AMERICA CORP.

5. Make sure the three timing marks on the timing chain are exactly aligned with the marks on the exhaust camshaft sprocket, intake camshaft sprocket, and crankshaft sprocket respectively.



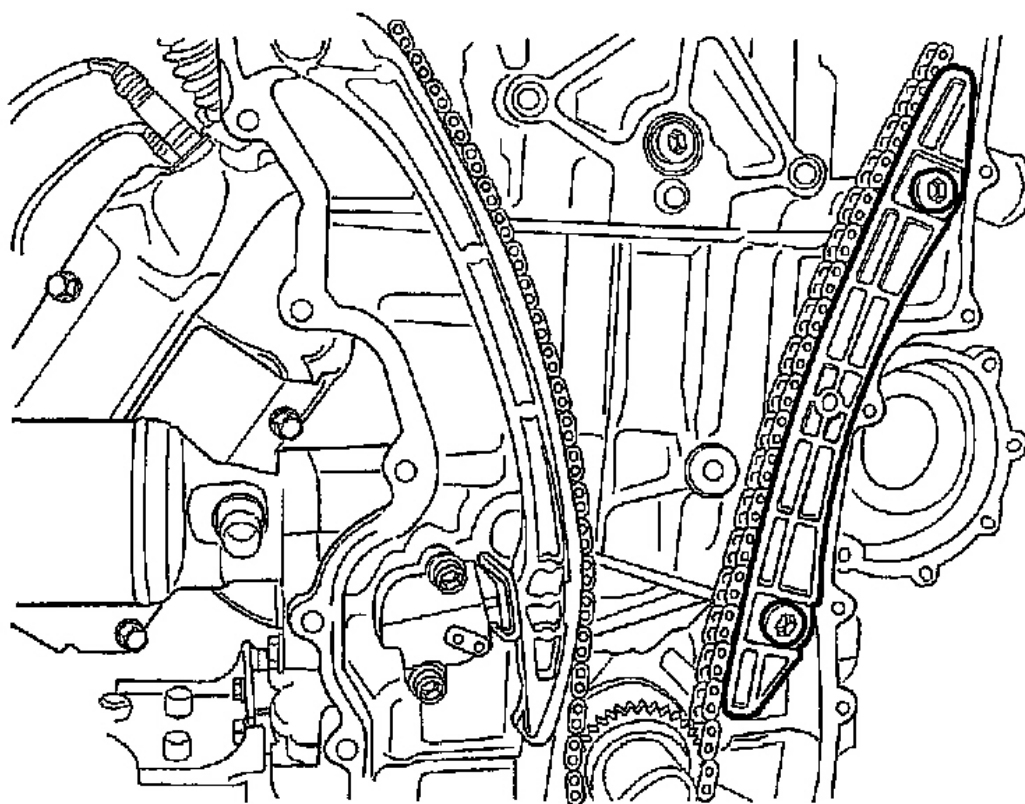
G01985680

Fig. 122: Aligning Timing Marks On Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the fixed timing chain guide.

Tighten

Tighten the fixed timing chain guide bolts to 18-22 N.m (13-16 lb-ft).



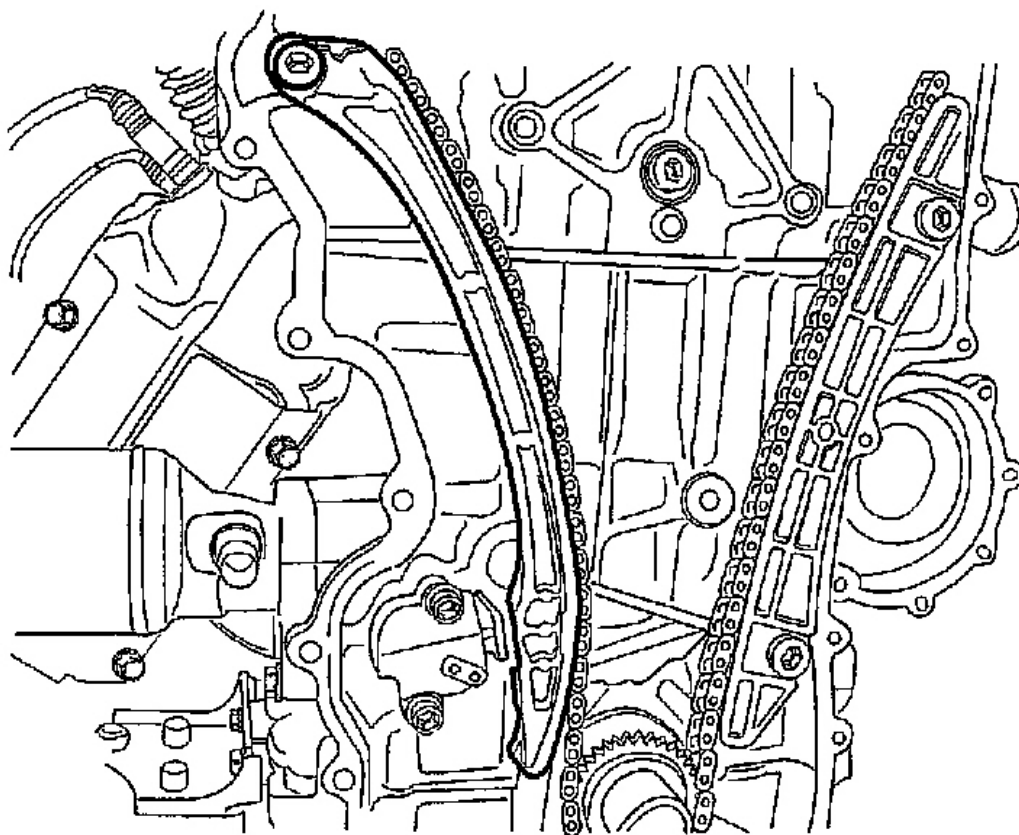
G01985681

Fig. 123: Installing Fixed Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the timing chain lever.

Tighten

Tighten the timing chain lever bolt to 18-22 N.m (13-16 lb-ft).



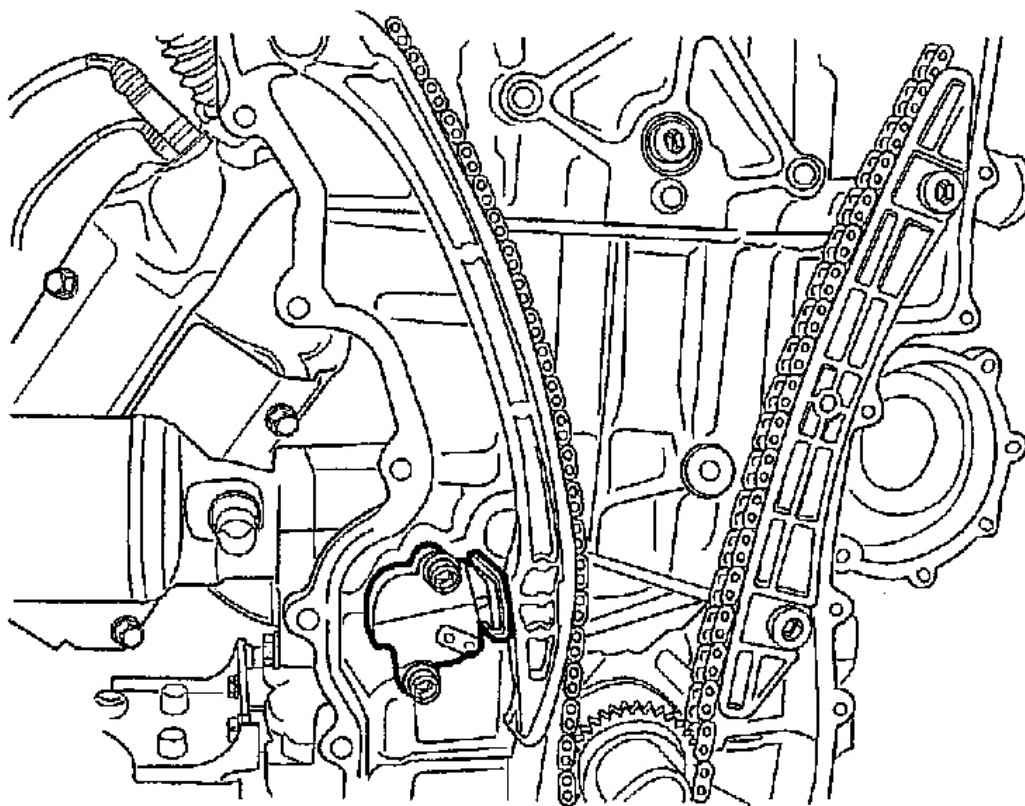
G01985682

Fig. 124: Installing Timing Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the timing chain tensioner.

Tighten

Tighten the timing chain tensioner bolt to 18-22 N.m (13-16 lb-ft).



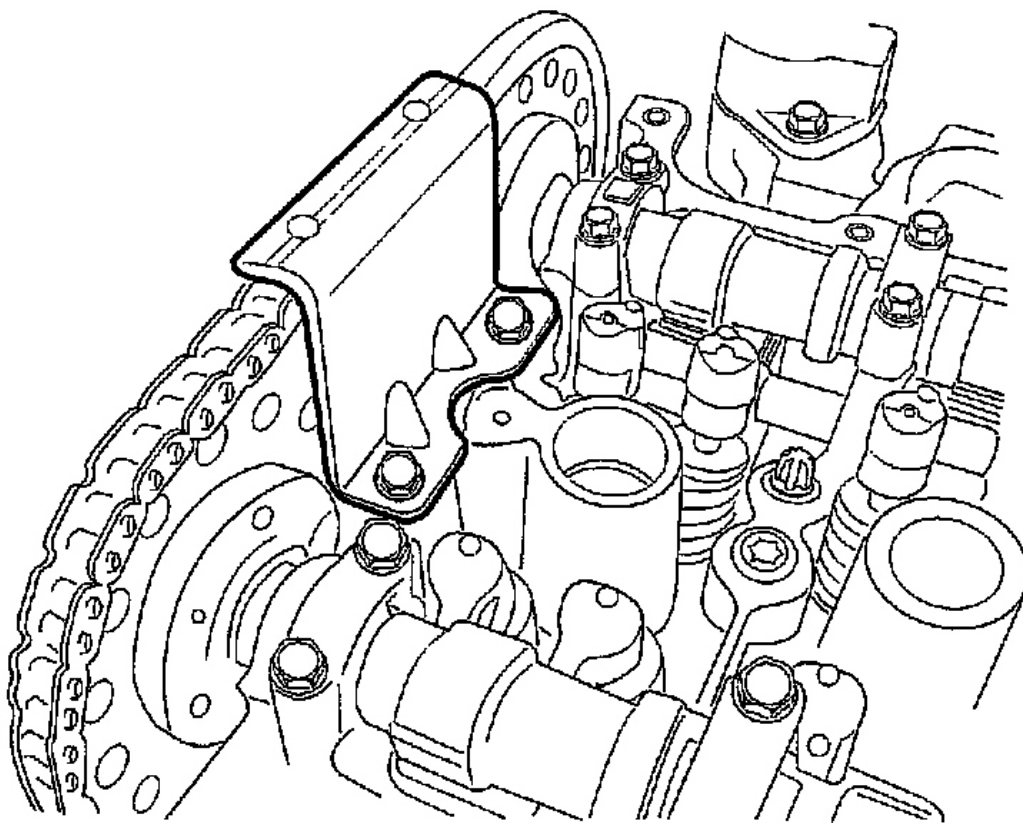
G01985683

Fig. 125: Installing Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

9. Install the top chain guide.

Tighten

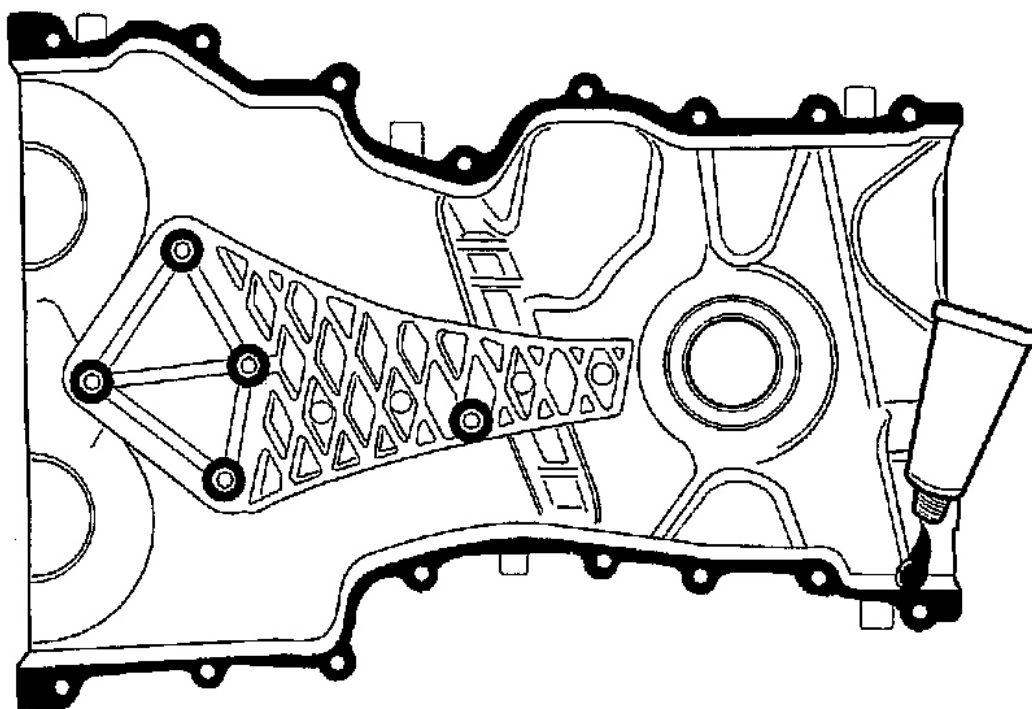
Tighten the top chain guide bolt to 9-11 N.m (80-97 lb-in).



G01985684

Fig. 126: Installing Top Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

10. Install two dowel rings.
11. Apply the liquid gasket (Loctite® 5900-M8585) on the timing chain cover.

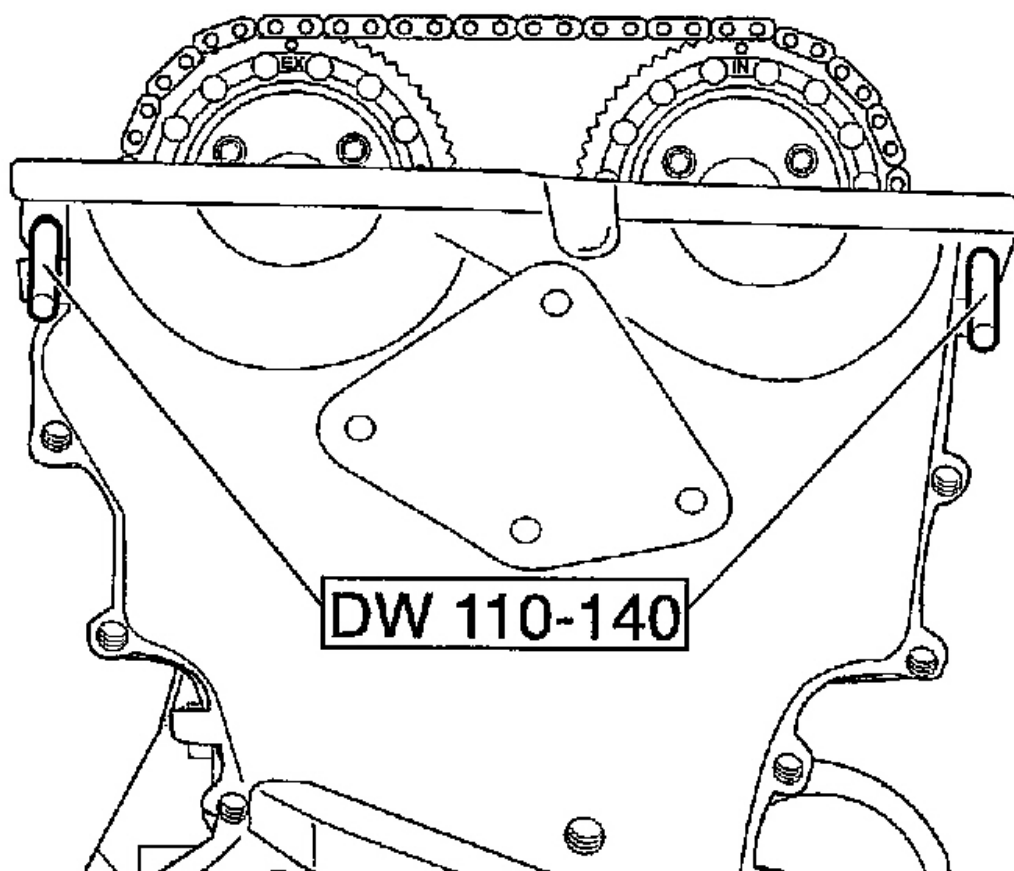


G01985685

Fig. 127: Applying Liquid Gasket On Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

12. Install the timing chain cover install guide pin DW110-140 and position the timing chain cover.

CAUTION: Be sure the applied liquid gasket is not damaged when installing the timing chain cover.



G01985686

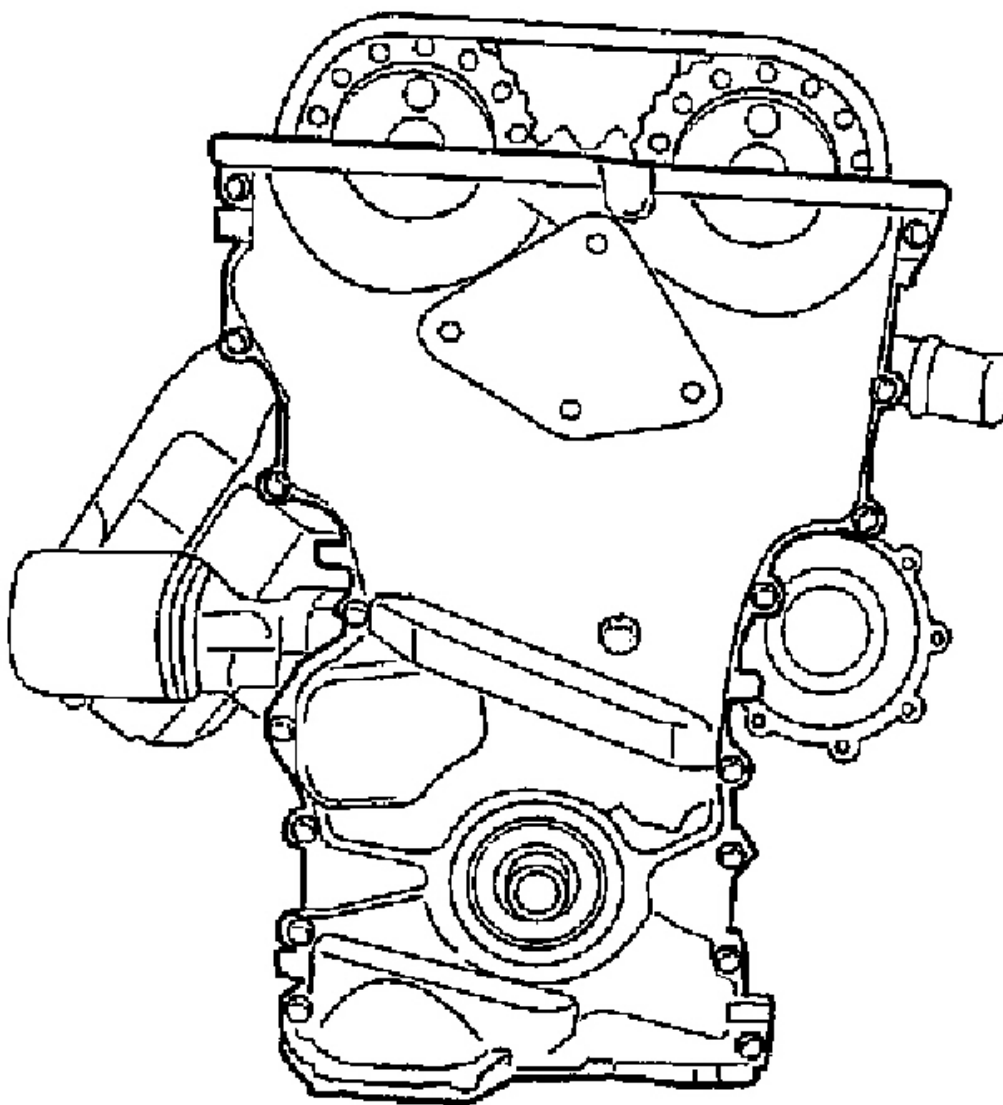
Fig. 128: Installing Timing Chain Cover Install Guide Pin
Courtesy of SUZUKI OF AMERICA CORP.

13. Install the timing chain cover.

Tighten

Tighten the timing chain cover bolt (Center) to 18-22 N.m (13-16 lb-ft).

Tighten the timing chain cover bolts to 6-10 N.m (53-89 lb-in)).



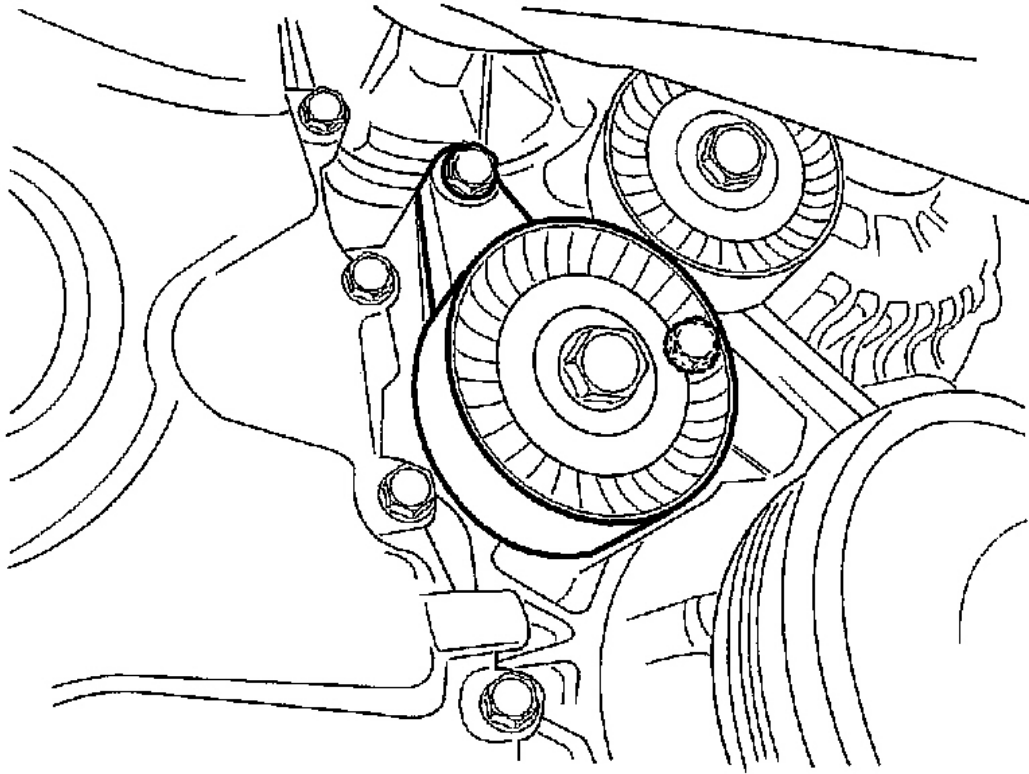
G01985687

Fig. 129: Installing Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the drive belt automatic tensioner.

Tighten

Tighten the drive belt automatic tensioner retaining bolt to 20-30 N.m (15-22 lb-ft).



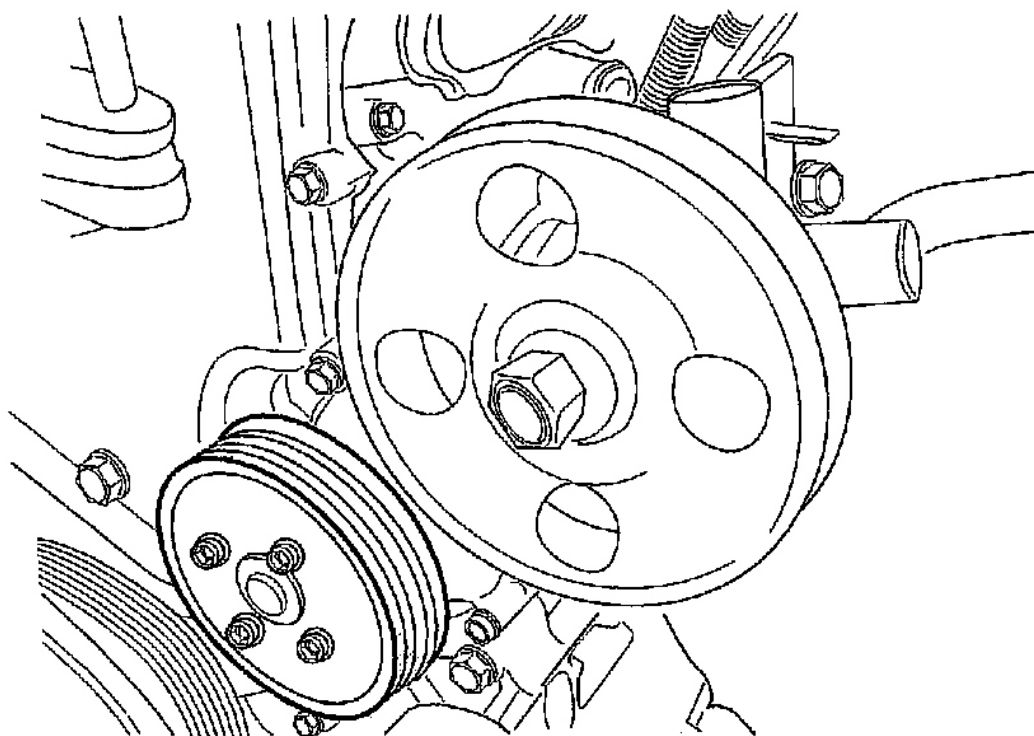
G01985688

Fig. 130: Installing Drive Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

15. Install the water pump pulley.

Tighten

Tighten the water pump pulley bolts to 8-12 N.m (71-106 lb-in).



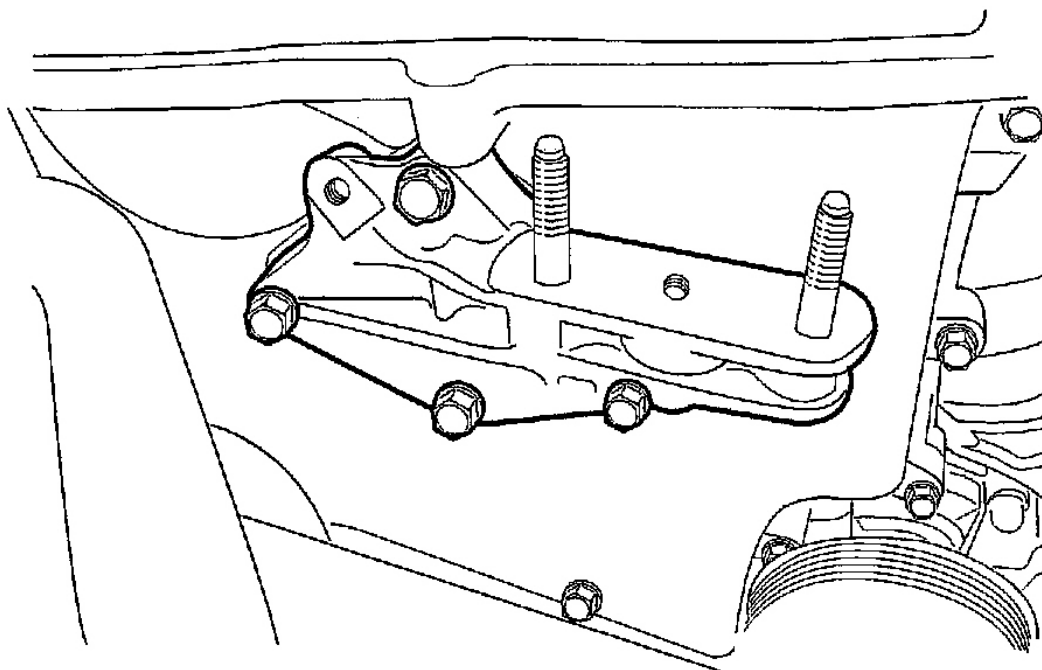
G01985689

Fig. 131: Installing Water Pump Pulley
Courtesy of SUZUKI OF AMERICA CORP.

16. Install the engine mount bracket support.

Tighten

Tighten the engine mount bracket support bolts to 25-31 N.m (18-23 lb-ft).



G01985690

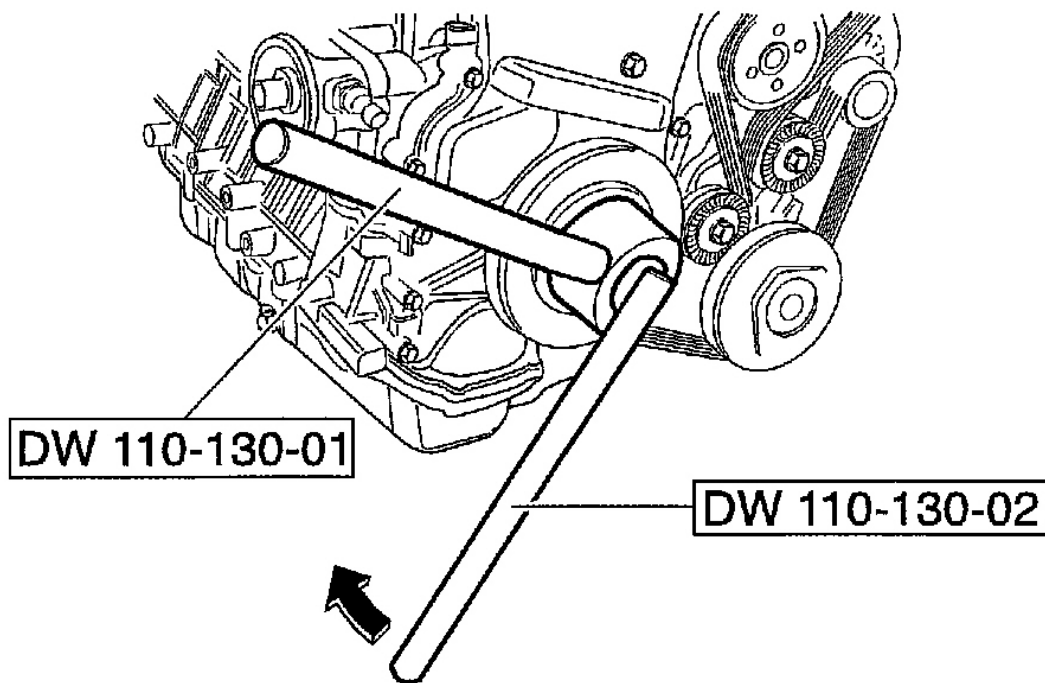
Fig. 132: Installing Engine Mount Bracket Support
Courtesy of SUZUKI OF AMERICA CORP.

17. Install the crankshaft pulley. Tighten the crankshaft pulley bolt using the crankshaft pulley holder DW110-130-01 and the crankshaft pulley installer/remover DW110-130-02.

CAUTION: Very high torque is required to remove or to install the crankshaft pulley. Never remove the crankshaft pulley when the vehicle is hung on the lift.

Tighten

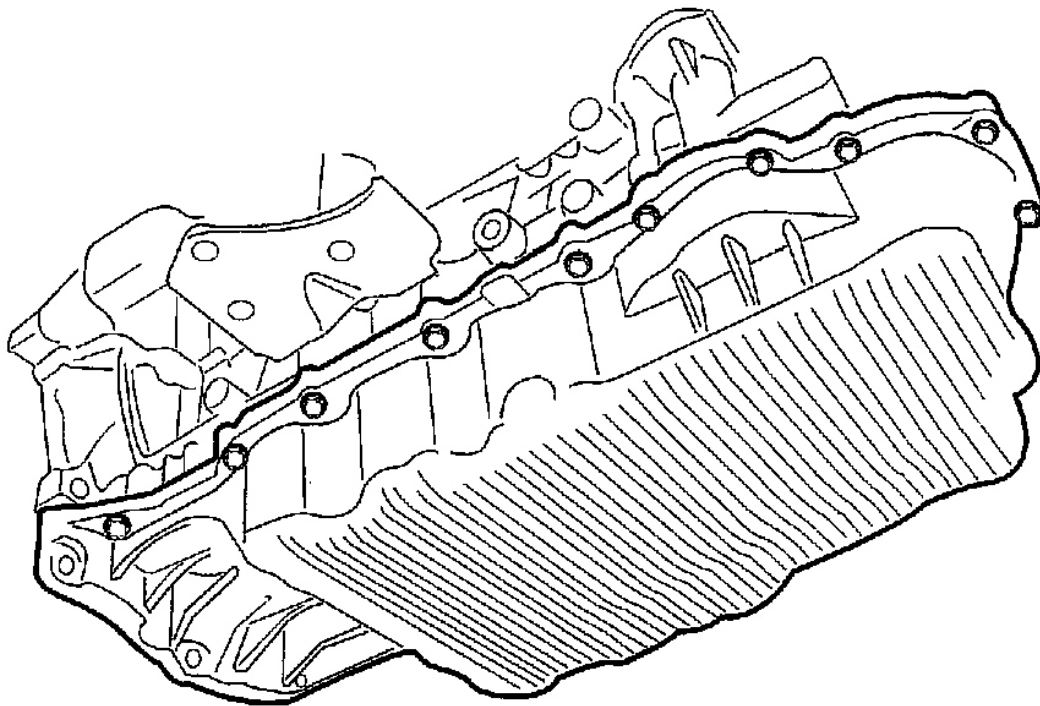
Tighten the crankshaft pulley bolt to 500-600 N.m (369-443 lb-ft).



G01985691

Fig. 133: Installing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

18. Install the oil pan. Refer to Oil Pan / Oil Pump Installation .

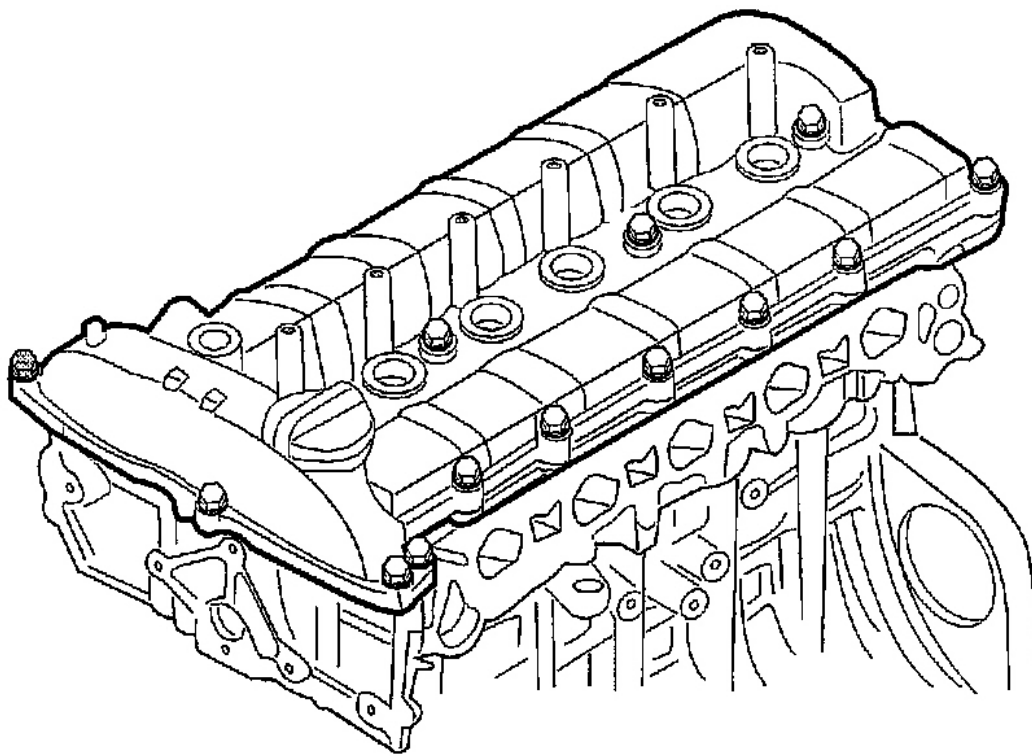


G01985692

Fig. 134: Installing Oil Pan

Courtesy of SUZUKI OF AMERICA CORP.

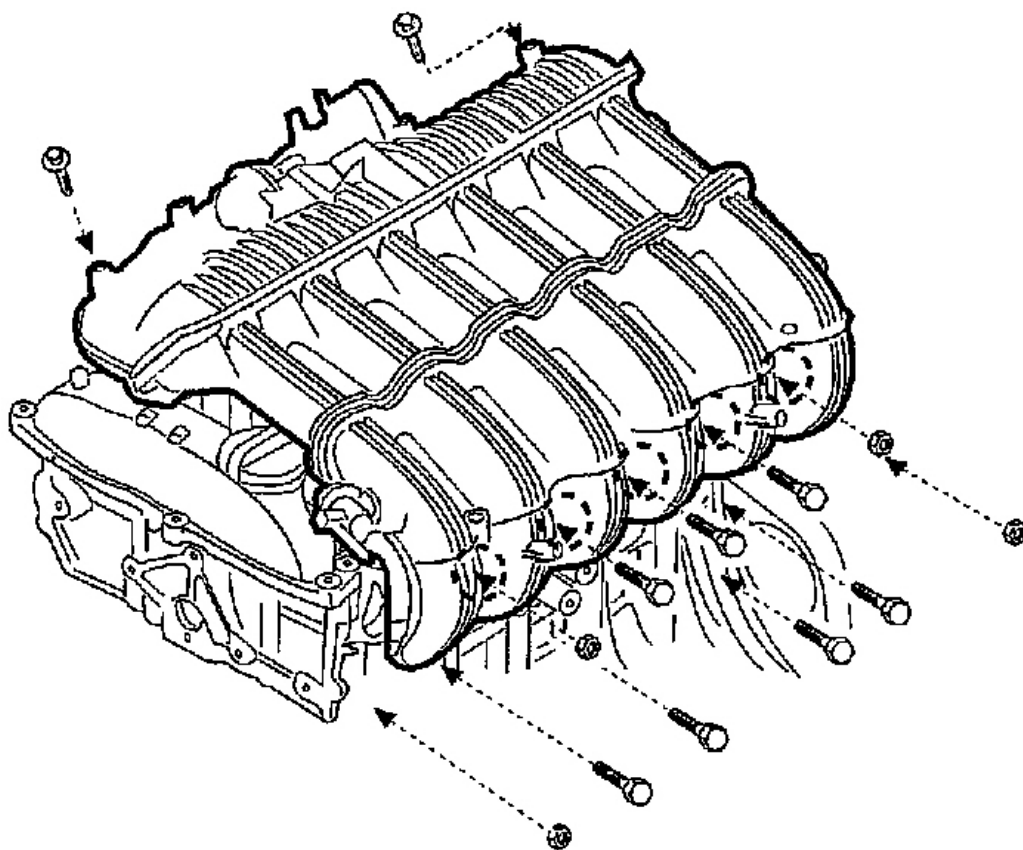
19. Install the cylinder head cover. Refer to Cylinder Head Cover Installation .



G01985693

Fig. 135: Installing Cylinder Head Cover
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the intake manifold. Refer to **Intake Manifold Installation** .



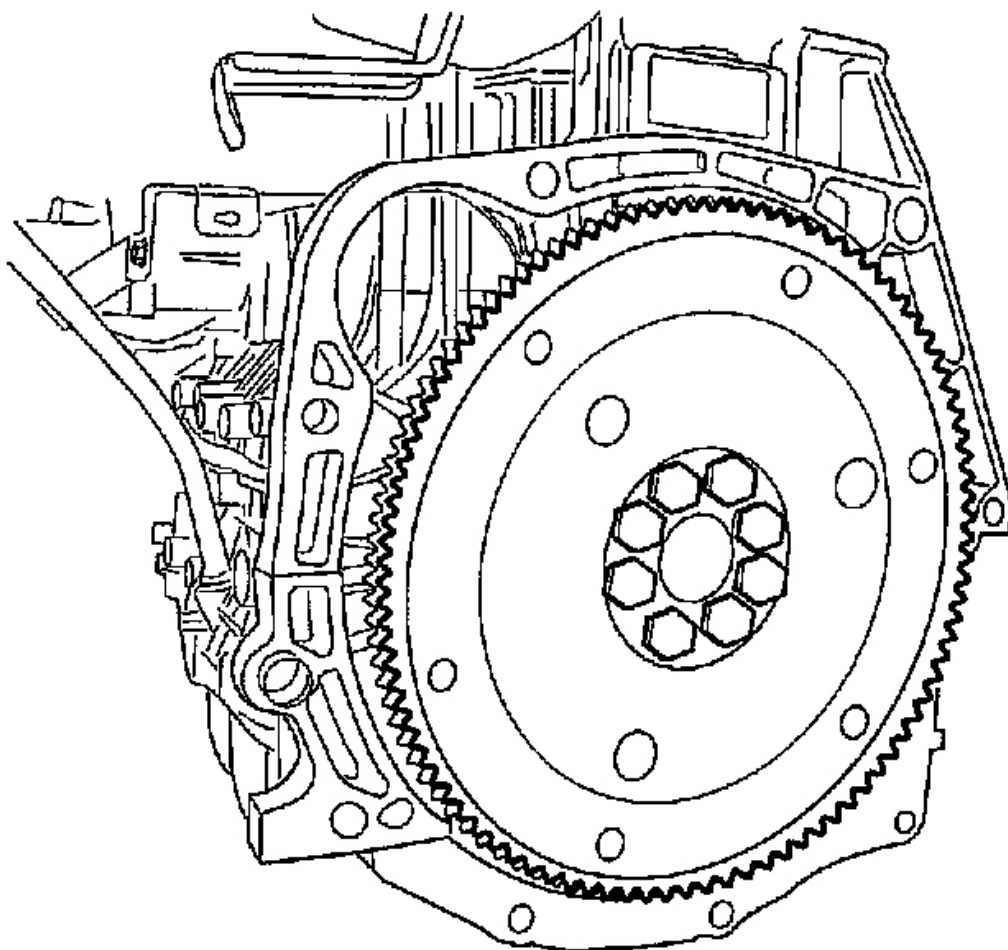
G01985694

Fig. 136: Installing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

21. Install the flexible plate.

Tighten

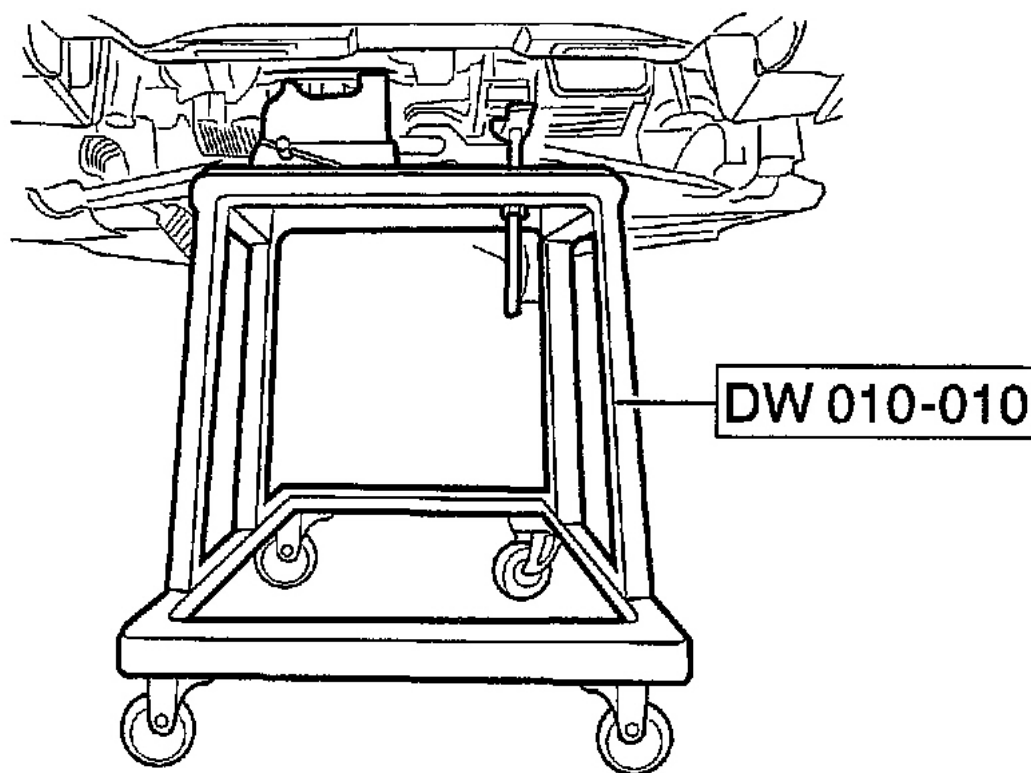
Tighten the flexible plate bolts to 70-80 N.m (52-59 lb-ft).



G01985695

Fig. 137: Installing Flexible Plate
Courtesy of SUZUKI OF AMERICA CORP.

22. Install the transaxle to the engine assembly.
23. Install the engine and transaxle assembly. Refer to **Engine Assembly Installation** .

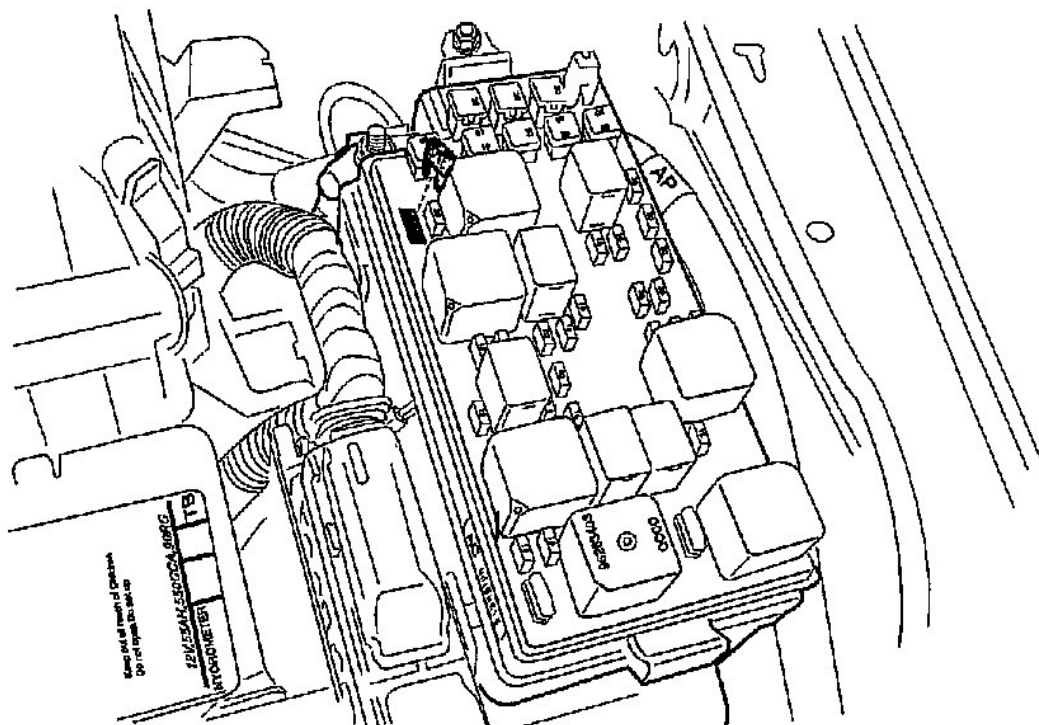


G01985696

Fig. 138: Installing Engine & Transaxle Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head Removal

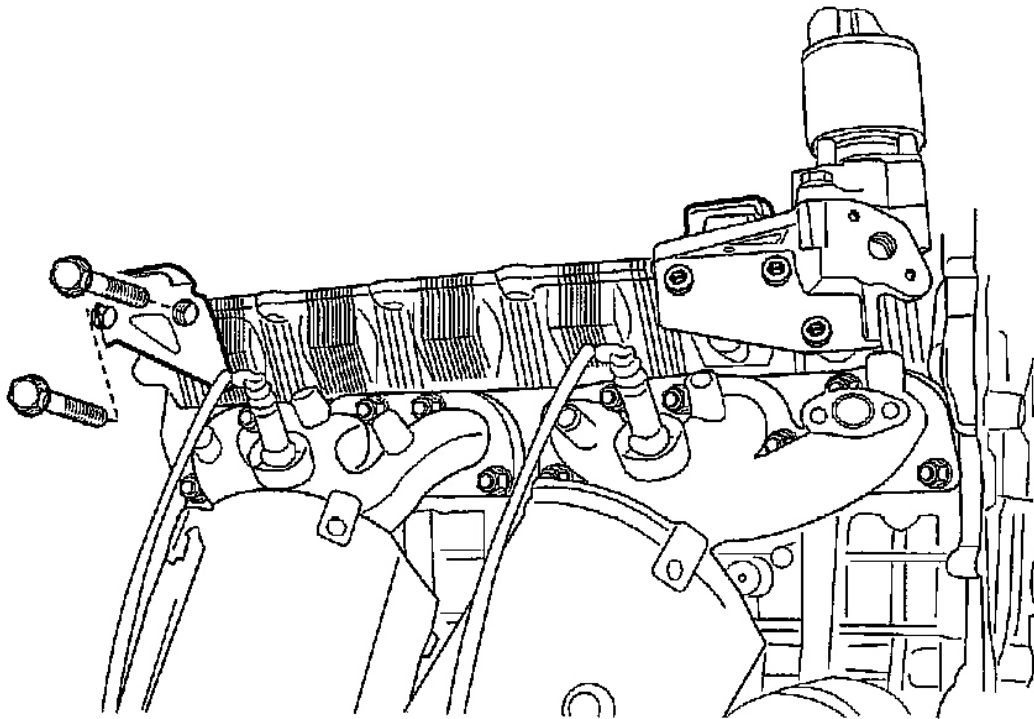
1. Remove the fuel pump fuse.
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
5. Drain the engine oil.
6. Drain the transaxle oil.



G01985697

Fig. 139: Draining Transaxle Oil
Courtesy of SUZUKI OF AMERICA CORP.

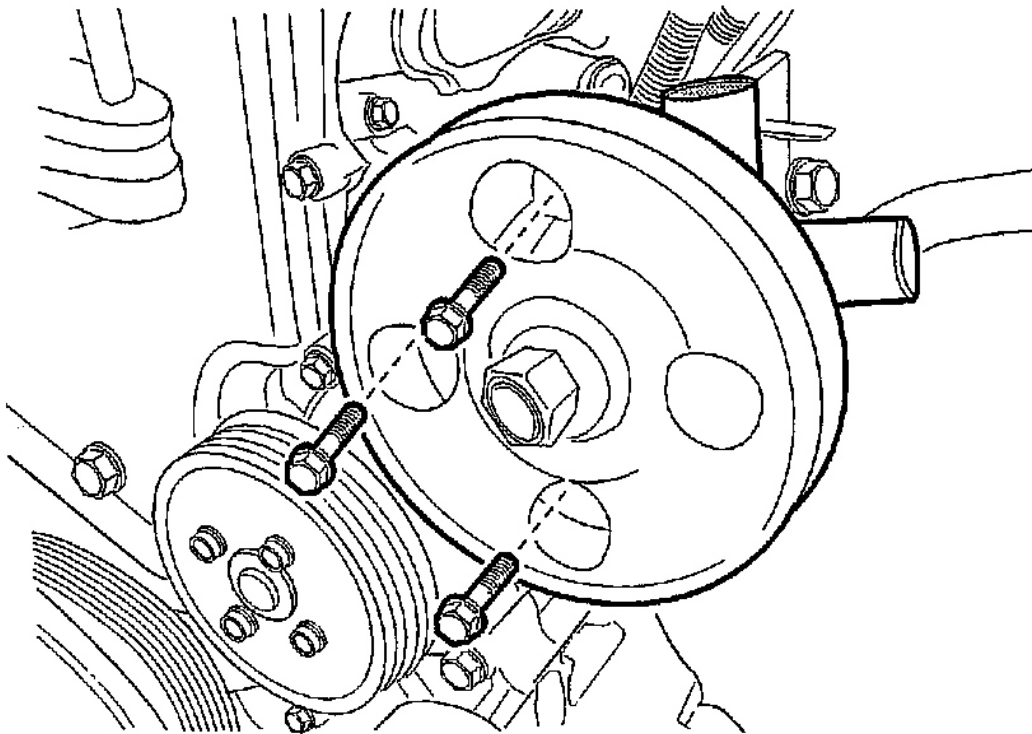
7. Drain the power steering oil.
8. Recover the refrigerant.
9. Remove the engine assembly. Refer to **Engine Assembly Removal** .
10. Remove the timing chain. Refer to **Timing Chain Removal** .
11. Remove the intake manifold support bracket.



G01985698

Fig. 140: Removing Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

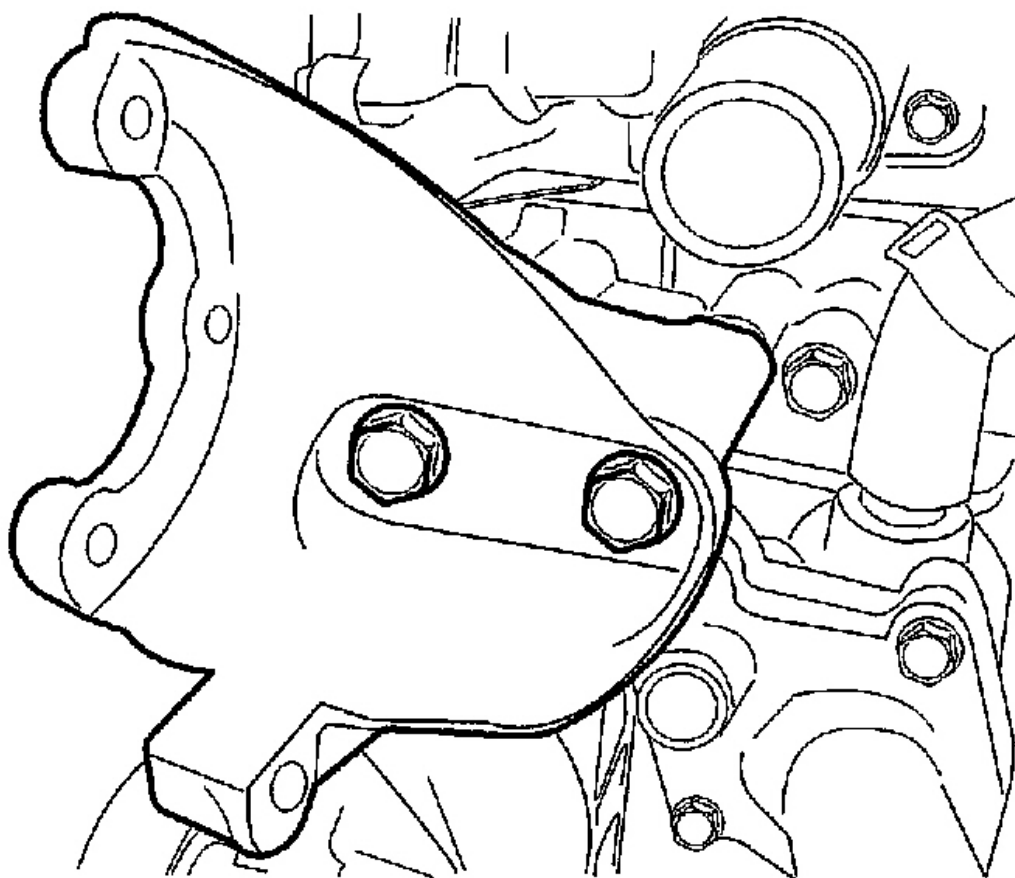
12. Remove the power steering pump.



G01985699

Fig. 141: Removing Power Steering Pump
Courtesy of SUZUKI OF AMERICA CORP.

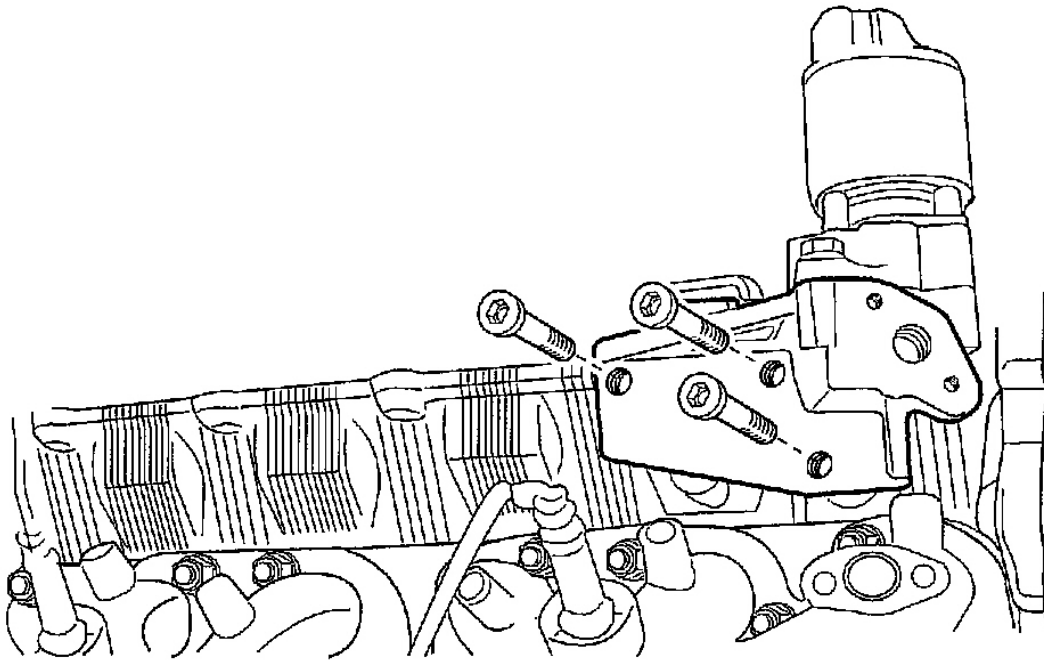
13. Remove the alternator. Refer to **GENERATOR**.
14. Remove the with A/C compressor if the A/C is equipped.



G01985700

Fig. 142: Removing With A/C Compressor (If Equipped)
Courtesy of SUZUKI OF AMERICA CORP.

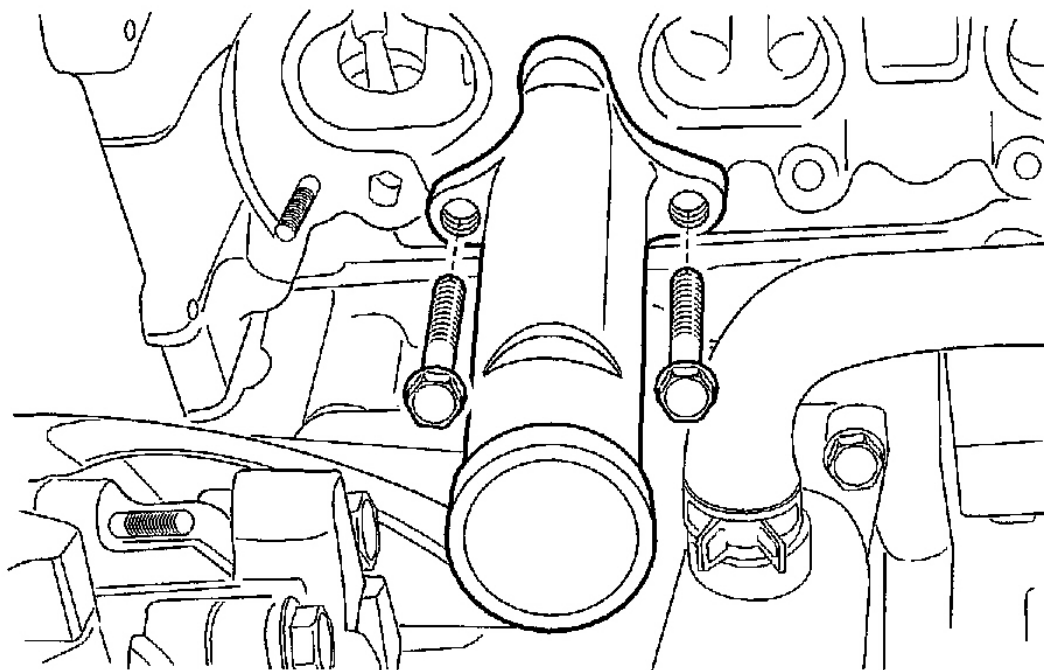
15. Remove the EGR valve. Refer to **EXHAUST GAS RECIRCULATION (EGR) VALVE REMOVAL** .
16. Remove the EGR pipes. Refer to **INTAKE EGR PIPE REMOVAL** and **EXHAUST EGR PIPE REMOVAL** .
17. Remove the EGR adapter.



G01985701

Fig. 143: Removing EGR Adapter
Courtesy of SUZUKI OF AMERICA CORP.

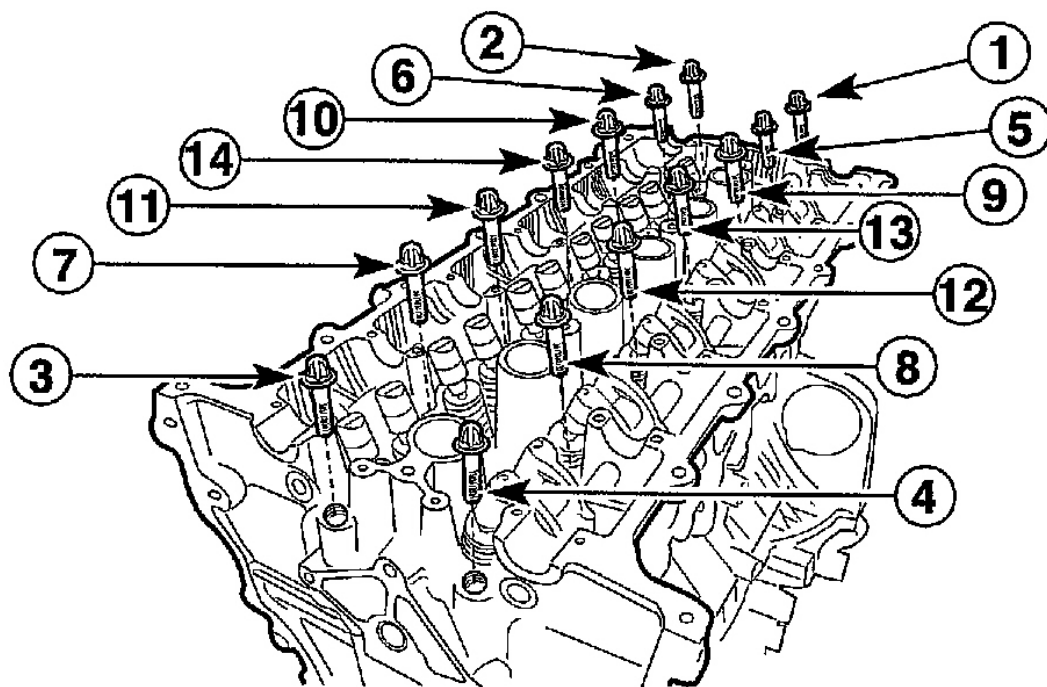
18. Remove the heater pipe.
19. Remove the exhaust manifold. Refer to **EXHAUST MANIFOLD REMOVAL** .
20. Remove the exhaust manifold gasket.
21. Remove the CMP (Camshaft Position) sensor. Refer to **CAMSHAFT POSITION (CMP) SENSOR REMOVAL** .
22. Remove the ECTS (Engine Coolant Temperature Sensor). Refer to **ENGINE COOLANT TEMPERATURE SENSOR REMOVAL** .
23. Remove the coolant outlet port.



G01985702

Fig. 144: Removing Coolant Outlet Port
Courtesy of SUZUKI OF AMERICA CORP.

24. Remove the cylinder head bolts in the sequence shown and the cylinder head.
25. Remove the cylinder head gasket.
26. Remove the liquid gasket.

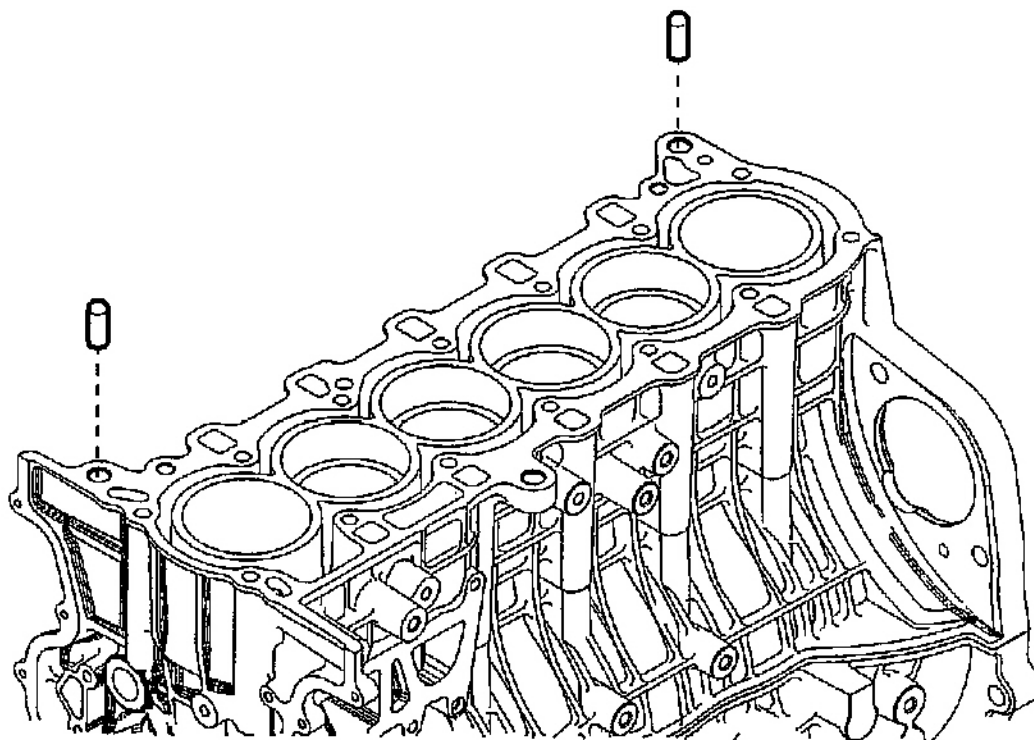


G01985703

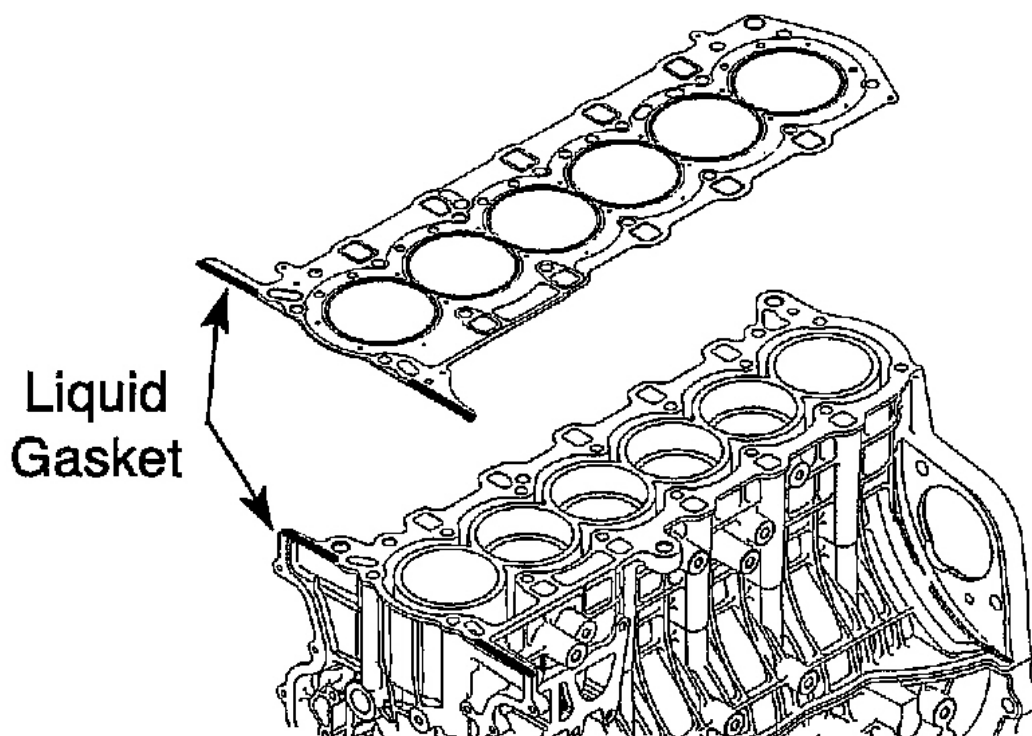
Fig. 145: Removing Liquid Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head Installation

1. Installation should follow the removal procedure in the reverse order.
2. Clean the contact surfaces between the cylinder head and the cylinder block.
3. Install the dowel pin.

**G01985704****Fig. 146: Installing Dowel Pin****Courtesy of SUZUKI OF AMERICA CORP.**

4. Apply the liquid gasket (Loctite® 5900-M8585) on the surface of the cylinder block as described in the illustration.
5. Install the cylinder head gasket.
6. Apply the liquid gasket (Loctite® 5900-M8585) on the upper surface of the cylinder head gasket as described in the illustration



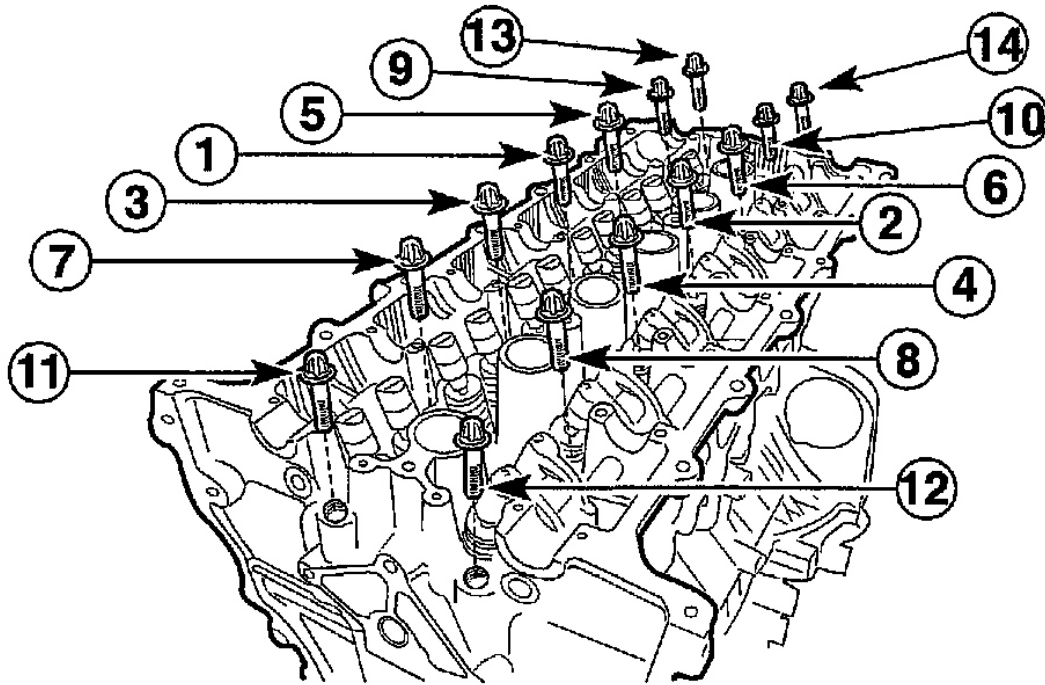
G01985705

Fig. 147: Applying Liquid Gasket On Upper Surface Of Cylinder Head Gasket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the cylinder head. Tighten the cylinder head bolts from center to outer as is described in the illustration.

Tighten

Tighten the cylinder head bolts to 20 N.m (15 lb-ft). After finishing the initial tightening, tighten all the cylinder head bolts to 25 N.m (18 lb-ft) and turn the bolts another two (2) turns of 70°.



G01985706

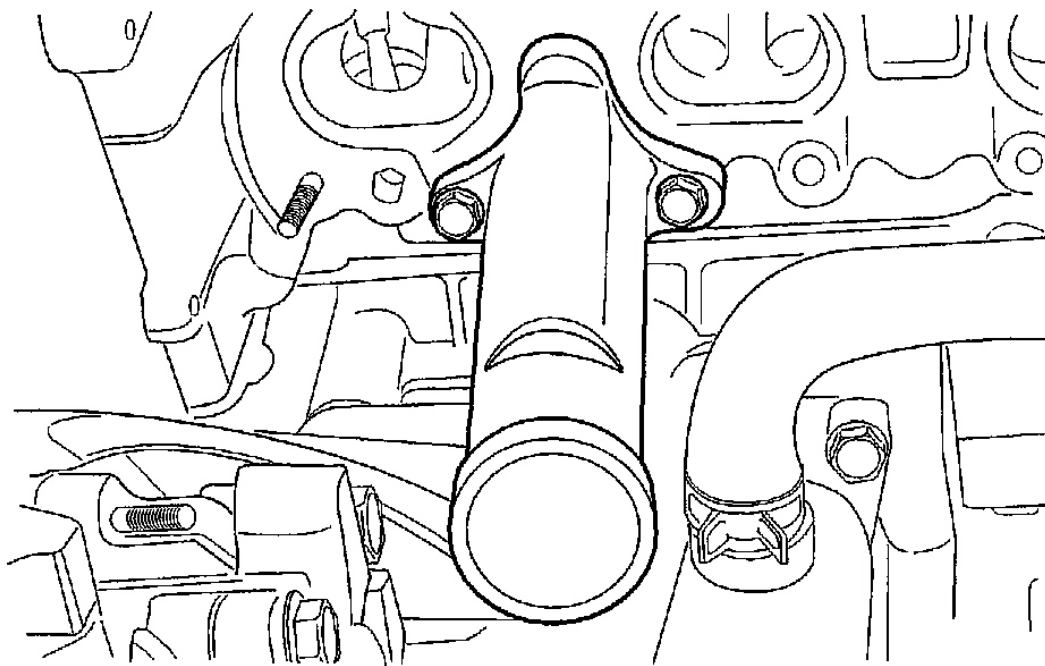
Fig. 148: Installing Cylinder Head
 Courtesy of SUZUKI OF AMERICA CORP.

8. Install the coolant outlet port.

Tighten

Tighten the coolant outlet port retaining bolts to 8-12 N.m (71-106 lb-in).

9. Install the ECTS (Engine Coolant Temperature Sensor). Refer to **ENGINE COOLANT TEMPERATURE SENSOR INSTALLATION**.
10. Install the CMP (Camshaft Position) sensor. Refer to **CAMSHAFT POSITION (CMP) SENSOR INSTALLATION**.
11. Discard used exhaust manifold gasket and replace with a new one.
12. Install the exhaust manifold. Refer to **EXHAUST MANIFOLD INSTALLATION**.
13. Install the heater pipe.



G01985707

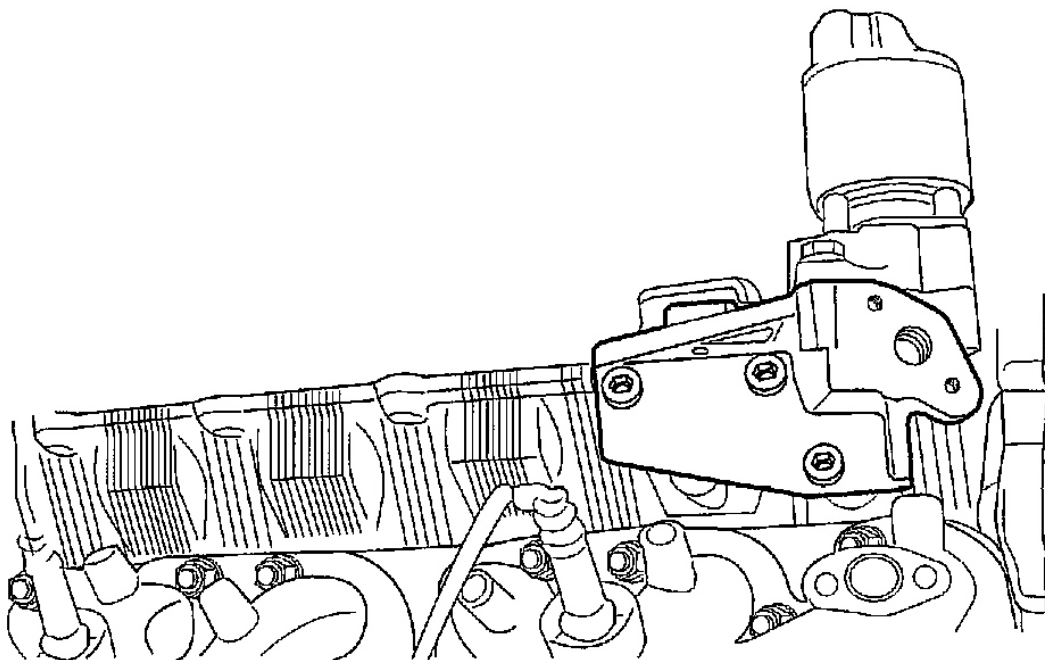
Fig. 149: Installing Heater Pipe
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the EGR adapter.

Tighten

Tighten the EGR adapter retaining bolts to 18-22 N.m (13-16 lb-ft).

15. Install the EGR pipes. Refer to **INTAKE EGR PIPE INSTALLATION** and **EXHAUST EGR PIPE INSTALLATION**.
16. Install the EGR valve. Refer to **EXHAUST GAS RECIRCULATION (EGR) VALVE INSTALLATION**.



G01985708

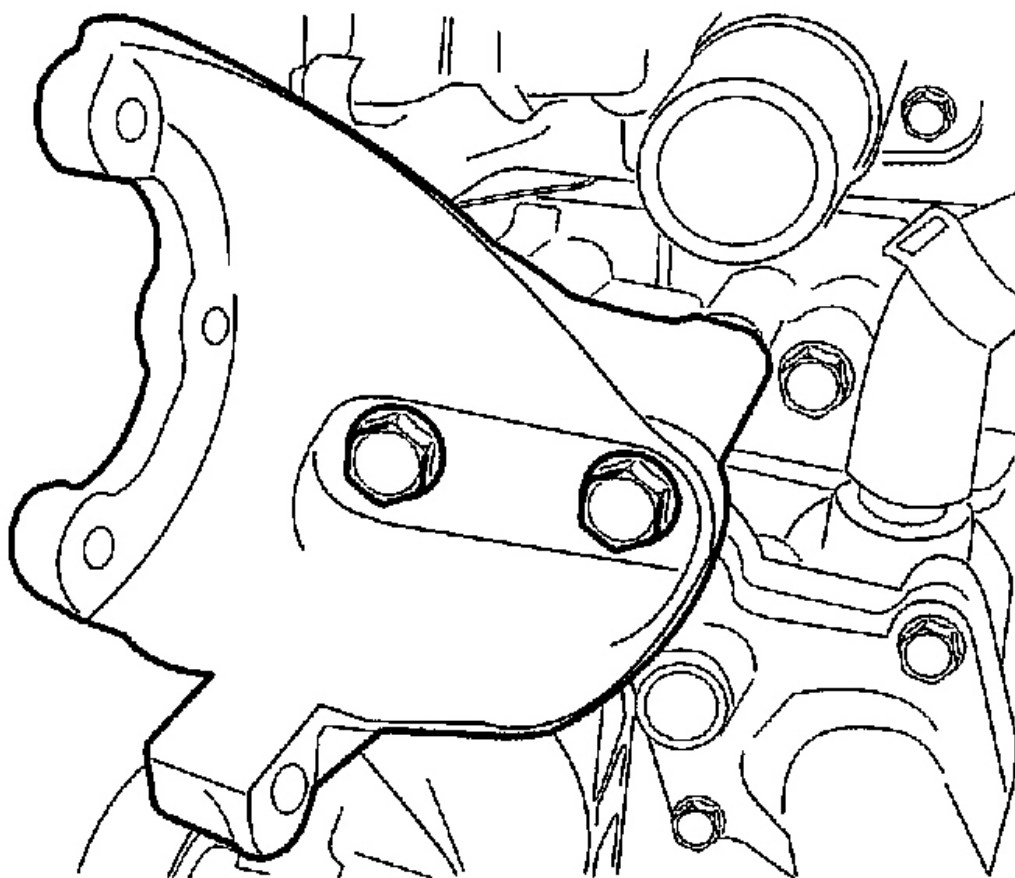
Fig. 150: Installing EGR Valve
Courtesy of SUZUKI OF AMERICA CORP.

17. Install the upper pad bracket.

Tighten

Tighten the upper pad bracket bolts to 35-55 N.m (26-41 lb-ft).

18. Install the alternator. Refer to **GENERATOR**.



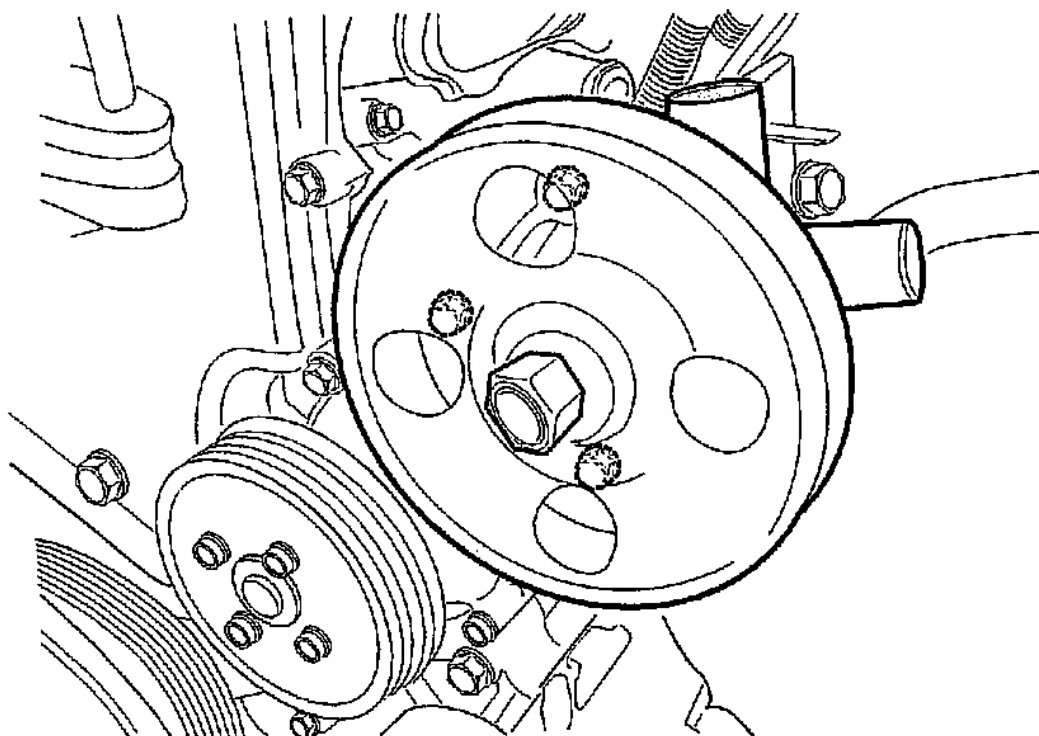
G01985709

Fig. 151: Installing Alternator
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the power steering pump.

Tighten

Tighten the power steering pump retaining bolts to 20-30 N.m (15-22 lb-ft).



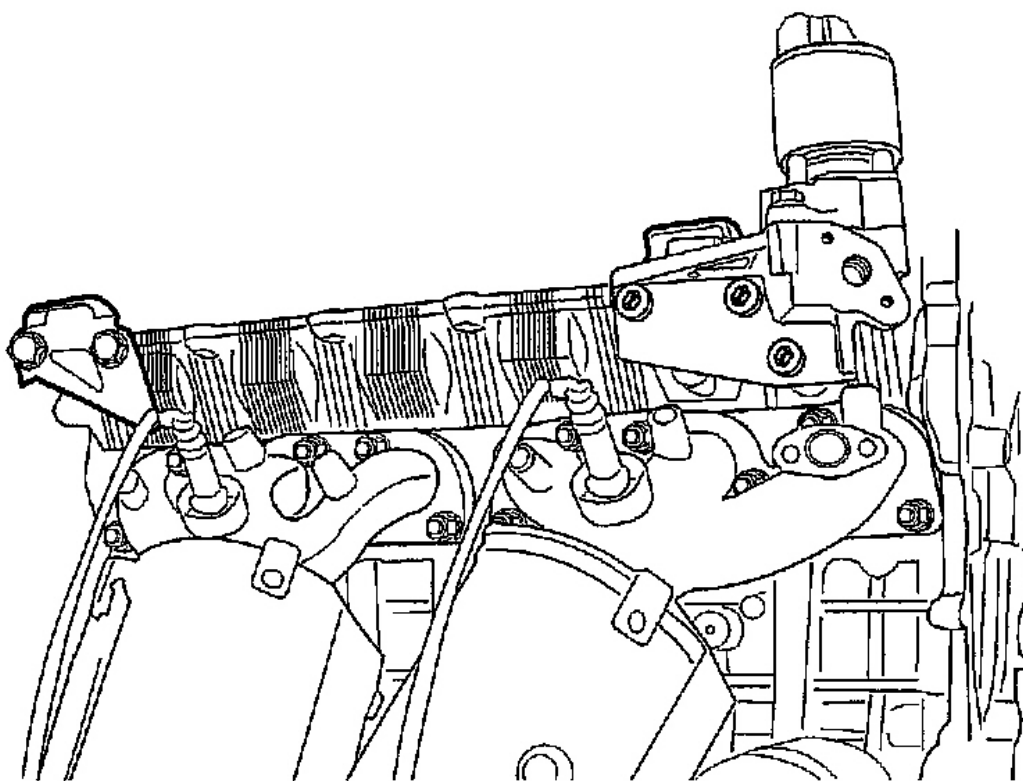
G01985710

Fig. 152: Installing Power Steering Pump
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the intake manifold support bracket.

Tighten

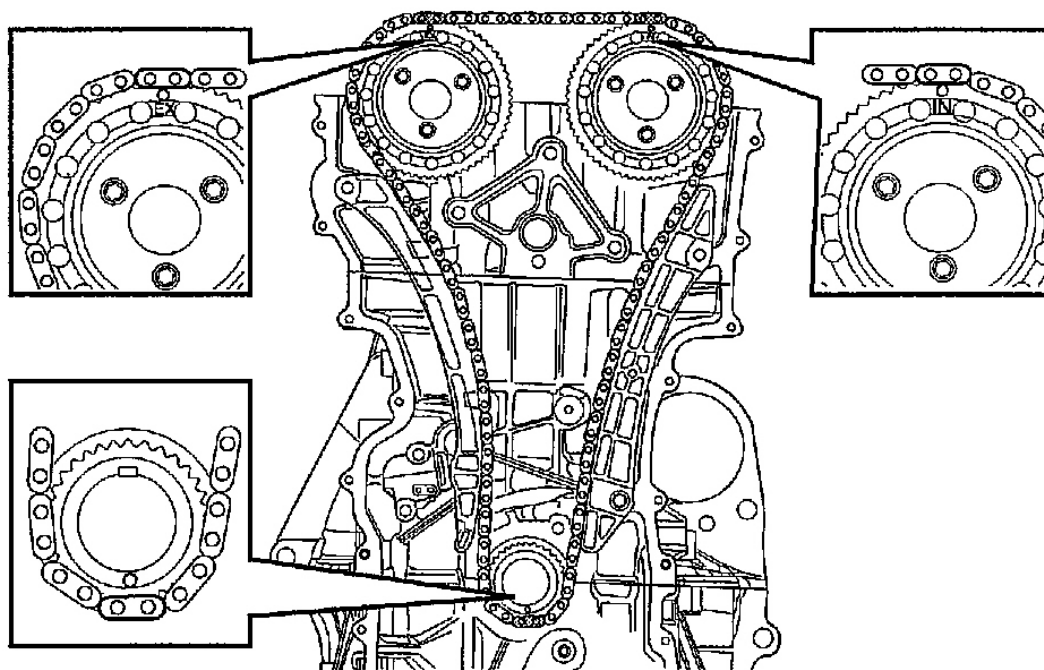
Tighten the intake manifold support bracket bolt to 20-30 N.m (15-22 lb-ft).



G01985711

Fig. 153: Installing Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

21. Install the timing chain and the timing chain cover. Refer to **Timing Chain Installation** .
22. Install the cylinder head cover. Refer to **Cylinder Head Cover Installation** .
23. Install the oil pan. Refer to **Oil Pan / Oil Pump Installation** .
24. Install the engine assembly. Refer to **Engine Assembly Installation** .

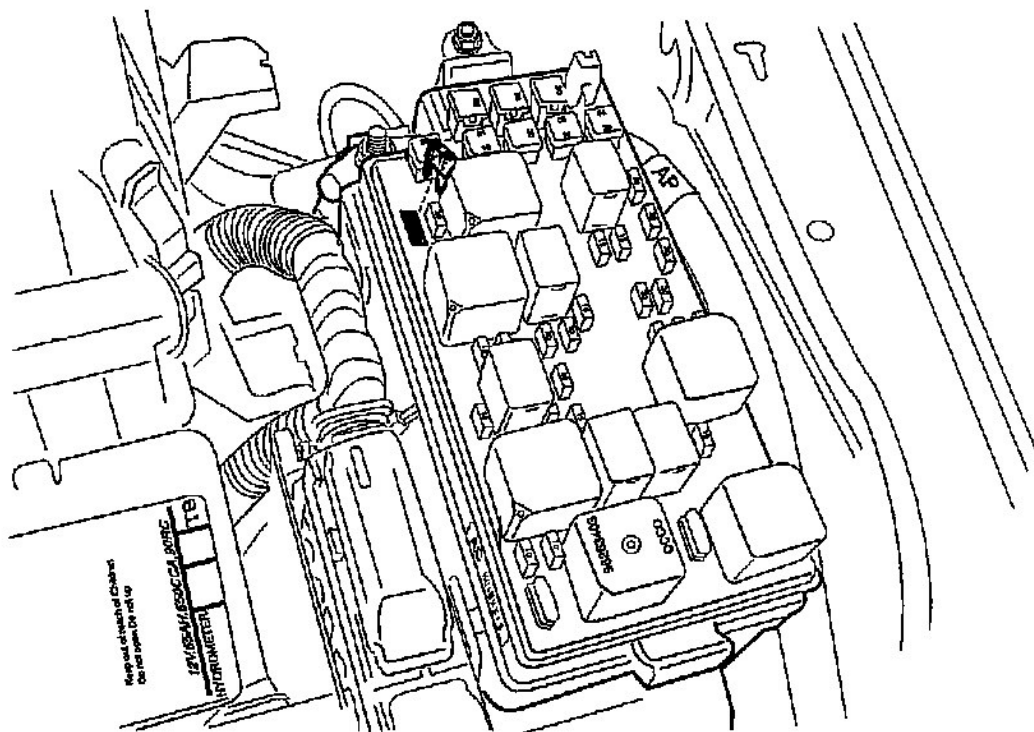


G01985712

Fig. 154: Installing Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Bed Plate Removal

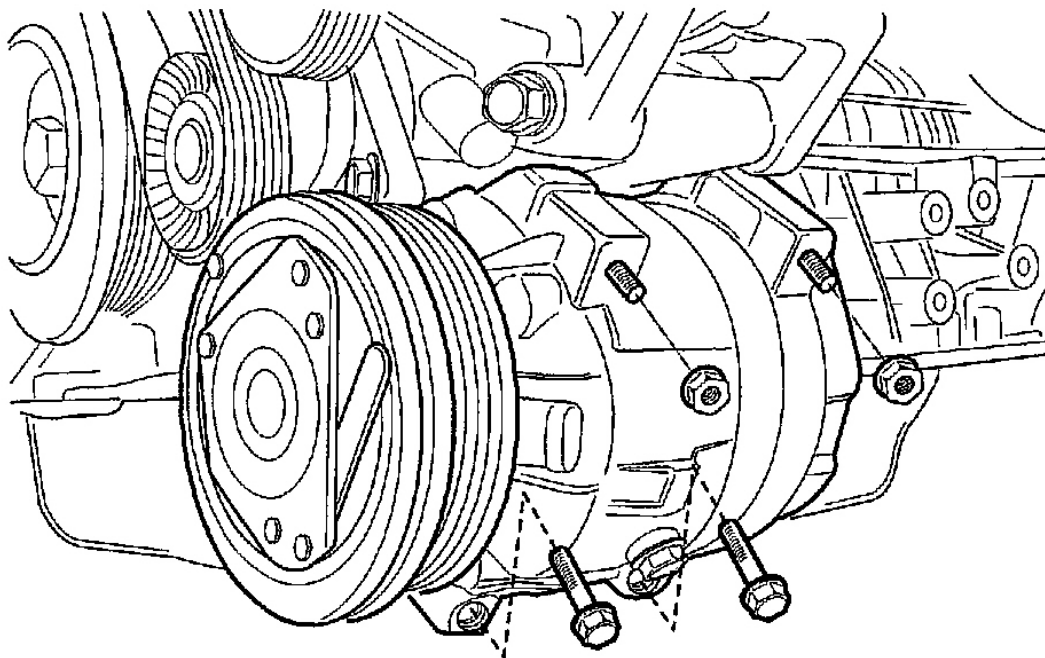
1. Remove the fuel pump fuse.
2. Start the engine and repeat cranking until the remaining fuel in the fuel line is all consumed.
3. Disconnect the negative battery cable.
4. Drain the engine coolant. Refer to **DRAINING AND REFILLING THE COOLING SYSTEM** .
5. Drain the engine oil.
6. Drain the transaxle oil.



G01985713

Fig. 155: Draining Transaxle Oil
Courtesy of SUZUKI OF AMERICA CORP.

7. Drain the power steering oil.
8. Recover the refrigerant.
9. Remove the engine assembly. Refer to **Engine Assembly Removal**.
10. Remove the timing chain cover. Refer to **Timing Chain Removal**.
11. Remove the compressor.

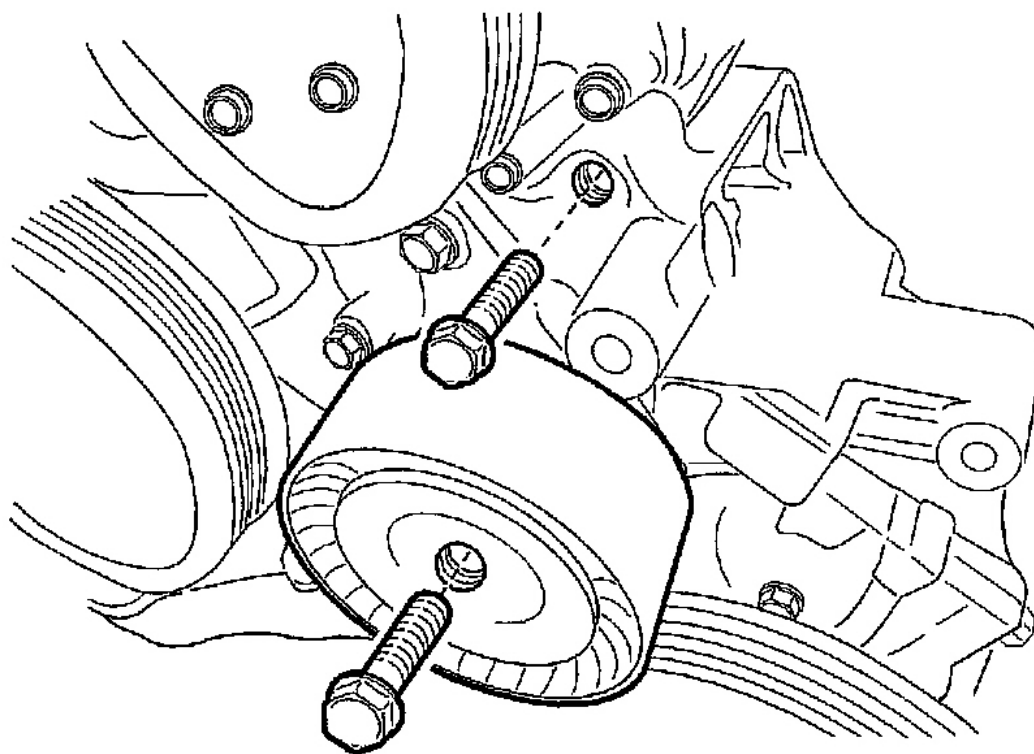


G01985714

Fig. 156: Removing Compressor

Courtesy of SUZUKI OF AMERICA CORP.

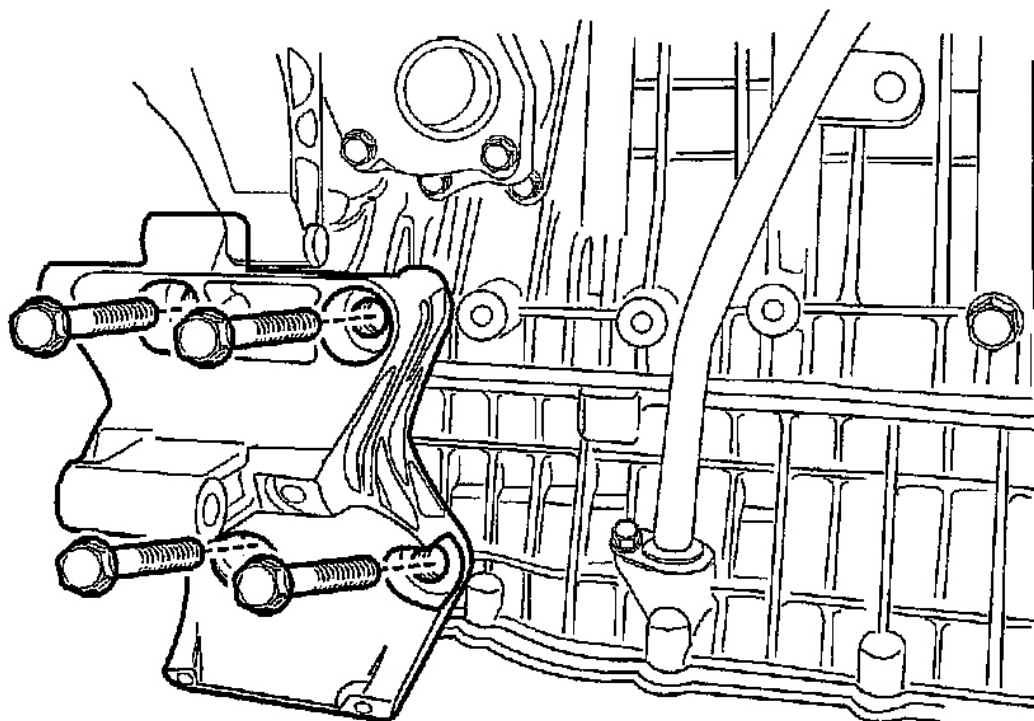
12. Remove the idler retaining bolt, upper pad-to-lower pad bracket bolt, and the idler. Refer to **Timing Chain Removal** .



G01985715

Fig. 157: Removing Idler Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

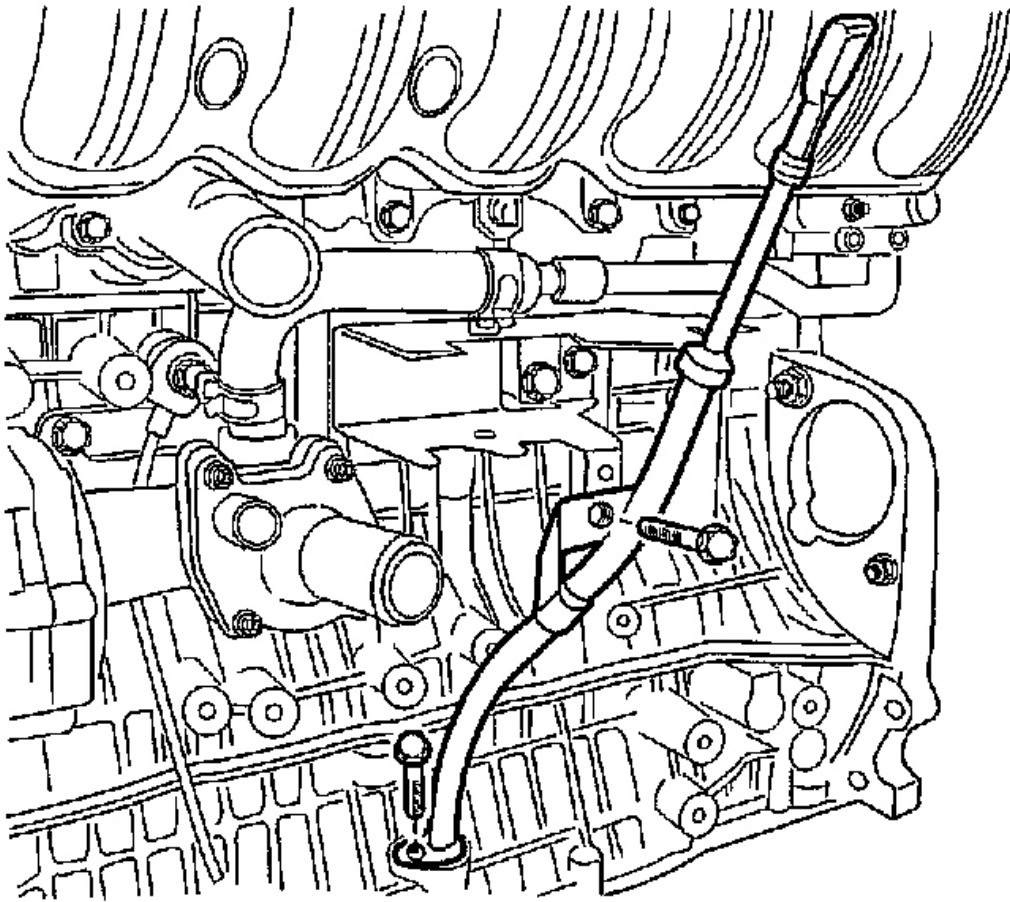
13. Remove the lower pad bracket.



G01985716

Fig. 158: Removing Lower Pad Bracket
Courtesy of SUZUKI OF AMERICA CORP.

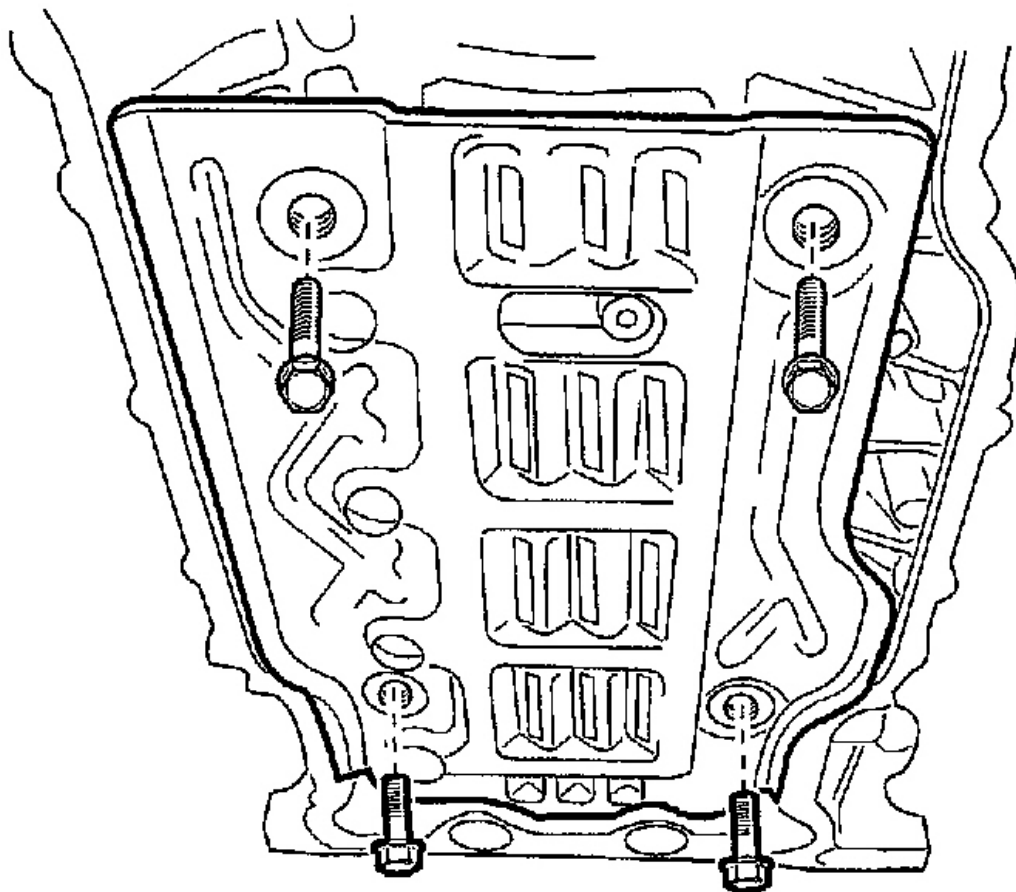
14. Remove the engine oil dipstick tube.
15. Remove the CKP (Crankshaft Position) sensor. Refer to **CRANKSHAFT POSITION (CKP) SENSOR REMOVAL** .



G01985717

Fig. 159: Removing CKP Sensor
Courtesy of SUZUKI OF AMERICA CORP.

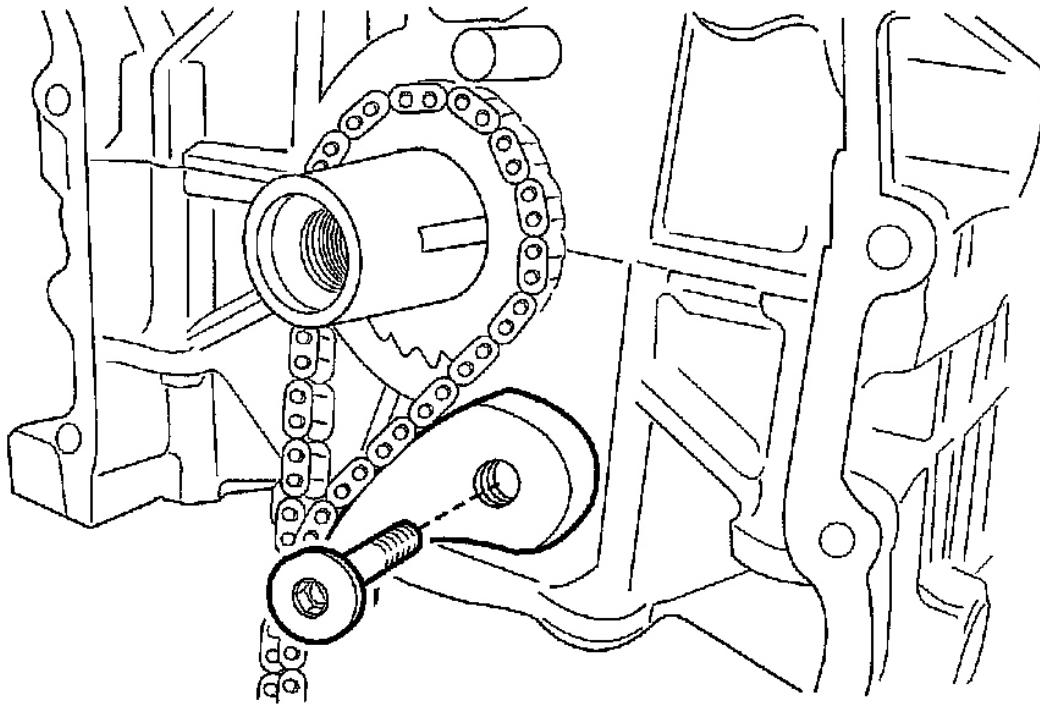
16. Remove the bed plate baffle.



G01985718

Fig. 160: Removing Bed Plate Baffle
Courtesy of SUZUKI OF AMERICA CORP.

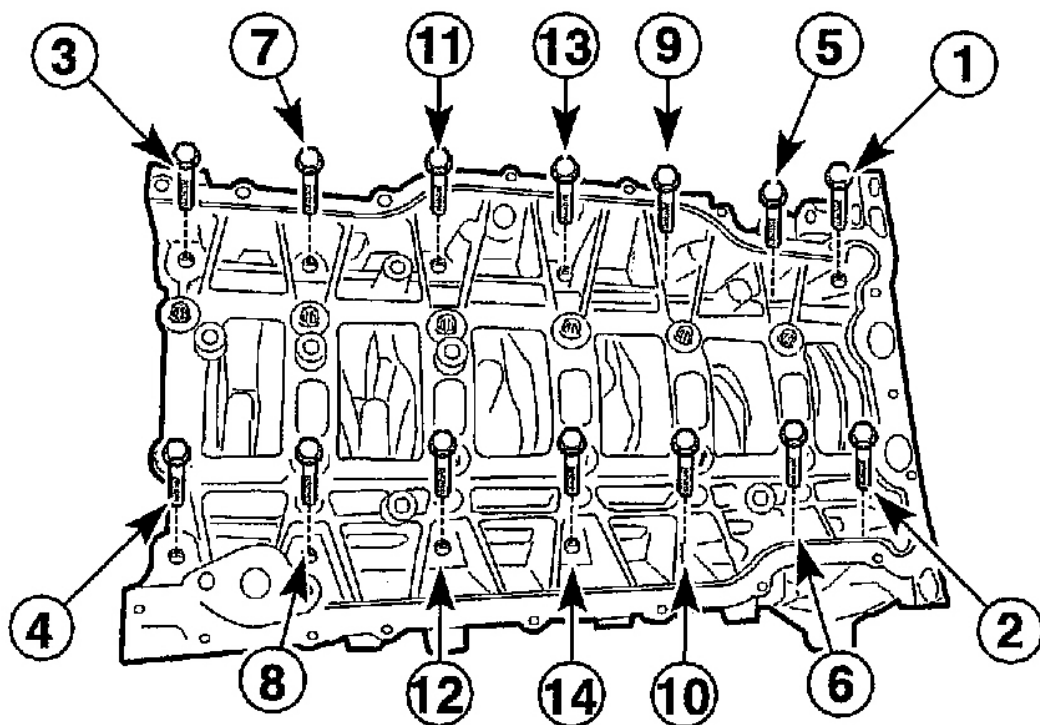
17. Remove the oil pump chain lever.



G01985719

Fig. 161: Removing Oil Pump Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

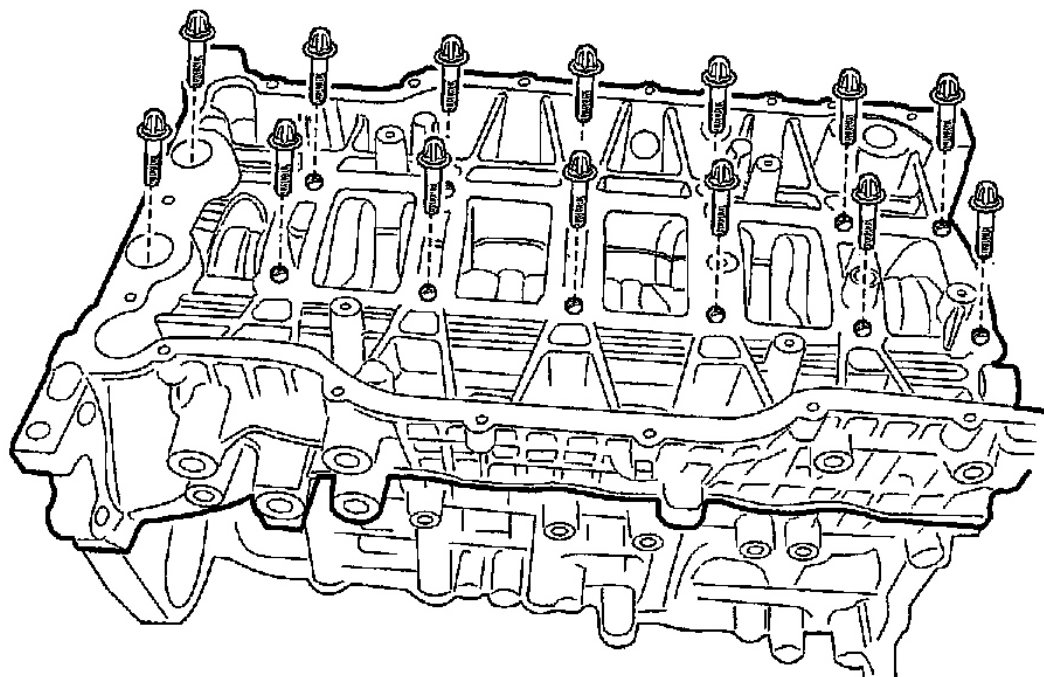
18. Remove the bed plate outer bolts in the sequence shown.



G01985720

Fig. 162: Removing Bed Plate Outer Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

19. Remove the bed plate inner bolts in the sequence shown.



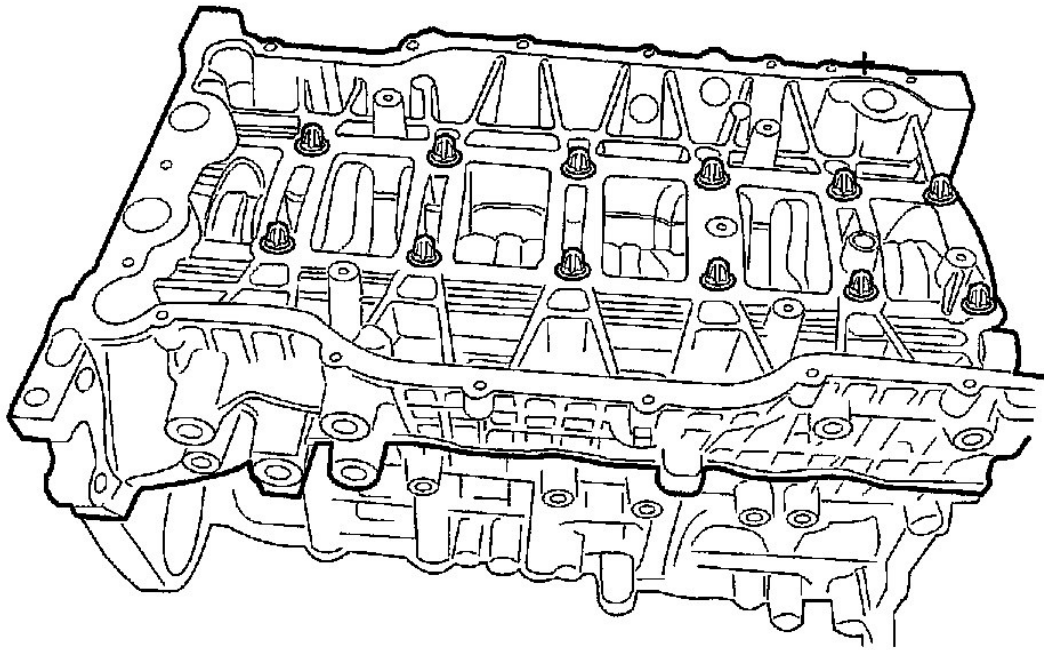
G01985721

Fig. 163: Removing Bed Plate Inner Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Bed Plate Installation

1. Installation should follow the removal procedure in the reverse order.
2. Clean the contact surfaces between the bed plate and the cylinder block.
3. Apply the liquid gasket (Loctite® 5900-M8585) on the bed plate.
4. Install the bed plate.
 - i. **Tighten**

Tighten the bed plate inner bolts to 33 N.m (24 lb-ft). After tightening all the inner bolts, turn the bolts by 135° each.



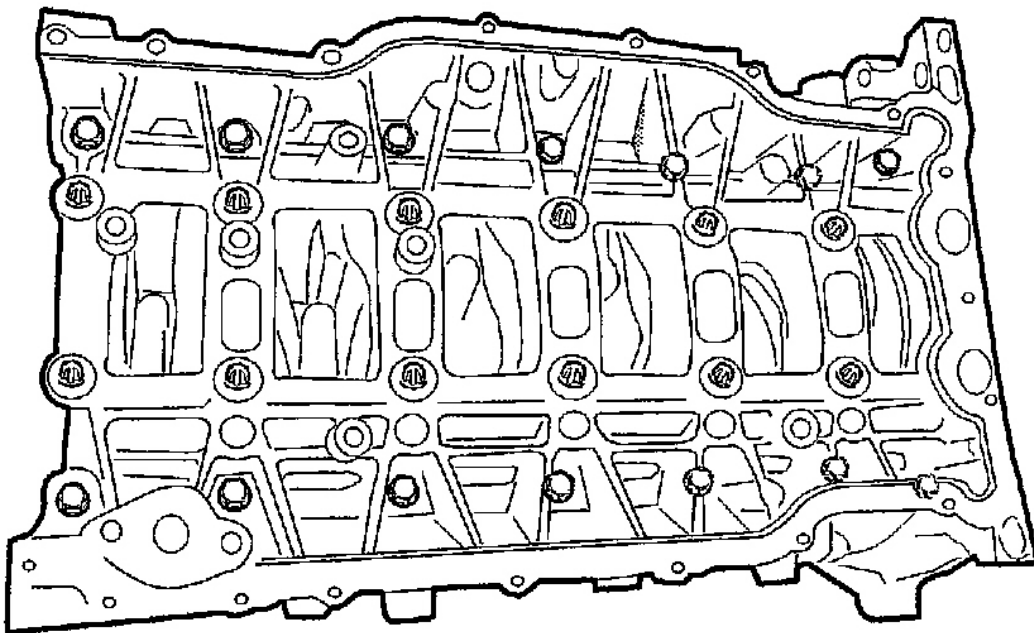
G01985722

Fig. 164: Installing Bed Plate (Inner Bolts)
Courtesy of SUZUKI OF AMERICA CORP.

5. Tighten the bed plate outer bolts.

Tighten

Tighten the bed plate outer bolts to 20-26 N.m (15-19 lb-ft).



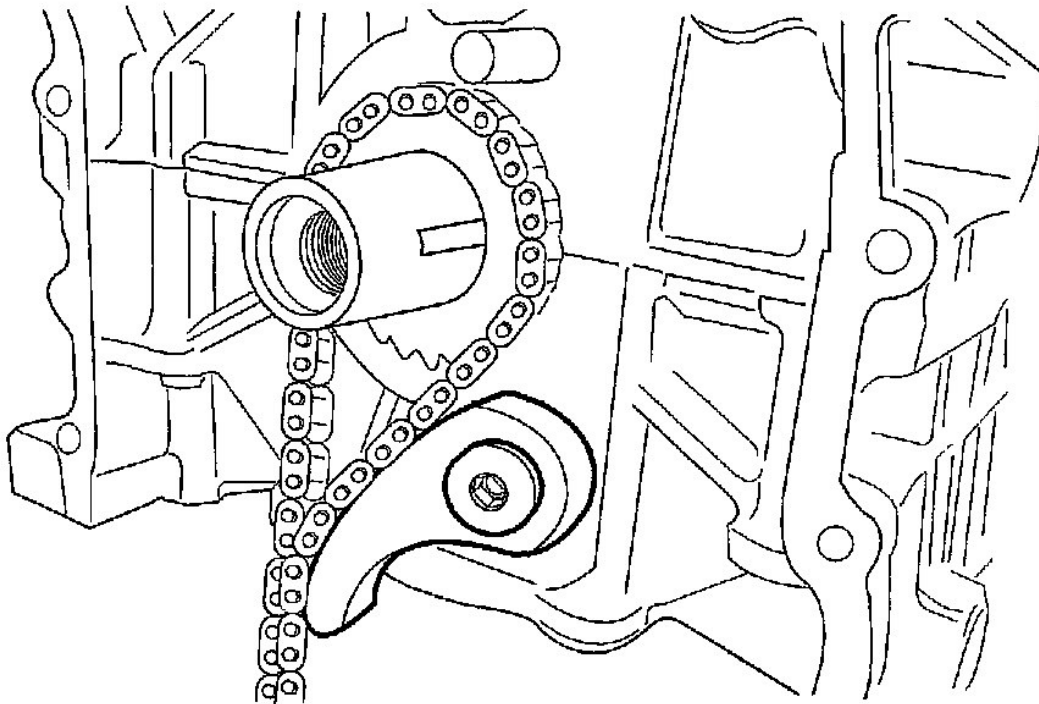
G01985723

Fig. 165: Installing Bed Plate (Outer Bolts)
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the oil pump. Refer to Oil Pan / Oil Pump Removal .
7. Install the oil pump chain lever.

Tighten

Tighten the oil pump chain lever bolt to 6-10 N.m (53-89 lb-in).



G01985724

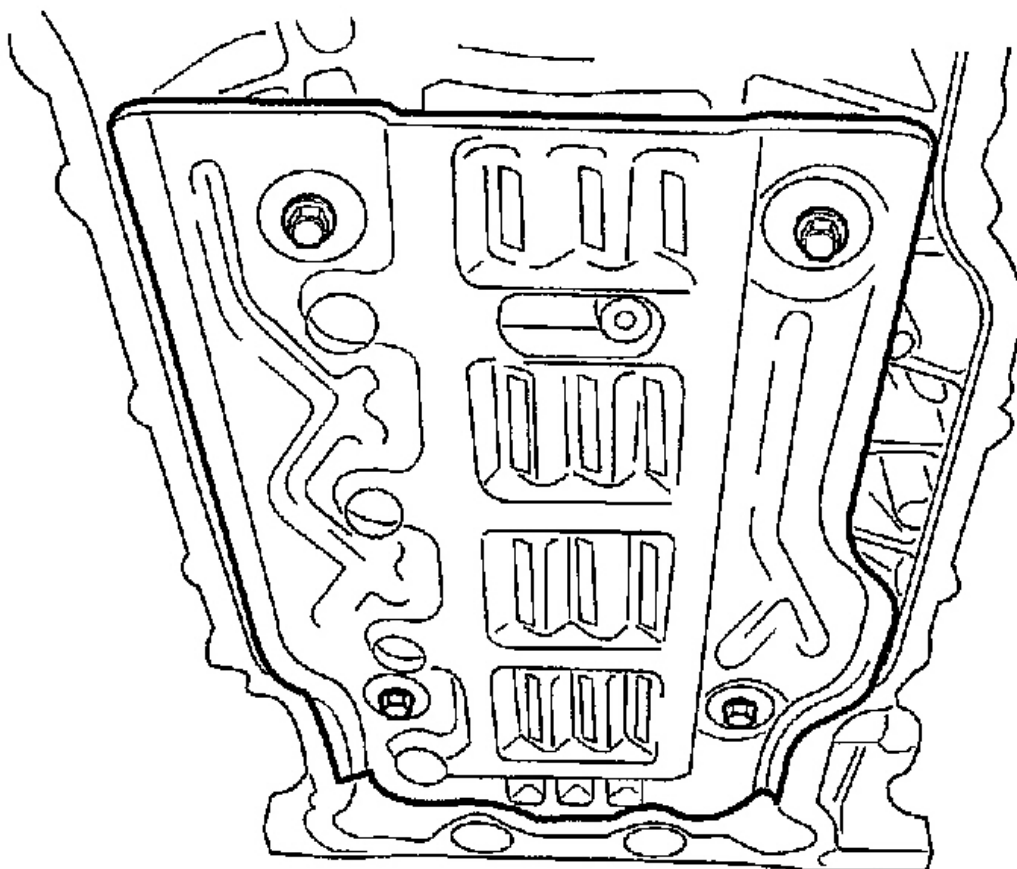
Fig. 166: Installing Oil Pump Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the bed plate baffle.

Tighten

Tighten the bed plate baffle bolts to 7-9 N.m (62-80 lb-in).

9. Install the oil pan. Refer to **Oil Pan / Oil Pump Installation** .



G01985725

Fig. 167: Installing Oil Pan

Courtesy of SUZUKI OF AMERICA CORP.

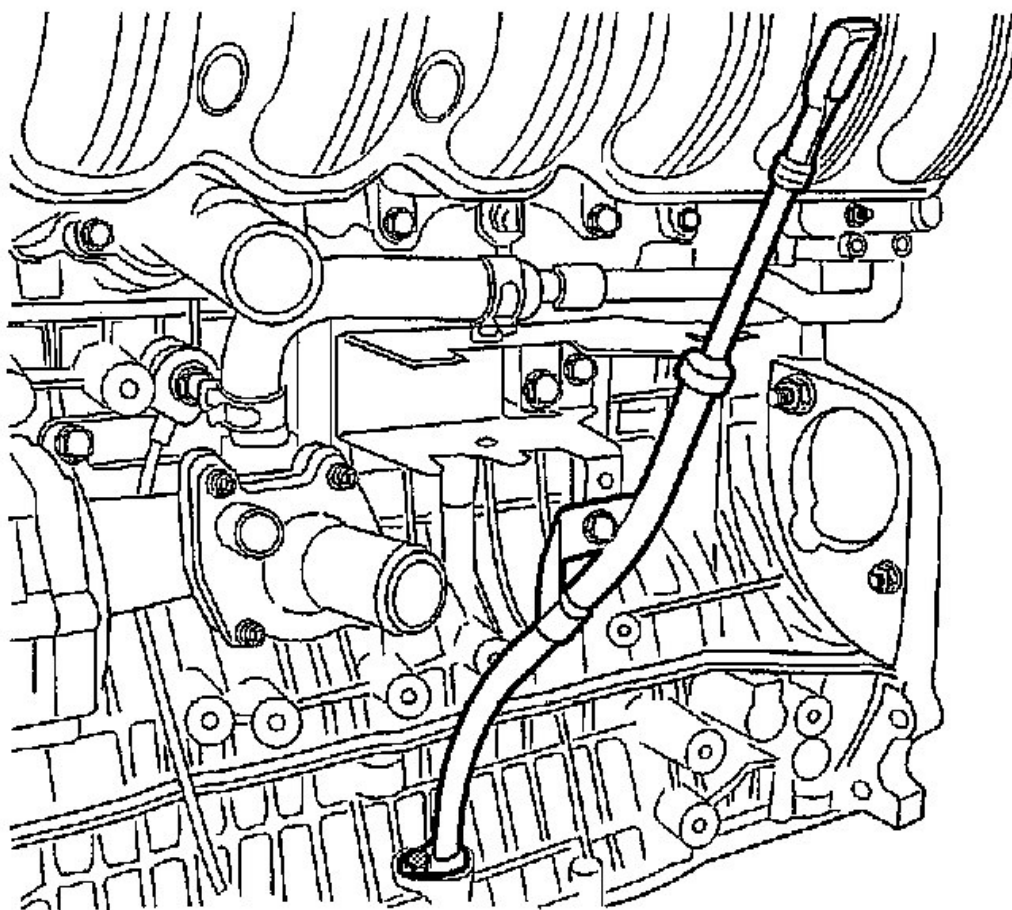
10. Install the engine oil dipstick tube.

Tighten

Tighten the engine oil dipstick tube bracket bolt to 18-22 N.m (13-16 lb-ft).

Tighten the engine oil dipstick tube bolt to 8-10 N.m (71-89 lb-in).

11. Install the CKP (Crankshaft Position) sensor. Refer to **CRANKSHAFT POSITION (CKP) SENSOR INSTALLATION**.



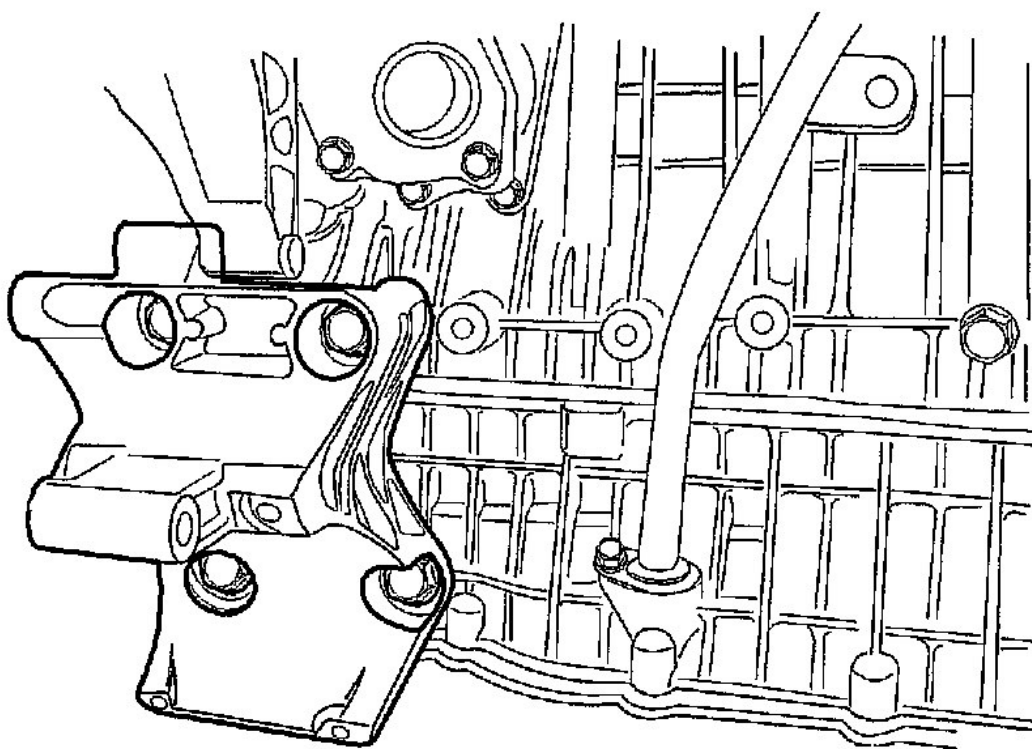
G01985726

Fig. 168: Installing CKP Sensor
Courtesy of SUZUKI OF AMERICA CORP.

12. Install the lower pad bracket.

Tighten

Tighten the lower pad bracket bolts to 35-55 N.m (26-33 lb-ft).



G01985727

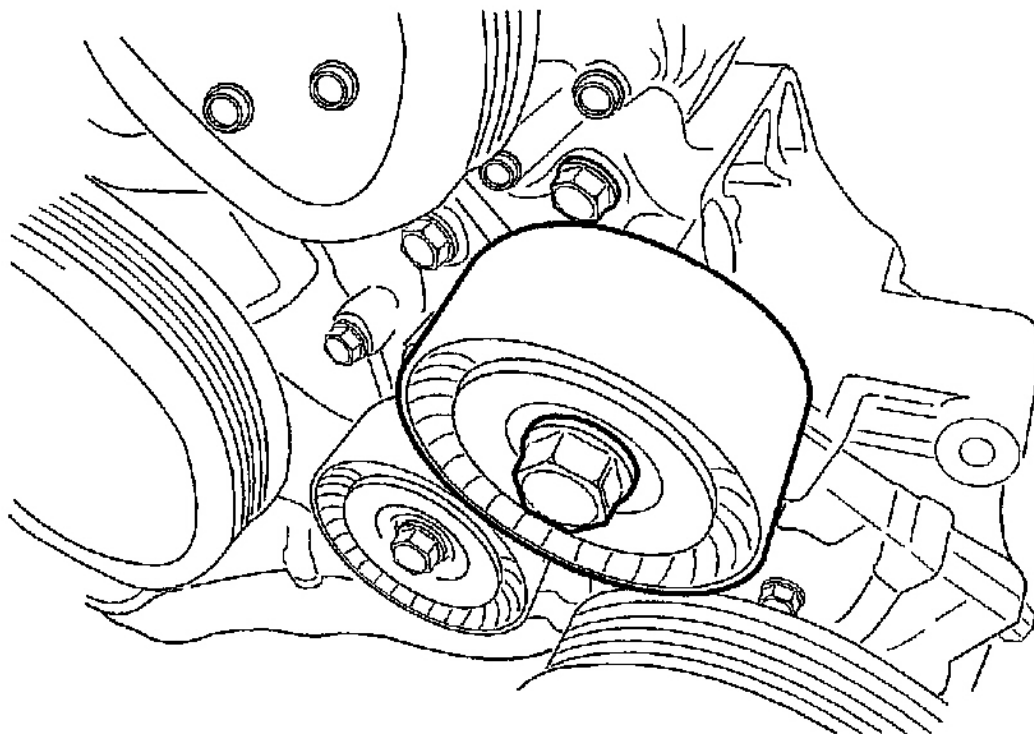
Fig. 169: Installing Lower Pad Bracket
Courtesy of SUZUKI OF AMERICA CORP.

13. Install the idler.

Tighten

Tighten the idler retaining bolt to 35-55 N.m (26-33 lb-ft).

Tighten the upper pad-to-lower pad bracket bolt to 30-40 N.m (22-30 lb-ft).



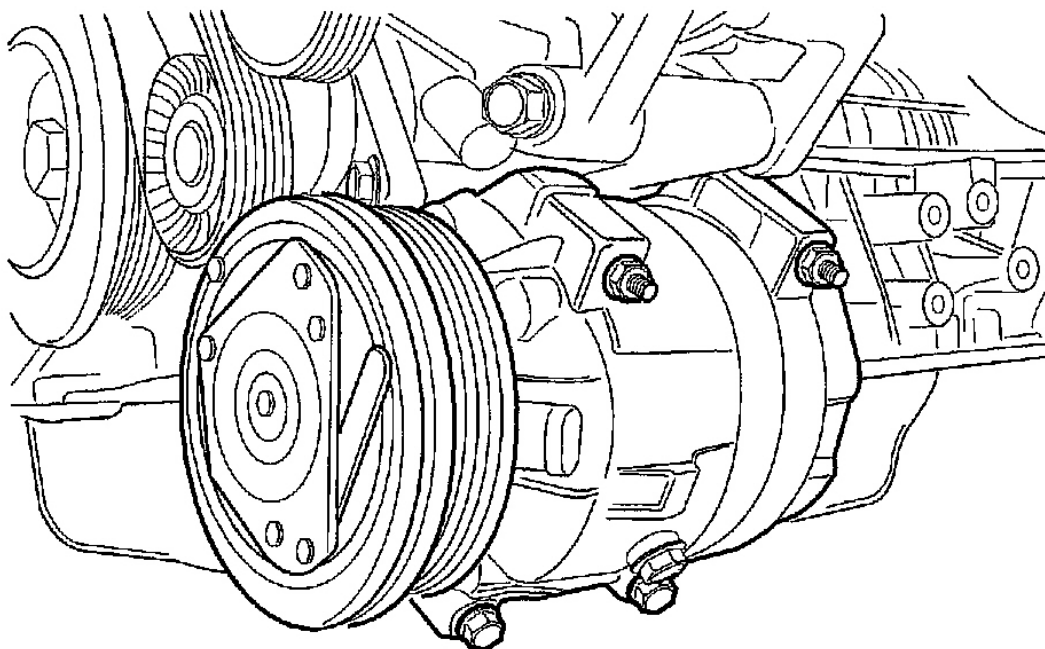
G01985728

Fig. 170: Installing Idler Pulley
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the compressor.

Tighten

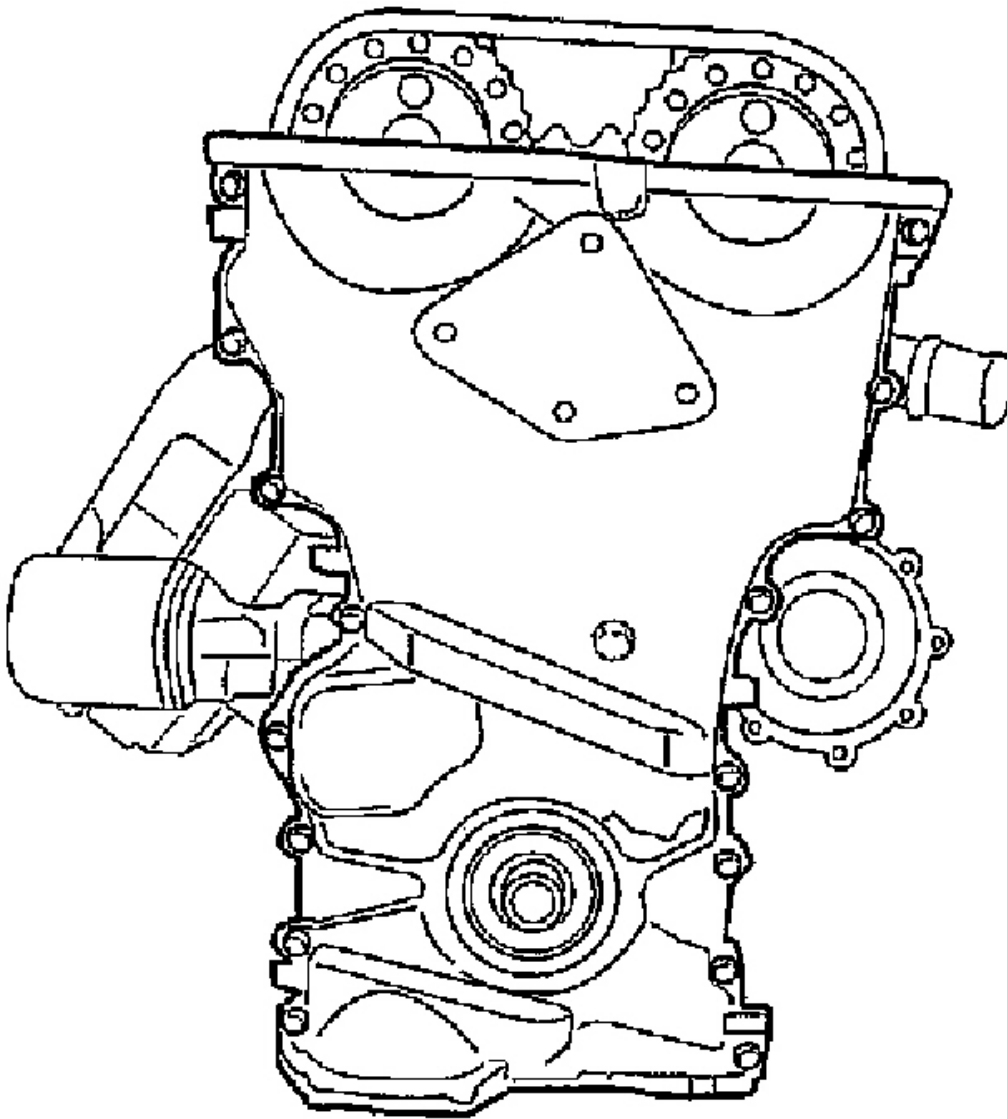
Tighten the compressor retaining bolts and nuts to 20-30 N.m (15-22 lb-ft).



G01985729

Fig. 171: Installing Compressor
Courtesy of SUZUKI OF AMERICA CORP.

15. Install the timing chain and timing chain cover. Refer to **Timing Chain Installation** .
16. Install the cylinder head cover. Refer to **Cylinder Head Cover Installation** .
17. Install the engine assembly. Refer to **Engine Assembly Installation** .



G01985730

Fig. 172: Installing Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head and Valve Train Components Removal

Tools Required

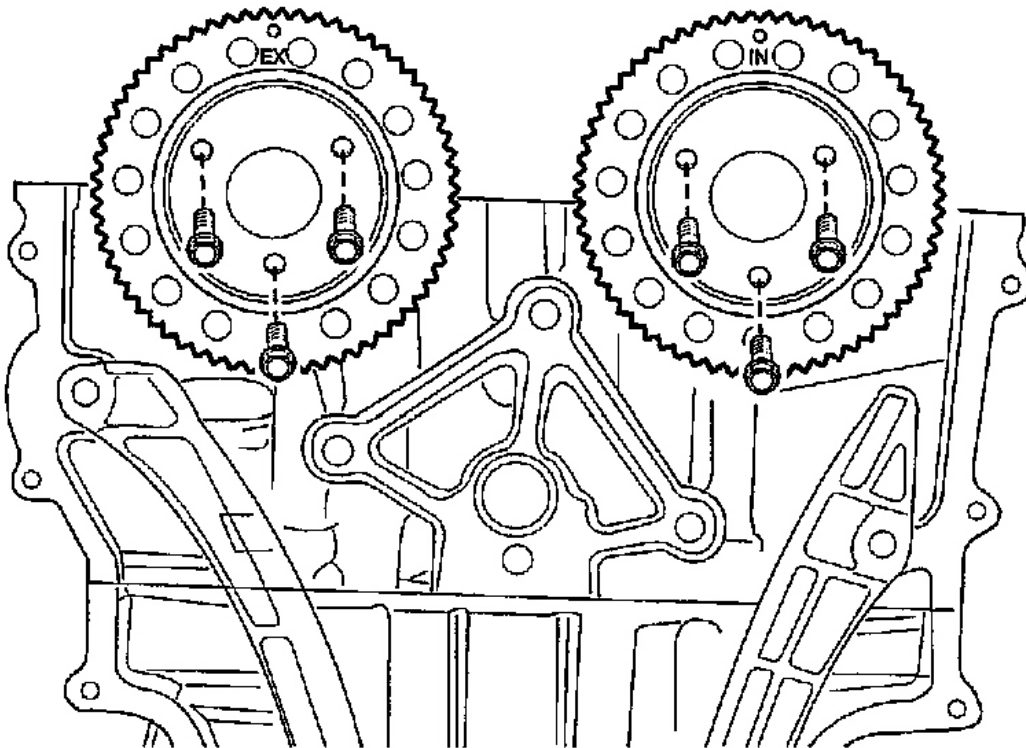
DW110-150 Camshaft Sprocket Holder

DW110-160 Rocker Arm Shaft Installer/Remover

09916-14510 Valve Spring Compressor

09916-48210 Valve Spring Compressor Attachment

1. Remove the cylinder head. Refer to **Cylinder Head Removal**.
2. Remove the intake cam sprocket and the exhaust cam sprocket.



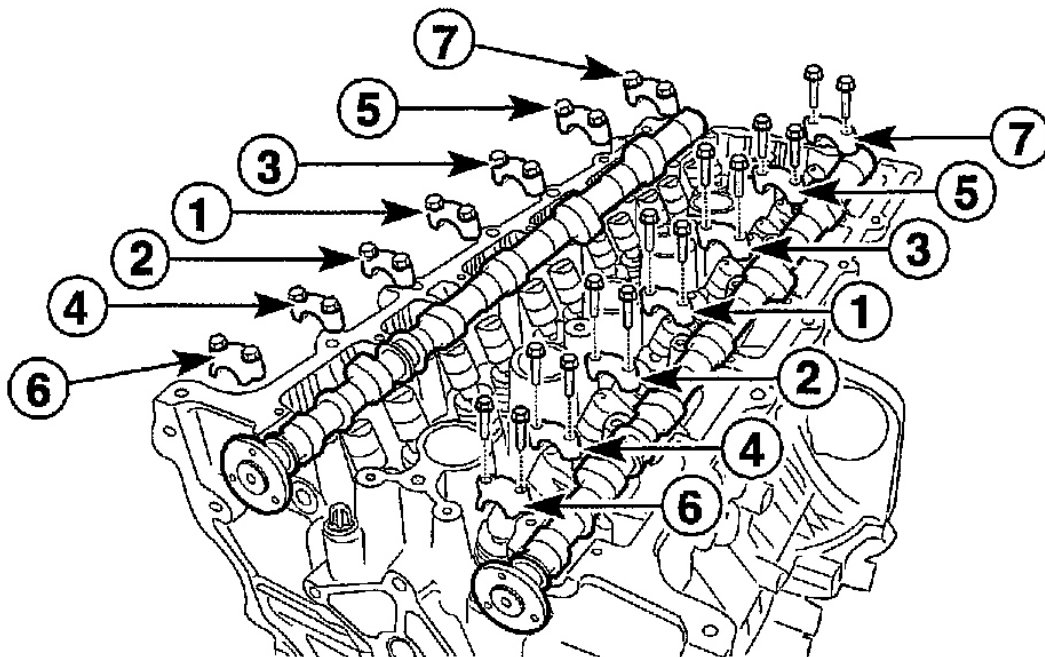
G01985731

Fig. 173: Removing Intake Cam Sprocket & Exhaust Cam Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

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

NOTE: Make sure the engraved position numbers on the camshaft caps are not mixed up. Camshaft caps should follow the numeric order when installing, intake camshaft caps 1-3-5-7-9-11-13 and exhaust camshaft caps 2-4-6-8-10-12-14.

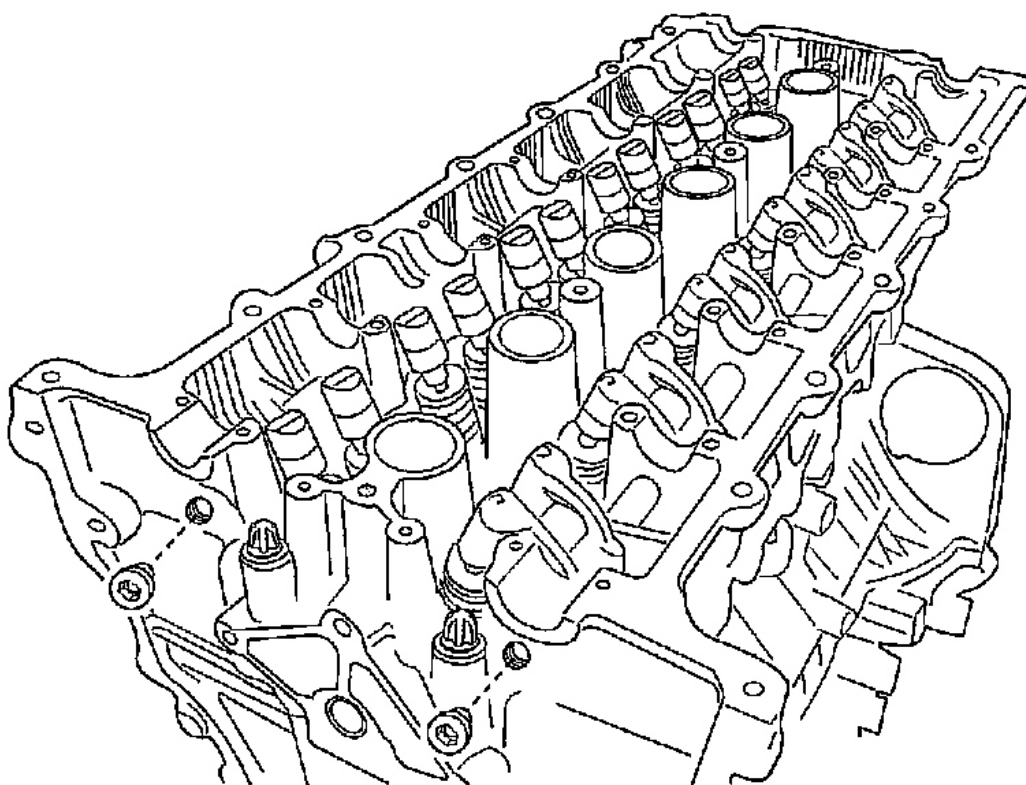
4. Remove the intake camshaft and the exhaust camshaft.



G01985732

Fig. 174: Removing Intake & Exhaust Camshaft
Courtesy of SUZUKI OF AMERICA CORP.

5. Remove the rocker arm shaft plugs at both ends of the cylinder block.



G01985733

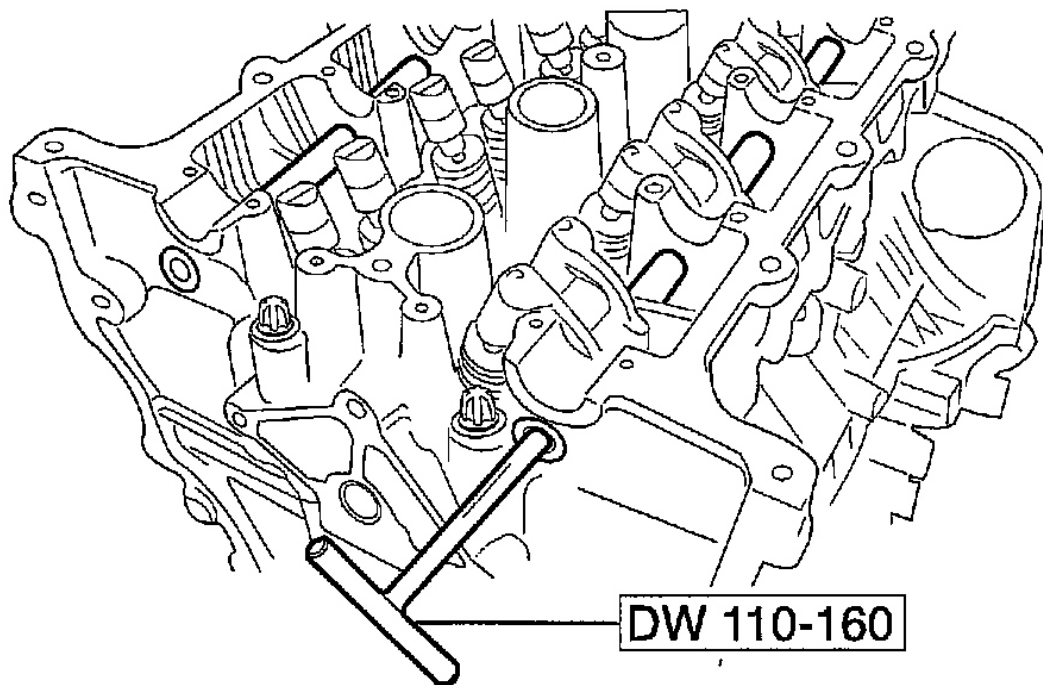
Fig. 175: Removing Rocker Arm Shaft Plugs
Courtesy of SUZUKI OF AMERICA CORP.

6. Remove the front and rear rocker arm shafts using rocker arm shaft installer / remover DW110-160.

CAUTION: To prevent the oil from leaking through the pressure chamber, do not flip the cylinder head over when removing or installing the rocker arm.

7. Remove the rocker arms.

CAUTION: To prevent the oil from leaking through the pressure chamber, do not flip the cylinder head over when removing or installing the rocker arm.

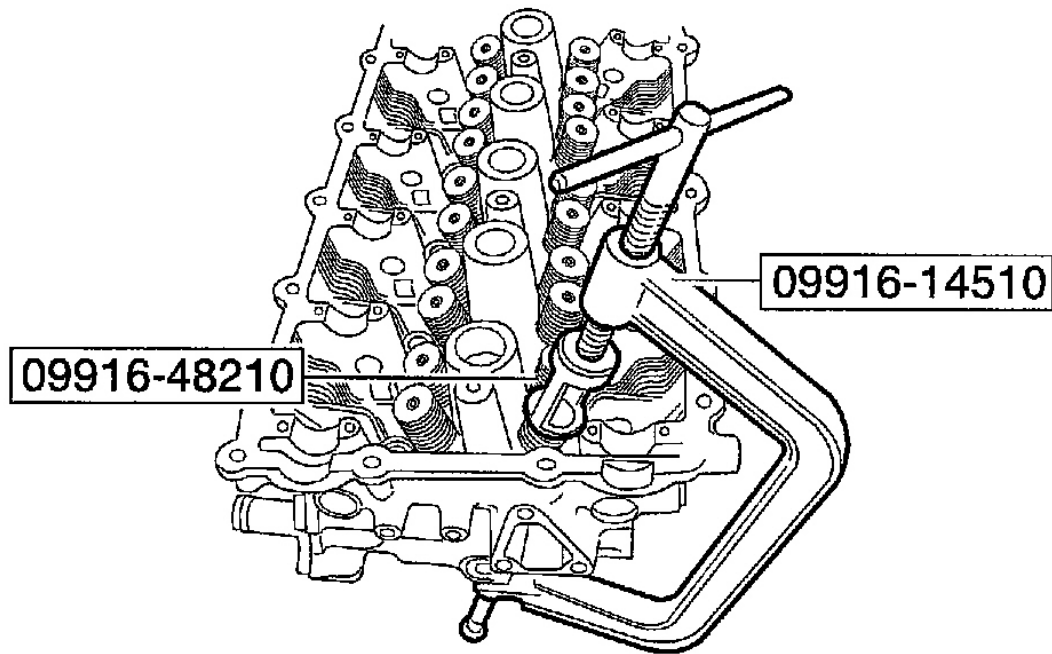


G01985734

Fig. 176: Removing Rocker Arms

Courtesy of SUZUKI OF AMERICA CORP.

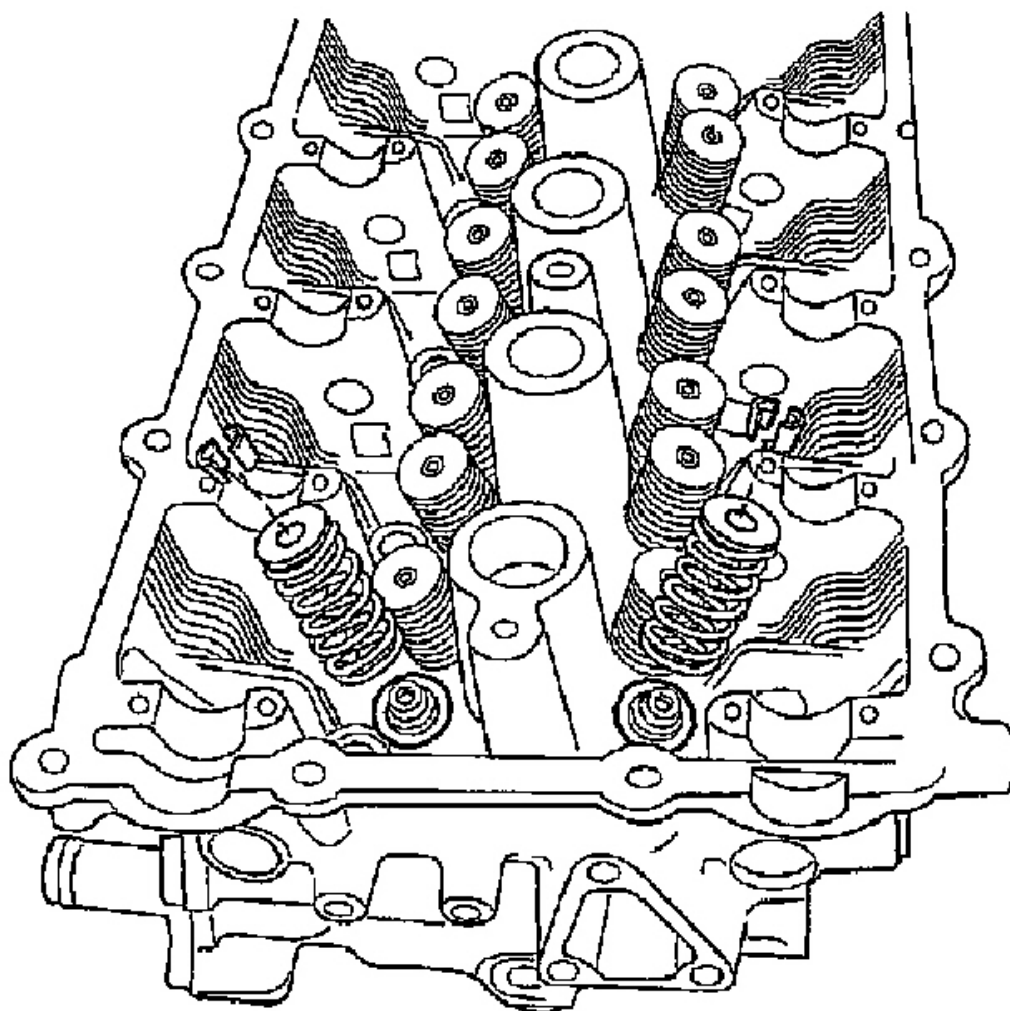
8. Remove the valve spring retainer, valve spring, valve key, and valve stem using the valve spring compressor 09916-14510 / valve spring compressor attachment 09916-48210.



G01985735

Fig. 177: Removing Valve Spring Retainer
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the intake and exhaust valves.

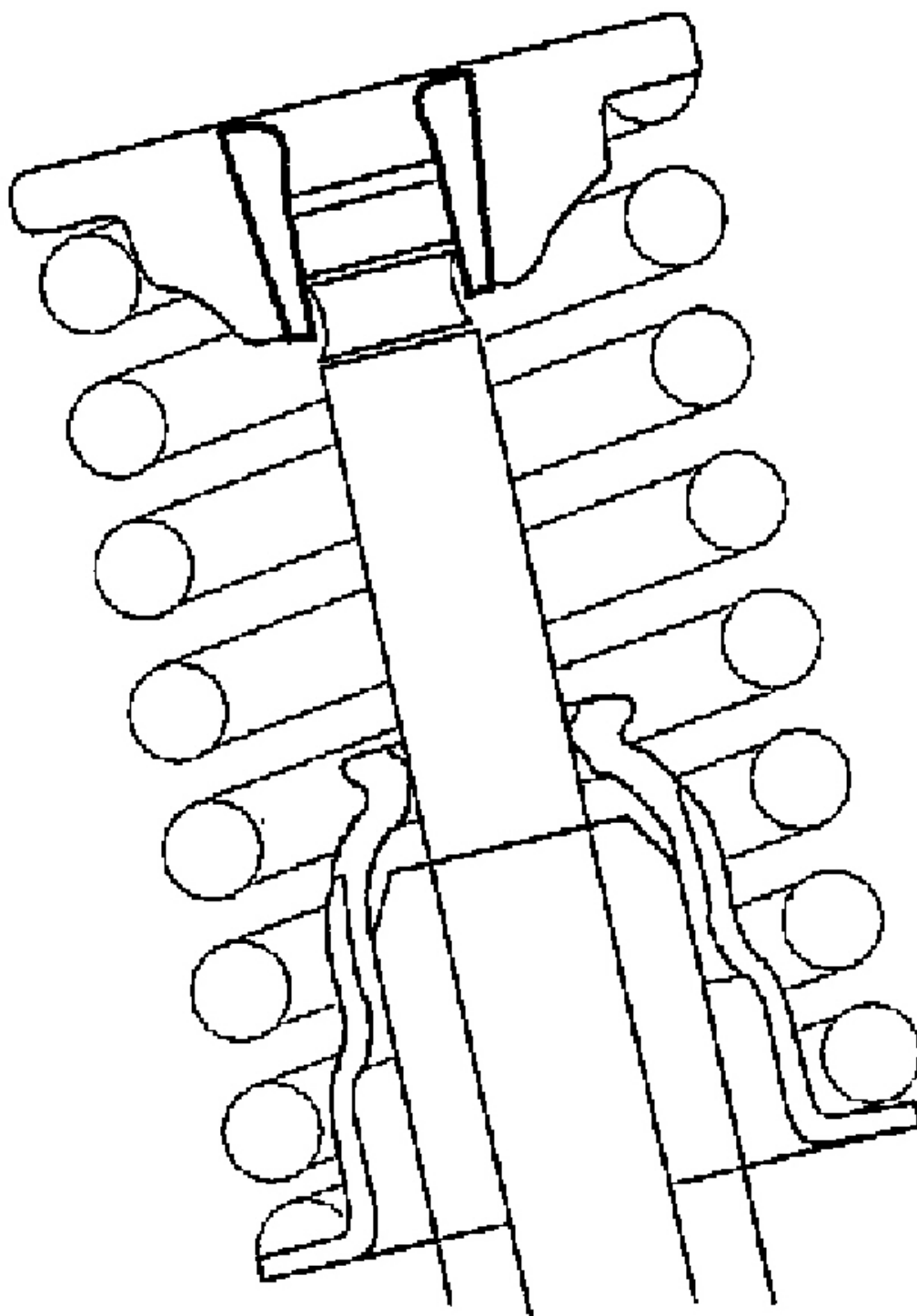


G01985736

Fig. 178: Removing Intake & Exhaust Valves
Courtesy of SUZUKI OF AMERICA CORP.

Cylinder Head and Valve Train Components Installation

1. Installation should follow the removal procedure in the reverse order.
2. Install the intake and exhaust valves, valve spring retainer, valve spring, valve key, and valve stem using the valve spring compressor 09916-14510 / valve spring compressor attachment 09916-48210.



G01985737

Fig. 179: Installing Intake & Exhaust Valves
 Courtesy of SUZUKI OF AMERICA CORP.

3. Make sure the correct positions for the intake and exhaust valves. The diameter of the intake valves is larger than the diameter of the exhaust valves.

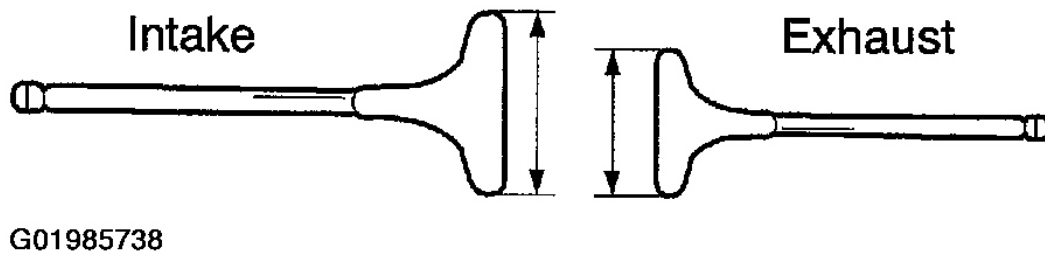


Fig. 180: Identifying Intake & Exhaust Valves
 Courtesy of SUZUKI OF AMERICA CORP.

4. Install the rocker arms.
5. Install the rocker arm shafts using the rocker arm shaft installer/remover DW110-160.

NOTE: Front rocker arm shaft which will be installed to the timing chain side can be identified by the hole for the rocker arm spring.

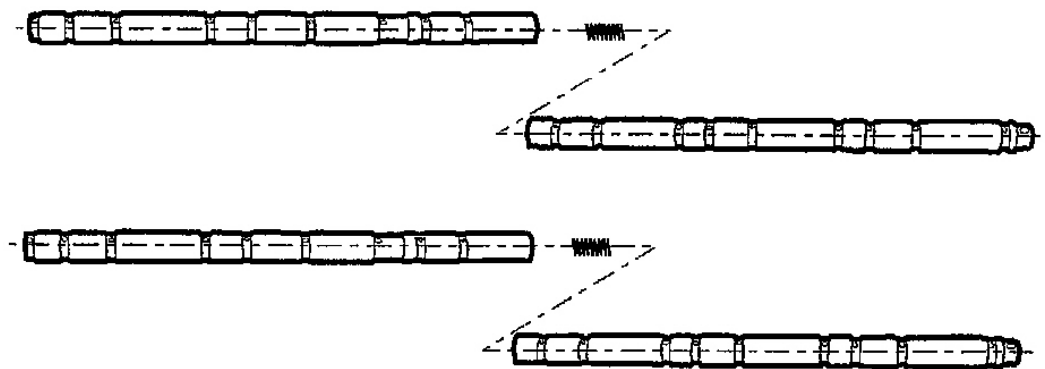


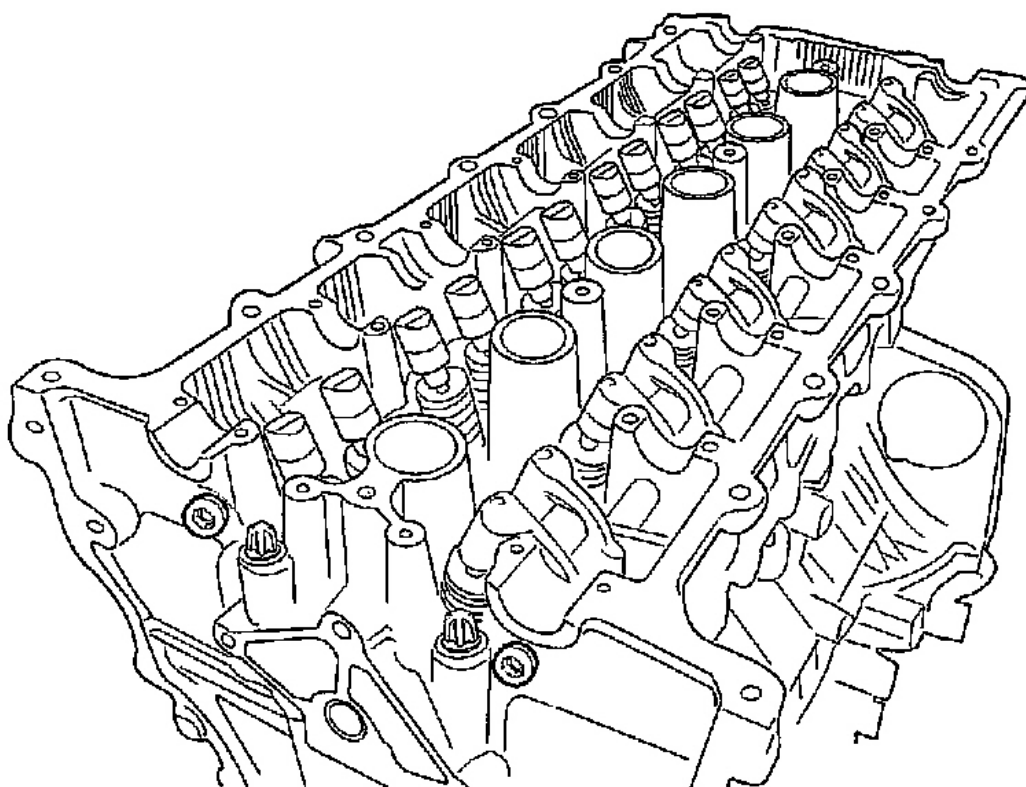
Fig. 181: Installing Rocker Arm Shaft
 Courtesy of SUZUKI OF AMERICA CORP.

6. Apply the sealant to the rocker arm shaft plugs.

7. Install the rocker arm shaft plugs.

Tighten

Tighten the rocker arm shaft plug to 35-45 N.m (26-33 lb-ft).



G01985740

Fig. 182: Installing Rocker Arm Shaft Plugs
Courtesy of SUZUKI OF AMERICA CORP.

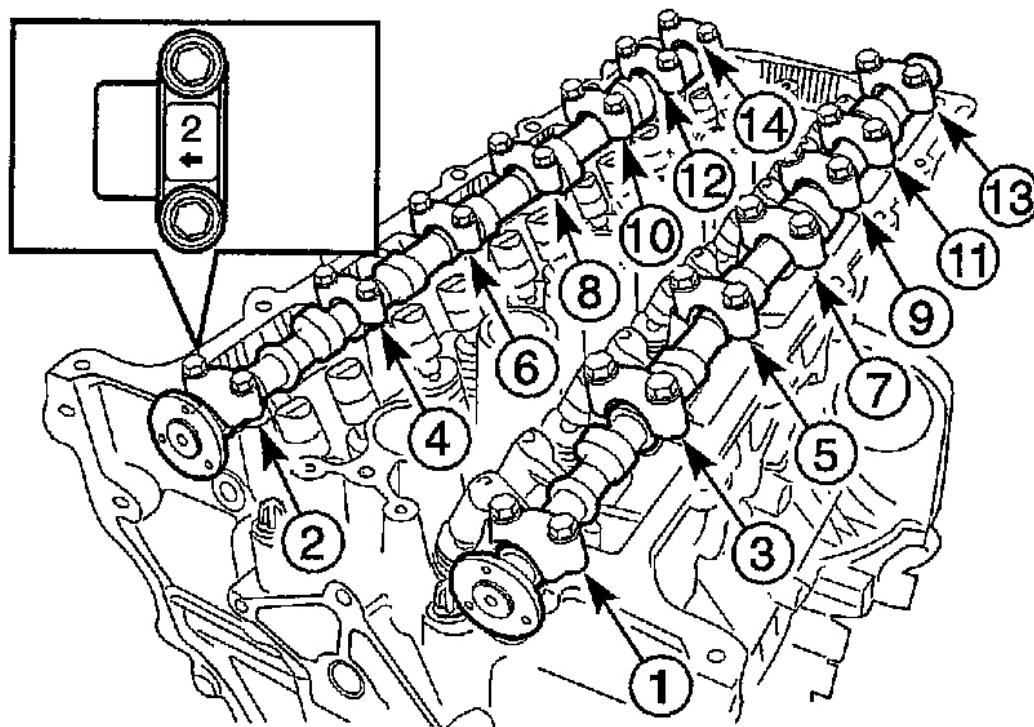
8. Position the intake and exhaust camshafts.

NOTE: The intake camshaft can be identified by the groove near the cam sprocket flange. The exhaust camshaft has no groove.

9. Install the camshaft caps in the sequence shown.

NOTE: Make sure the engraved position numbers on the camshaft caps are not mixed up. Camshaft caps should follow the numeric order when installing,

intake camshaft caps 1-3-5-7-9-11-13 and exhaust camshaft caps 2-4-6-8-10-12-14.



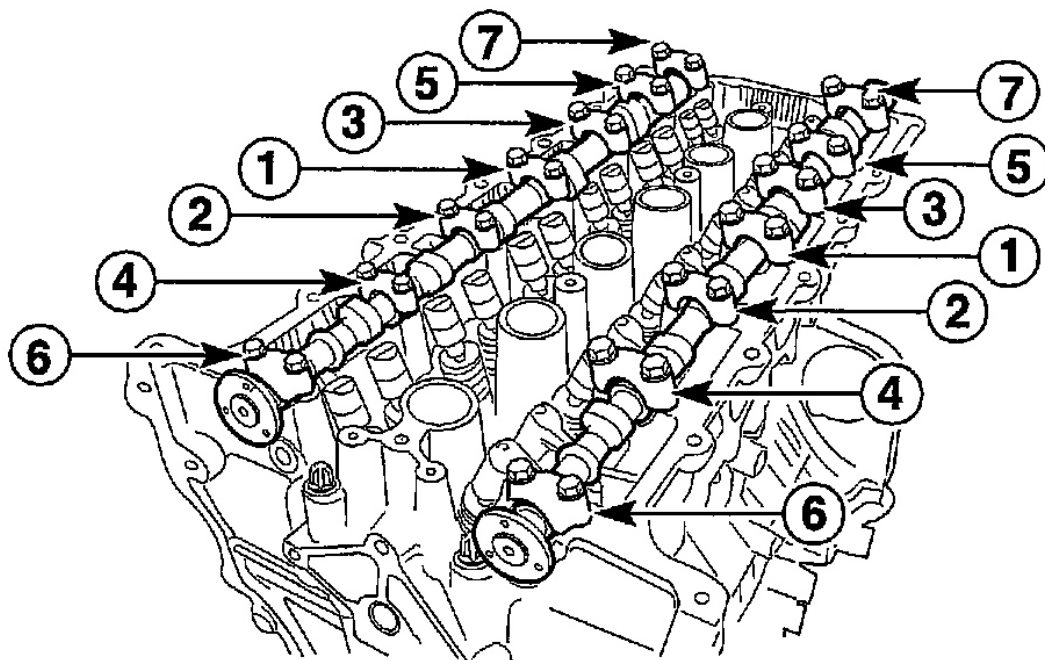
G01985741

Fig. 183: Installing Camshaft Caps In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

10. Tighten the camshaft cap bolts in the sequence shown.

Tighten

Tighten the camshaft cap bolts to 10-14 N.m (89-124 lb-in).



G01985742

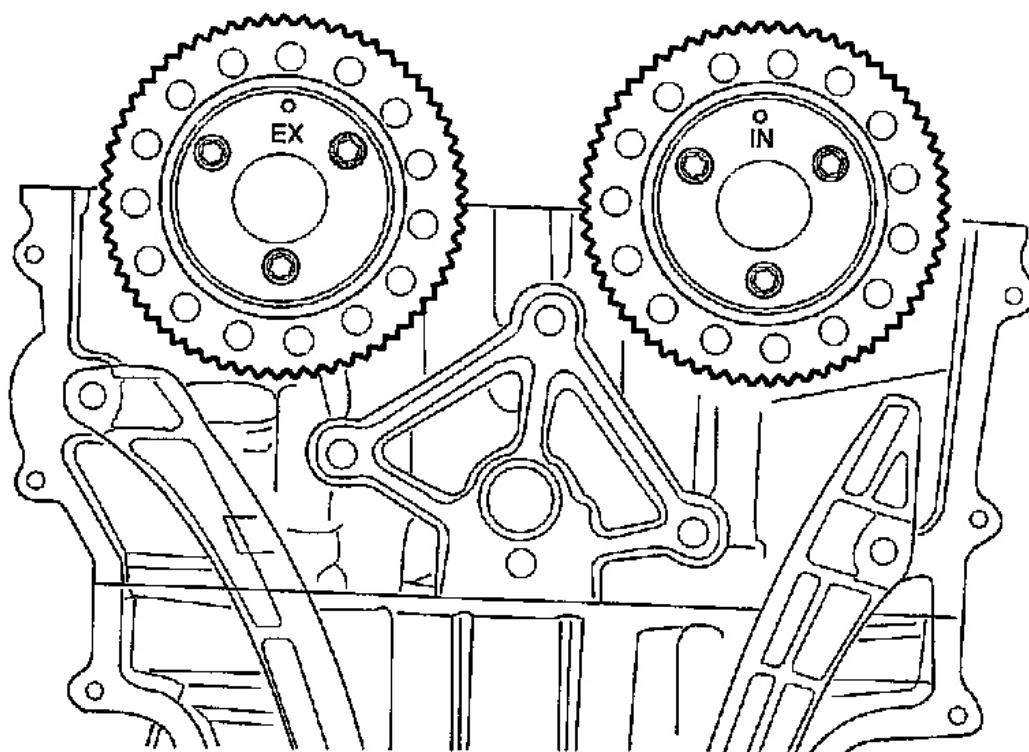
Fig. 184: Tightening Camshaft Cap Bolts In Sequence
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the cam sprockets.

NOTE: Intake and exhaust cam sprockets are identified by the engraved marks, "IN" for intake and "EX" for exhaust respectively.

Tighten

Tighten the cam sprocket bolts to 18-22 N.m (13-16 lb-ft).



G01985743

Fig. 185: Installing Cam Sprockets

Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Bearings and Connecting Rod Bearings Removal

Tools Required

DW110-170-01 Piston Ring Compressor (2.0L)

DW110-170-02 Piston Ring Compressor (2.5L)

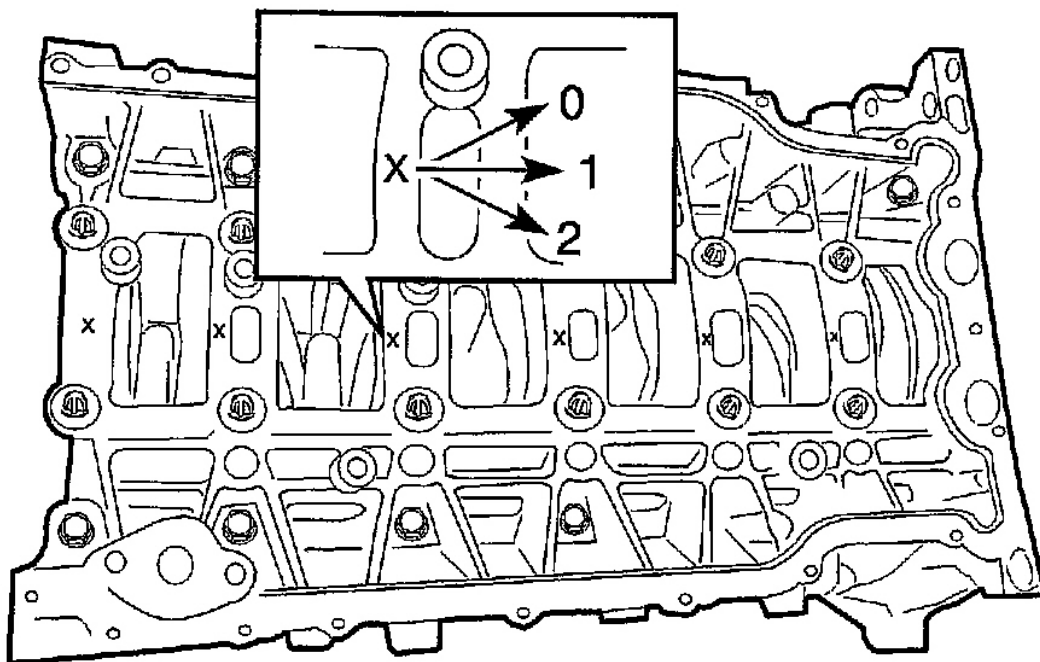
DW110-190 Crankshaft Adjuster

DW110-180-02 Crankshaft Rear Oil Seal Installer

DW110-180-01 Crankshaft Front Oil Seal Installer

1. Remove the bed plate. Refer to **Bed Plate Removal** .

NOTE: The sizes of each upper crankshaft bearing are marked on the bed plate as shown in the illustration.

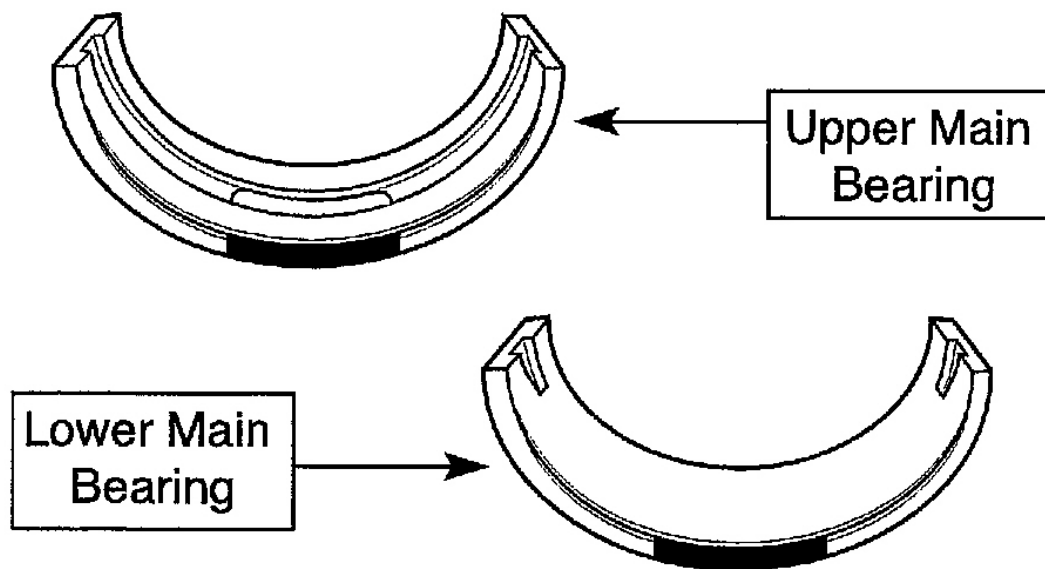


G01985744

Fig. 186: Removing Bed Plate
Courtesy of SUZUKI OF AMERICA CORP.

2. Remove the lower crankshaft bearings.

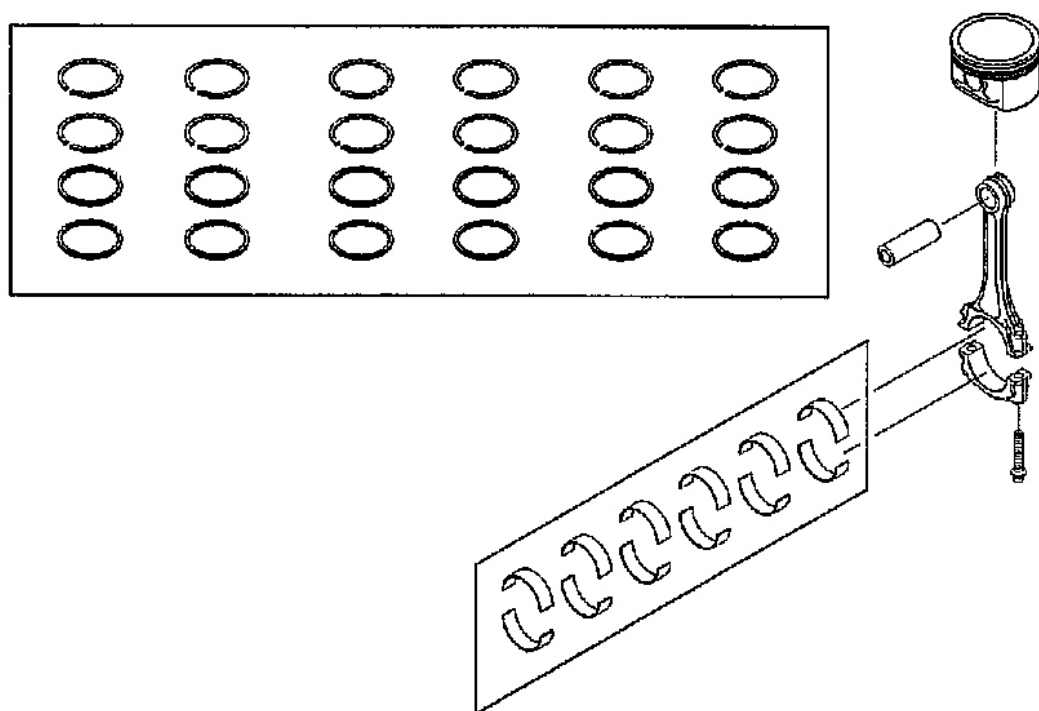
NOTE: The lower crankshaft bearings have different groove shape and the sizes of the crankshaft bearings are identified by the color marks on the side of the bearing, which are green (Size-0), yellow (Size-1), and pink (Size-2).



G01985745

Fig. 187: Removing Lower Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

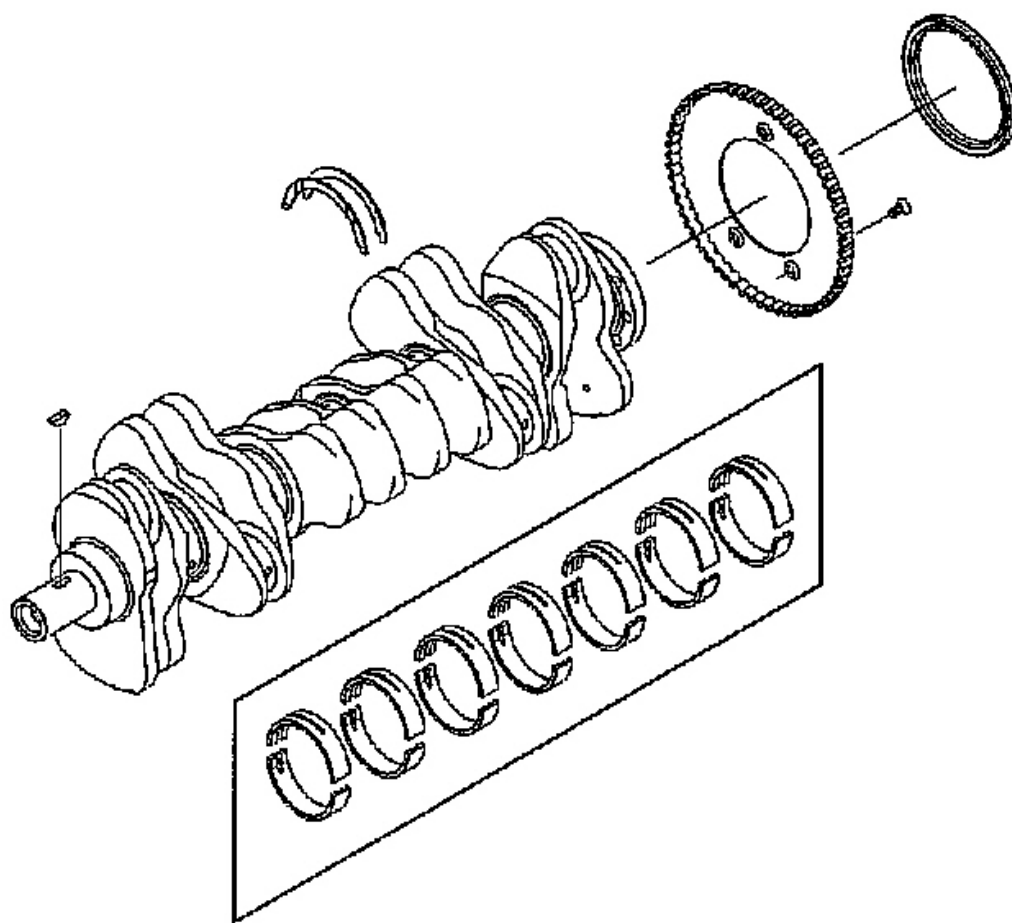
3. Move the piston to the bottom of the piston stroke.
4. Mark the connecting rod cap for position.
5. Remove the connecting rod caps and bearings.



G01985746

Fig. 188: Removing Connecting Rod Caps & Bearings
 Courtesy of SUZUKI OF AMERICA CORP.

6. Remove the piston.
7. Remove the piston rings.
8. Remove the crankshaft.
9. Remove the upper connecting rod bearing.
10. Remove the rear crankshaft seal.



G01985747

Fig. 189: Removing Rear Crankshaft Seal
Courtesy of SUZUKI OF AMERICA CORP.

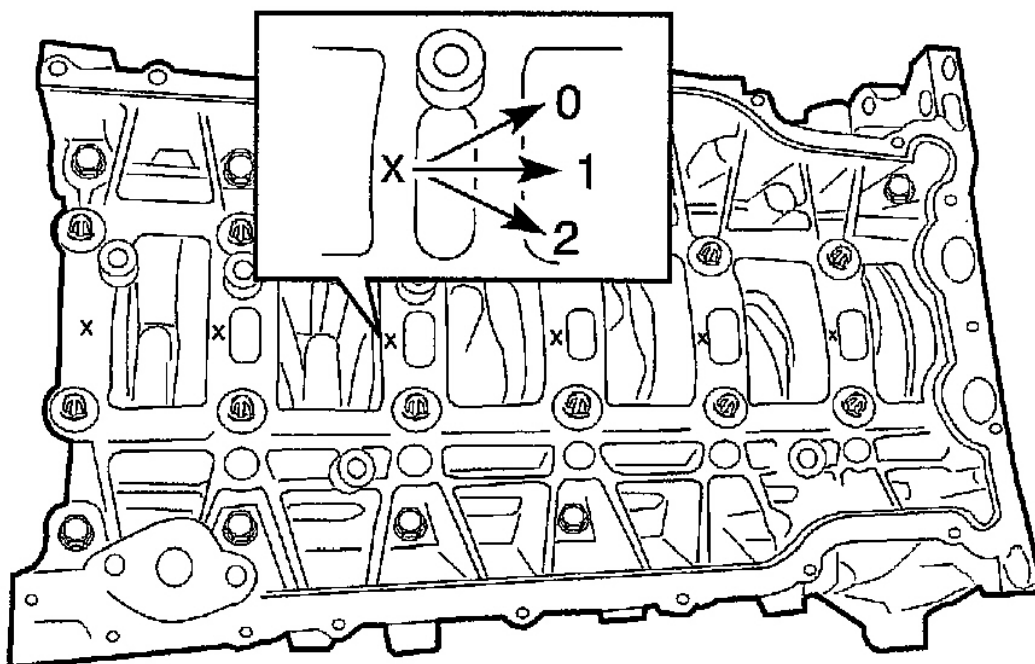
Crankshaft Bearings and Connecting Rod Bearings Installation

1. Installation should follow the removal procedure in the reverse order.
2. Install the upper crankshaft bearings.

NOTE: The sizes of each upper crankshaft bearing are marked on the bed plate as shown in the illustration.

NOTE: The lower crankshaft bearings have different groove shape and the sizes

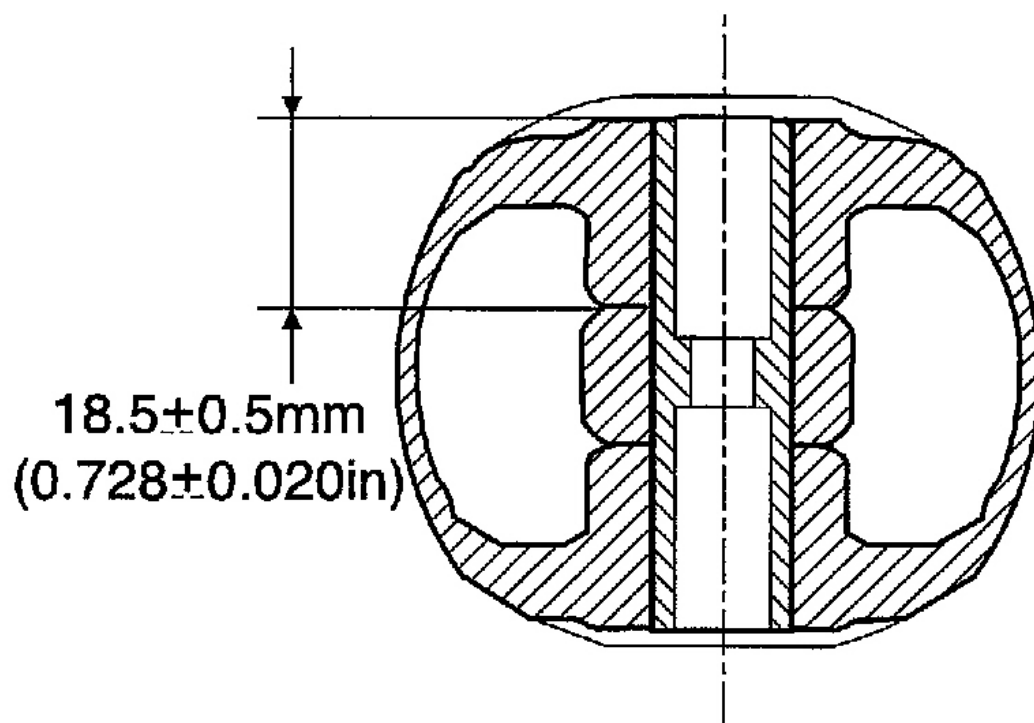
of the crankshaft bearings are identified by the color marks on the side of the bearing, which are green (Size-0), yellow (Size-1), and pink (Size-2).



G01985748

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

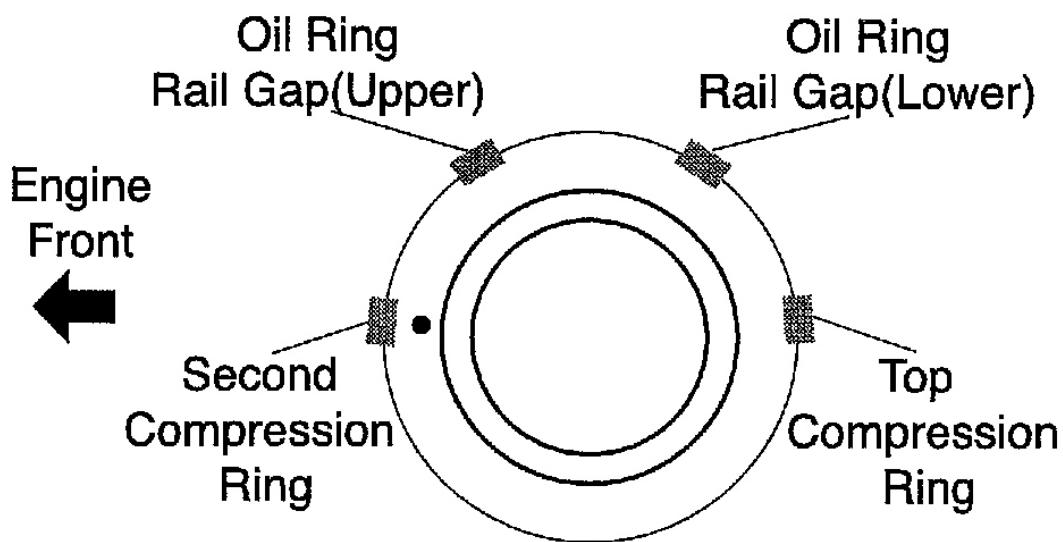
3. Install the crankshaft.
4. Install the piston pin.



G01985749

Fig. 191: Installing Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the piston rings.

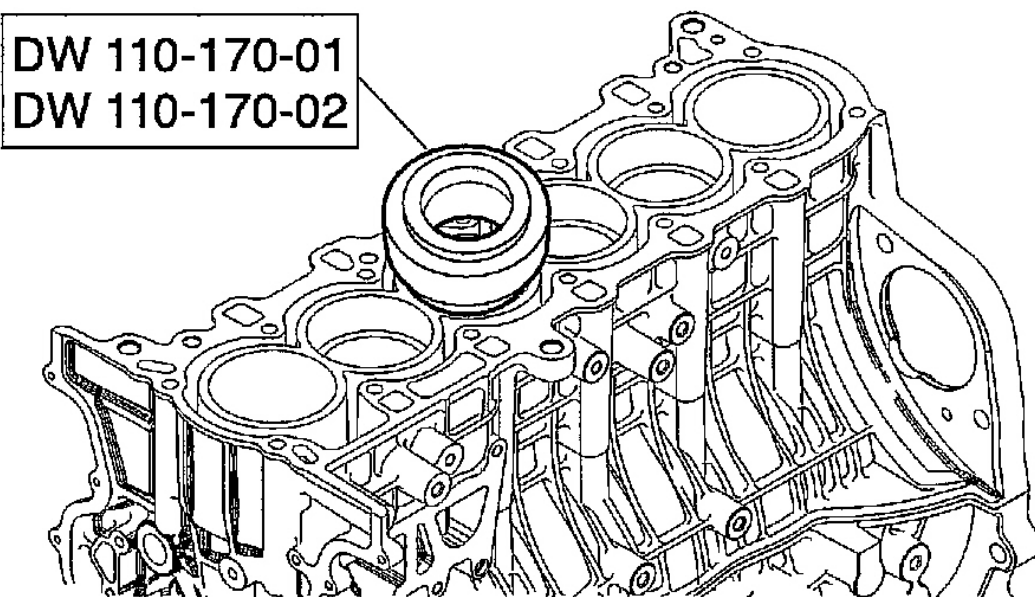


G01985750

Fig. 192: Installing Piston Rings

Courtesy of SUZUKI OF AMERICA CORP.

6. Install the piston using the piston ring compressor DW110-170-01 (2.0L) or DW110-170-02 (2.5L). Observe the installation order of the piston as follows: 2 -> 5 -> 1 -> 6 -> 3 -> 4 (piston number).

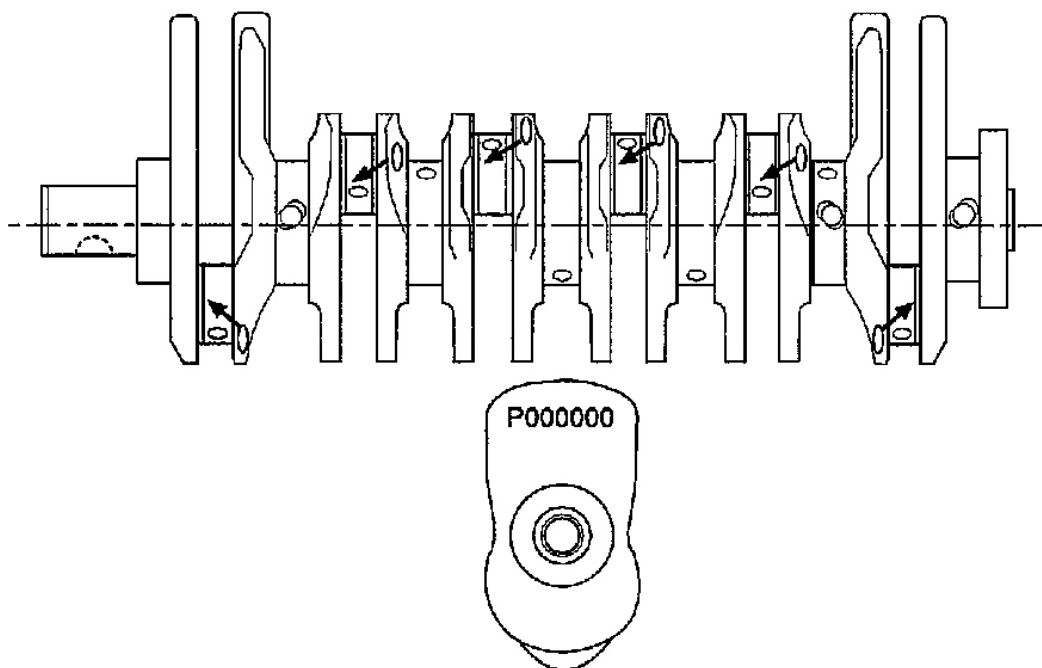


G01985751

Fig. 193: Installing Piston Using Piston Ring Compressor
Courtesy of SUZUKI OF AMERICA CORP.

7. Seat the connecting rod bearings and temporarily install the connecting rod cap.

NOTE: The sizes of the connecting rod bearings are identified by the color marks on the side of the bearing, which are green (Size-0) and yellow (Size-1).

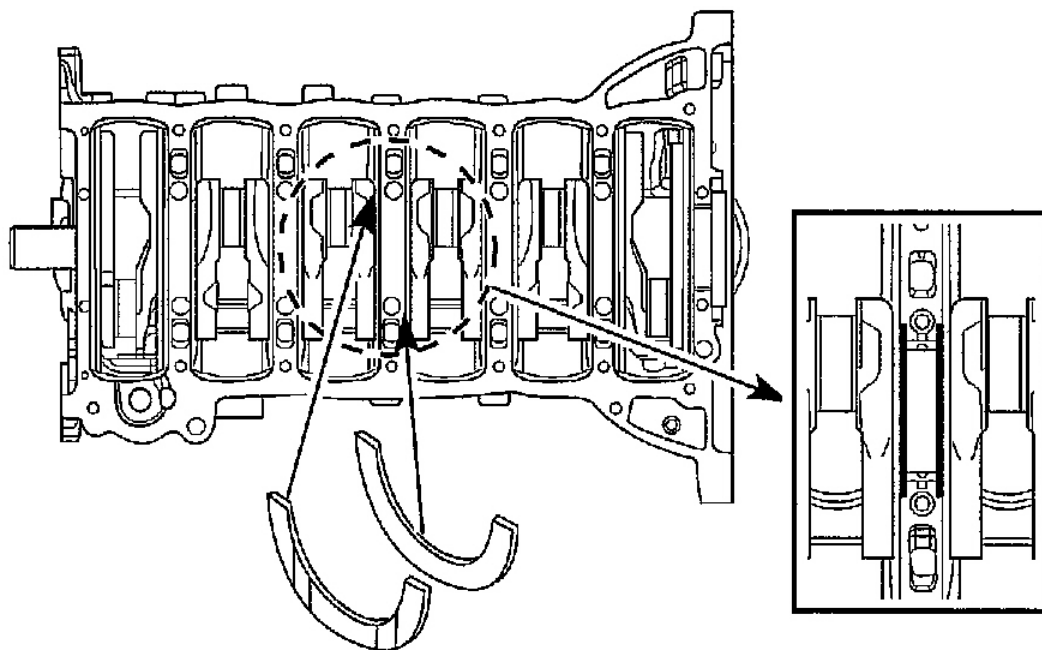


G01985752

Fig. 194: Seating Connecting Rod Bearings
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the thrust bearing.

NOTE: Make sure the oil groove on the thrust bearing is installed facing outside.



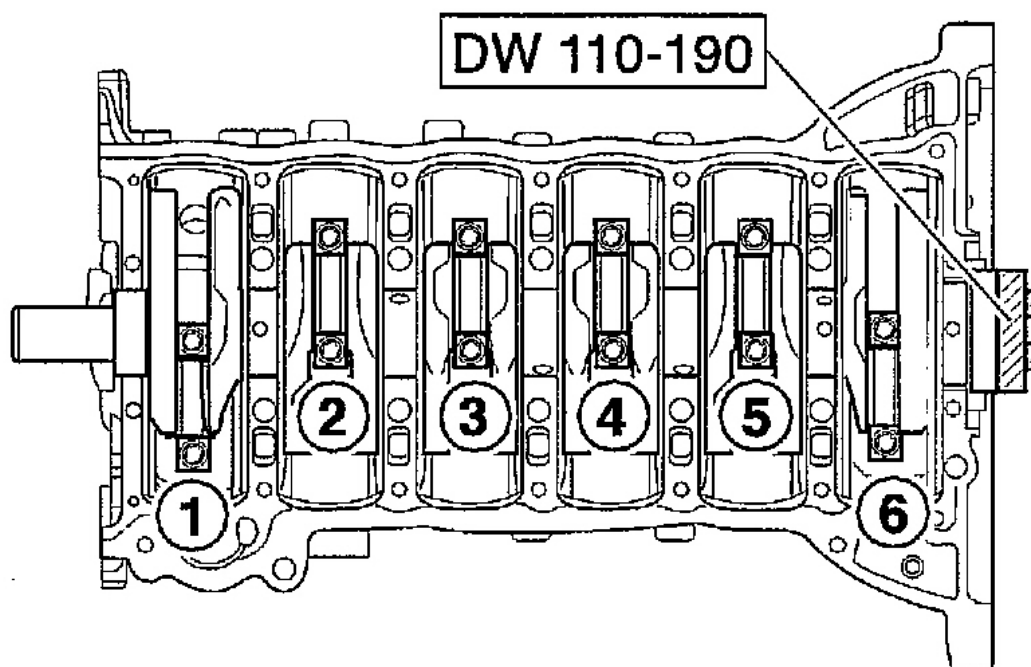
G01985753

Fig. 195: Installing Thrust Bearing
Courtesy of SUZUKI OF AMERICA CORP.

9. Tighten the connecting rod cap bolts using crankshaft adjuster DW110-190. Observe the tightening order of the connecting rod cap bolts as follows: 2 -> 5 -> 1 -> 6 -> 3 -> 4 (piston number).

Tighten

Tighten the connecting rod cap bolts to 200 N.m (148 lb-ft). After finishing the initial tightening, turn the bolts by 45° then another 90°.

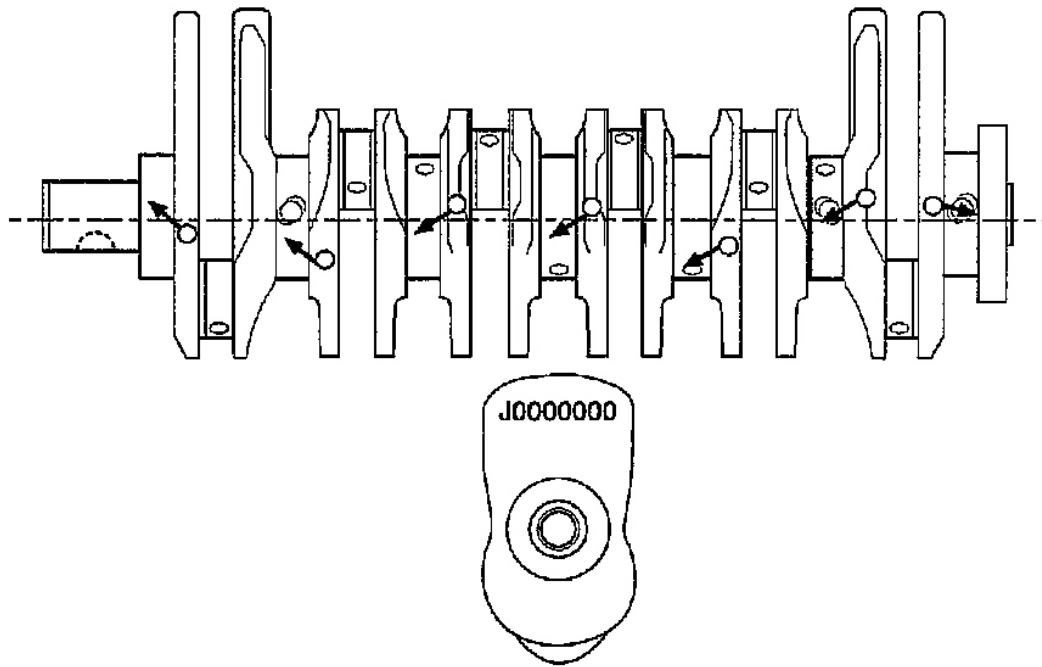


G01985754

Fig. 196: Tightening Connecting Rod Cap Bolts
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the lower crankshaft bearing.

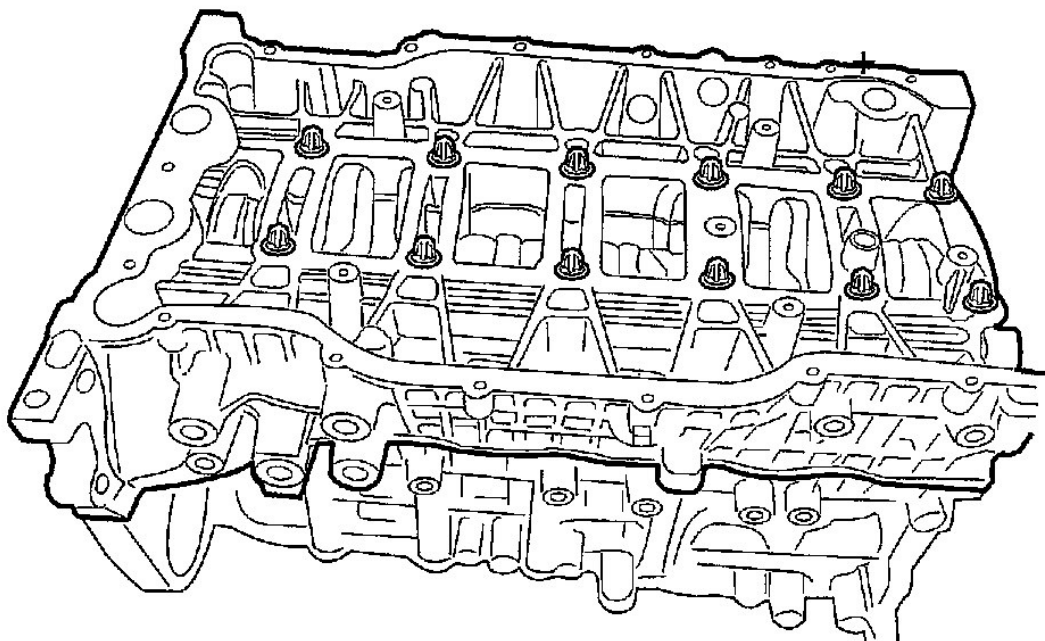
NOTE: The lower crankshaft bearings have different groove shape and the sizes of the crankshaft bearings are identified by the color marks on the side of the bearing, which are green (Size-0), yellow (Size-1), and pink (Size-2).



G01985755

Fig. 197: Installing Lower Crankshaft Bearing
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the bed plate. Refer to **Bed Plate Installation** .

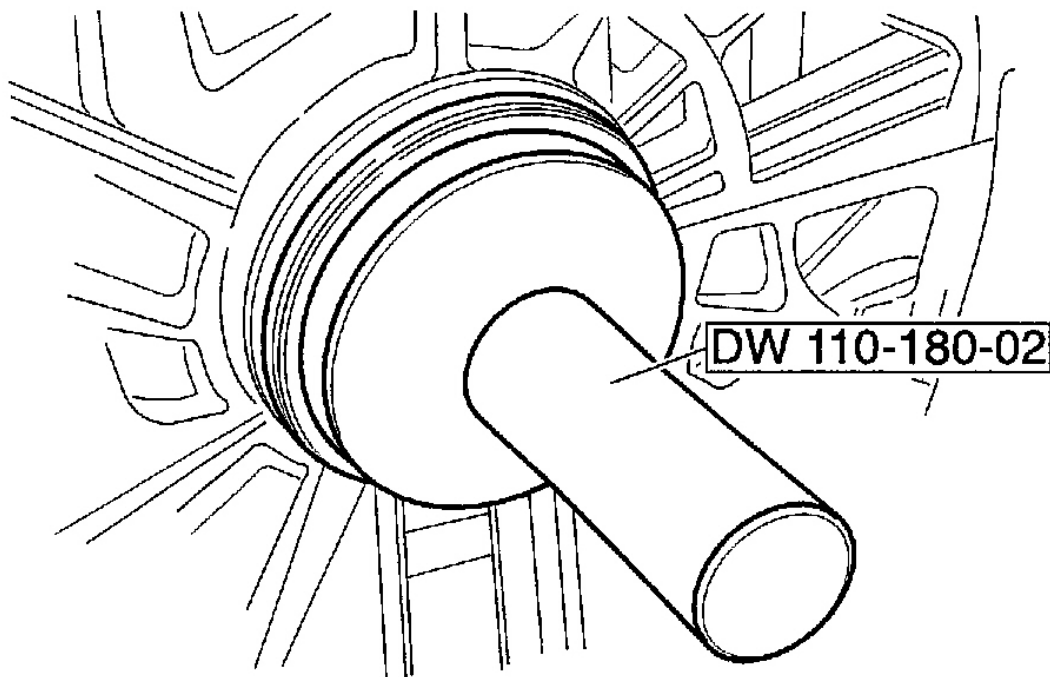


G01985756

Fig. 198: Installing Bed Plate

Courtesy of SUZUKI OF AMERICA CORP.

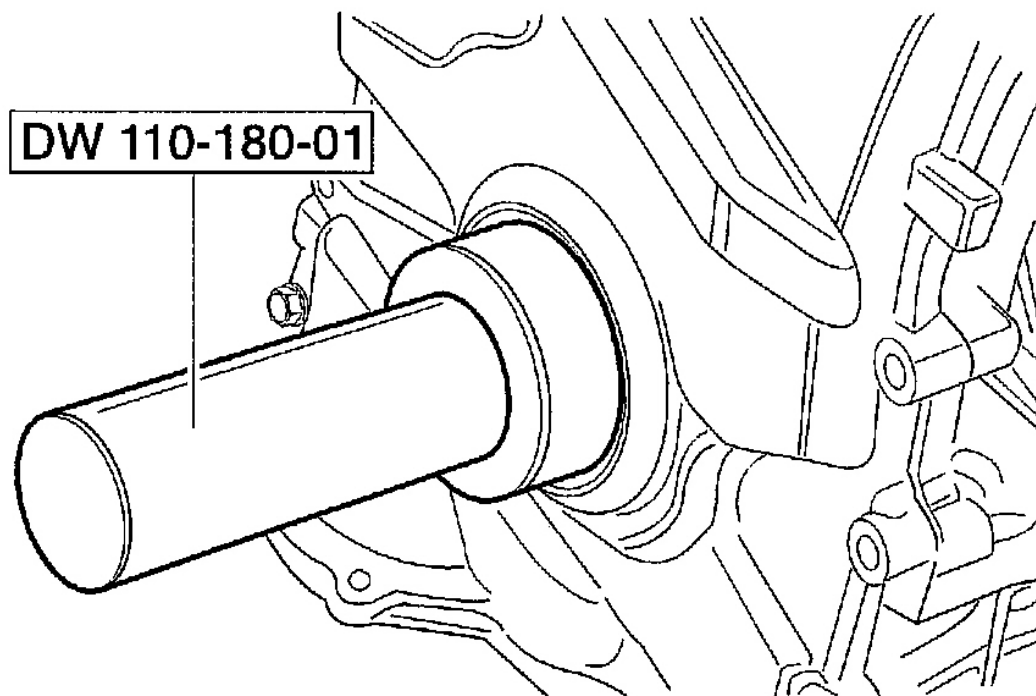
12. Seat and install the crankshaft rear oil seal using the crankshaft rear oil seal installer DW110-180-02.



G01985757

Fig. 199: Seating & Installing Crankshaft Rear Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

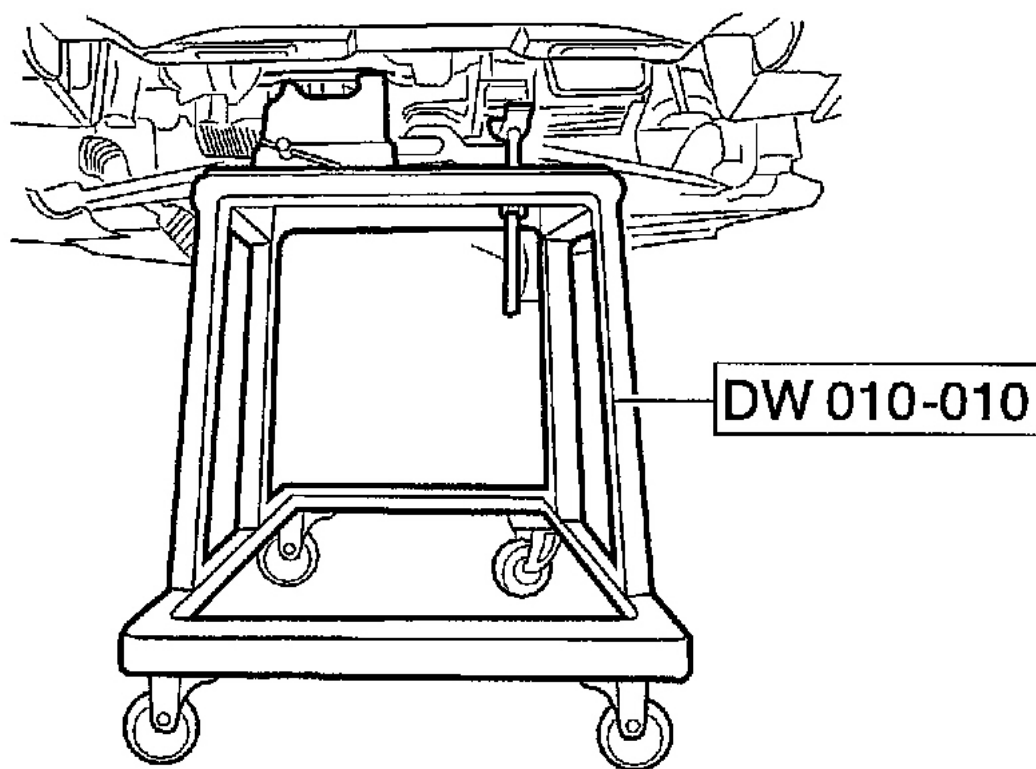
13. Install the cylinder head. Refer to **Cylinder Head Installation** .
14. Install the timing chain cover. Refer to **Timing Chain Installation** .
15. Install the crankshaft front oil seal using the crankshaft front oil seal installer DW110-180-01.



G01985758

Fig. 200: Installing Crankshaft Front Oil Seal
Courtesy of SUZUKI OF AMERICA CORP.

16. Install the cylinder head cover. Refer to **Cylinder Head Cover Installation** .
17. Install the intake manifold. Refer to **Intake Manifold Installation** .
18. Install the engine assembly. Refer to **Engine Assembly Installation** .



G01985759

Fig. 201: Installing Engine Assembly
 Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

Engine Specifications

Engine Specifications

Application	Description
General Data:	
Engine Type	6 Cylinder (In-Line)
Displacement	2,492 cm ³ (152 in ³)
Bore Stroke	77 x 89.2 mm (3.03 in x 3.51 in)
Compression Ratio	10.2:1
Firing Order	1-5-3-6-2-4
Cylinder Bore:	
Diameter	76.994~77.006 mm (3.0313~3.0317 in)

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Out of Round (Maximum)	0.01 mm (0.0004 in)
Cylinder Bore Taper (Maximum)	0.01 mm (0.0004 in)
Piston Protrusion	0.5 mm (0.0197 in)
Oversize (Measure Replacement Piston before Re-boring)	none
Block Face Distortion	0.007 mm (0.0003 in)
Piston:	
Diameter	76.970~76.998 mm (3.0303~3.0314 in)
Clearance to Bore	0.002~0.030 mm (0.00008~0.000178 in)
Piston Rings:	
Ring, End Gap, Top Compression	0.2~0.35 mm (0.00787~0.01378 in)
Ring, End Gap, Second Compression	0.35~0.5 mm (0.01378~0.01969 in)
Oil	0.2~0.7 mm (0.00787~0.02756 in)
Piston Pin:	
Diameter	18.995~19.000 mm (0.74783~0.74803 in)
Pin Offset	0.6 mm (0.02362 in.)
Clearance: In Piston	0.009~0.019 mm (0.00035~0.00075 in)
Clearance: In Rod	Interference Fit in Rod (-0.010 ~ -0.025 mm)
Length	55.7~56.0 mm (2.193~2.205 in)
Camshaft:	
Lift - Intake	10 mm (0.39 in)
Lift - Exhaust	9 mm (0.35 in)
Camshaft Cap to Bearing Journal Clearance	0.03~0.071 mm (0.00118~0.00280 in)
Bearing Journal OD	24.95~24.97 mm (0.98228~0.98307 in)
Crankshaft:	
Main Journal - Diameter (All)	57.980~58.000 mm (2.2827~2.2835 in)
Main Journal - Radial Run out (Shaft Support on No. 1 and No. 7 Bearings Measured at No. 4 Journal)	0.06 mm (0.00236 in)
Main Bearing Clearance (All)	0.019~0.049 mm (0.00075~0.000193 in)
End Play	0.055~0.265 mm (0.002~0.010 in)
Service Oversize, Available in 2 sizes	Not Necessary
Connecting Rod Journal:	
Diameter (All)	47.2~47.212 mm (1.8583~1.8587 in)
Out of Round (Maximum)	0.008 mm (0.00031 in)
Rod Bearing Play	0.080~0.260 mm (0.00315~0.01024 in)
Rod Bearing Clearance	0.031~0.065 mm (0.00122~0.00256 in)
Cylinder Head:	
Valve Stem Protrusion	27 mm (1.063 in)
Valve Guide Height	11.7~12.0 mm (0.46063~0.47244 in)
Overall Height	128.2~128.4 mm (5.04724~5.05512 in)
Minimum Overall Height After Machining	128.1 mm (5.04331 in)

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Valve System:

Valve Lash Compensators	Hydraulic
Seat Run Out (Maximum, All)	0.05 mm (0.00197 in)
Face Run Out (Maximum, All)	0.03 mm (0.00118 in)
Valve Stem Diameter Intake	5.465~5.479 mm (0.21516~0.21571 in)
Valve Stem Diameter Exhaust	5.465~5.470 mm (0.21480~0.21535 in)
Valve Diameter Intake	30.1~30.3 mm (1.18504~1.19291 in)
Valve Diameter Exhaust	25.7~25.9 mm (1.01181~1.01969 in)
Valve Seat Width Intake	1.0~1.4 mm (0.03937~0.05512 in)
Valve Seat Width Exhaust	1.4~1.8 mm (0.05512~0.07087 in)
Valve Face Angle	90° ~ 90°40'
Valve Seat Angle	89.5°~90°
Valve Guide Inside Diameter	5.5~5.512 mm (0.21654~0.21701 in)

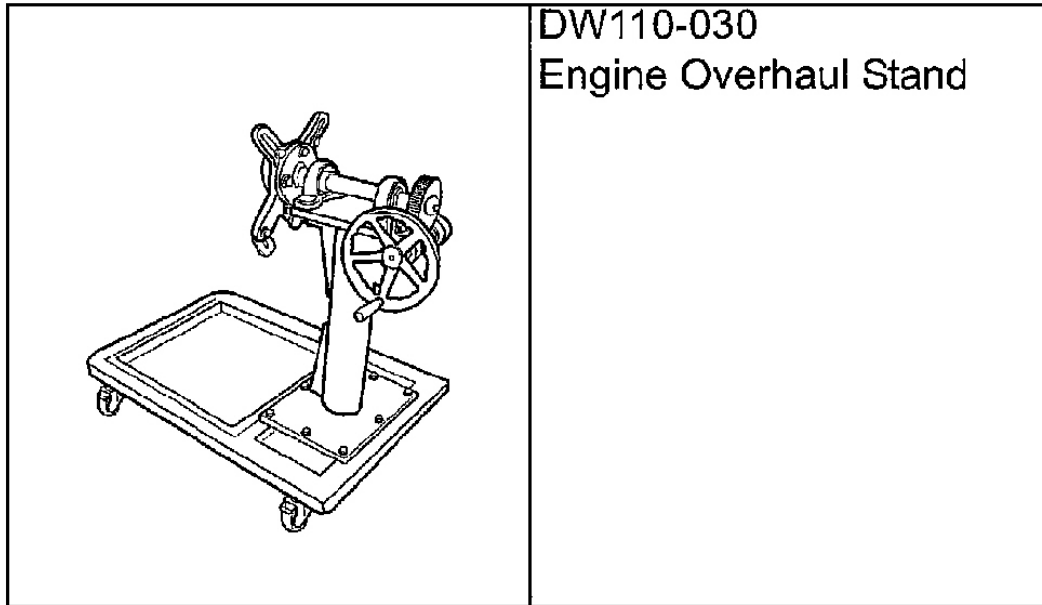
Oil Pump:

Outer Gear to Body	0.1~0.19 mm (0.00394~0.00748 in)
Outer Gear to Crescent	0.02~0.07 mm (0.00079~0.00276 in)
Inner Gear to Crescent	0.02~0.07 mm (0.00079~0.00276 in)
End Clearance (TIP clearance)	0.02~0.16 mm (0.00079~0.00630 in)

Sealants and Adhesives:

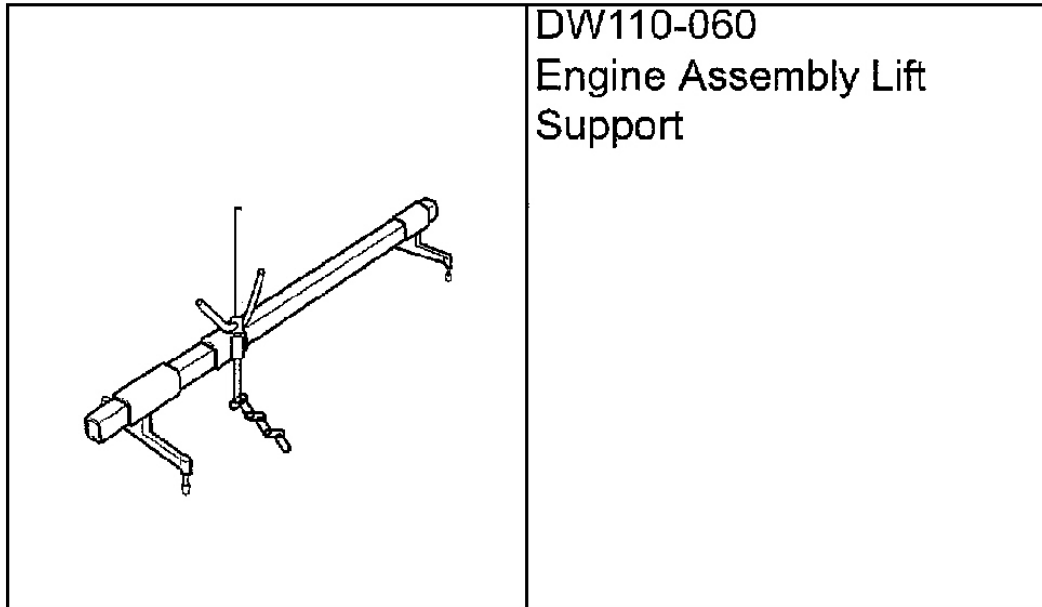
Oil Pan Bolts (Oil pan x Bed plate)	Loctite® 5900
Oil Gallery Plug	Loctite® 242
Coolant Jacket Caps and Plugs (Freeze Plugs)	Dry seal-lock coated in plug

SPECIAL TOOLS AND EQUIPMENT**Special Tool**



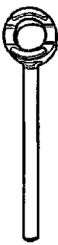
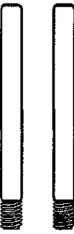
G01985765

Fig. 202: Identifying Special Tools (1 Of 5)
Courtesy of SUZUKI OF AMERICA CORP.



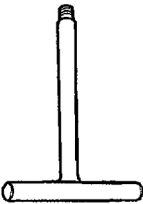
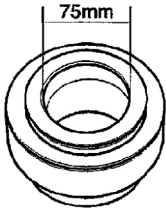
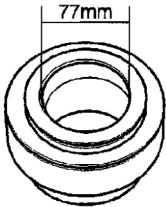
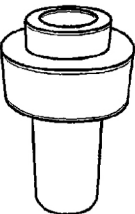
G01985766

Fig. 203: Identifying Special Tools (2 Of 5)
Courtesy of SUZUKI OF AMERICA CORP.

	DW110-130-01 Crankshaft Pulley Holder
	DW110-130-02 Crankshaft Pulley Installer/Remover
	DW110-140 Timing Chain Cover Install Guide Pin
	DW110-150 Camshaft Sprocket Holder

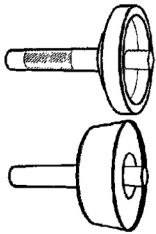
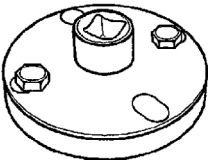
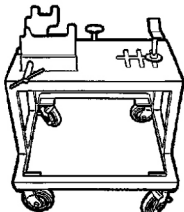
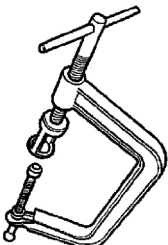
G01985767

Fig. 204: Identifying Special Tools (3 Of 5)
Courtesy of SUZUKI OF AMERICA CORP.

	DW110-160 Rocker Arm Shaft Installer/Remover
	DW110-170-01 Piston Ring Compressor (2.0L)
	DW110-170-02 Piston Ring Compressor (2.5L)
	DW110-180-01 Crankshaft Front Oil Seal Installer

G01985768

Fig. 205: Identifying Special Tools (4 Of 5)
Courtesy of SUZUKI OF AMERICA CORP.

	DW110-180-02 Crankshaft Rear Oil Seal Installer
	DW110-190 Crankshaft Adjuster
	DW010-010 Power Pack Stand
	09916-14510 Valve Lifter 09916-48210 Valve Lifter Attachment

G01985769

Fig. 206: Identifying Special Tools (5 Of 5)
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE LUBRICATION SYSTEM

GENERAL DESCRIPTION

Oil Pan Description

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

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

Oil Pump Description

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or other engine components. When the crankshaft rotates, the oil pump driven gear rotates. This causes the space between the gears to open and narrow continually, pulling oil in from the oil pan when the space opens, and pumping the oil out to the engine as the space narrows. At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and a valve keep the bypass closed, directing all of the pumped oil to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the relief valve and drain back to the oil pan.

DIAGNOSTIC INFORMATION AND PROCEDURES

Oil Pressure Test

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
1	Is low or no oil pressure indicated?	-	Go to Step 2.	System OK
2	Check the oil level in the crankcase. Is the level low?	-	Go to Step 3.	Go to Step 4.
3	Add oil so that the oil level is up to the full mark on the indicator. Is the repair complete?	-	Go to Step 1.	-
4	Check the idle speed. Is the idle speed below the value specified?	850 rpm	Go to Step 5.	Go to Step 6.
5	Increase the idle speed. Is the speed increased?	-	Go to Step 1.	-
6	Inspect the oil pressure switch. Is the oil pressure switch incorrect or malfunctioning?	-	Go to Step 7.	Go to Step 8.
7	Install a new oil pressure switch. Is the repair complete?	-	Go to Step 1.	-
8	Inspect the oil pressure gauge on the cluster. Is the oil pressure gauge incorrect or malfunctioning?	-	Go to Step 9.	Go to Step 10.
9	Install a new oil pressure gauge. Is the repair complete?	-	Go to Step 1.	-
10	Inspect the engine oil. Is the engine oil in the crankcase diluted or of the improper viscosity?	-	Go to Step 11.	Go to Step 12.
11	Install new engine oil of the proper viscosity for the expected temperatures. Is the repair complete?	-	Go to Step 1.	-
12	Inspect the oil pump. Is the pump worn or dirty?	-	Go to Step 13.	Go to Step 14.
13	Replace the oil pump. Is the repair complete?	-	Go to Step 1.	-

G01985770

Fig. 207: Oil Pressure Test Chart (1 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Step	Action	Value(s)	Yes	No
14	Inspect the oil filter. Is the oil filter plugged?	-	Go to Step 15.	Go to Step 16.
15	Install a new oil filter. Is the repair complete?	-	Go to Step 1.	-
16	Inspect the oil pickup screen. Is the oil pickup screen loose or plugged?	-	Go to Step 17.	Go to Step 18.
17	Tighten or replace the oil pickup screen as necessary. Is the repair complete?	-	Go to Step 1.	-
18	Inspect the oil pickup tube. Are there any holes in the oil pickup tube?	-	Go to Step 19.	Go to Step 20.
19	Replace the oil pickup tube. Is the repair complete?	-	Go to Step 1.	-
20	Inspect the bearing clearances. Are the bearing clearances more than the values specified?	Crankshaft 0.06 mm (0.00236 in.) Connecting Rod 0.031 - 0.065 mm (0.00122 - 0.00256 in.)	Go to Step 21.	Go to Step 22.
21	Replace the bearing, if necessary. Is the repair complete?	-	Go to Step 1.	-
22	Inspect the oil galleries. Are the oil galleries cracked, porous, or plugged?	-	Go to Step 23.	Go to Step 24.
23	Repair or replace the engine block. Is the repair complete?	-	Go to Step 1.	-
24	Inspect the gallery plugs. Are any of the gallery plugs missing or installed properly?	-	Go to Step 25.	Go to Step 26.
25	Install the plugs or repair as necessary. Is the repair complete?	-	Go to Step 1.	-
26	Inspect the camshaft. Is the camshaft worn or is there evidence of poor machining?	-	Go to Step 27.	System OK
27	Replace the camshaft. Is the repair complete?	-	Go to Step 1.	-

G01985771

Fig. 208: Oil Pressure Test Chart (2 Of 2)
Courtesy of SUZUKI OF AMERICA CORP.

Oil Leak Diagnosis

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

Finding the Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, power steering fluid, etc.
2. Identify where the fluid is leaking from.
 1. After running the vehicle at normal operating temperature, park the vehicle over a large sheet of paper.
 2. Wait a few minutes.
 3. You should be able to find the approximate location of the leak by the drippings on the paper.
3. Visually check around the suspected component. Check around all the gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.

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

Powder Method

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

Black Light and Dye Method

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

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

Repairing the Leak

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

Gaskets

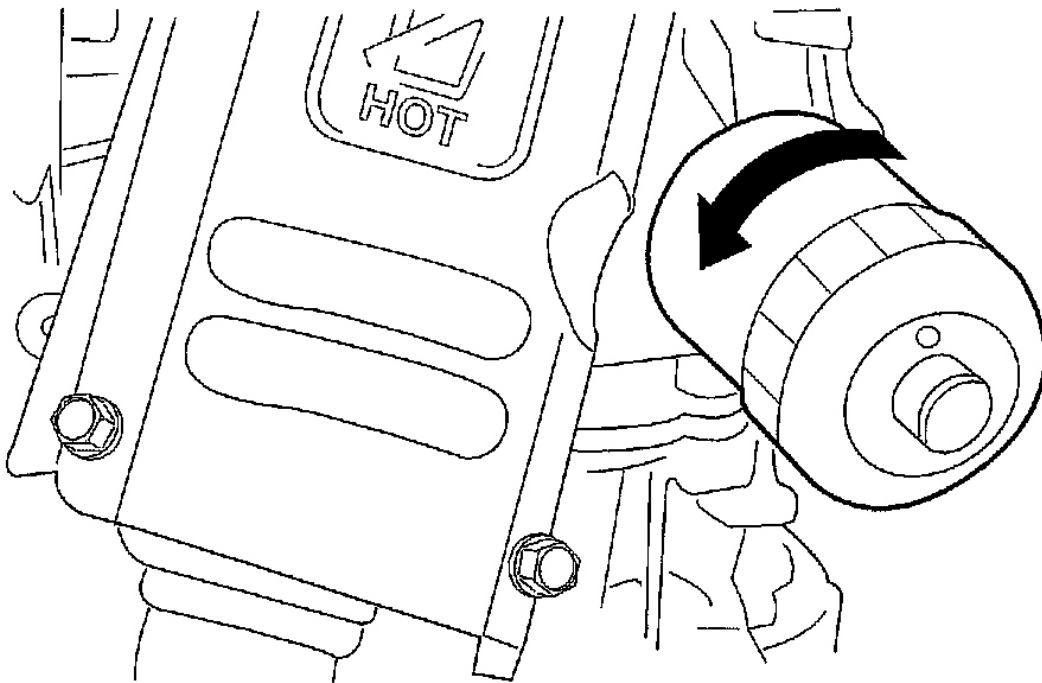
- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The fasteners are tightened improperly or the threads are dirty or damaged.
- The flanges or the sealing surface is warped.
- There are scratches, burrs or other damage to the sealing surface.
- The gasket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

Seals

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

REPAIR INSTRUCTIONS**Oil Filter / Oil Filter Adapter Removal**

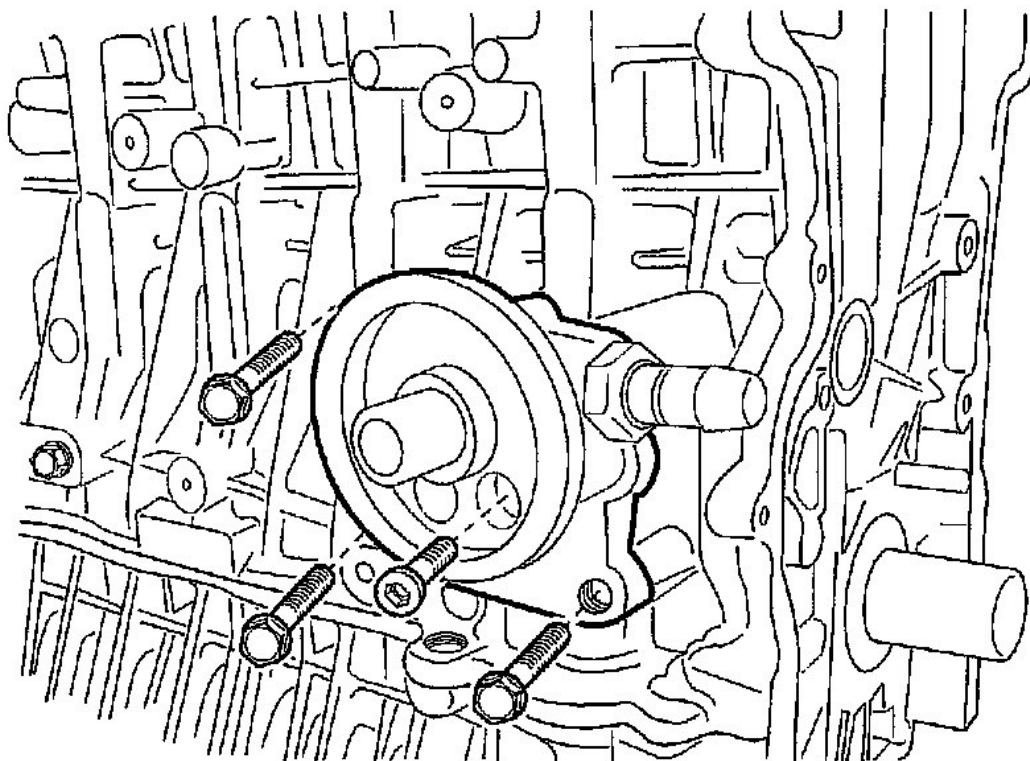
1. Disconnect the negative battery cable.
2. Remove the oil filter.



G01985772

Fig. 209: Removing Oil Filter
Courtesy of SUZUKI OF AMERICA CORP.

3. Remove the oil filter adapter retaining bolts and oil filter adapter.



G01985773

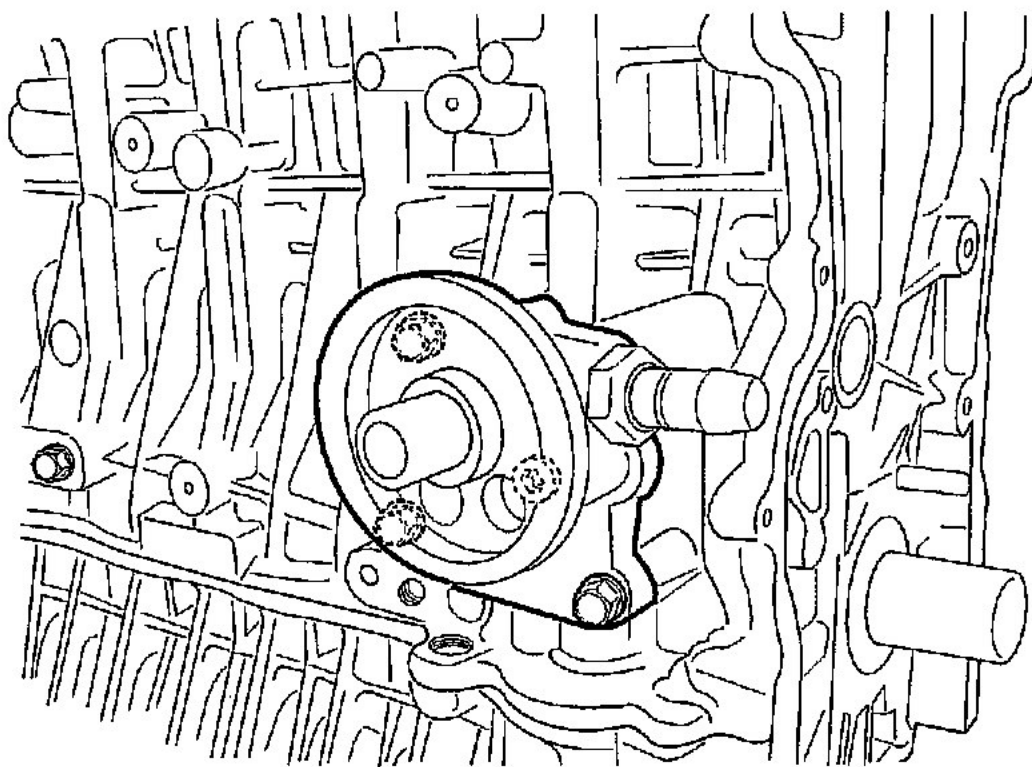
Fig. 210: Removing Oil Filter Adapter Retaining Bolts & Oil Filter Adapter
Courtesy of SUZUKI OF AMERICA CORP.

Oil Filter / Oil Filter Adapter Installation

1. Installation should follow the removal procedure in the reverse order.
2. Install the oil filter adapter.

Tighten

Tighten the oil filter adapter retaining bolts to 20-26 N.m (15-19 lb-ft).

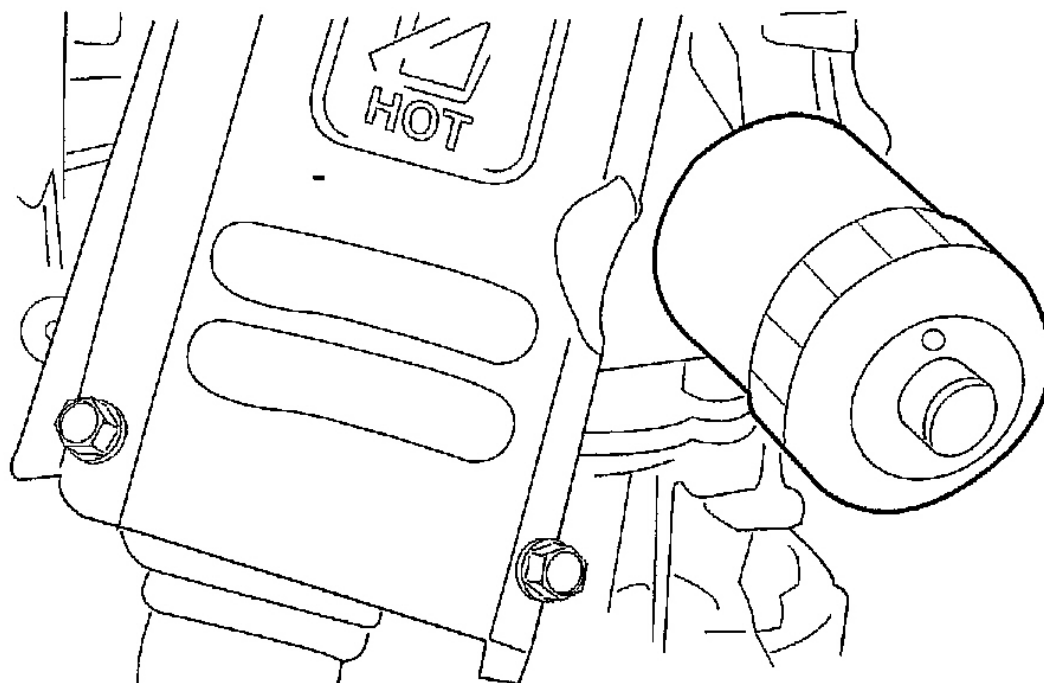


G01985774

Fig. 211: Installing Oil Filter Adapter
Courtesy of SUZUKI OF AMERICA CORP.

3. Install the oil filter.
 - i. **Tighten**

Tighten the oil filter to 12-16 N.m (9-12 lb-ft).



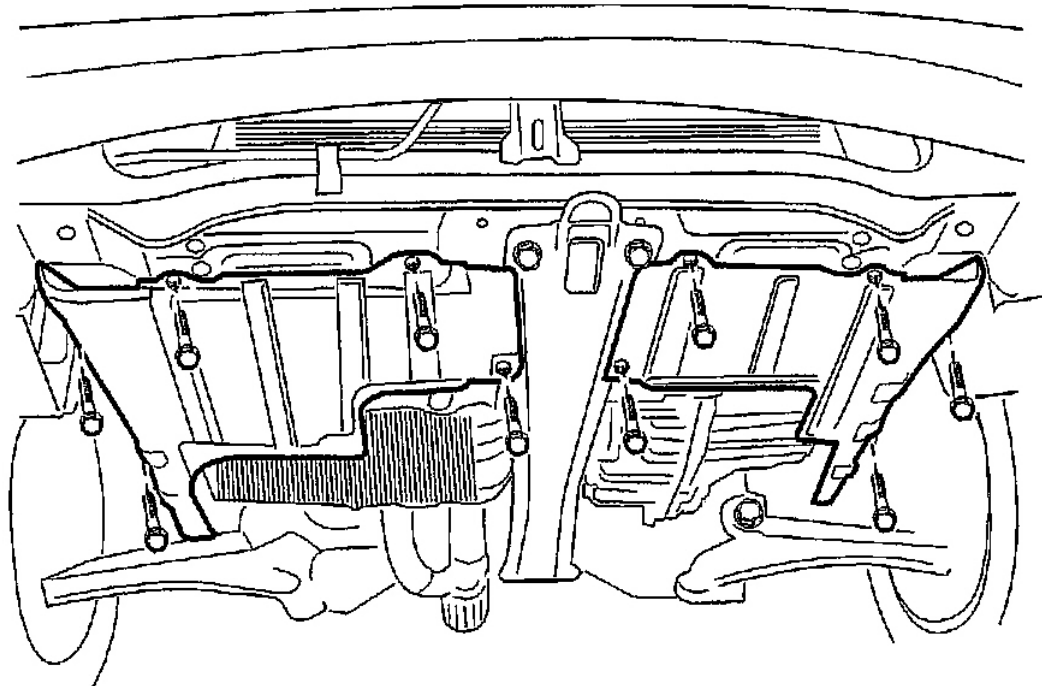
G01985775

Fig. 212: Installing Oil Filter

Courtesy of SUZUKI OF AMERICA CORP.

Oil Pan / Oil Pump Removal

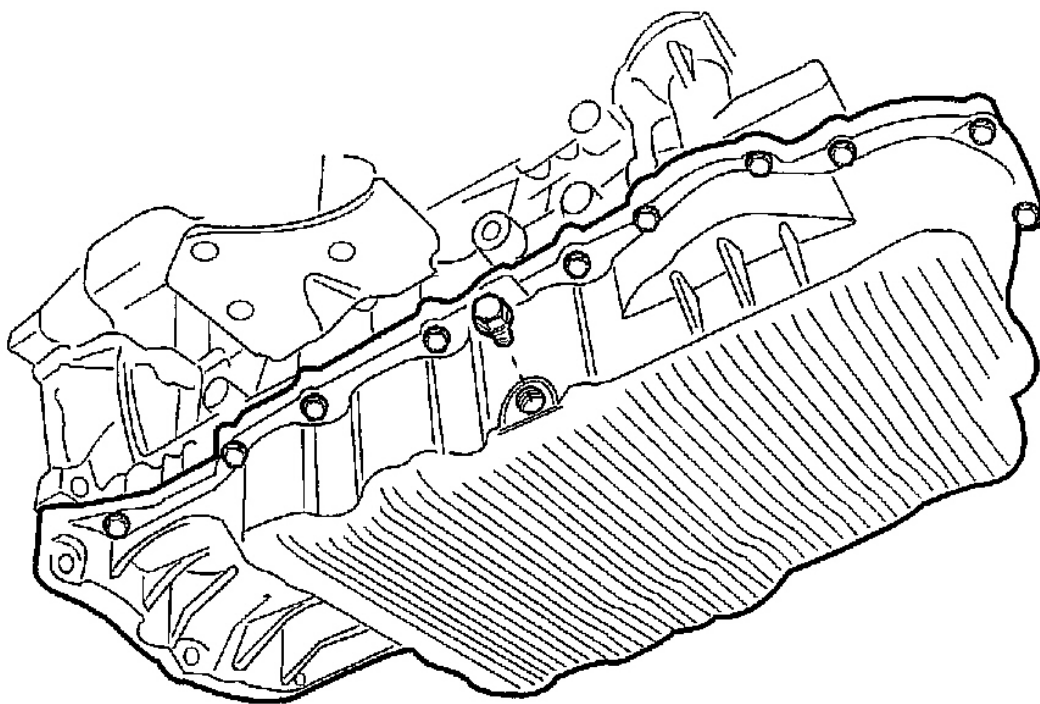
1. Disconnect the negative battery cable.
2. Remove the engine under cover.



G01985776

Fig. 213: Removing Engine Under Cover
Courtesy of SUZUKI OF AMERICA CORP.

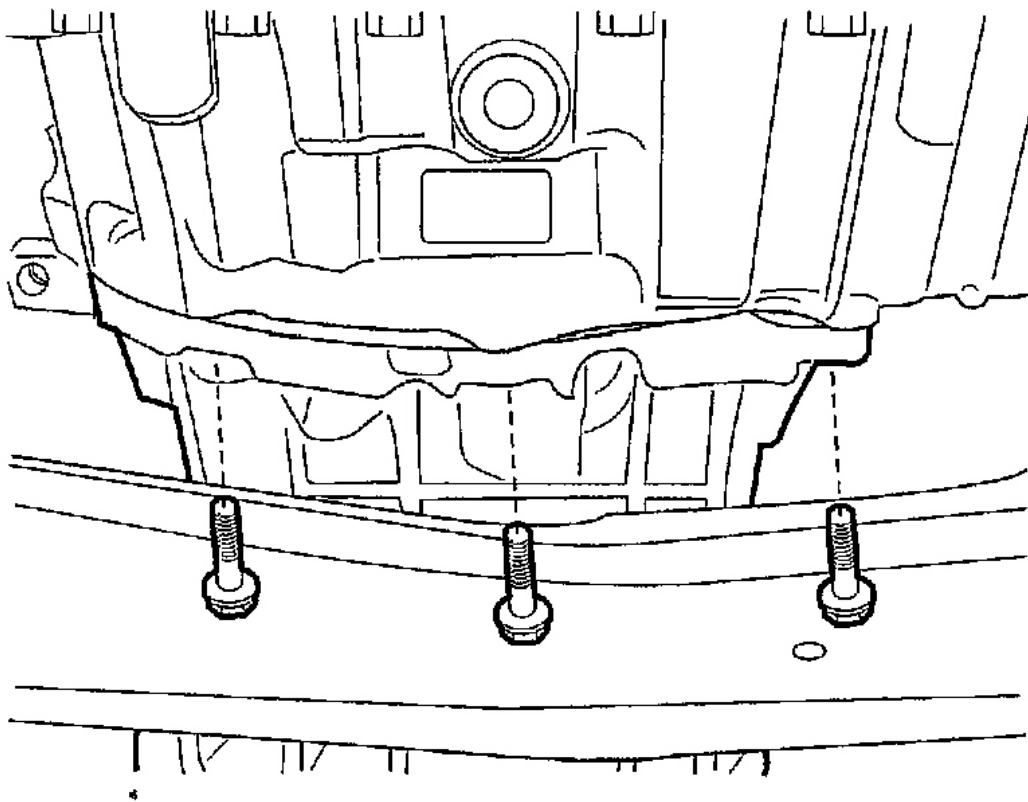
3. Remove the oil pan drain plug and drain the engine oil.



G01985777

Fig. 214: Removing Oil Pan Drain Plug & Drain Engine Oil
Courtesy of SUZUKI OF AMERICA CORP.

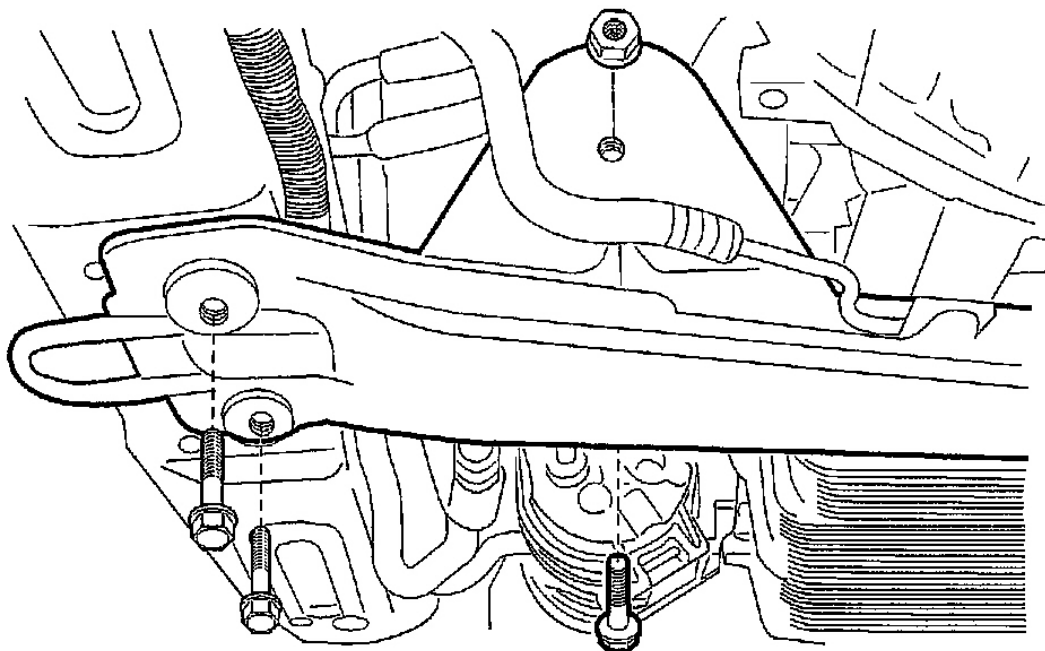
4. Remove the oil pan flange-to-transaxle bolts.



G01985778

Fig. 215: Removing Oil Pan Flange-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

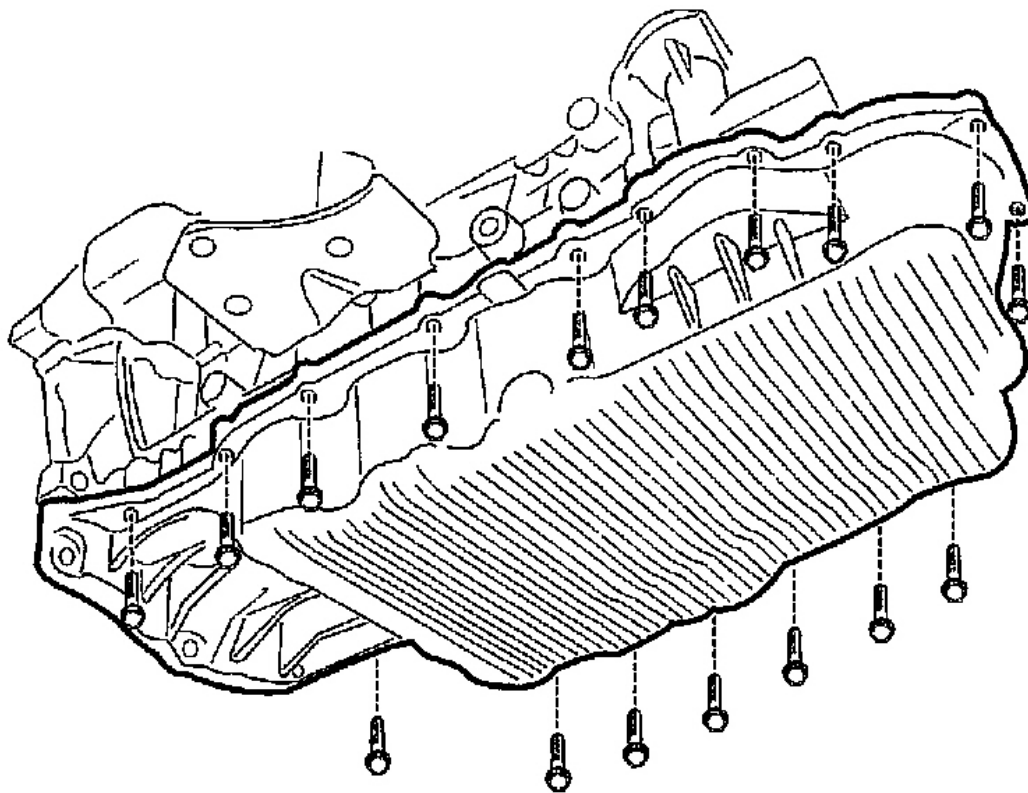
5. Remove the front engine mount bracket-to-damper bush bolt.
6. Remove the center front suspension member bolts.



G01985779

Fig. 216: Removing Center Front Suspension Member Bolts
Courtesy of SUZUKI OF AMERICA CORP.

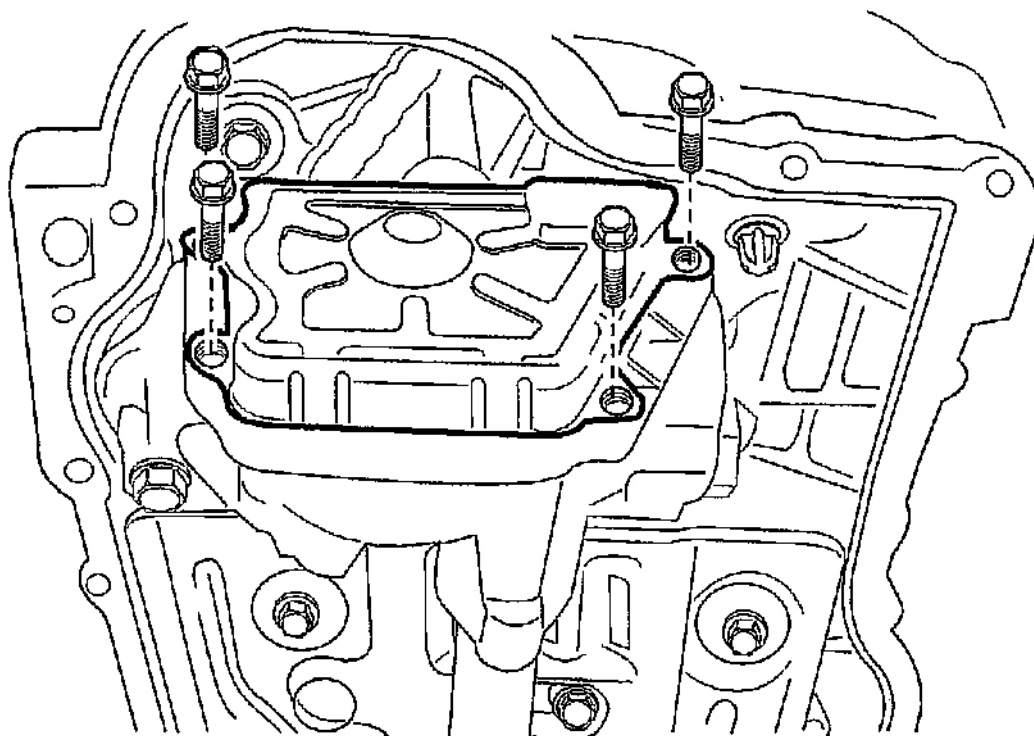
7. Remove the oil pan retaining bolts and the oil pan.



G01985780

Fig. 217: Removing Oil Pan Retaining Bolts & Oil Pan
Courtesy of SUZUKI OF AMERICA CORP.

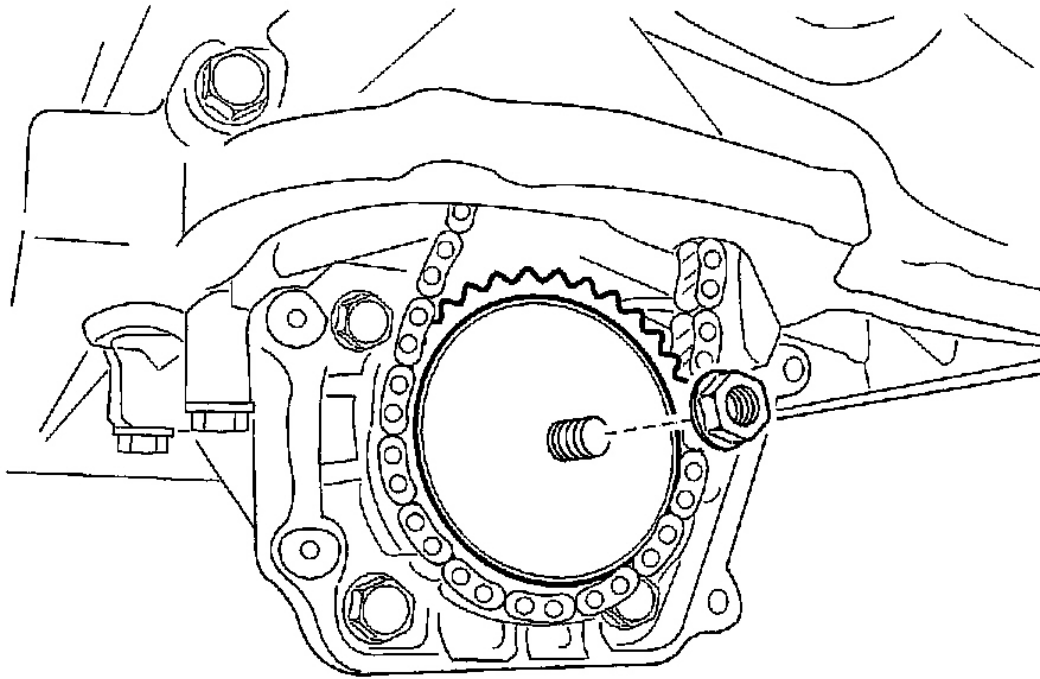
8. Remove the oil pump sprocket cover bolts and the oil pump sprocket cover.



G01985781

Fig. 218: Removing Oil Pump Sprocket Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

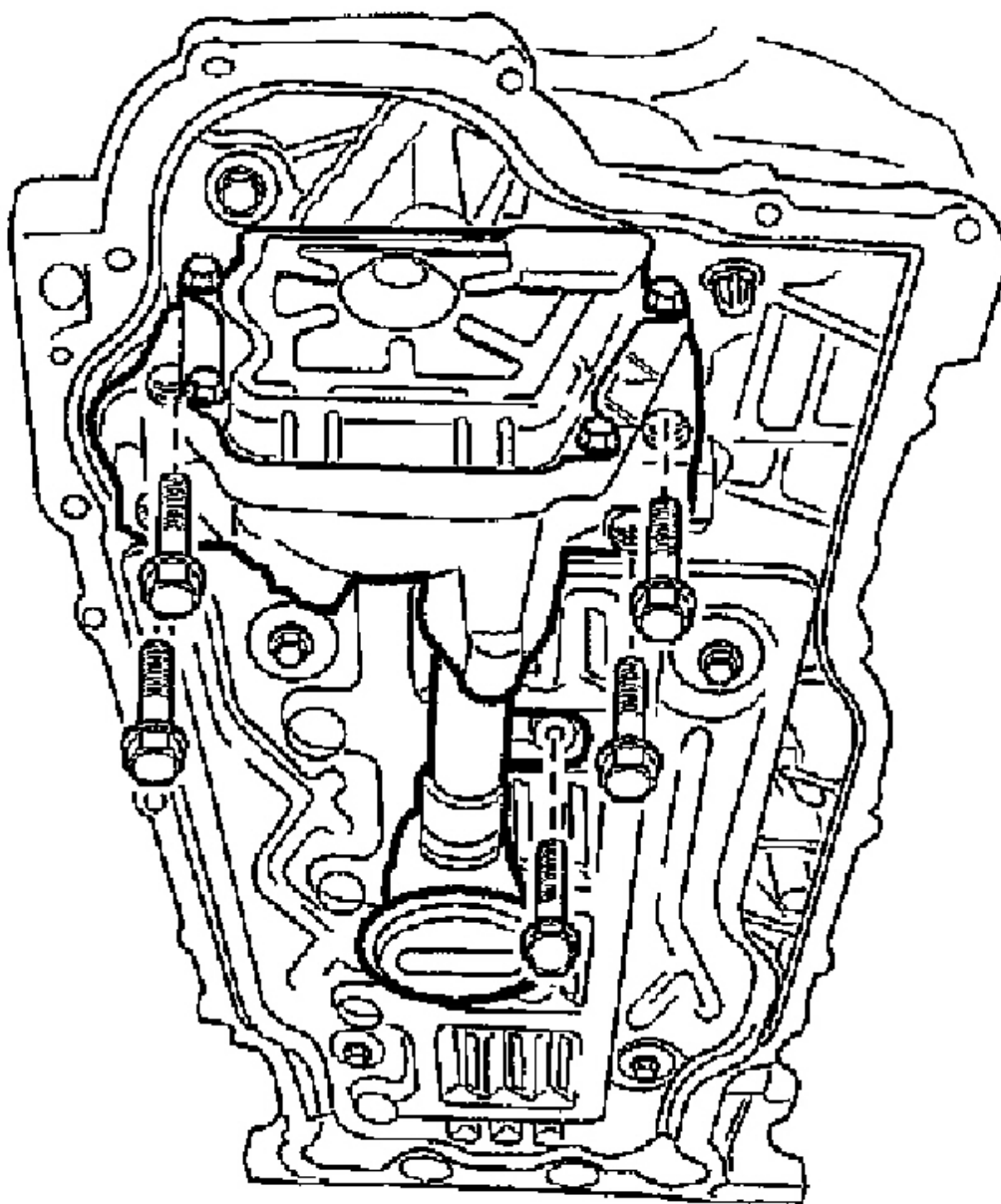
9. Remove the oil pump sprocket retaining nut and the oil pump sprocket.



G01985782

Fig. 219: Removing Oil Pump Sprocket Retaining Nut
Courtesy of SUZUKI OF AMERICA CORP.

10. Remove the oil suction pipe bracket bolt.
11. Remove the four (4) oil pump retaining bolts and the oil pump.
12. Remove the oil ring from the oil pump.
13. Remove the two (2) oil suction pipe-to-oil pump retaining bolts.
14. Remove the oil suction pipe gasket.



G01985783

Fig. 220: Removing Oil Suction Pipe Gasket
Courtesy of SUZUKI OF AMERICA CORP.

Oil Pan / Oil Pump Installation

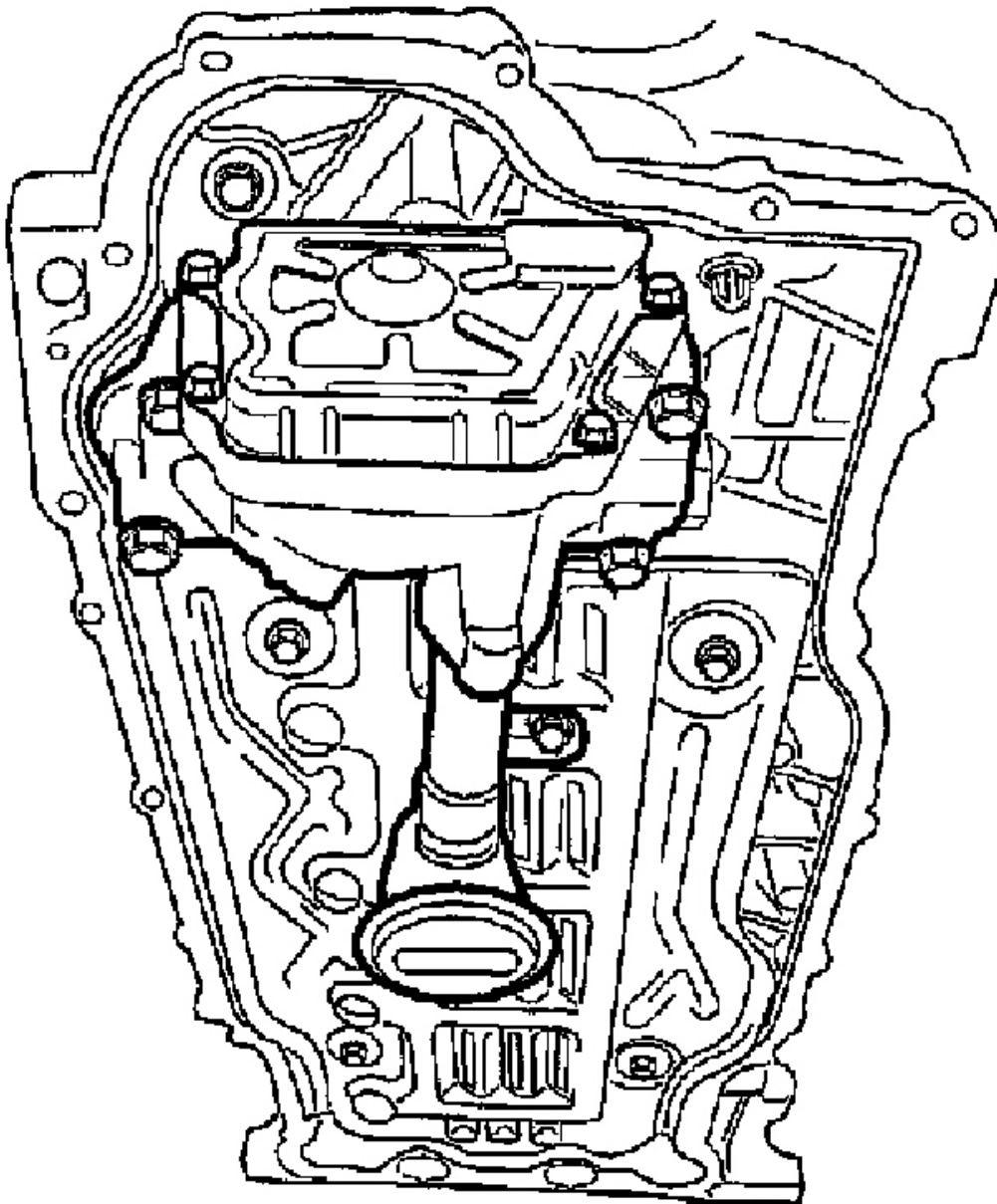
1. Installation should follow the removal procedure in the reverse order.
2. Discard used oil pump oil ring and install new one.
3. Tighten the oil suction pipe-to-oil pump retaining bolts, oil suction pipe bracket bolt, and the oil pump retaining bolt.

Tighten

Tighten the oil suction pipe-to-oil pump retaining bolts to 8-12 N.m (106-124 lb-in).

Tighten the oil suction pipe bracket bolt to 8-12 N.m (106-124 lb-in).

Tighten the oil pump retaining bolts to 18-22 N.m (13-16 lb-ft).



G01985784

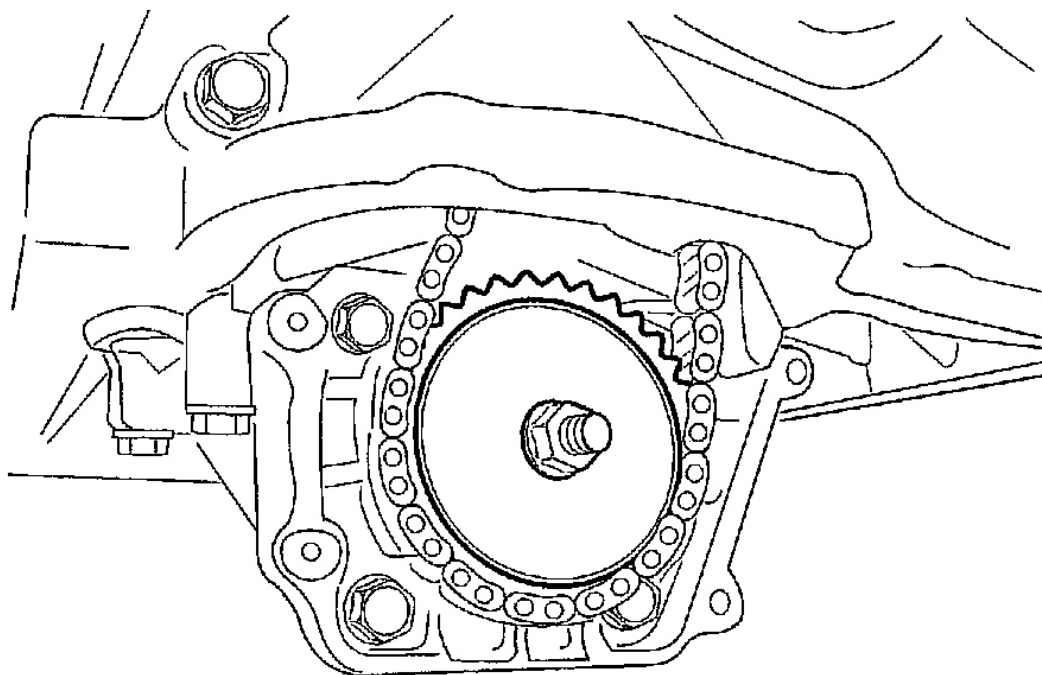
Fig. 221: Tightening Oil Suction Pipe-To-Oil Pump Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Install the oil pump sprocket.

NOTE: Make sure that the dotted surface on the sprocket faces toward the oil pump.

Tighten

Tighten the oil pump sprocket retaining nut to 18-22 N.m (13-16 lb-ft).



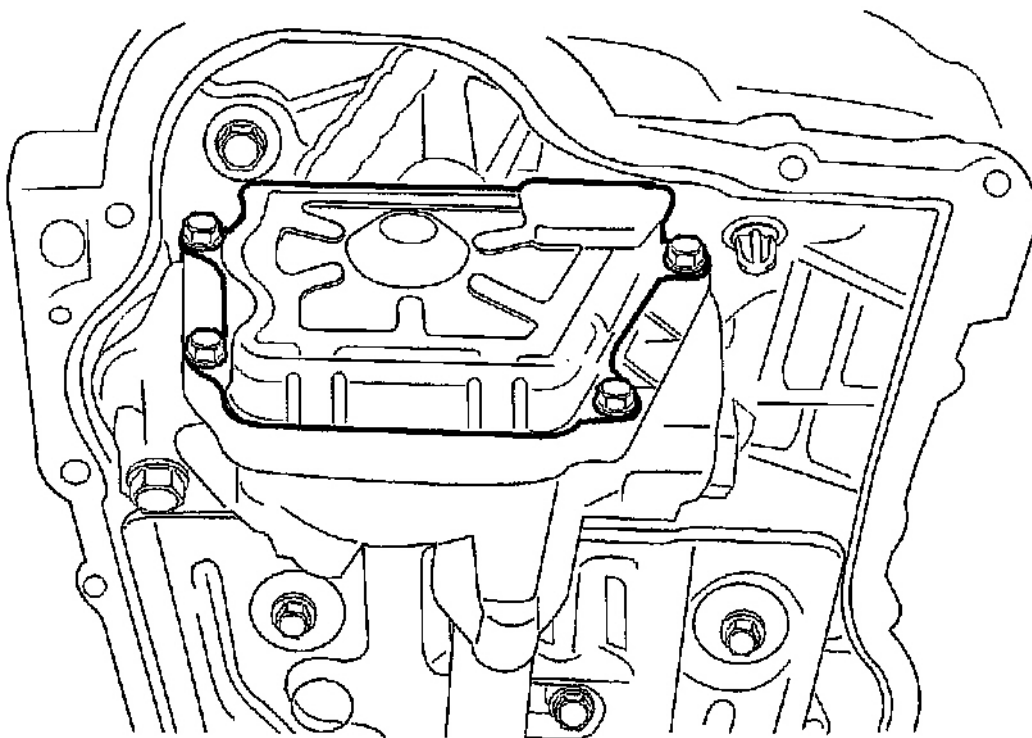
G01985785

Fig. 222: Installing Oil Pump Socket
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the oil pump sprocket cover.

Tighten

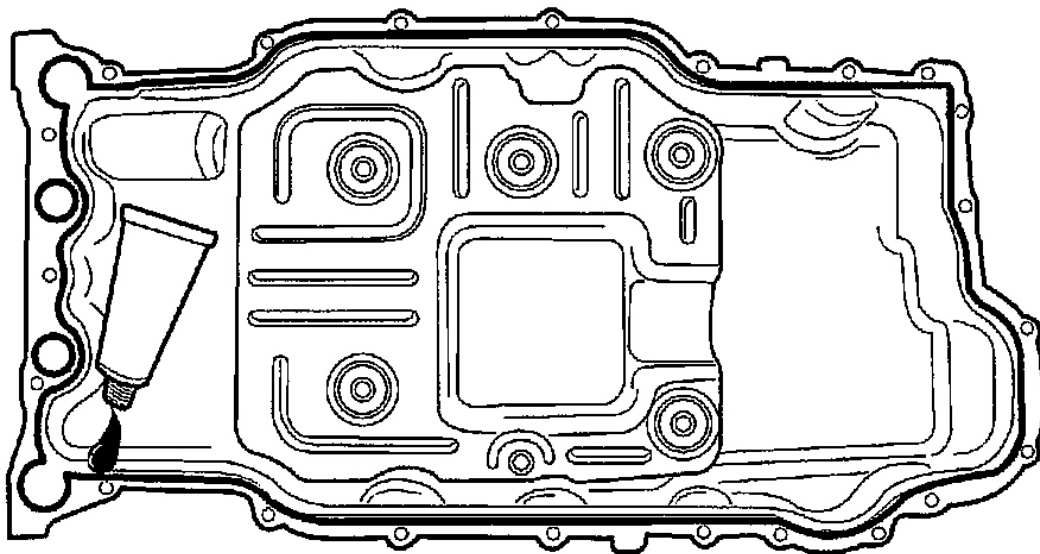
Tighten the oil pump sprocket cover retaining bolts to 5-7 N.m (44-62 lb-in).



G01985786

Fig. 223: Installing Oil Pump Sprocket Cover
Courtesy of SUZUKI OF AMERICA CORP.

6. After cleaning the remaining liquid gasket and oil, apply new liquid gasket (Loctite® 5900 - M8585) on the oil pan.



G01985787

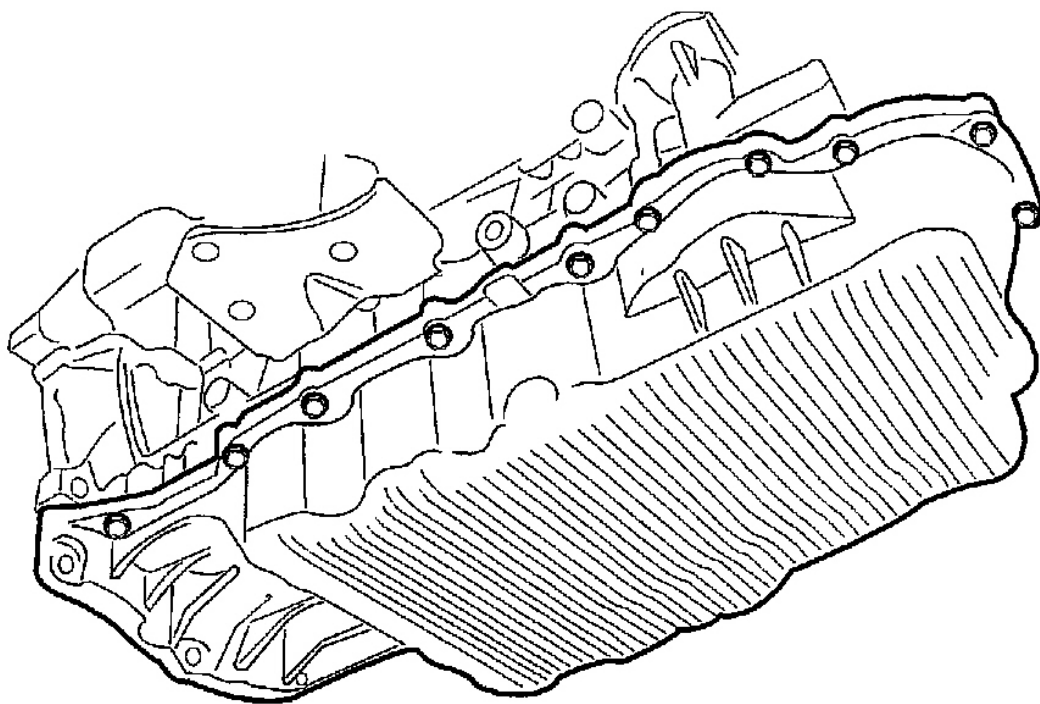
Fig. 224: Applying Liquid Gasket On Oil Pan

Courtesy of SUZUKI OF AMERICA CORP.

7. After cleaning the remaining liquid gasket and oil on the bed plate flange, install the oil pan.

Tighten

Tighten the oil pan retaining bolts to 8-12 N.m (71-106 lb-in).



G01985788

Fig. 225: Installing Oil Pan

Courtesy of SUZUKI OF AMERICA CORP.

8. Tighten the center front suspension member bolts.

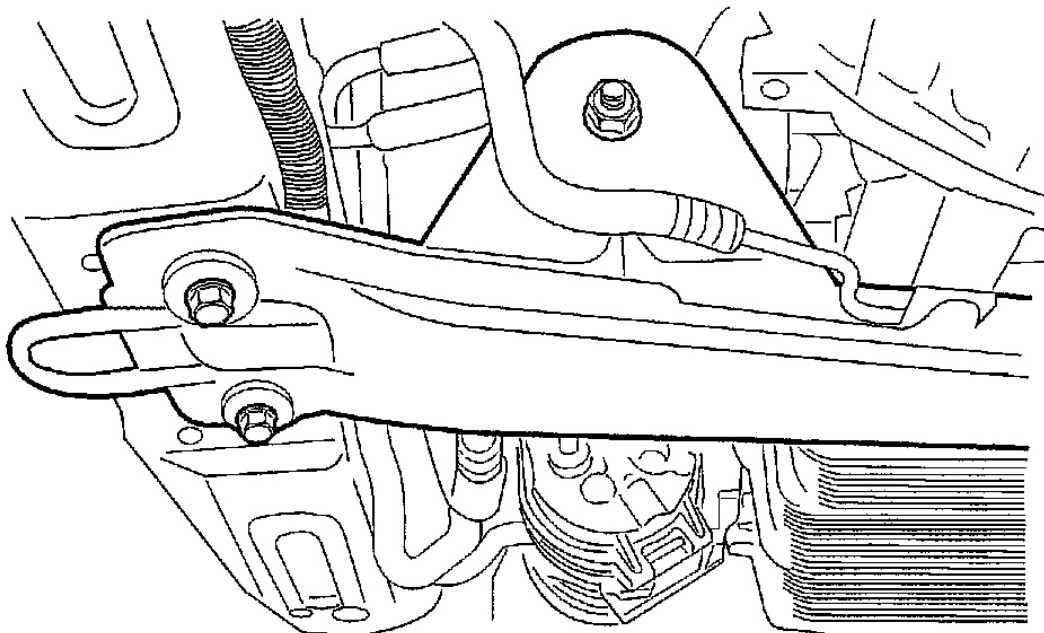
Tighten

Tighten the center front suspension member bolts to 80-100 N.m (59-74 lb-ft).

9. Tighten the front engine mount bracket-to-damper bush bolt.

Tighten

Tighten the front engine mount bracket-to-damper bush bolt to 70-90 N.m (52-66 lb-ft).



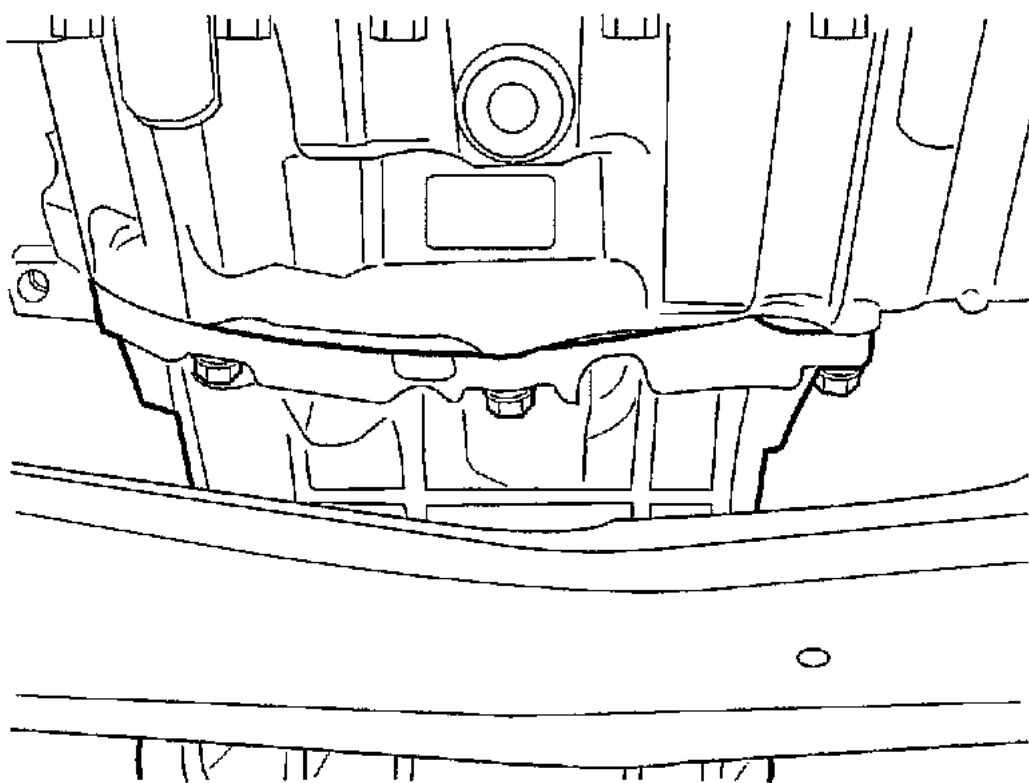
G01985789

Fig. 226: Tightening Front Engine Mount Bracket-To-Damper Bush Bolt
Courtesy of SUZUKI OF AMERICA CORP.

10. Tighten the oil pan flange-to-transaxle bolt.

Tighten

Tighten the oil pan flange-to-transaxle bolt to 27-35 N.m (20-26 lb-ft).



G01985790

Fig. 227: Tightening Oil Pan Flange-To-Transaxle Bolt
Courtesy of SUZUKI OF AMERICA CORP.

11. Discard used oil pan drain plug washer and replace it with a new one.
12. Install the oil pan drain plug.

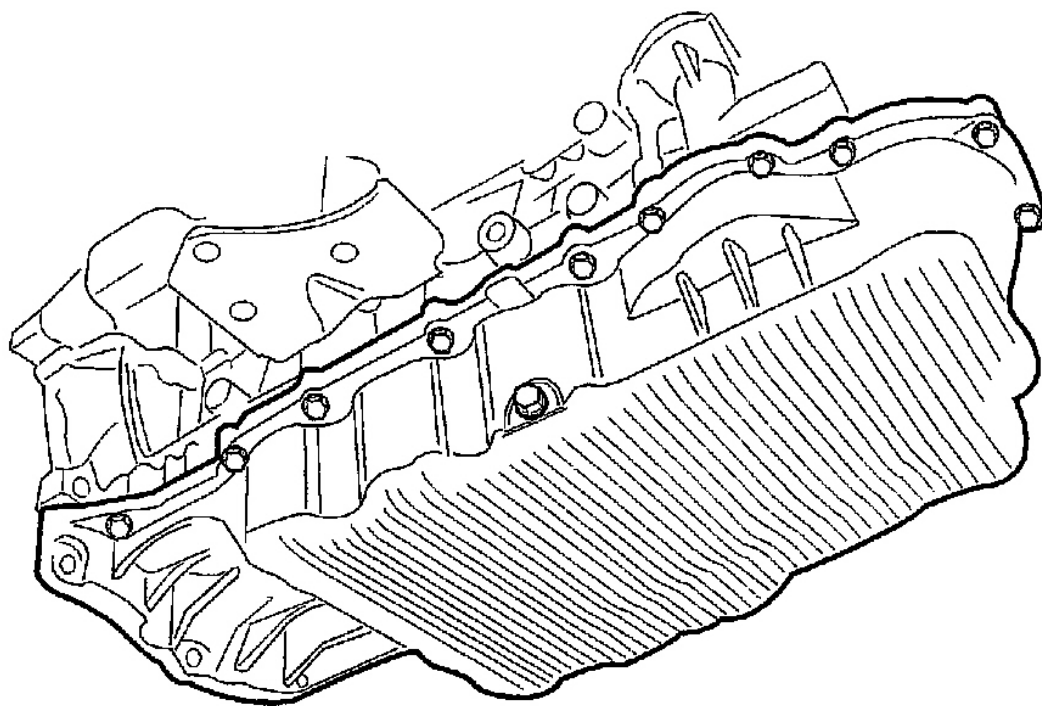
Tighten

Tighten the oil pan drain plug to 35-45 N.m (26-33 lb-ft).

13. Refill the engine with engine oil.
14. Install the engine under cover.

Tighten

Tighten the engine under cover retaining bolts to 17-27 N.m (13-20 lb-ft).



G01985791

Fig. 228: Installing Engine Under Cover
 Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

Tightening Torque Specifications

Refer to TORQUE SPECIFICATIONS .

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Alternator Lower Bolt	22-33 (30-45)
Alternator Upper Bolt	22-30 (30-40)
Bed Plate	
Inner Bolt	(1) 24 (33)
Outer Bolt	15-19 (20-26)
Cam Sprocket Bolt	13-16 (18-22)
Center Front Suspension Member Bolt	59-74 (80-100)

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Compressor Retaining Bolt/Nut	15-22 (20-30)
Connecting Piece	13-17 (17-23)
Connecting Rod Cap Bolt	
Step 1	(2)
Step 2	(3)
Step 3	(4)
Coolant Reservoir Retaining Bolt	26-33 (35-45)
Crankshaft Pulley Bolt	(5)
Cylinder Head Bolt ⁽⁶⁾	
Step 1	15 (20)
Step 2	(7)
Step 3	(8)
Drive Belt Automatic Tensioner Retaining Bolt	15-22 (20-30)
EGR Adapter Retaining Bolt	13-16 (18-22)
EGR Bolt	15-22 (20-30)
Engine Block Ground Bolt	11-18 (15-25)
Engine Block-To-Transaxle Bolt	44-63 (60-85)
Engine Coolant Temperature Sensor	11-15 (15-20)
Engine Mount Bracket Bolt	31-44 (42-60)
Engine Mount Bracket Nut	31-44 (42-60)
Engine Mount Bracket Support Bolt	18-23 (25-31)
Engine Mount Bracket-To-Hydro Mount Nut	41-52 (55-70)
Engine Oil Dipstick Tube Bracket Bolt	13-16 (18-22)
Engine Under Cover Bolt	13-20 (18-27)
Exhaust Manifold	
Heat Shield Bolt	13-16 (18-22)
Retaining Nut	20-22 (27-30)
Fixed Timing Chain Guide Bolt	13-16 (18-22)
Flexible Plate Bolt	52-59 (70-80)
Front Damper Bush Bracket Bolt	41-55 (55-75)
Front Engine Mount Bracket-To-Damper Bush Bolt/Nut	52-66 (70-90)
Front Exhaust Pipe Lower Bracket Bolt	24-35 (32-48)
Front Exhaust Pipe Nut	24-35 (32-48)
Front Exhaust Pipe-To-Front Muffler Nut	18-26 (25-35)
Front Muffler-To-Rear Muffler Nut	24-35 (32-48)
Front Support Bracket Retaining Bolt	11-18 (15-25)
Heater Adapter Bolt	13-16 (18-22)
Idler Retaining Bolt	26-41 (35-55)
Intake Air Temperature Sensor	15-22 (20-30)
Intake Manifold Support Bracket Bolt	15-22 (20-30)

2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Knock Sensor	13-15 (18-20)
Lower Pad Bracket Bolt	26-33 (35-45)
Oil Filter Adapter Retaining Bolt	15-19 (20-26)
Oil Filter Bolt	(9)
Oil Pan Drain Plug	26-33 (35-45)
Oil Pan Flange-To-Transaxle Bolt	20-26 (27-35)
Oil Pump Bolt	13-16 (18-22)
Oil Pump Sprocket Retaining Nut	13-16 (18-22)
Oxygen Sensor	25-32 (34-44)
Power Steering Pump Retaining Bolt	15-22 (20-30)
Rear Support Bracket Retaining Bolt (Exhaust Side)	13-18 (18-25)
Rear Transaxle Mount Bracket Bolt	40-55 (55-75)
Rear Transaxle Mount Bracket-To-Damper Bush Bolt/Nut	52-66 (70-90)
Rocker Arm Shaft Plug	26-33 (35-45)
Spark Plug	15-22 (20-30)
Starter Motor Mount-To-Engine Block Bolt	30-37 (40-50)
Starter Motor Mount-To-Transaxle Bolt	33-41 (45-55)
Throttle Body Assembly Retaining Bolt	(10)
Timing Chain Cover Bolt (Center)	13-16 (18-22)
Timing Chain Lever Bolt	13-16 (18-22)
Timing Chain Tensioner Bolt	13-16 (18-22)
Transaxle Mount Cage-To-Longitudinal Member Bolt	41-55 (55-75)
Transaxle Mount Cage-To-Transaxle Mount Bracket Bolt	41-55 (55-75)
Transaxle Mount Cage-To-Transaxle Mount Bracket Nut	40-55 (55-75)
Transaxle Mount Cage Through Bolt	74-89 (100-120)
Transaxle-To-Engine Block Bolt	44-63 (60-85)
Transaxle Torque Converter Bolt	30-37 (40-50)
Upper Pad Bracket Bolt	26-41 (35-55)
Upper Pad-To-Lower Pad Bracket Bolt	22-30 (30-40)
INCH Lbs. (N.m)	
Air Filter Housing Bolt	71-106 (8-12)
Air Filter Snorkel Retaining Bolt	44-62 (5-7)
Battery Rod Clamp Nut	35 (4)
Bed Plate Baffle Bolt	62-80 (7-9)
Camshaft Cap Bolt	(11) 88- 124 (10-14)
Camshaft Position Sensor	88-124 (10-14)
Catalytic Converter Heat Shield Nut	18-26 (2-3)
Coolant Outlet Port Retaining Bolt	71-106 (8-12)
Coolant Reservoir Bolt	35-44 (4-5)
Cooling Fan Assembly Bolt	44-71 (4-5)
Crankshaft Position Sensor Bolt	18-26 (5-8)

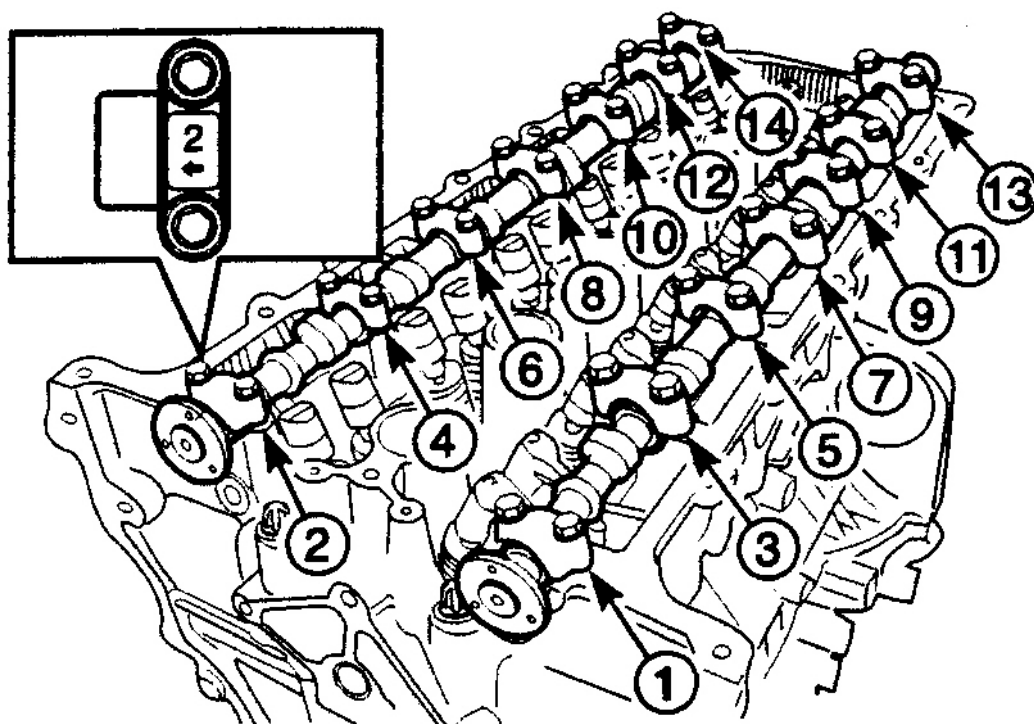
2004 Suzuki Verona EX

2004 ENGINES 2.5L 6-Cylinder

Cylinder Head Cover Bolt	106-124 (12-14)
Engine Beautification Cover Bolt	71-106 (8-12)
Engine Oil Dipstick Tube Bolt	71-88 (8-10)
Front Muffler Heat Shield Nut	18-26 (2-3)
Fuel Pressure Regulator Retaining Bolt	88-115 (10-13)
Ignition Coil Retaining Bolt	53-71 (6-8)
Intake EGR Pipe Retaining Bolt	71-106 (8-12)
Intake Manifold	
Retaining Bolt	88-124 (10-14)
Retaining Nut	88-124 (10-14)
Support Bracket Bolt	88-124 (10-14)
Manifold Absolute Pressure Sensor Bolt	53-88 (6-10)
Oil Pan Retaining Bolt	71-106 (8-12)
Oil Pump Chain Lever Bolt	53-88 (6-10)
Oil Pump Sprocket Cover Bolt	44-62 (5-7)
Oil Suction Pipe Bracket Bolt	71-106 (8-12)
Oil Suction Pipe-To-Oil Pump Retaining Bolt	71-106 (8-12)
PCV Valve Bolt	71-106 (8-12)
Radiator Bracket Bolt	88-71 (10-8)
Rear Muffler Heat Shield Nut	18-26 (2-3)
Rear Support Bracket Retaining Bolt (Intake Side)	71-106 (8-12)
Target Wheel Bolt	62-97 (7-11)
Thermostat Housing Bolt	71-106 (8-12)
Timing Chain Cover Bolt	53-88 (6-10)
Top Chain Guide Bolt	80-97 (9-11)
Vacuum Tank Retaining Bolt	62-80 (7-9)
Water Pump Pulley Bolt	71-106 (8-12)
Wiring Harness Bracket Bolt	71-106 (8-12)

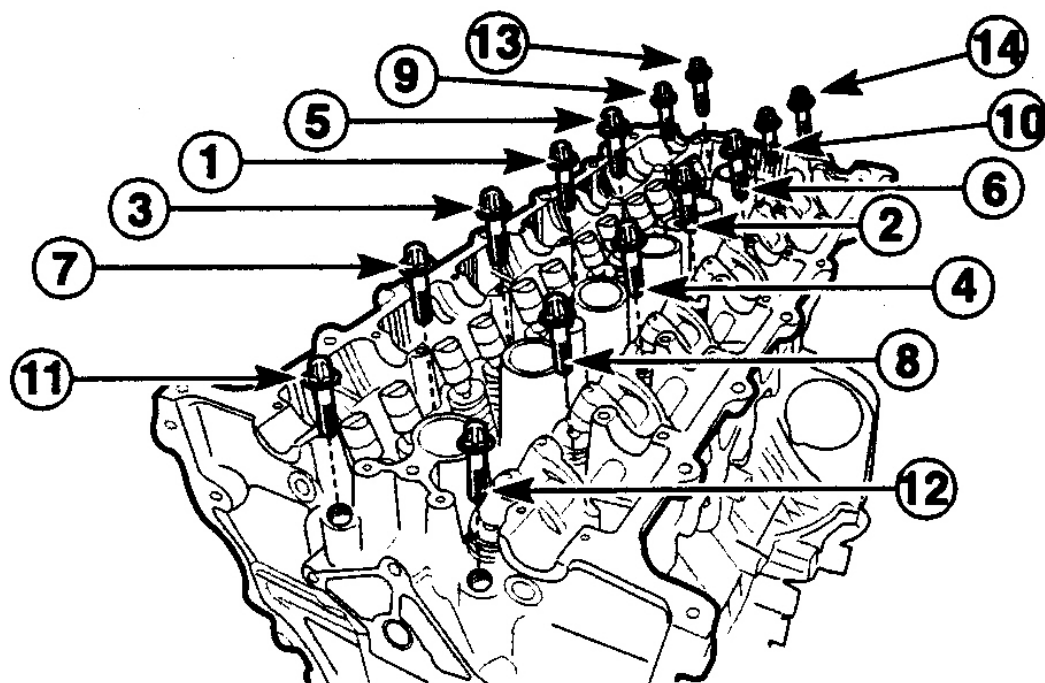
- (1) After tightening all the inner bolts, turn the bolts by 135° each.
- (2) Tighten connecting rod cap bolts 15 Ft. Lbs (20 N.m).
- (3) Tighten an additional 45°.
- (4) Tighten an additional 90°.
- (5) Information is not available from manufacturer.
- (6) For cylinder head bolts, see **Fig. 230**.
- (7) After finishing the initial tightening, tighten all the cylinder head bolt to 18 Ft. Lbs. (25 N.m).
- (8) Turn the cylinder head bolts another 2 turns of 70° each.
- (9) Tighten oil filter bolts to 106 INCH Lbs. (12 N.m) - 12 Ft. Lbs. (16 N.m).
- (10) Tighten throttle body assembly retaining bolts to 71 INCH. Lbs. (8 N.m) - 13 Ft. Lbs (18 N.m)

(11) Camshaft caps should follow the numeric order when installing, intake camshafts 1, 3, 5, 7, 9, 11, 13 and exhaust camshaft caps are 2, 4, 6, 8, 10, 12, 14. See **Fig. 229**.



G00311790

Fig. 229: Camshaft Cap Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.



G00311794

Fig. 230: Cylinder Head Bolts Tightening Sequence
 Courtesy of SUZUKI OF AMERICA CORP.