2005 ENGINE

Engine Mechanical - Verona

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

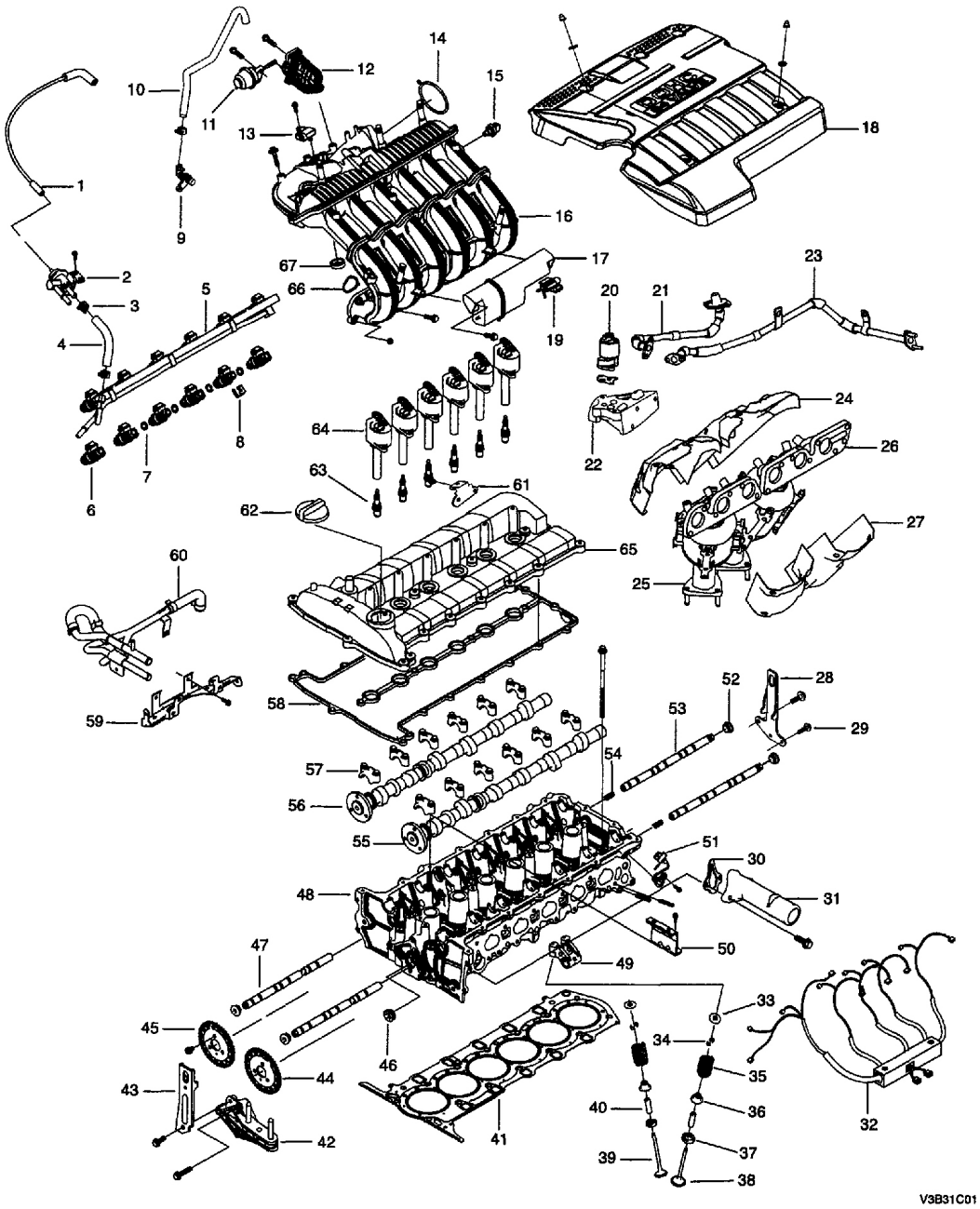
The cylinder head is made of an aluminum alloy. The cylinder head uses cross-flow intake and exhaust ports. A spark plug is located in the center of each combustion chamber. The cylinder head houses the dual camshafts.

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

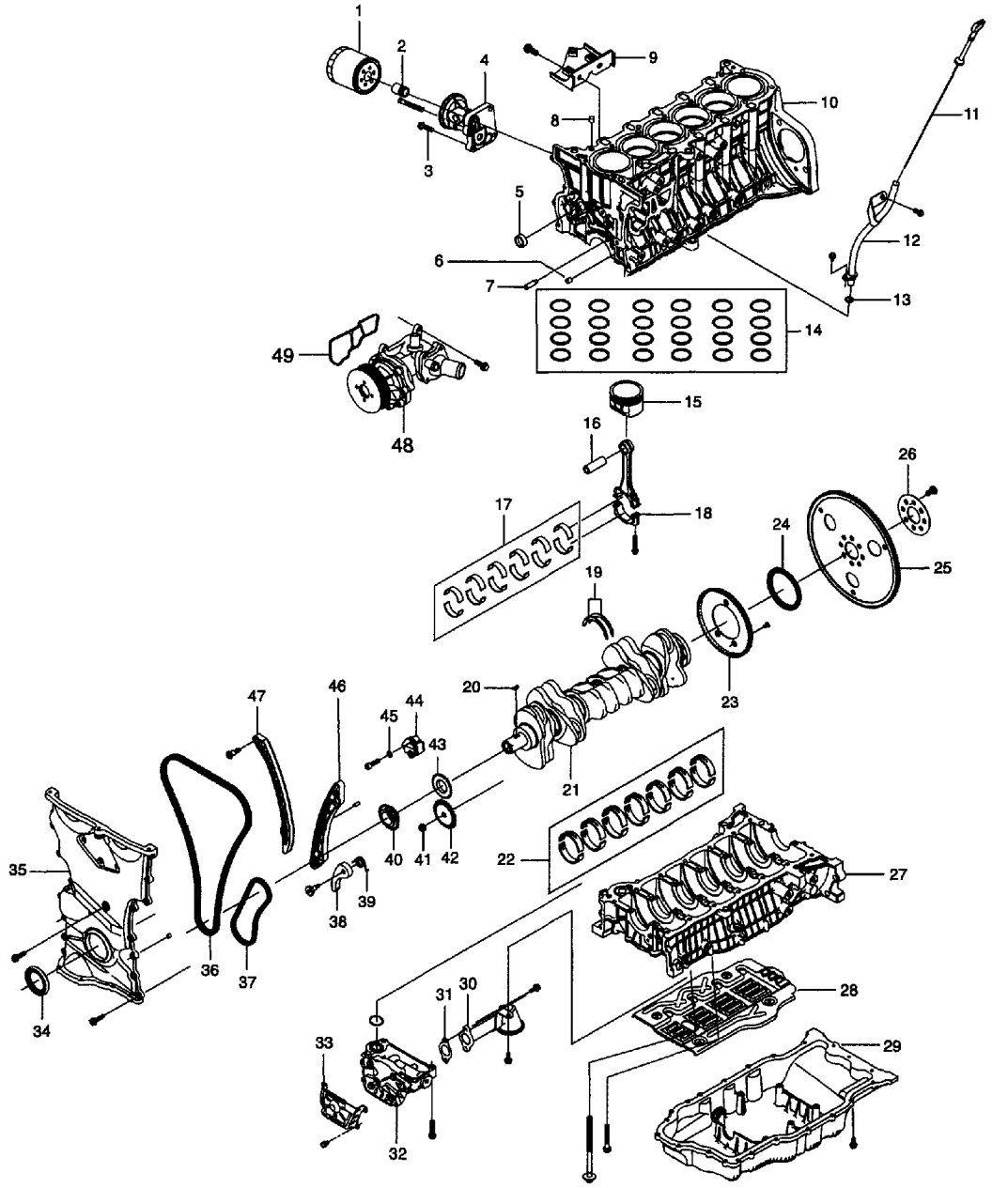
Upper End Location



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

Fig. 1: Exploded View Of Engine Components (Upper End)
Courtesy of SUZUKI OF AMERICA CORP.

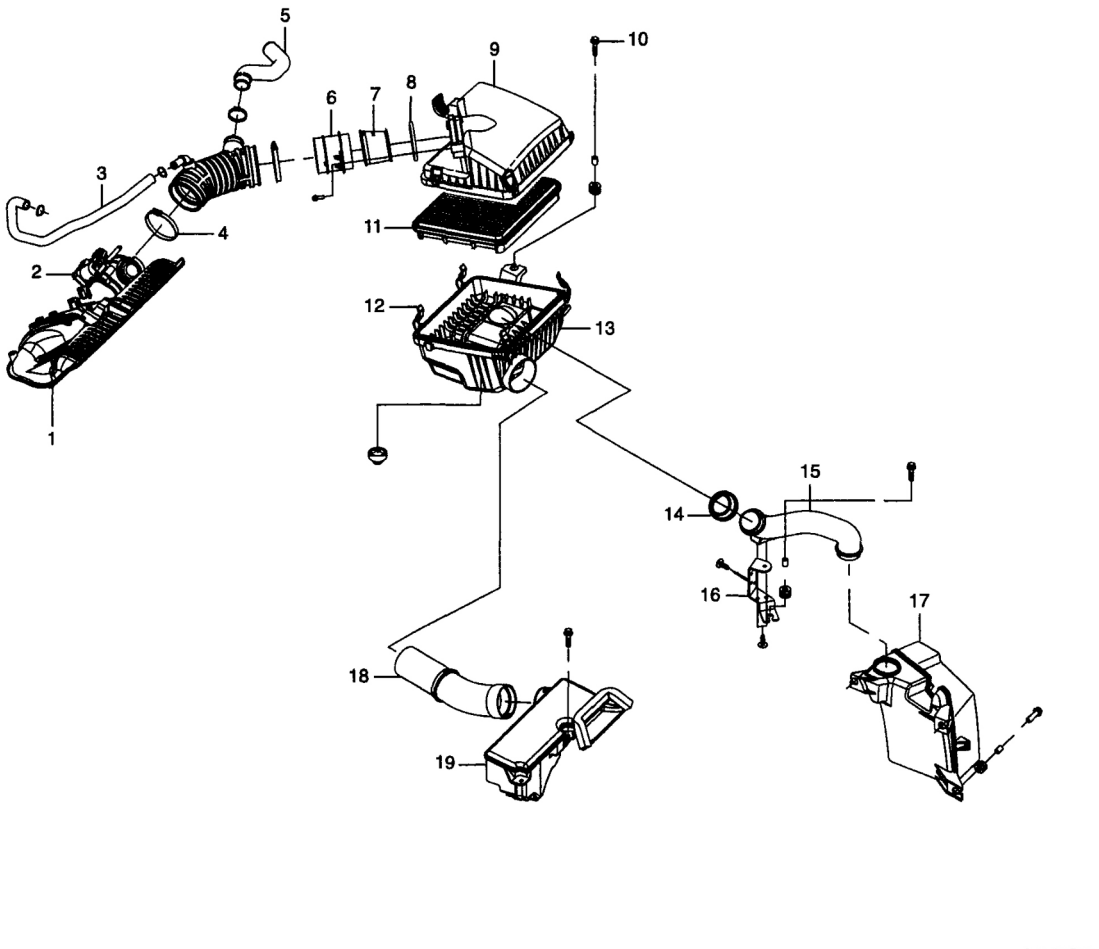
Lower End Location



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		

Fig. 2: Exploded View Of Engine Components (Lower End)
Courtesy of SUZUKI OF AMERICA CORP.

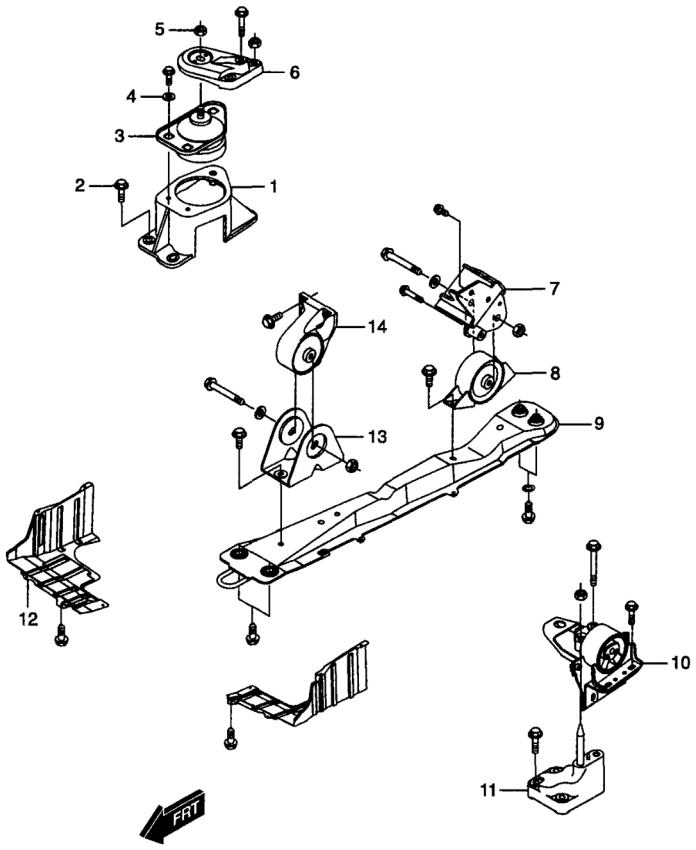
Air Intake System Location



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	

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

Engine Mount System Location



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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	

Fig. 4: Exploded View Of Engine Mount System
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.

ENGINE KNOCKS COLD AND CONTINUES FOR TWO-THREE MINUTES AND/OR KNOCK INCREASES WITH ENGINE TORQUE

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.	-
	Inspect the piston-to-bore clearance.	0.002 - 0.030 mm	Go to	Go to

6	Is the clearance more than the value specified?	(0.00008 - 0.00178 in.)	Step 7.	Step 8.
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete?(1)	-	Go to Step 1.	-
8	Inspect the connecting rod. Is the connecting rod bent?	-	Go to Step 9.	System OK
9	Replace the connecting rod. Is the repair complete?	-	Go to Step 1.	-
(1) Cold engine piston knock usually disappears when the cylinder is grounded out. Cold engine piston knock, which disappears in about 1.5 minutes, is considered acceptable.				

HEAVY KNOCK HOT WITH TORQUE APPLIED

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.	-
6	Inspect the accessory belts. Are the belts too tight or nicked?	-	Go to Step 7.	Go to Step 8.
7	Replace and/or tension the belts to specifications, as necessary. Is the repair complete?	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.	-

LIGHT KNOCK HOT

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.	-

KNOCKS DURING INITIAL START-UP BUT LASTS ONLY A FEW SECONDS

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

	Is the clearance more than specified value?	0.010 in.)	Step 7.	8.
7	Replace the crankshaft thrust bearing. Is the repair complete?	-	Go to Step 1.	-
8	Inspect the front main bearing clearance. Is the clearance more than the 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.	-
(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.				

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.

KNOCKS AT IDLE HOT

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.	-

Noise Diagnosis

MAIN BEARING NOISE

Step	Action	Value(s)	Yes	No
1	Are dull thuds or knocks heard with every engine revolution?	-	Go to Step 2.	System OK
2	Check the oil pump pressure. Is the oil pump pressure low?	-	Go to "**OIL PRESSURE TEST** ".	Go to Step 3.
3	Inspect the crankshaft end play. 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

CONNECTING ROD BEARING NOISE SYMPTOM

Step	Action	Value (s)	Yes	No
1	Is a knock noise heard under all engine speeds?	-	Go to Step 2.	System OK

2	Inspect the crankshaft connecting rod journal. Is the crankshaft connecting rod journal worn?	-	Go to "**CRANKSHAFT 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

PISTON NOISES

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.
			Go to "**CYLINDER HEAD AND VALVE**	

4	Inspect the connecting rods. Is there a misaligned connecting rod?	-	**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

VALVE MECHANISM OR VALVE TRAIN NOISES

Step	Action	Value (s)	Yes	No
1	Is a light tapping sound heard from the engine?	-	Go to Step 2.	System OK
2	Inspect the valve springs. Are the springs weak or broken?	-	Go to "**CYLINDER HEAD AND VALVE TRAIN COMPONENTS 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

REPAIR INSTRUCTIONS

Throttle Body Assembly Removal

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

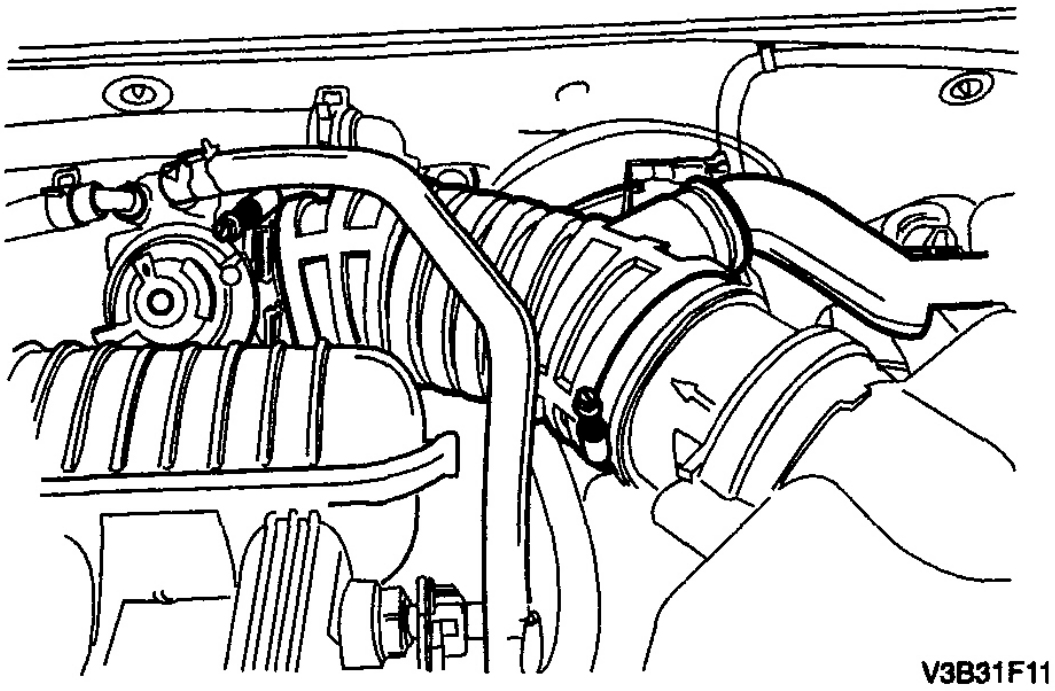

Fig. 5: Removing Air Filter Outlet Hose
Courtesy of SUZUKI OF AMERICA CORP.

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

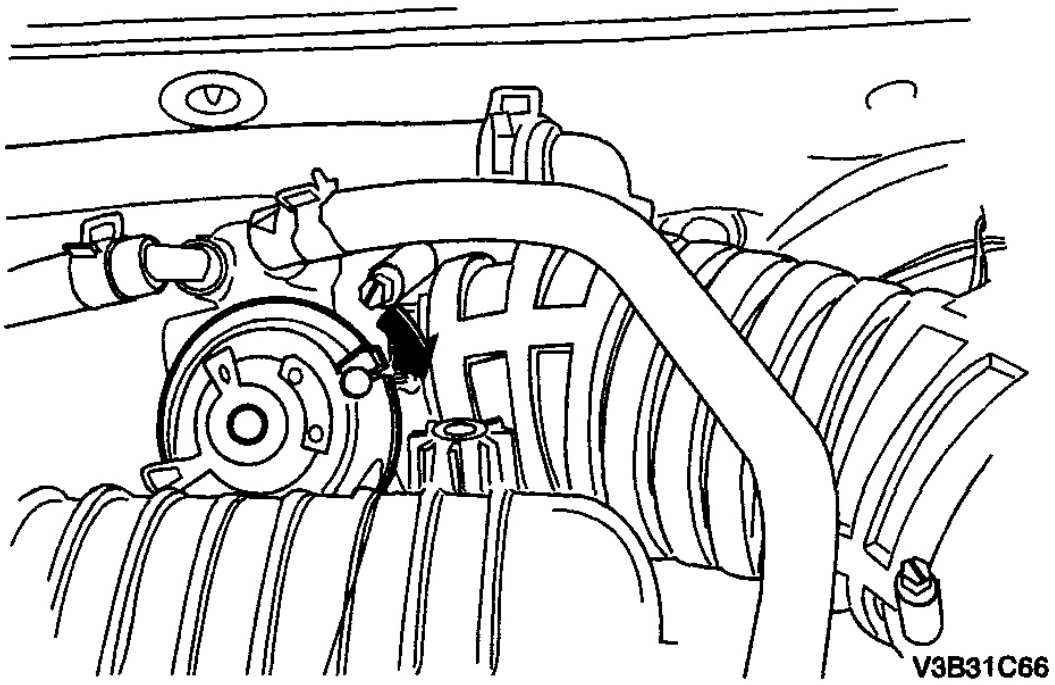

Fig. 6: Disconnecting Throttle Cable
Courtesy of SUZUKI OF AMERICA CORP.

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

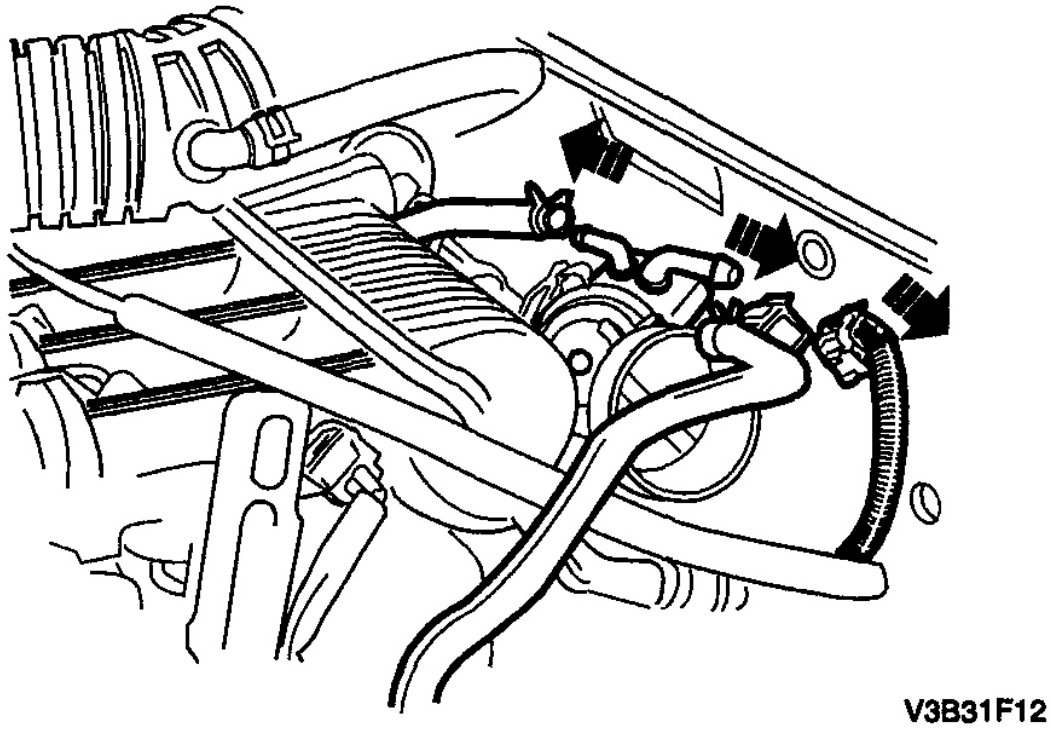

Fig. 7: Removing Coolant Inlet And Outlet Hoses
Courtesy of SUZUKI OF AMERICA CORP.

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

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

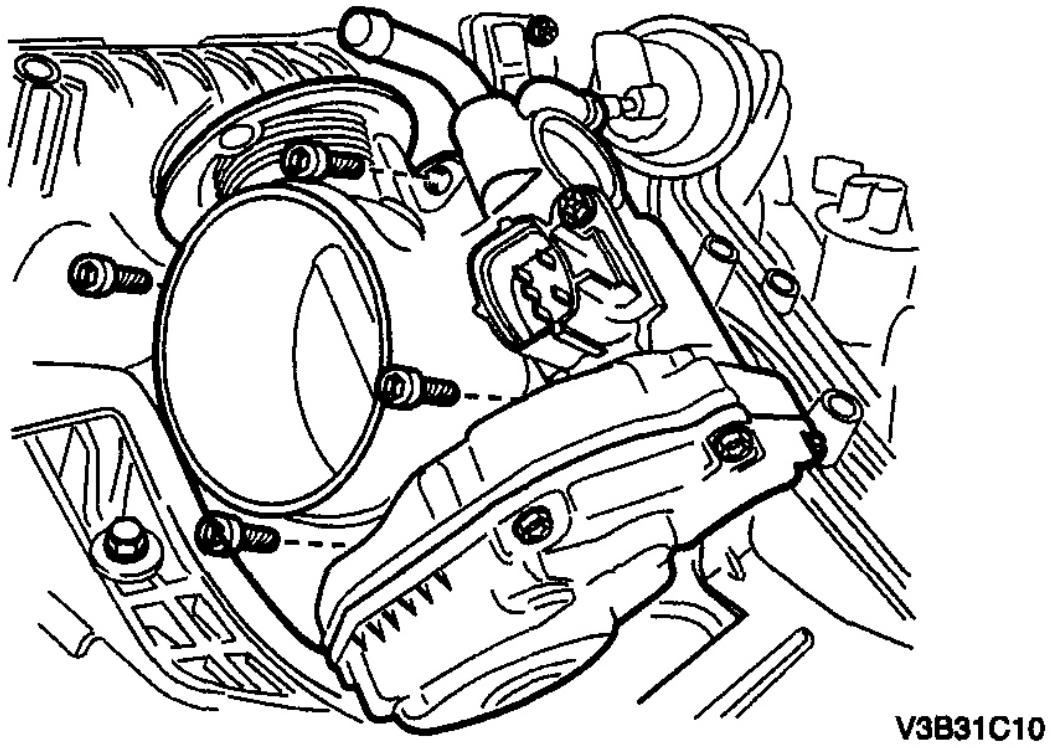

Fig. 8: Removing Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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).

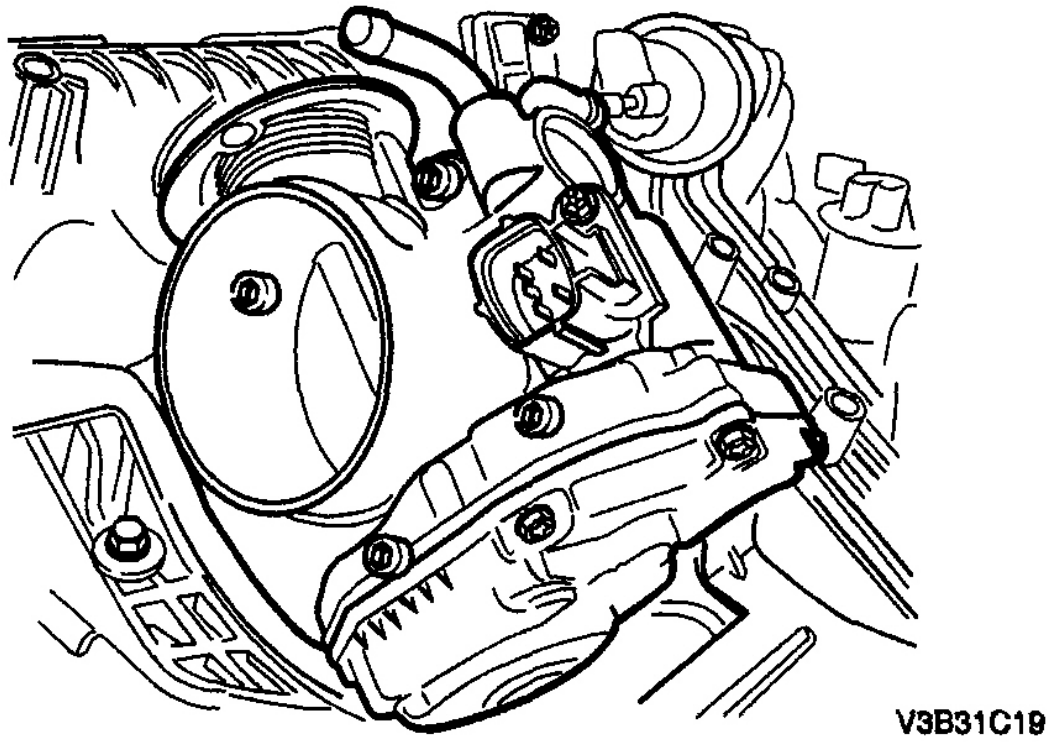

Fig. 9: Installing Throttle Body Assemble
Courtesy of SUZUKI OF AMERICA CORP.

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** ".

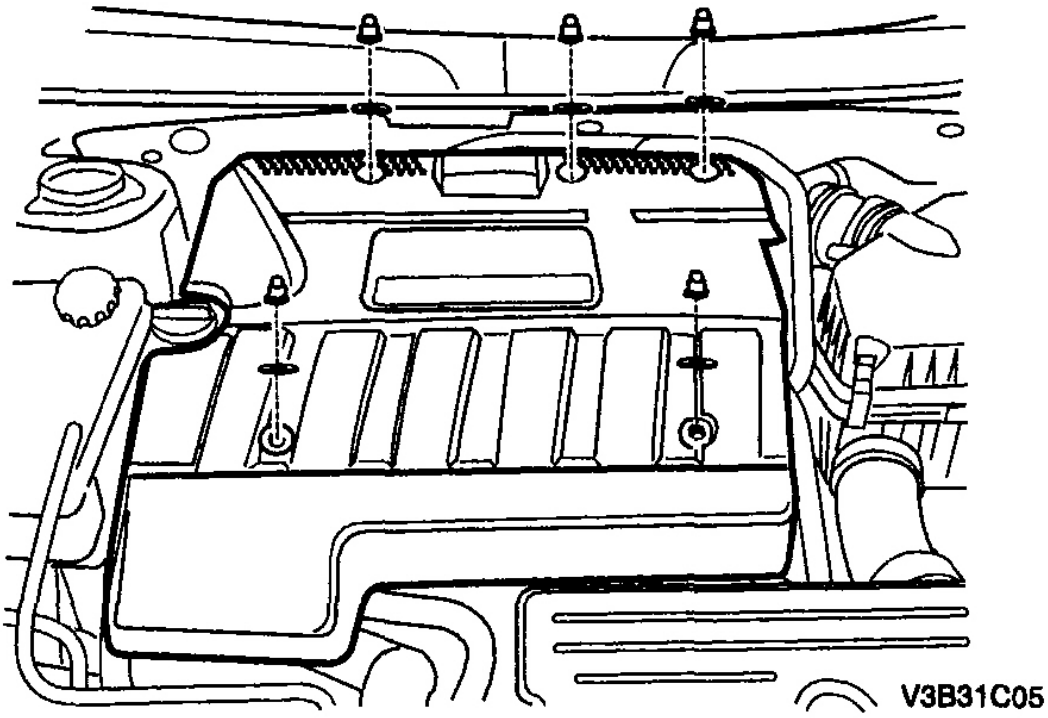

Fig. 10: Removing Engine Beautification Cover Retaining Nut
Courtesy of SUZUKI OF AMERICA CORP.

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

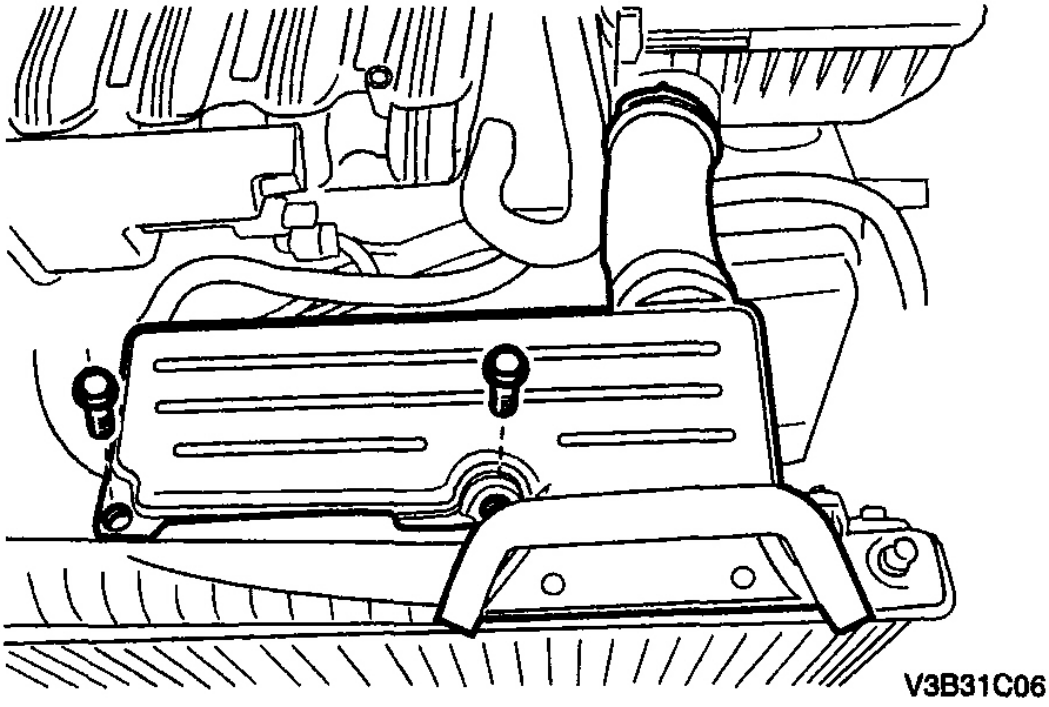

Fig. 11: Removing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

7. Remove the VIS vacuum tank.

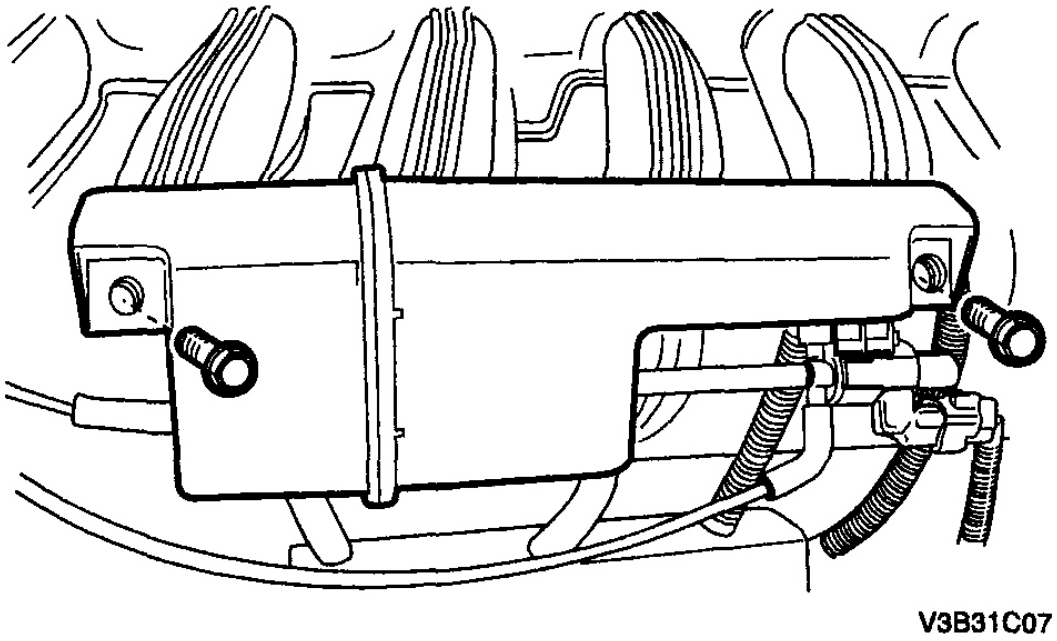

Fig. 12: Removing VIS Vacuum Tank
Courtesy of SUZUKI OF AMERICA CORP.

8. Disconnect the fuel pressure regulator vacuum hose.
9. Disconnect the fuel line.

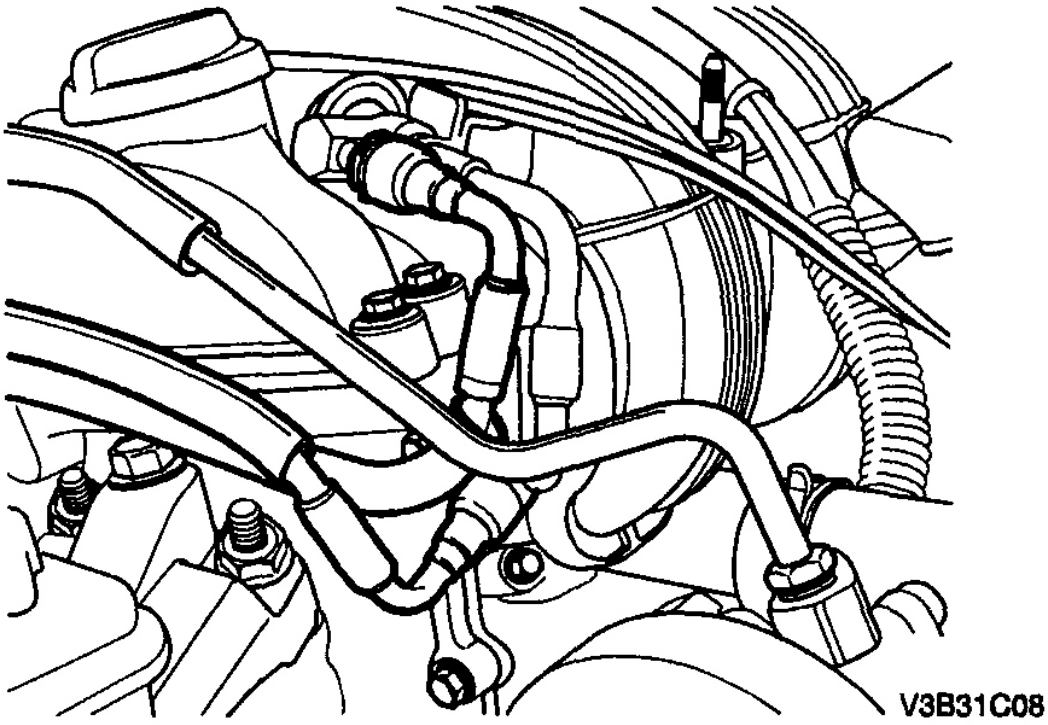

Fig. 13: Disconnecting Fuel Pressure Regulator Vacuum Hose
Courtesy of SUZUKI OF AMERICA CORP.

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

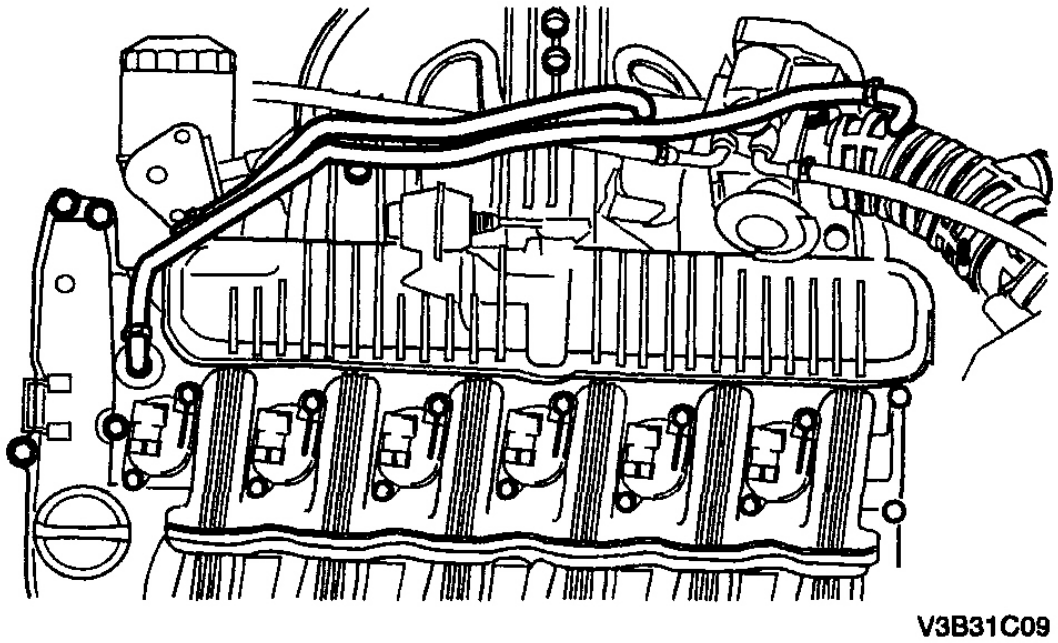

Fig. 14: Removing Breather And PCV Hose
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the air filter outlet hose. Refer to "**AIR INTAKE SYSTEM LOCATION**".
13. Remove the throttle body assembly. Refer to "**THROTTLE BODY ASSEMBLY REMOVAL**".

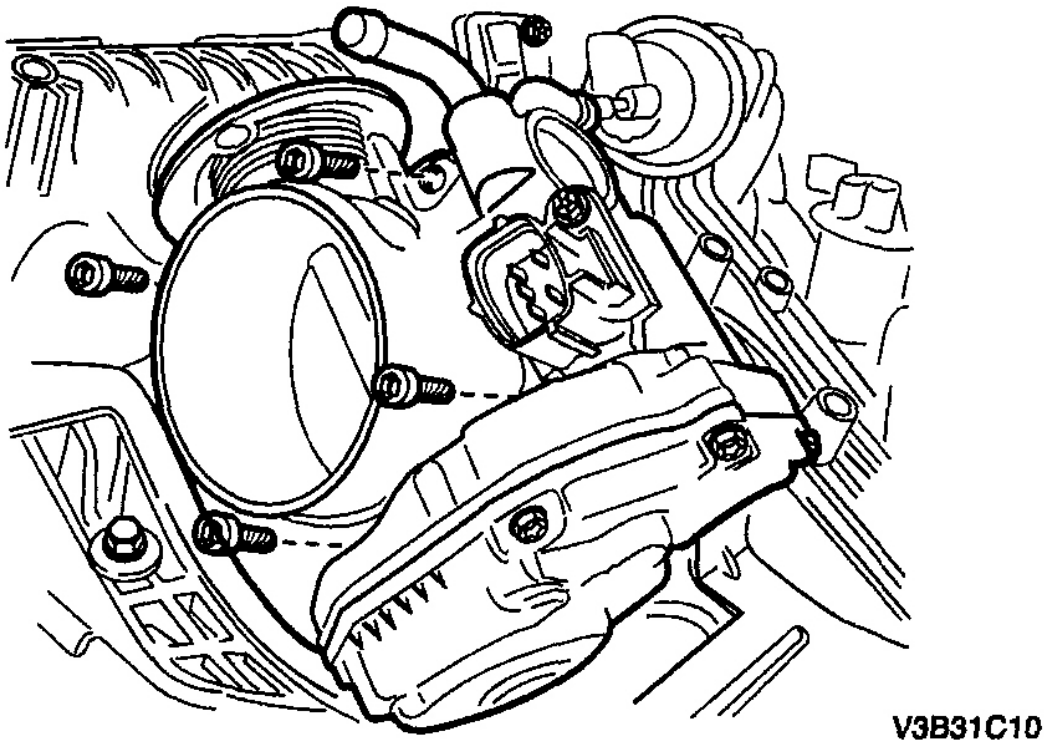

Fig. 15: Removing Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

14. Disconnect the charcoal canister purge solenoid connector and hose. Refer to "**AIR INTAKE SYSTEM LOCATION**".
15. Disconnect the O2S (Oxygen Sensor) connector. Refer to "**OXYGEN SENSOR (O2S) REMOVAL** ".
16. Disconnect the MAP (Manifold Absolute Pressure) sensor connector. Refer to "**MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL** ".
17. Disconnect the CKP (Crankshaft Position) sensor connector. Refer to "**CRANKSHAFT POSITION (CKP) SENSOR REMOVAL** ".

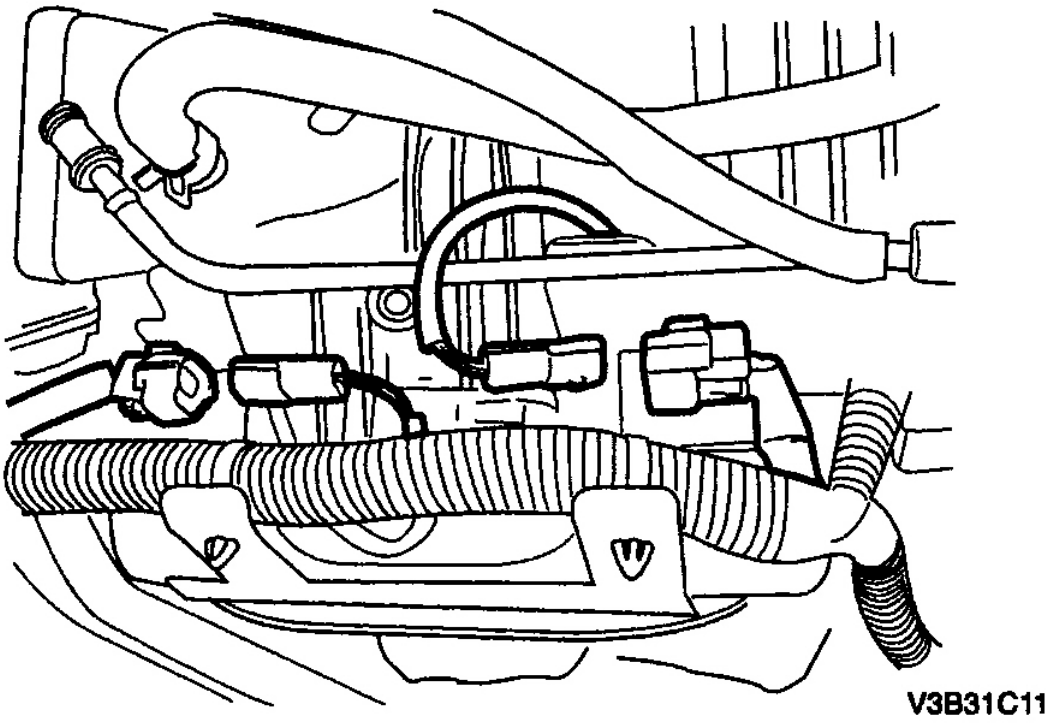

Fig. 16: Disconnecting CKP (Crankshaft Position) Sensor Connector
Courtesy of SUZUKI OF AMERICA CORP.

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

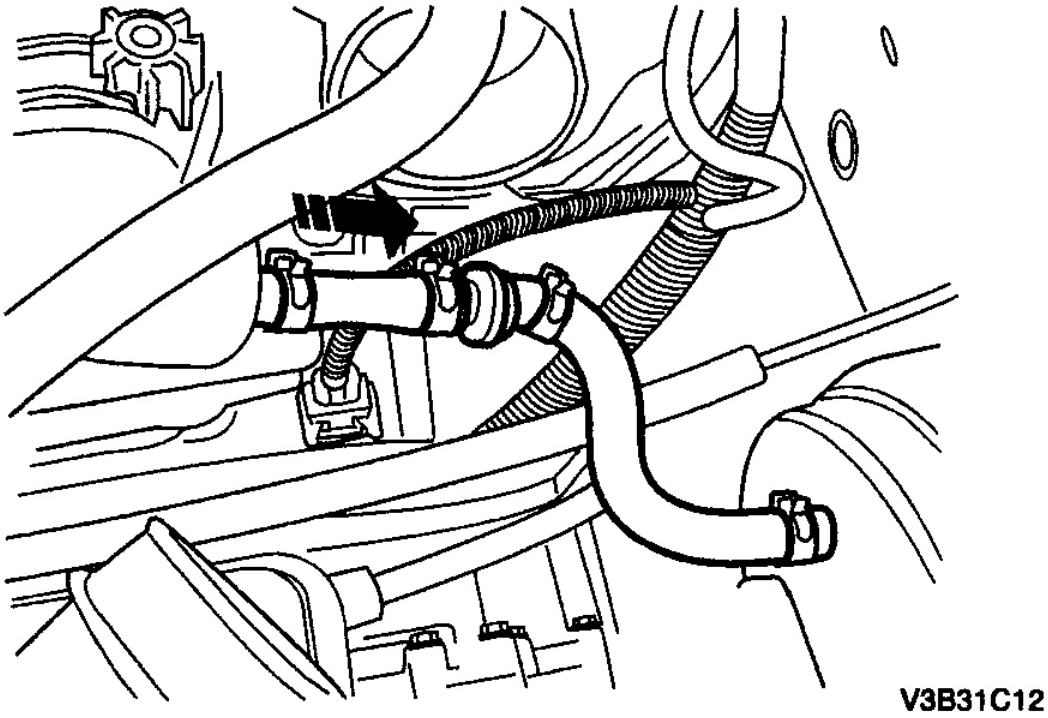

Fig. 17: Removing Vacuum Hose On Brake Booster
Courtesy of SUZUKI OF AMERICA CORP.

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

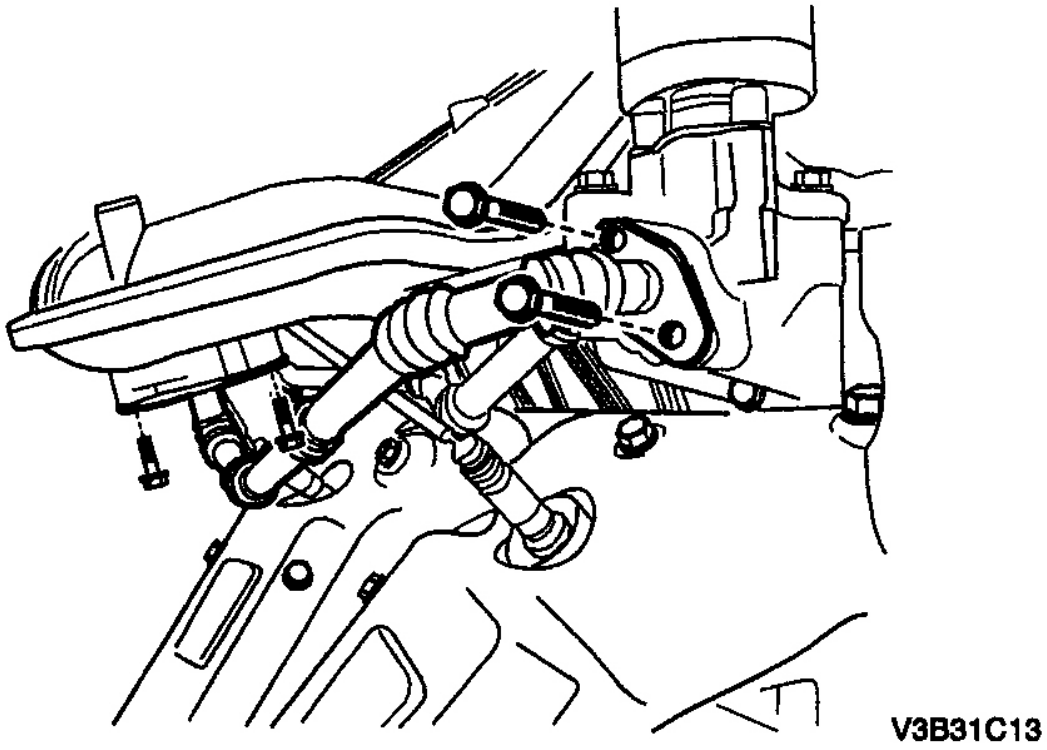

Fig. 18: Removing EGR Pipe From Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

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

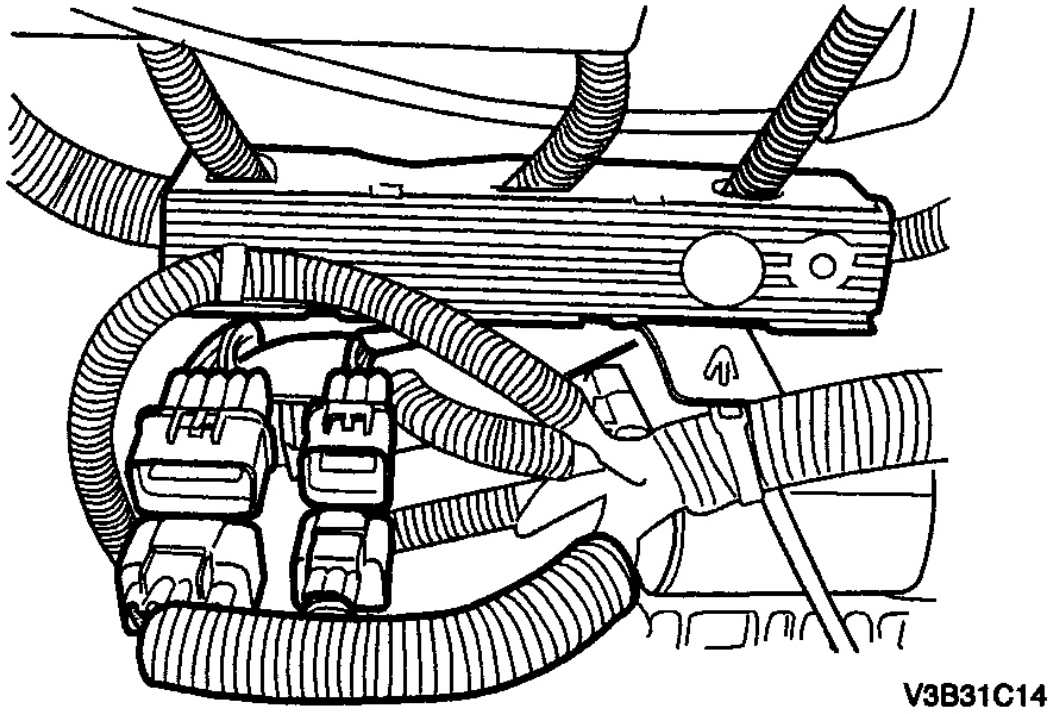

Fig. 19: Removing Wiring Harness From Support Bracket On Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

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

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

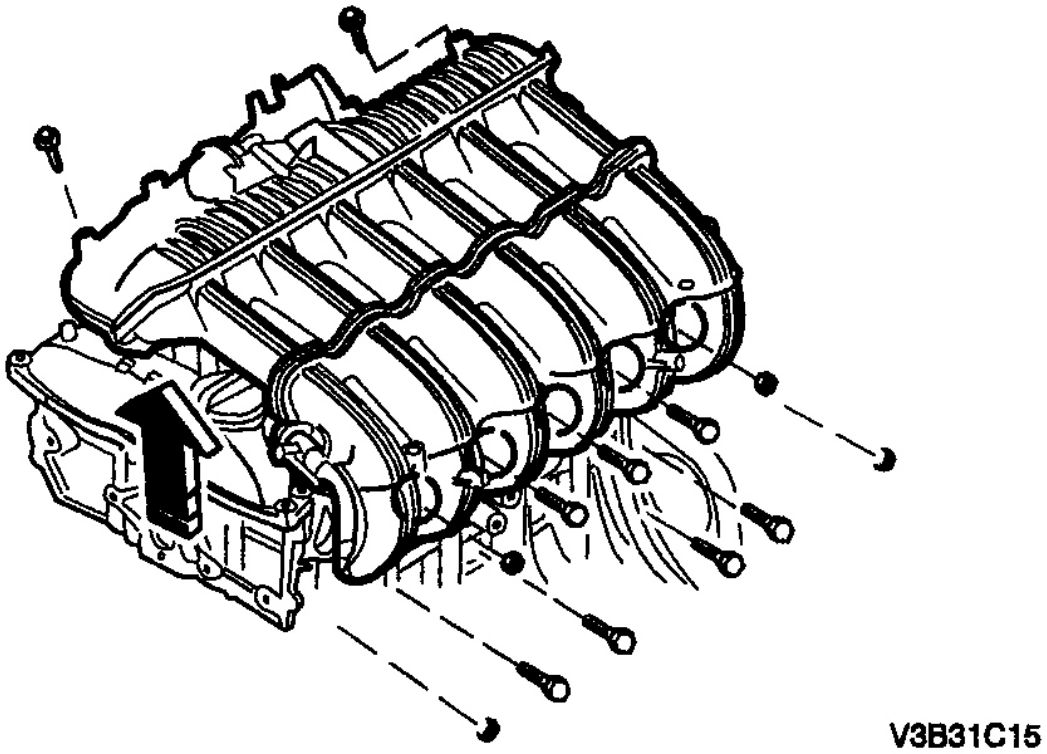

Fig. 20: Removing Intake Manifold Retaining Nuts/Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

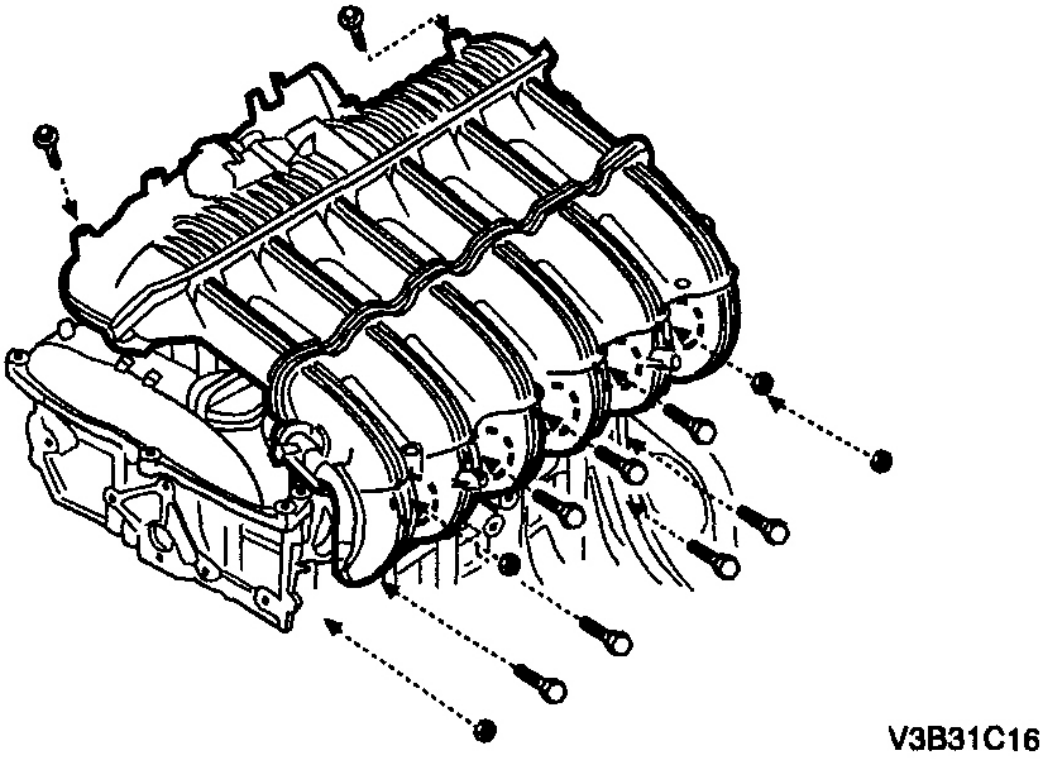

Fig. 21: Tightening Intake Manifold Retaining Nuts And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Tighten the intake EGR pipe retaining bolts on the intake manifold. Refer to "**INTAKE EGR PIPE INSTALLATION** ".

Tighten

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

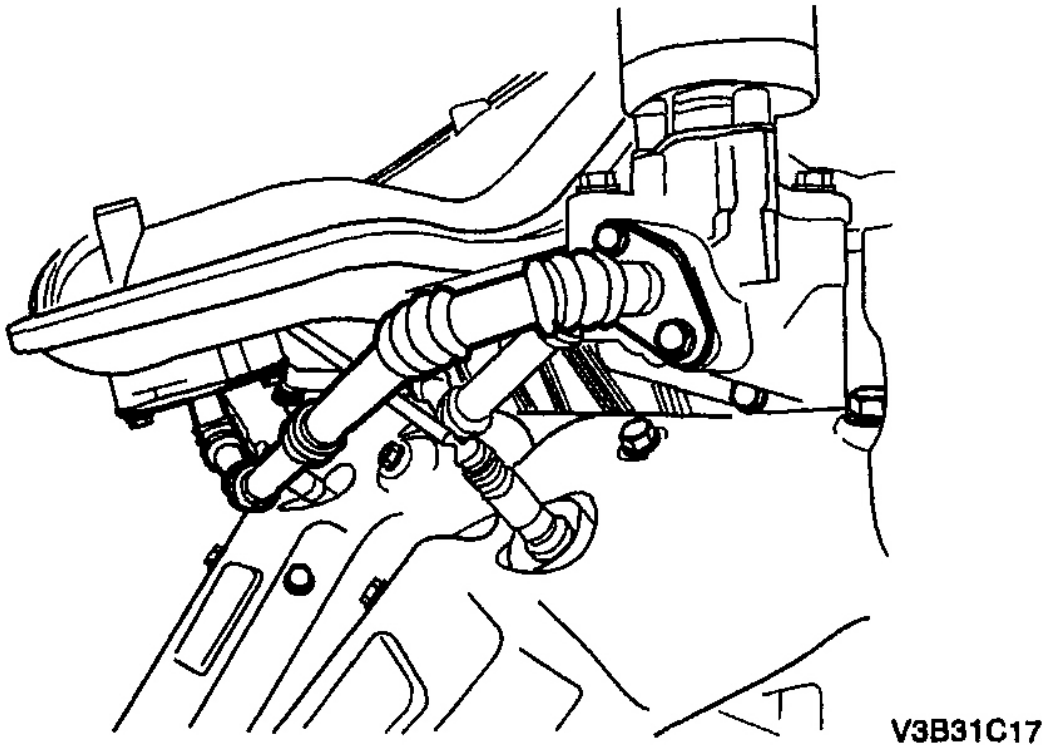

Fig. 22: Installing Intake EGR Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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).

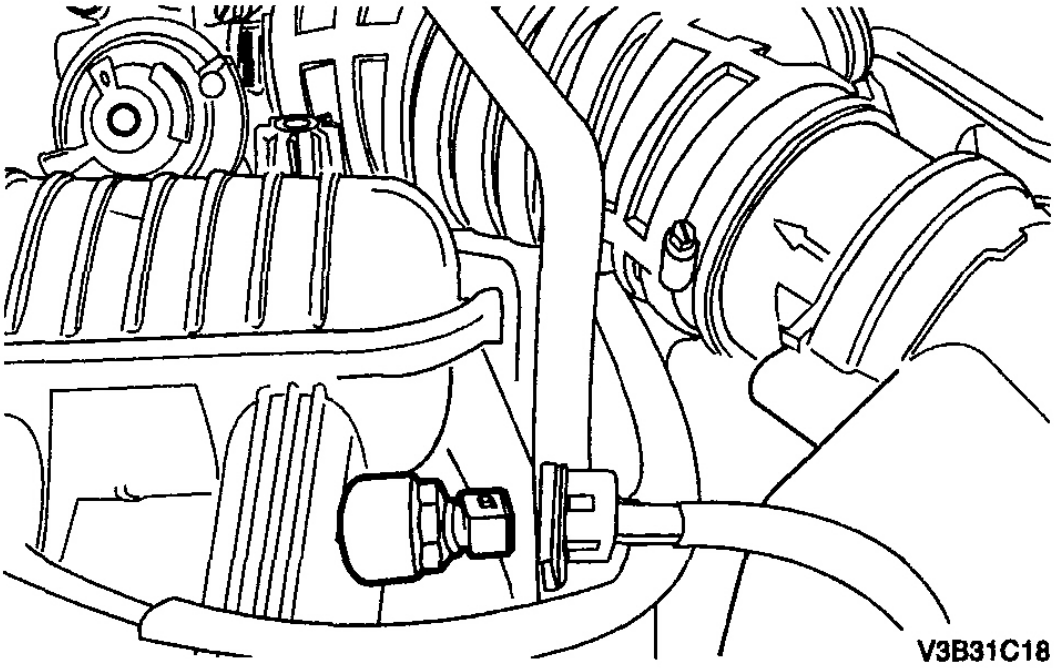

Fig. 23: Installing IAT (Intake Air Temperature) Sensor
Courtesy of SUZUKI OF AMERICA CORP.

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).

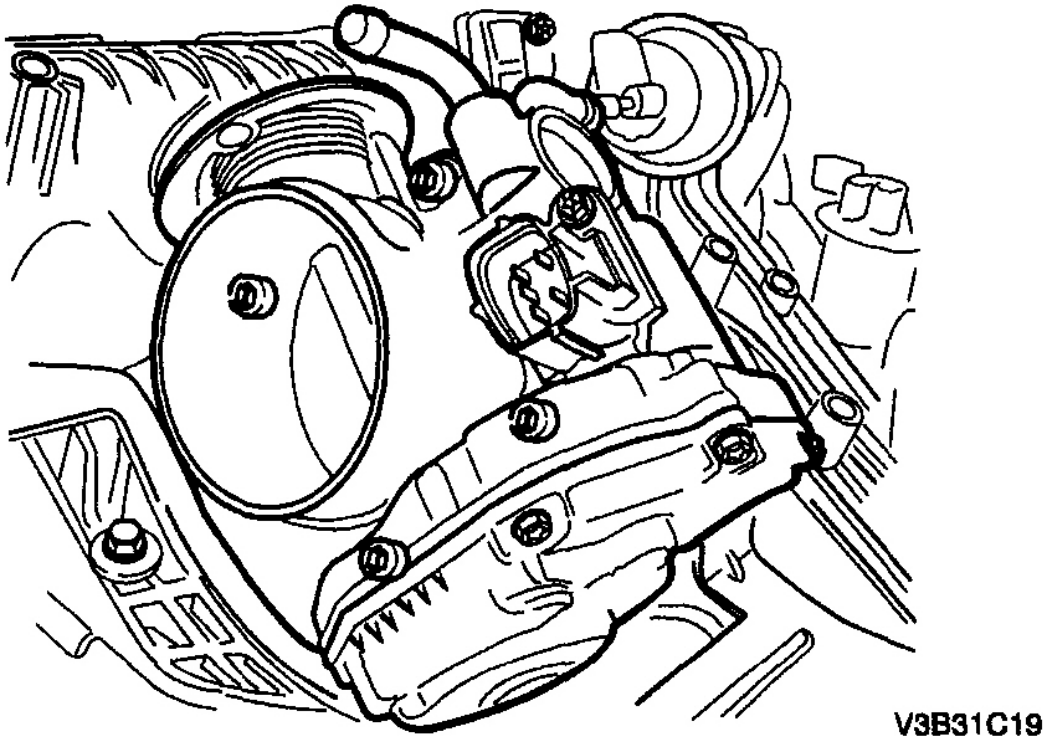

Fig. 24: Installing Throttle Body Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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).

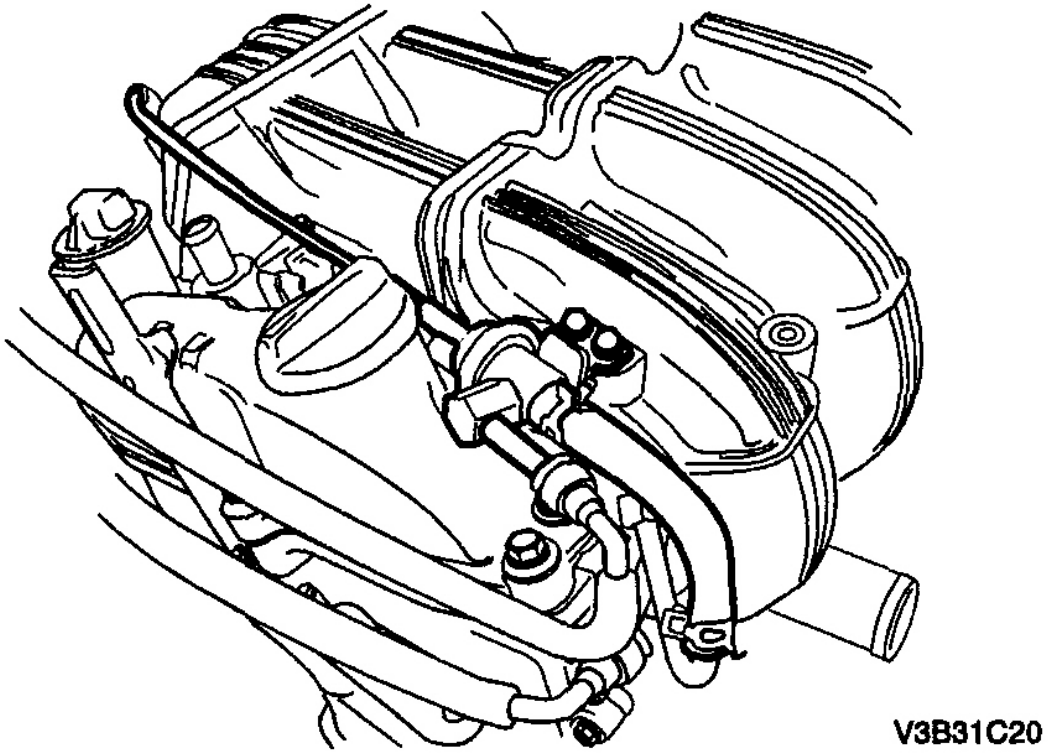

Fig. 25: Installing Fuel Pressure Regulator
Courtesy of SUZUKI OF AMERICA CORP.

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).

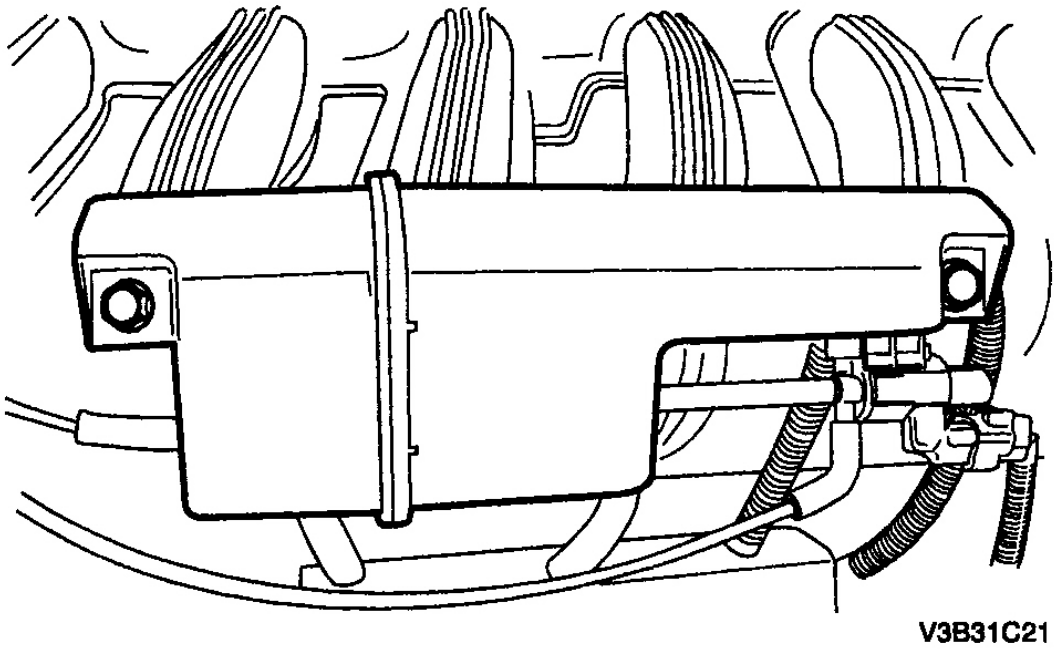

Fig. 26: Installing VIS Vacuum Tank
Courtesy of SUZUKI OF AMERICA CORP.

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).

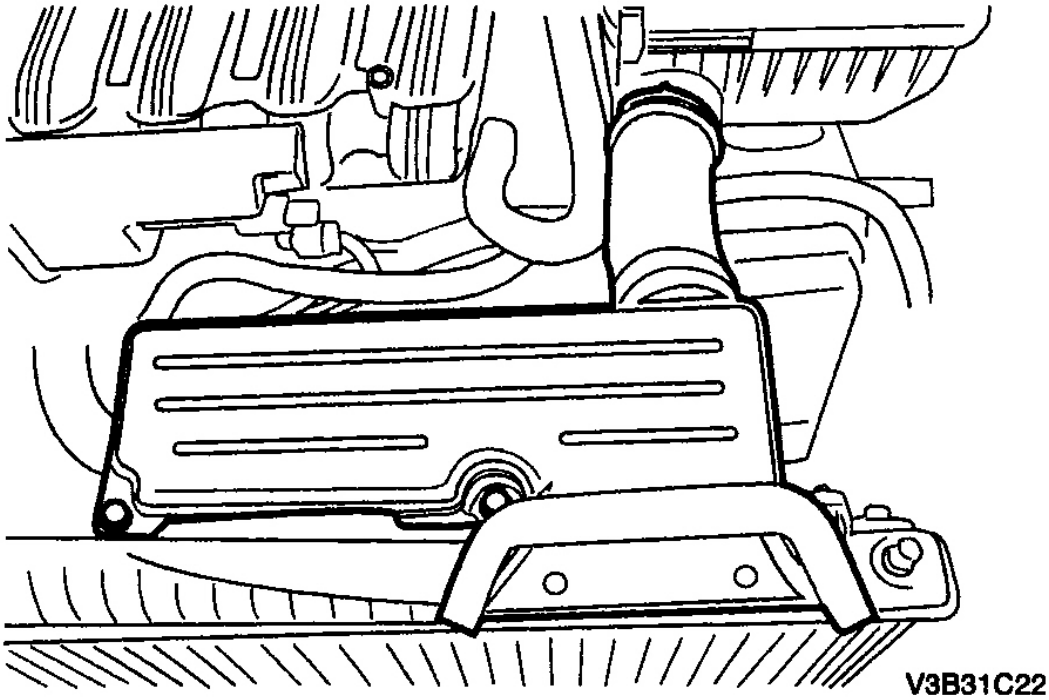

Fig. 27: Installing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the engine beautification cover.

Tighten

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

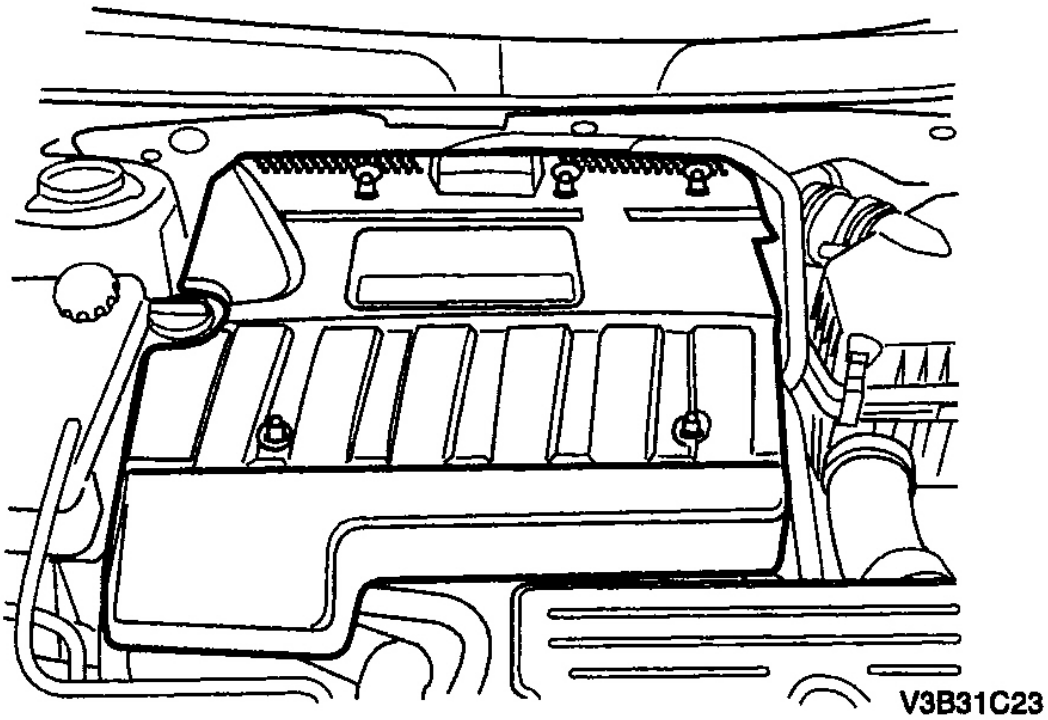

Fig. 28: Installing Engine Beautification Cover
Courtesy of SUZUKI OF AMERICA CORP.

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**".

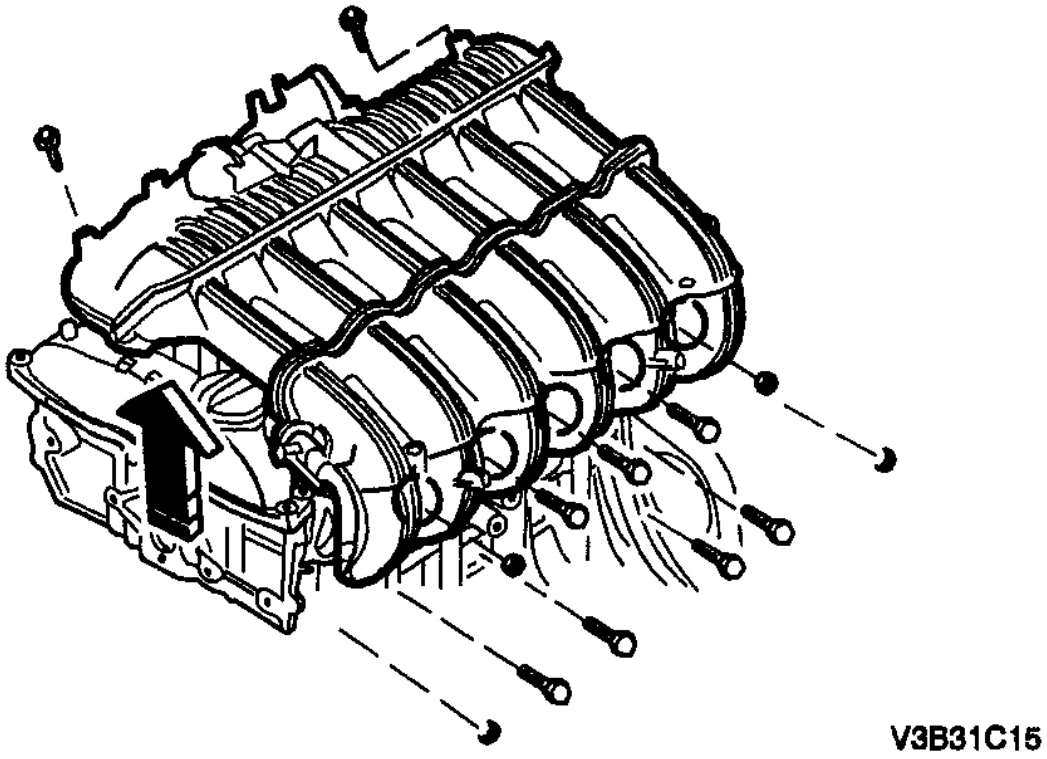

Fig. 29: Removing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

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

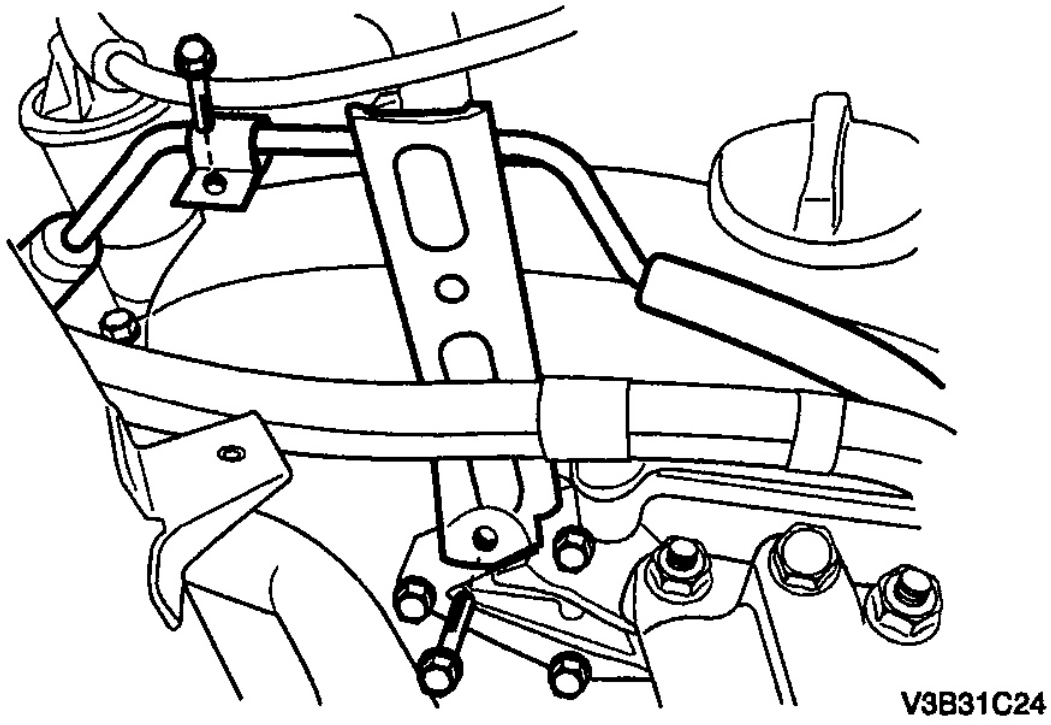

Fig. 30: Removing Front Support Bracket Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

8. Remove the air filter housing.

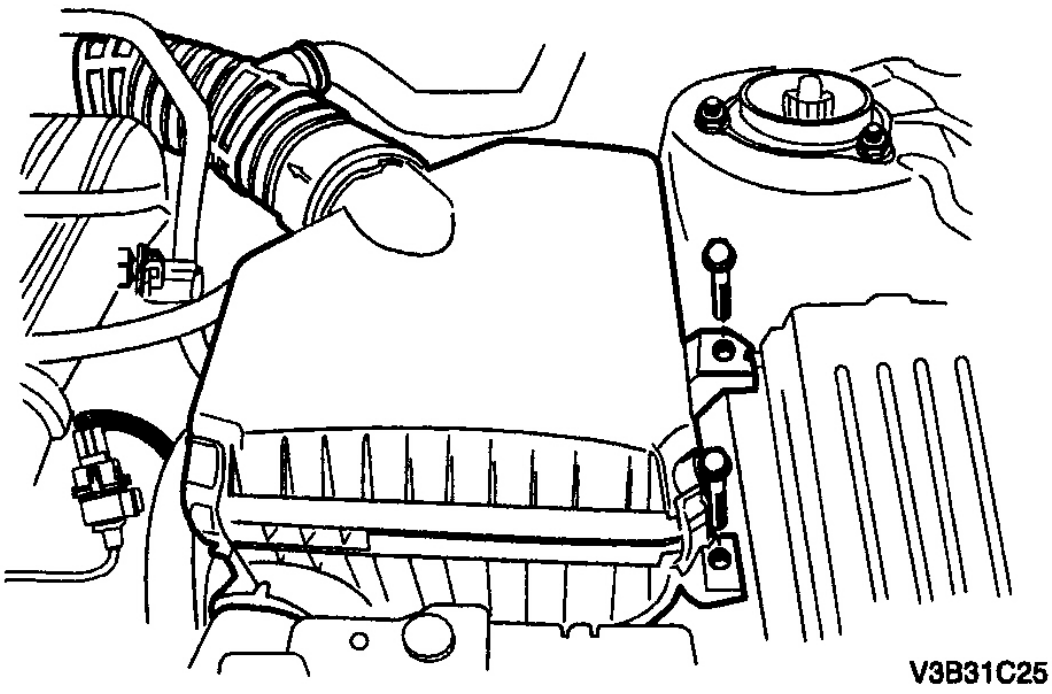

Fig. 31: Removing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

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

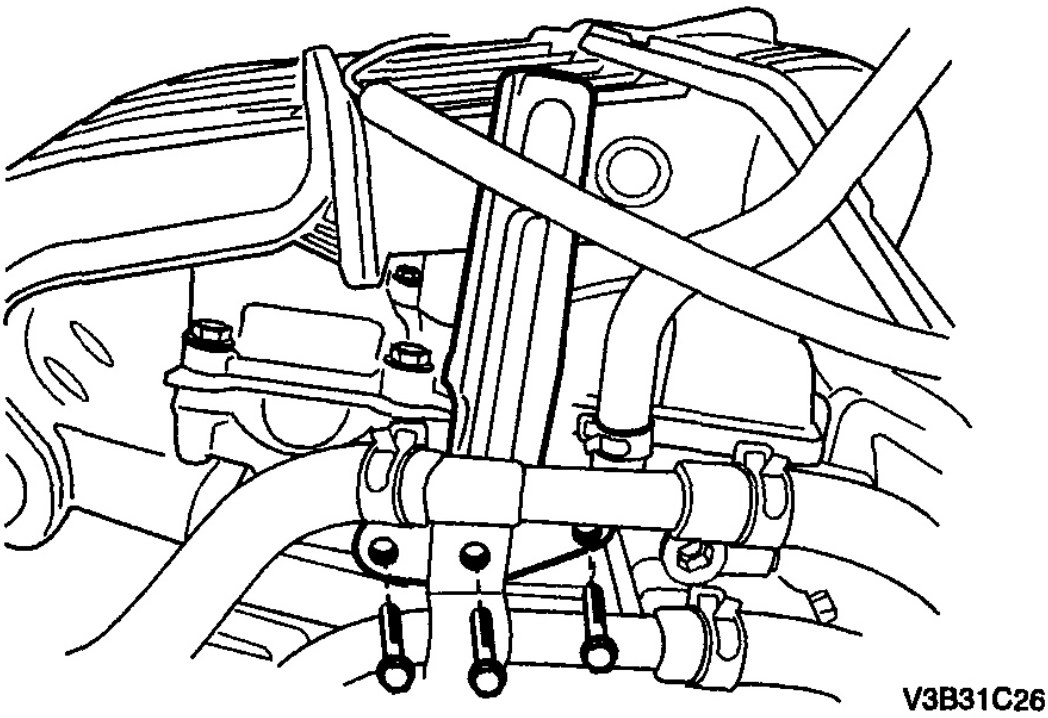

Fig. 32: Removing Rear Support Bracket Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

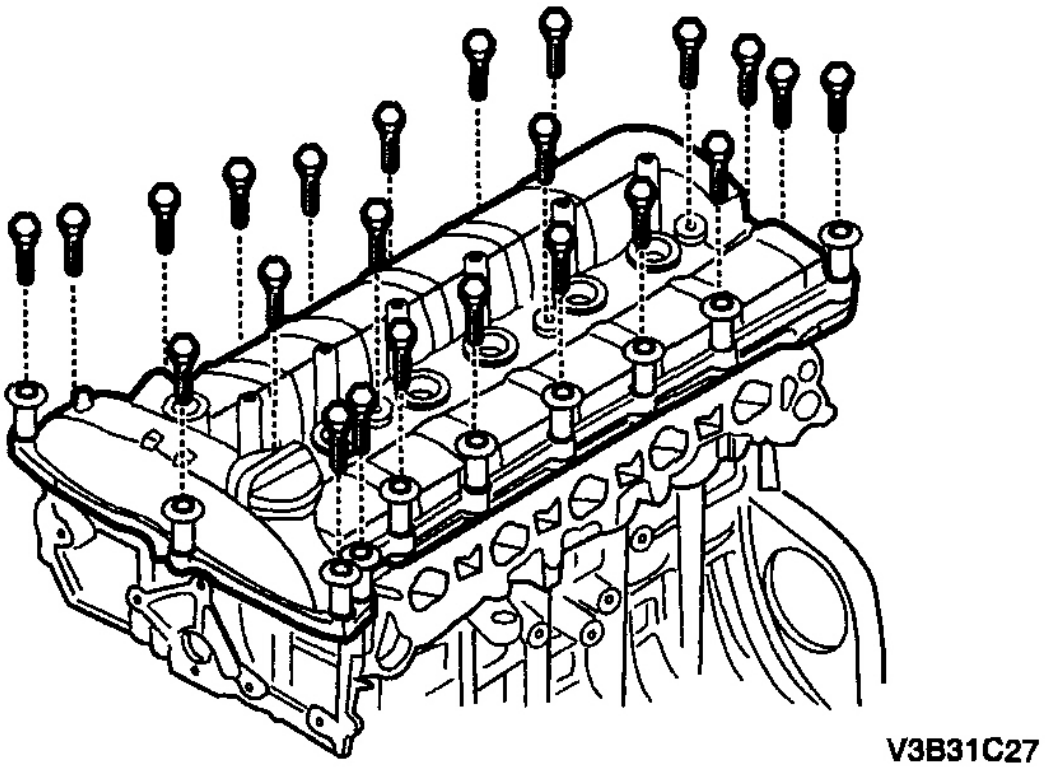

Fig. 33: Removing Cylinder Head Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

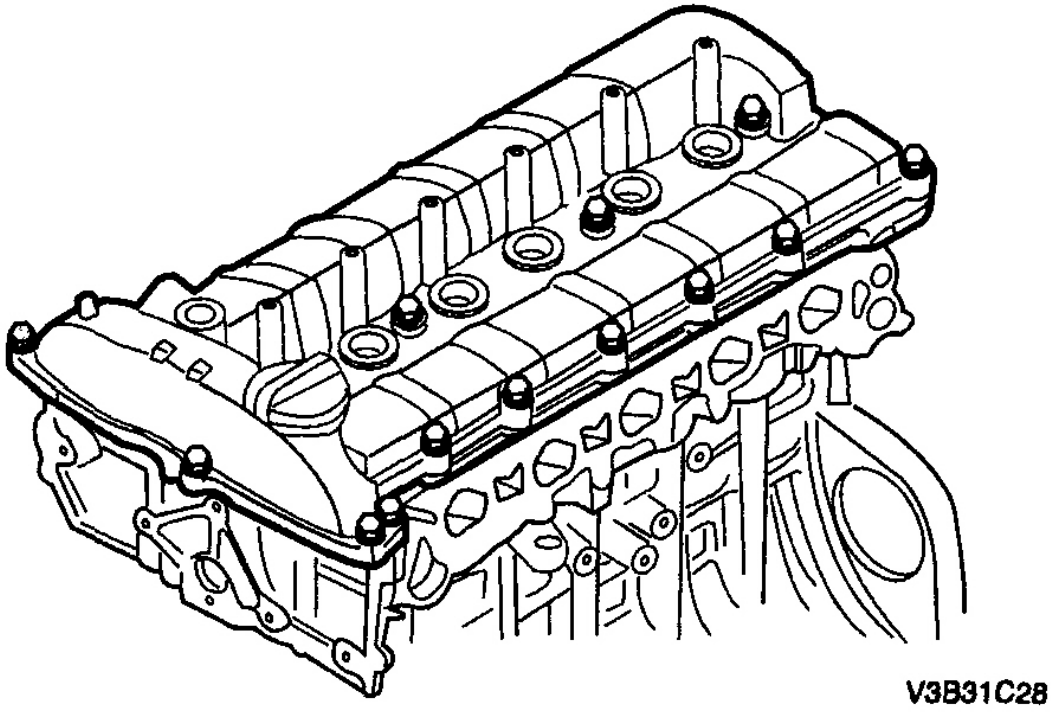

Fig. 34: Tightening Cylinder Head Cover Bolts
Courtesy of SUZUKI OF AMERICA CORP.

4. Install the ignition coils.

Tighten

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

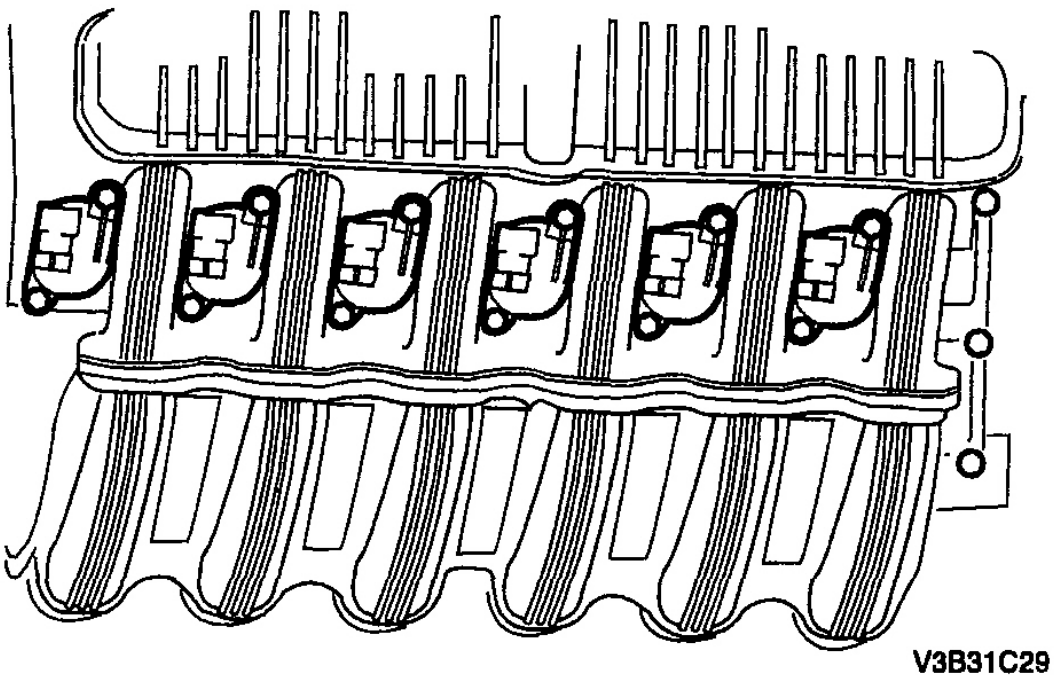

Fig. 35: Installing Ignition Coils
Courtesy of SUZUKI OF AMERICA CORP.

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).

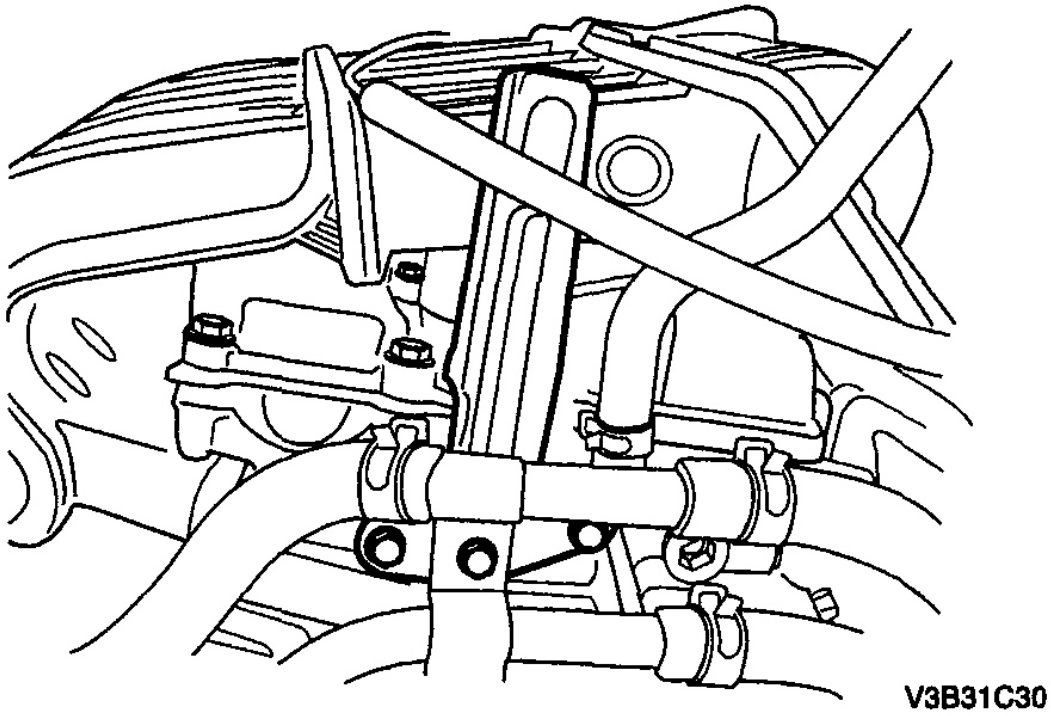

Fig. 36: Installing Rear Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the air filter housing.

Tighten

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

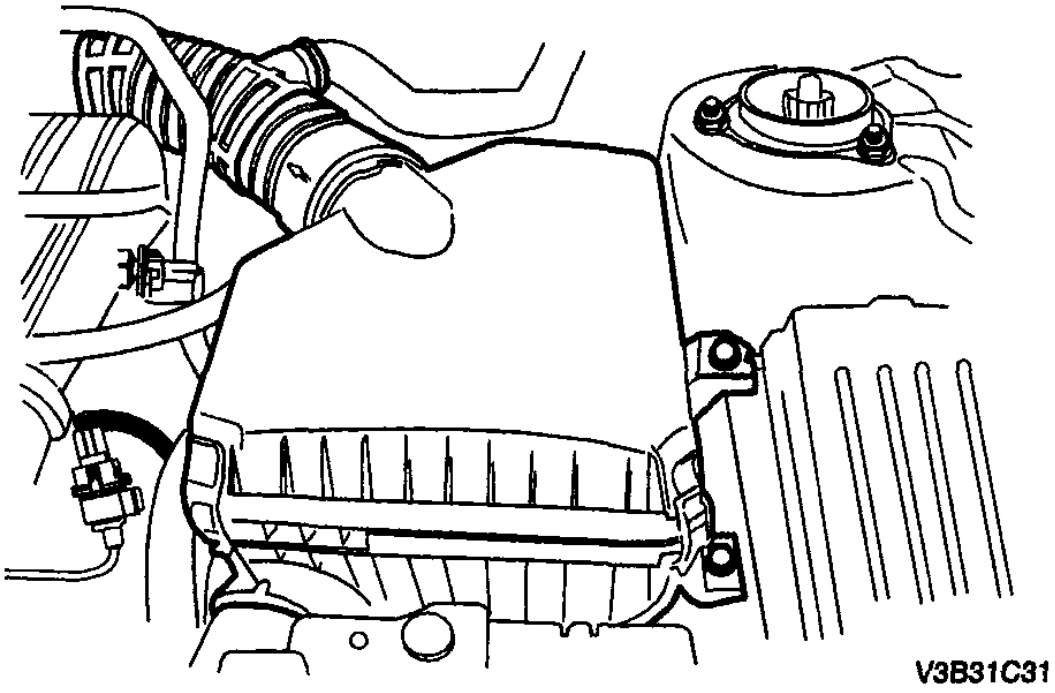

Fig. 37: Installing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the front support bracket.

Tighten

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

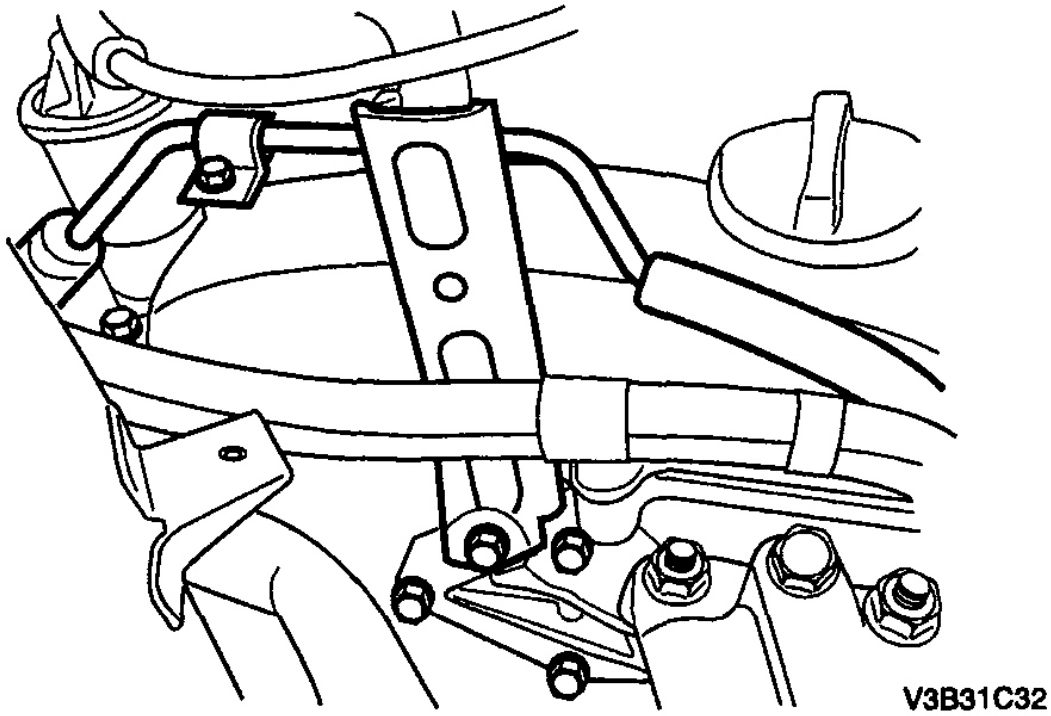

Fig. 38: Installing Front Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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).

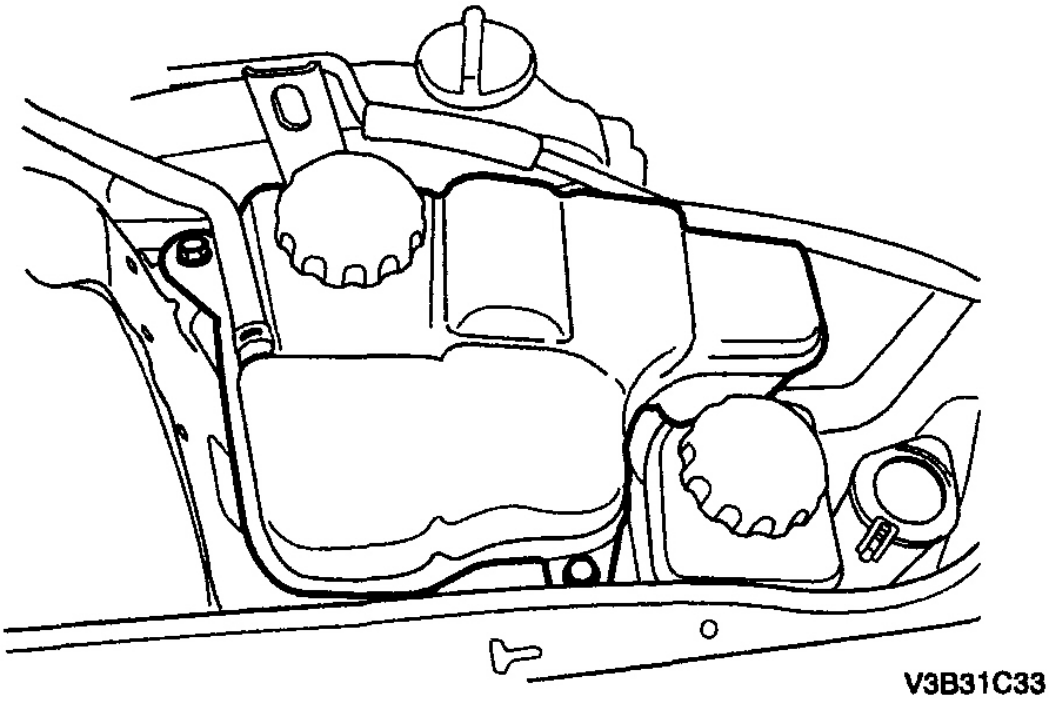

Fig. 39: Installing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

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).

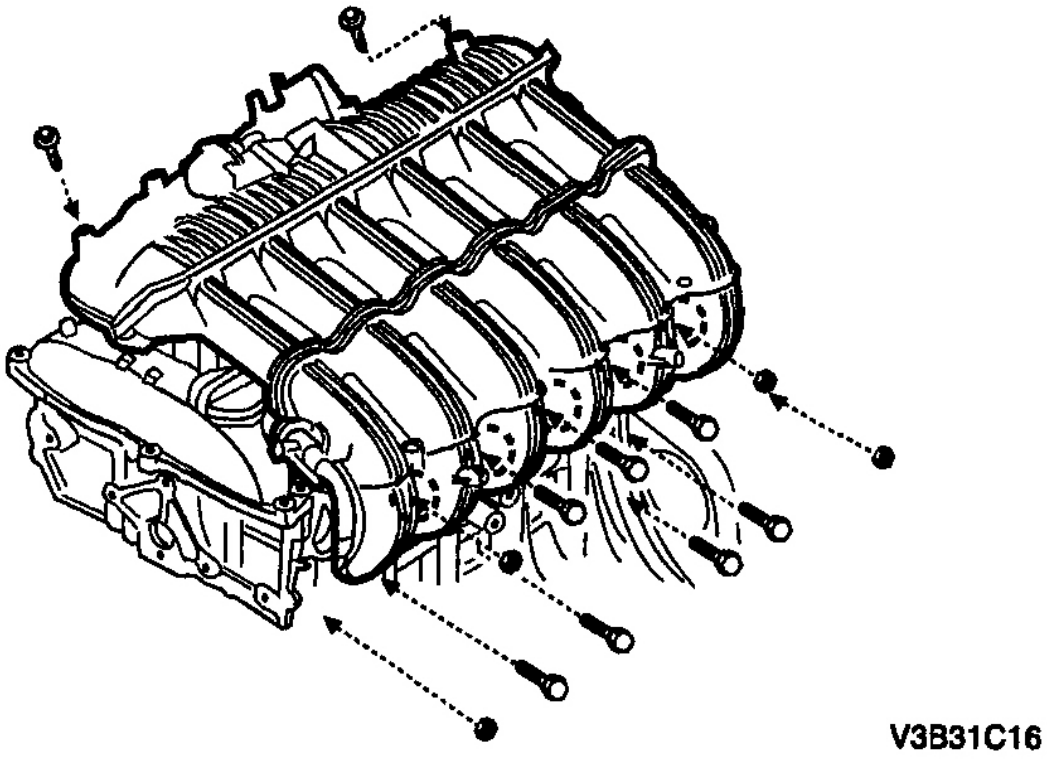

Fig. 40: Tightening Intake Manifold Retaining Nuts And Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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.

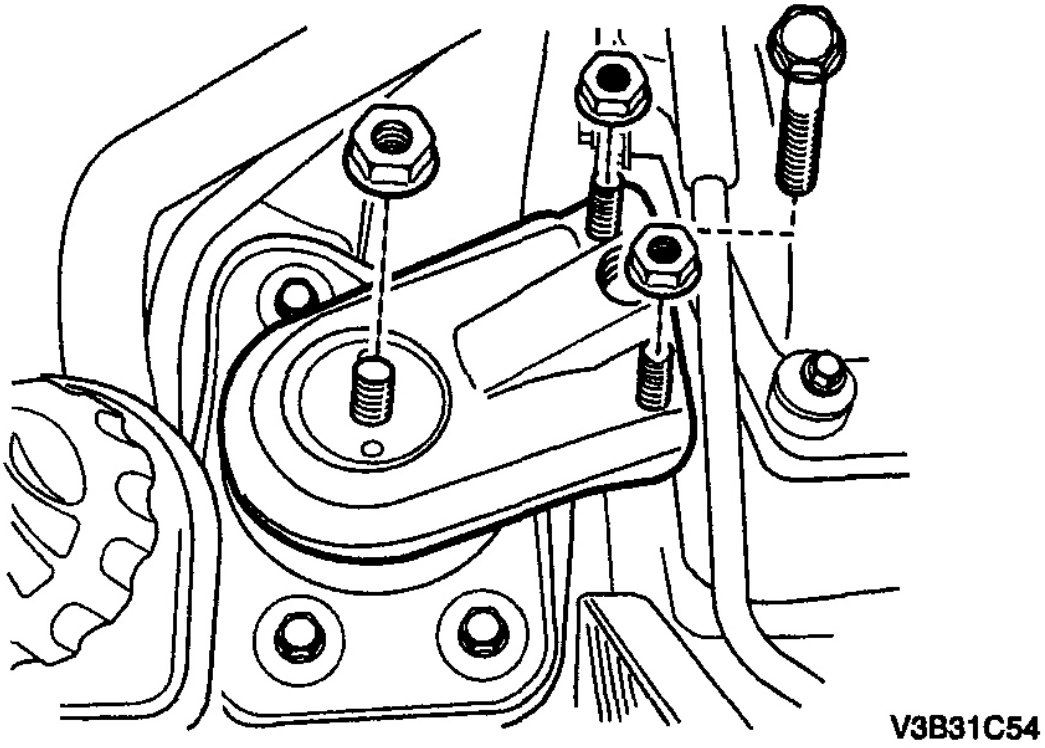

Fig. 41: Removing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

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).

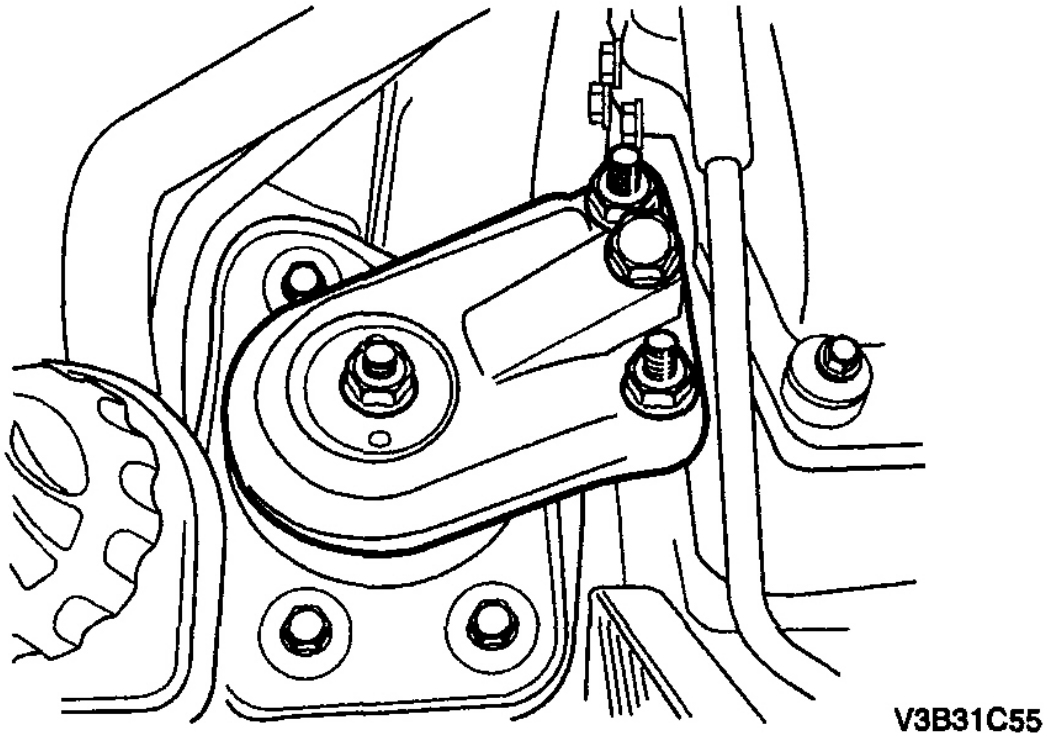

Fig. 42: Installing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

Engine Mount (LH) Removal

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

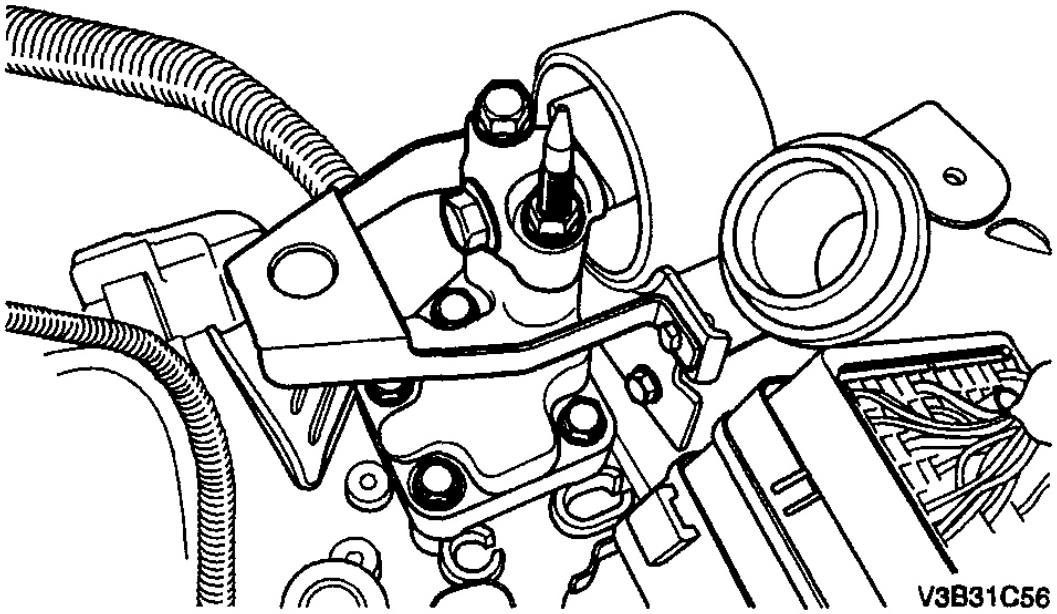

Fig. 43: Removing Engine Mount (LH)
Courtesy of SUZUKI OF AMERICA CORP.

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).

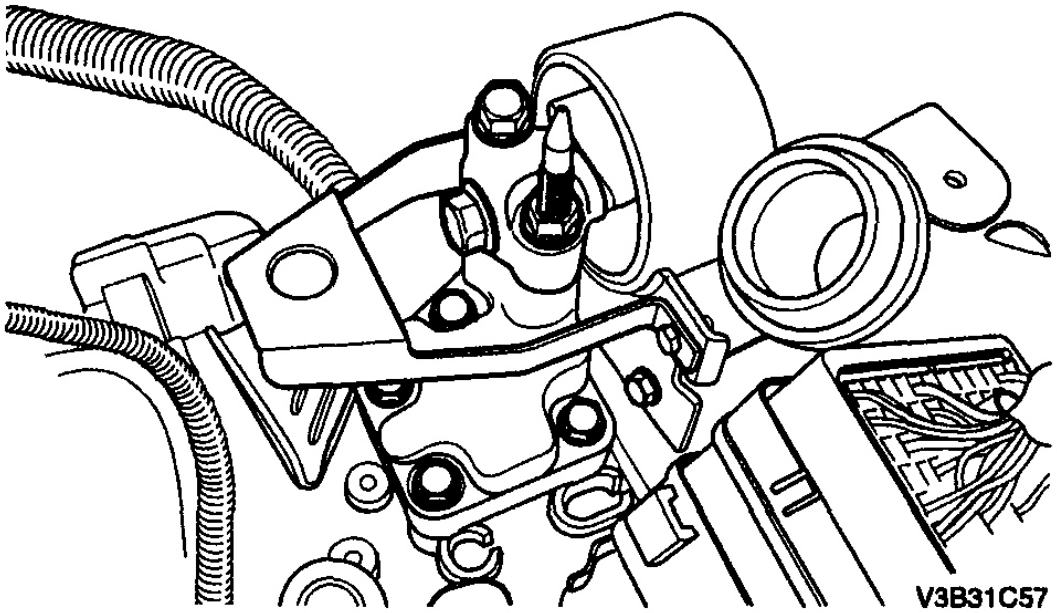

Fig. 44: Installing Engine Mount (LH)
Courtesy of SUZUKI OF AMERICA CORP.

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 "**DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEM** ".
9. Remove the engine beautification cover.
10. Remove the air filter snorkel.

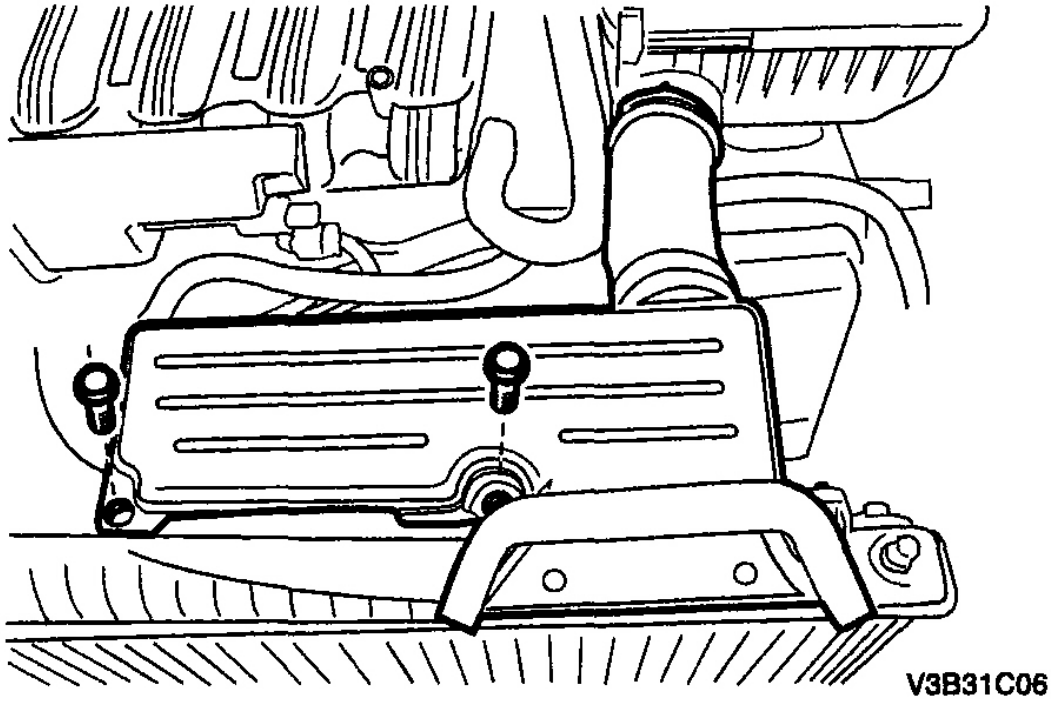

Fig. 45: Removing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

11. Remove the air filter housing assembly.

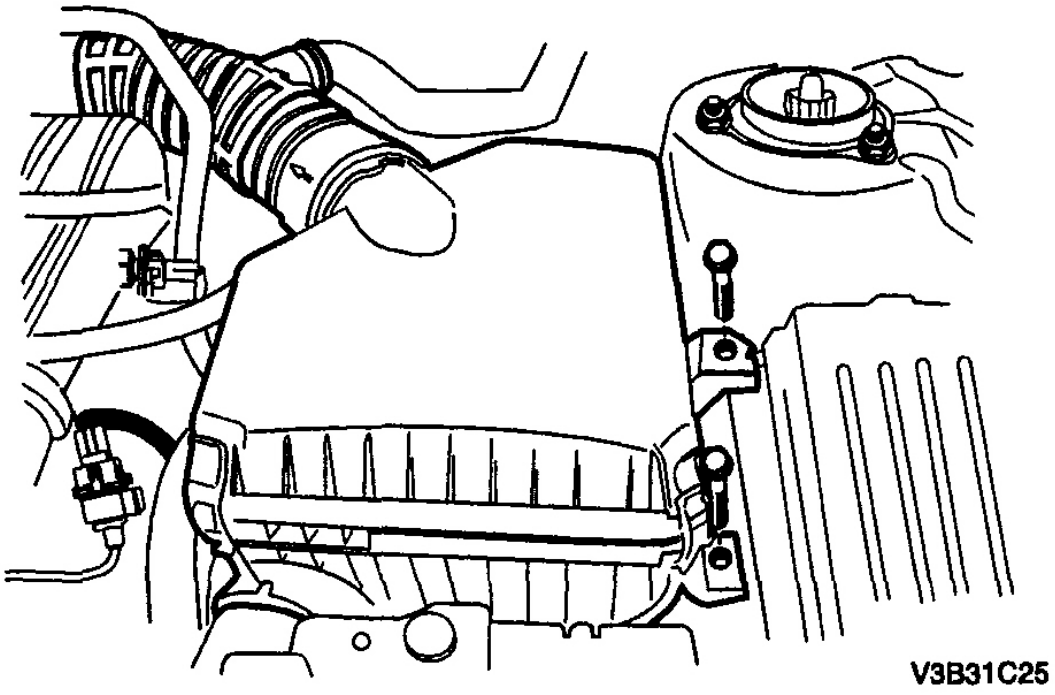

Fig. 46: Removing Air Filter Housing Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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

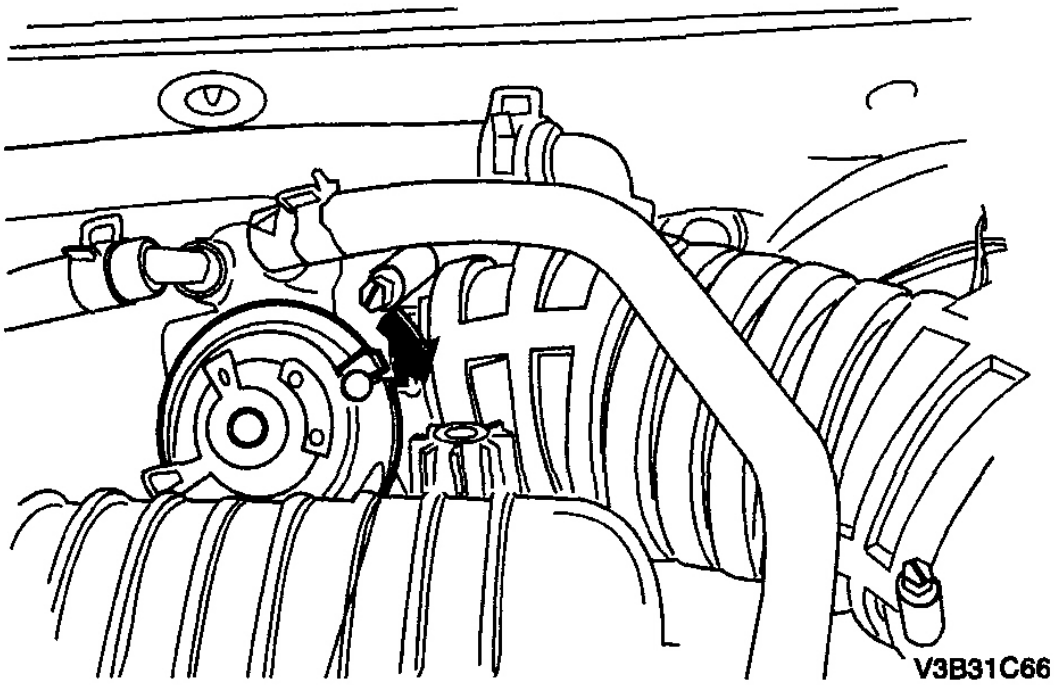

Fig. 47: Disconnecting Throttle Cable From Throttle Body Assembly.
Courtesy of SUZUKI OF AMERICA CORP.

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

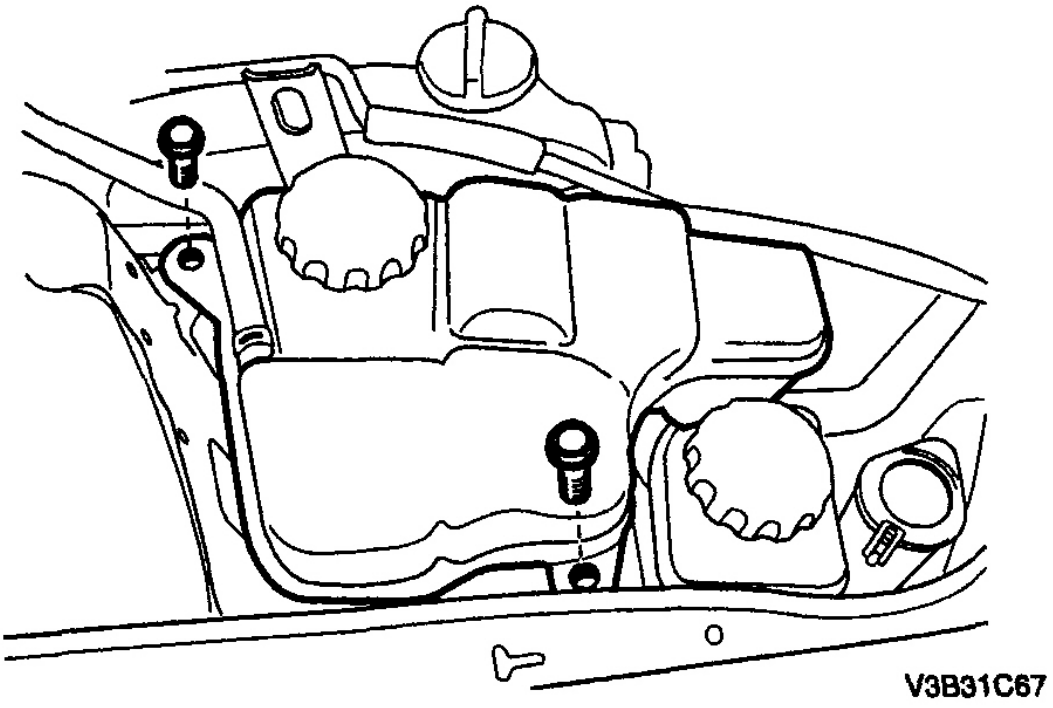

Fig. 48: Removing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

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

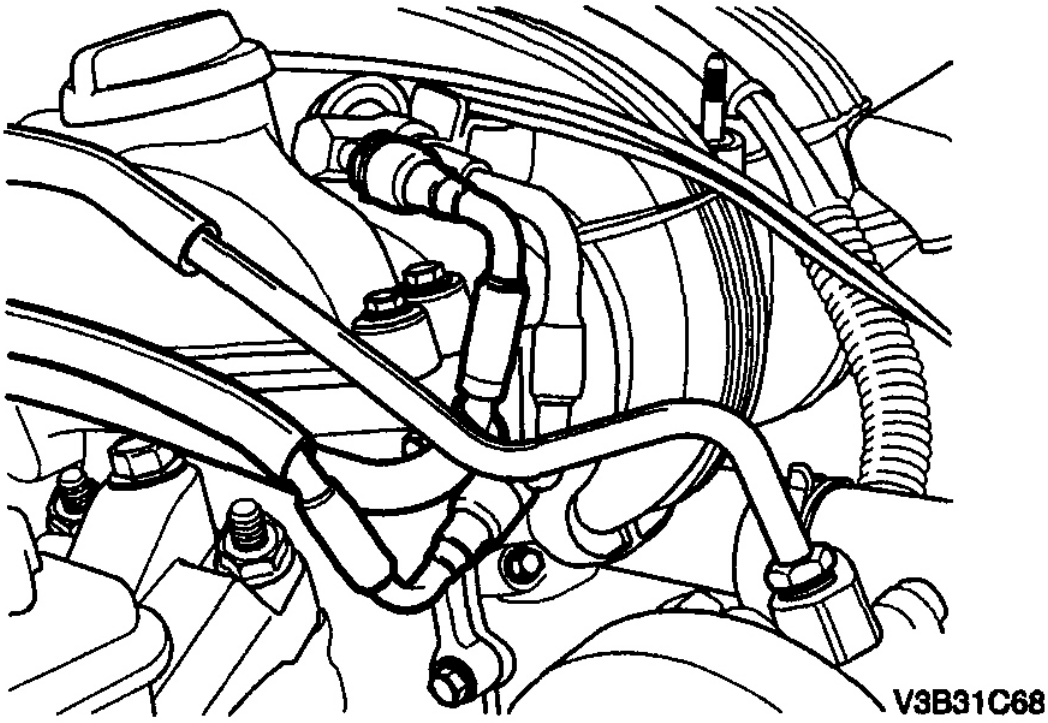

Fig. 49: Disconnecting Fuel Rail Hose And Fuel Feeding/Return Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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.

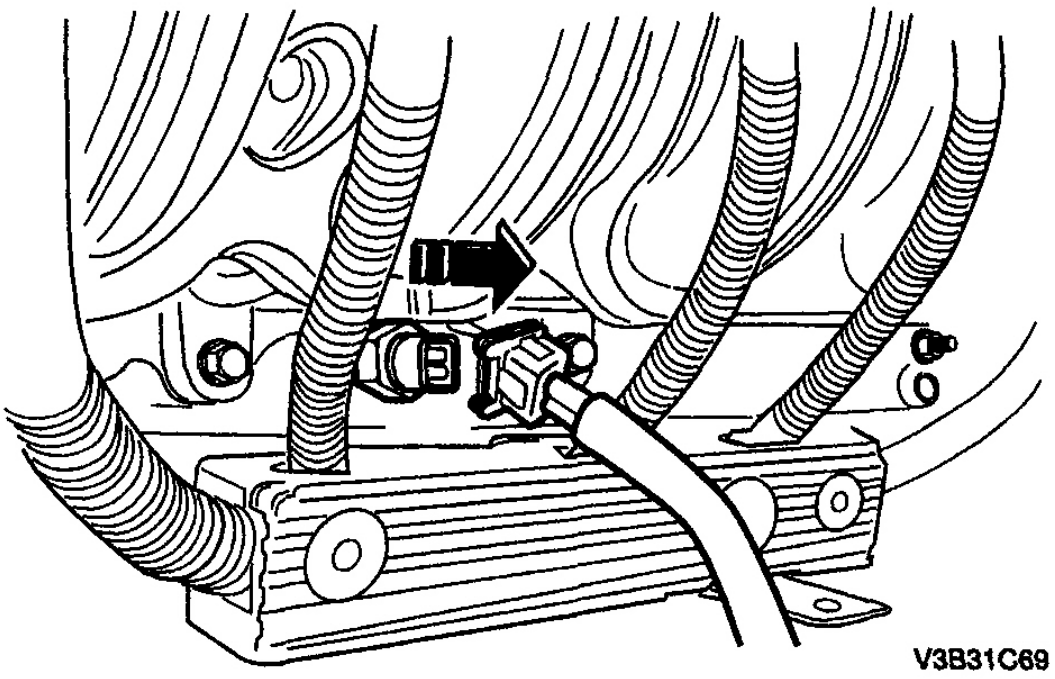

Fig. 50: Disconnecting Connectors
Courtesy of SUZUKI OF AMERICA CORP.

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

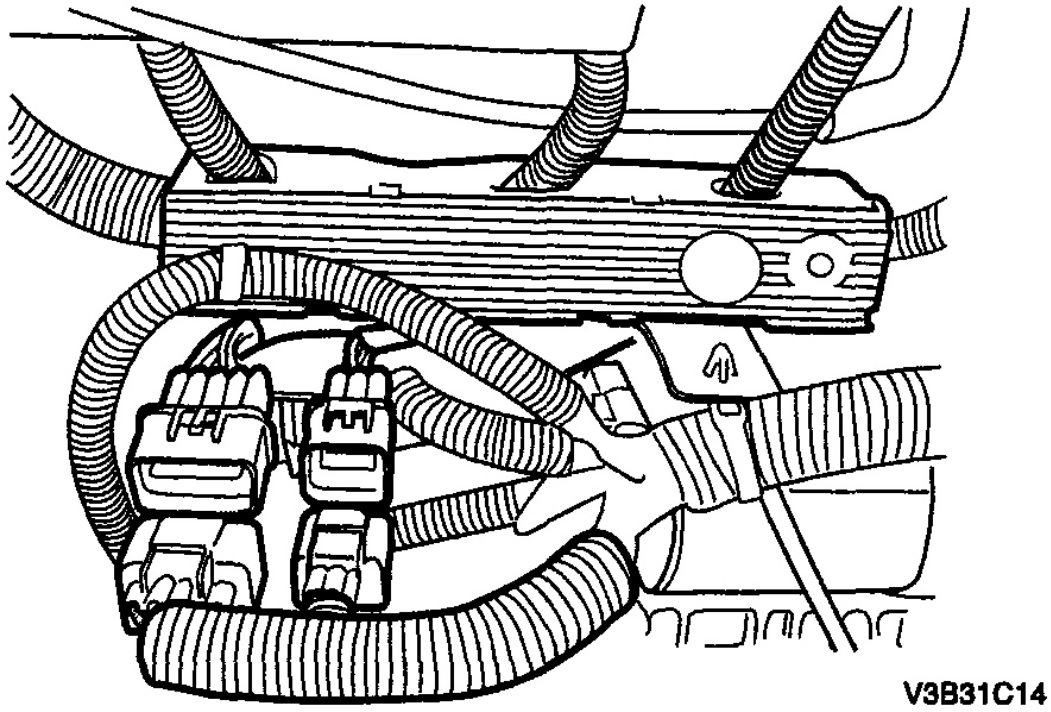

Fig. 51: Detaching Wiring Harness From Wiring Harness Bracket On Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

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

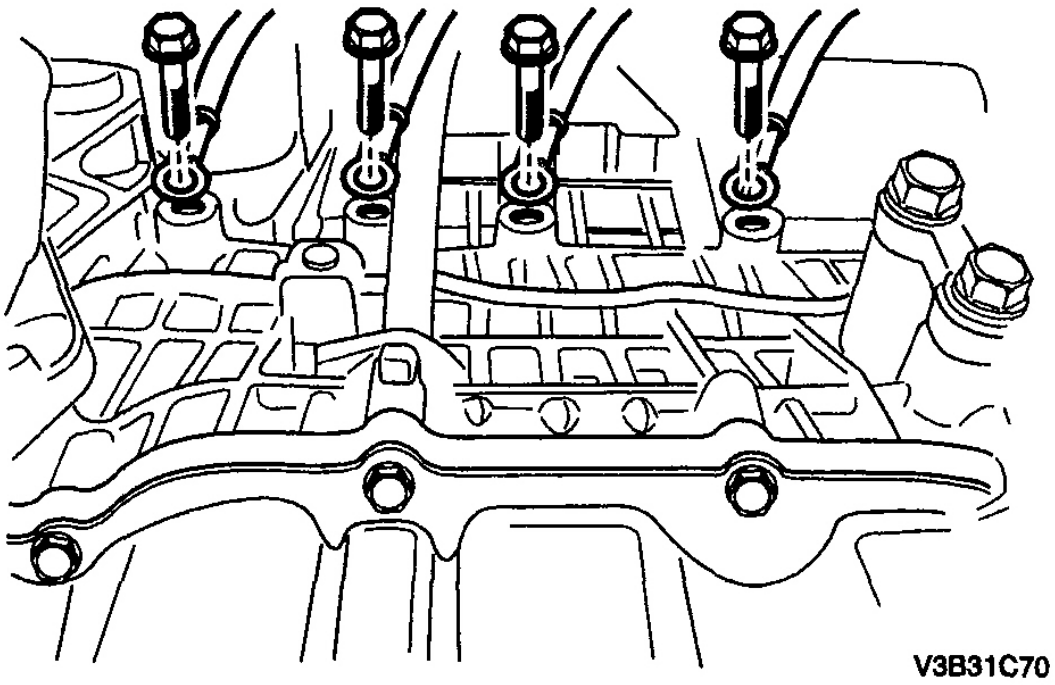

Fig. 52: Removing Engine Block Ground Bolts
Courtesy of SUZUKI OF AMERICA CORP.

21. Remove the battery.

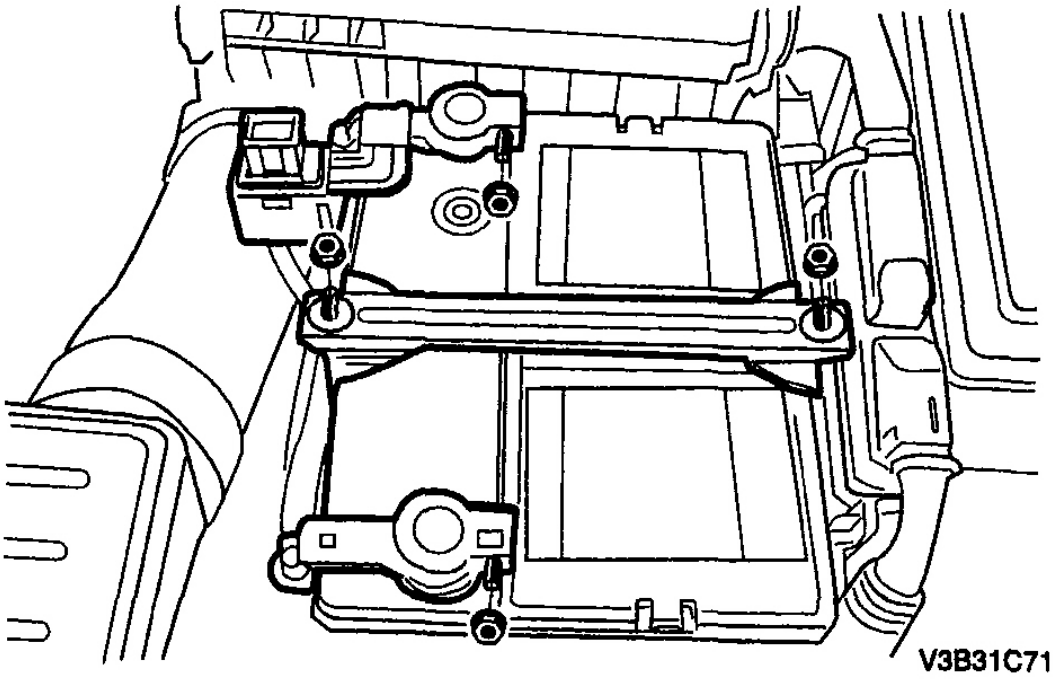

Fig. 53: Removing Battery
Courtesy of SUZUKI OF AMERICA CORP.

22. Disconnect the automatic transaxle cable.
23. Disconnect the inhibit switch connector.
24. Disconnect the connectors on the transaxle. Refer to "**TRANSAXLE ASSEMBLY REMOVAL** ".
25. Disconnect the alternator connector and wiring harness. Refer to "**GENERATOR REMOVAL** ".

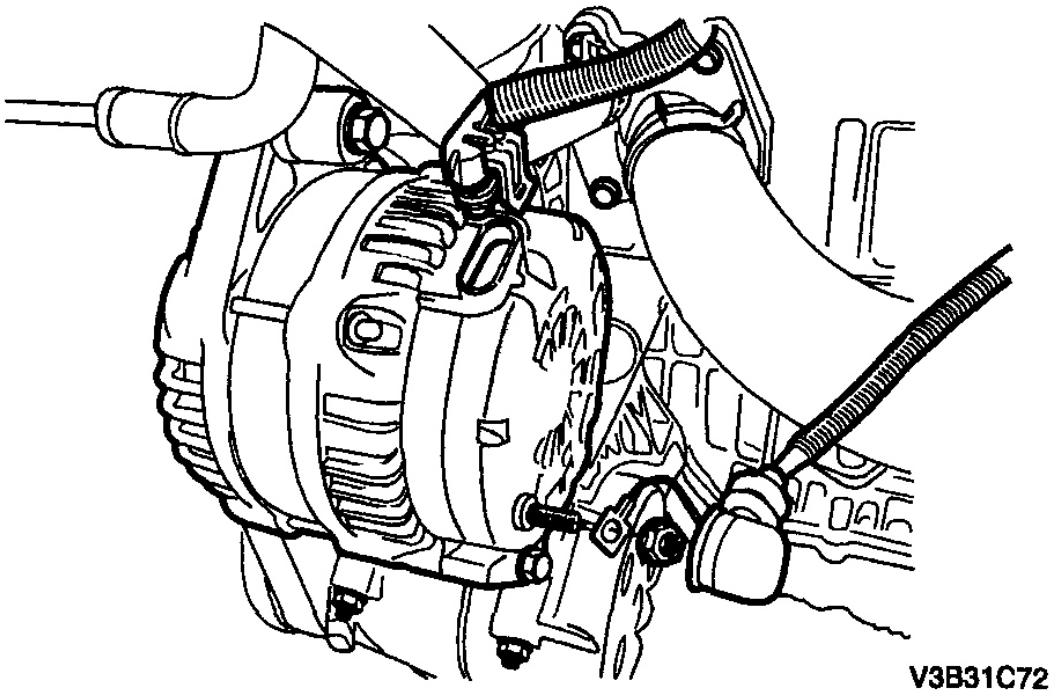

Fig. 54: Disconnecting Alternator Connector And Wiring Harness
Courtesy of SUZUKI OF AMERICA CORP.

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

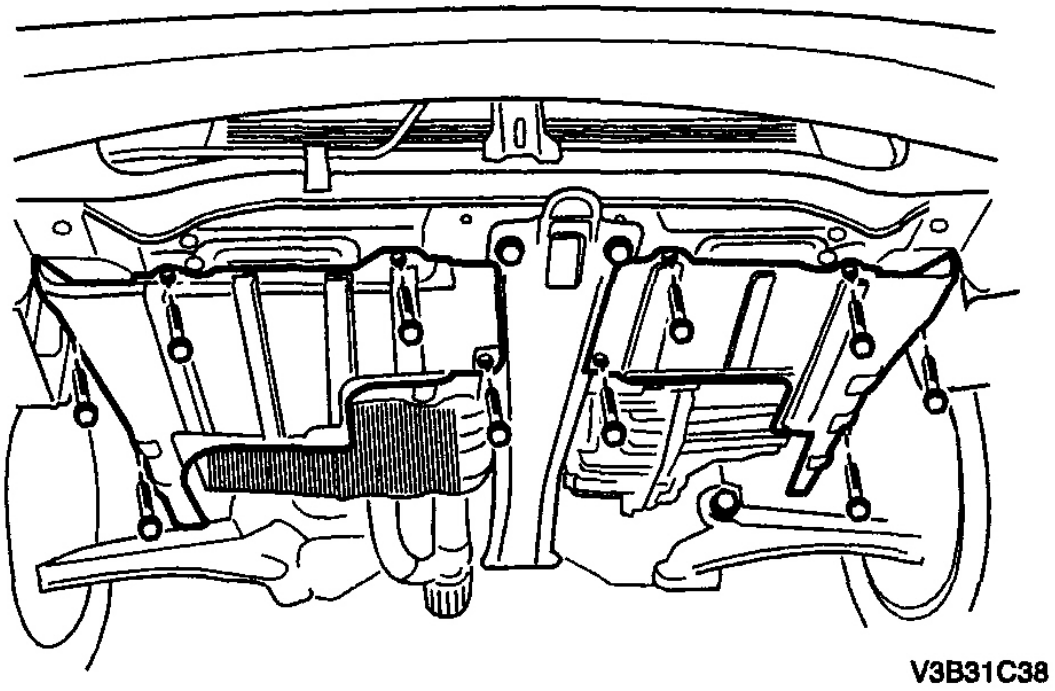

Fig. 55: Removing Engine Under Covers
Courtesy of SUZUKI OF AMERICA CORP.

29. Remove the front axle shaft. Refer to "**DRIVE AXLE ASSEMBLY REMOVAL** ".
30. Remove the front muffler. Refer to "**MUFFLER - FRONT REMOVAL** ".

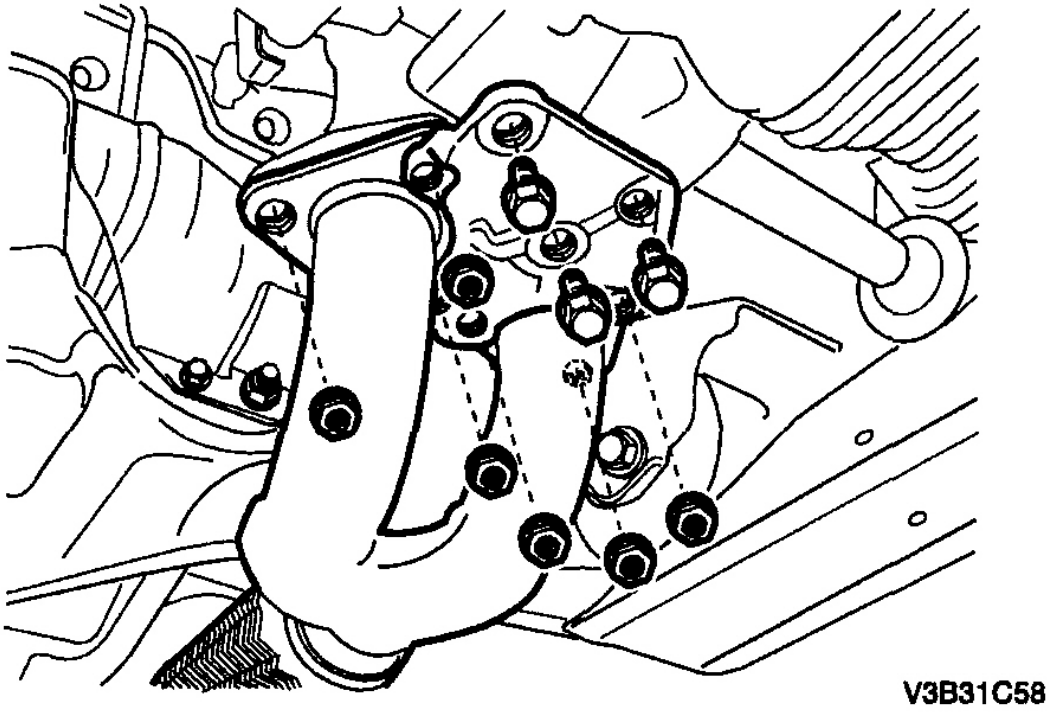

Fig. 56: Removing Front Muffler
Courtesy of SUZUKI OF AMERICA CORP.

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

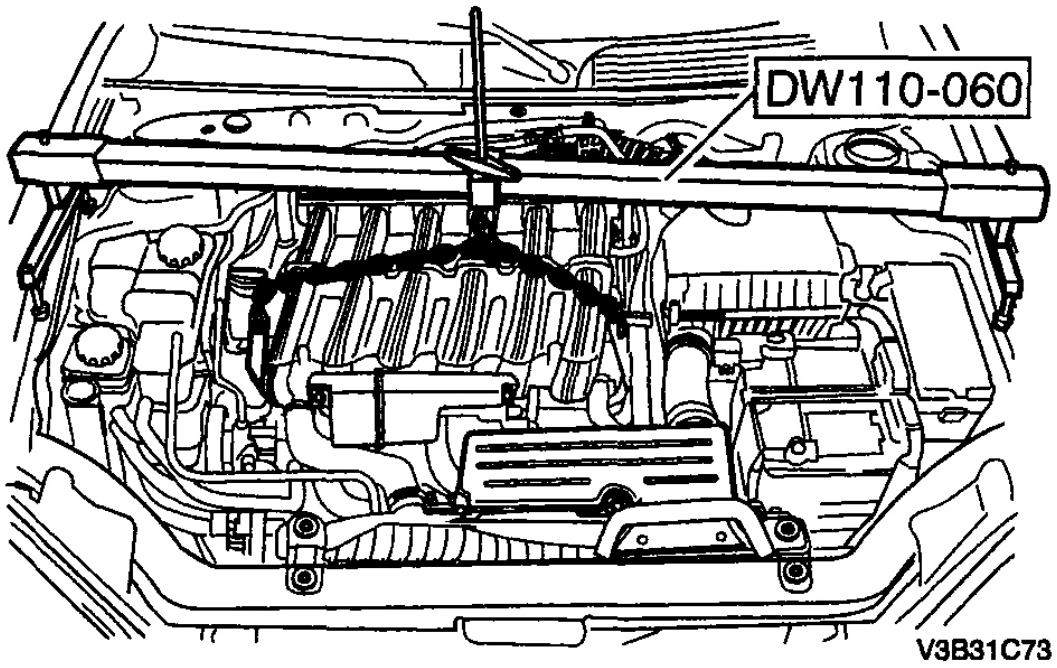

Fig. 57: Supporting Engine Assembly Using Engine Assembly Lift Support DW110-060
Courtesy of SUZUKI OF AMERICA CORP.

32. Remove the impact beam. Refer to "**IMPACT BEAM REMOVAL** ".

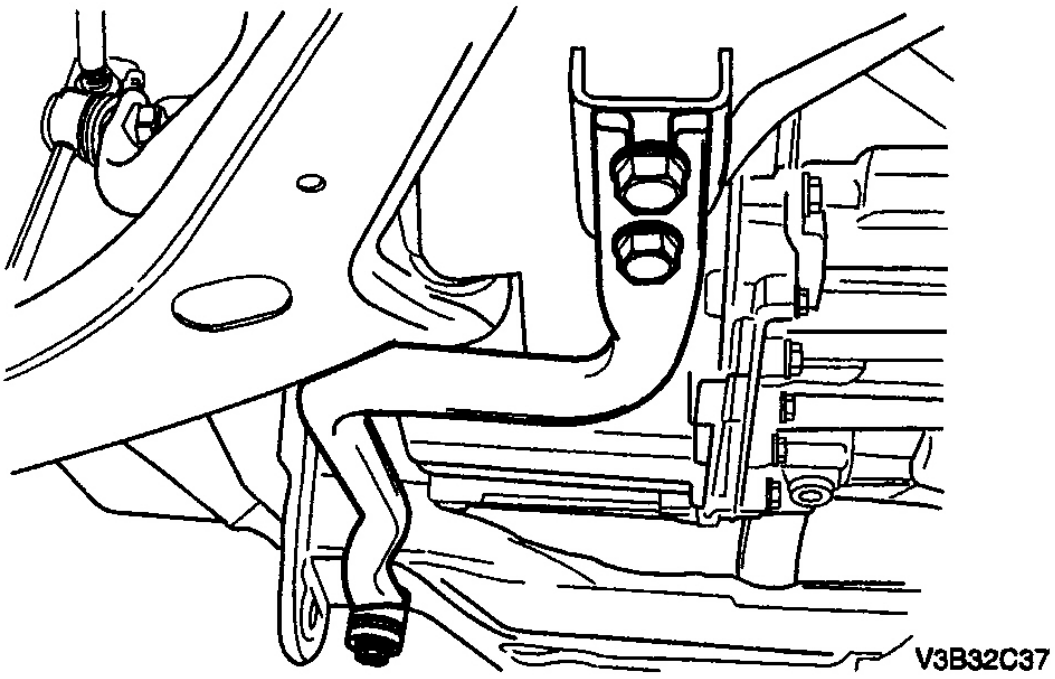

Fig. 58: Removing Impact Beam
Courtesy of SUZUKI OF AMERICA CORP.

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

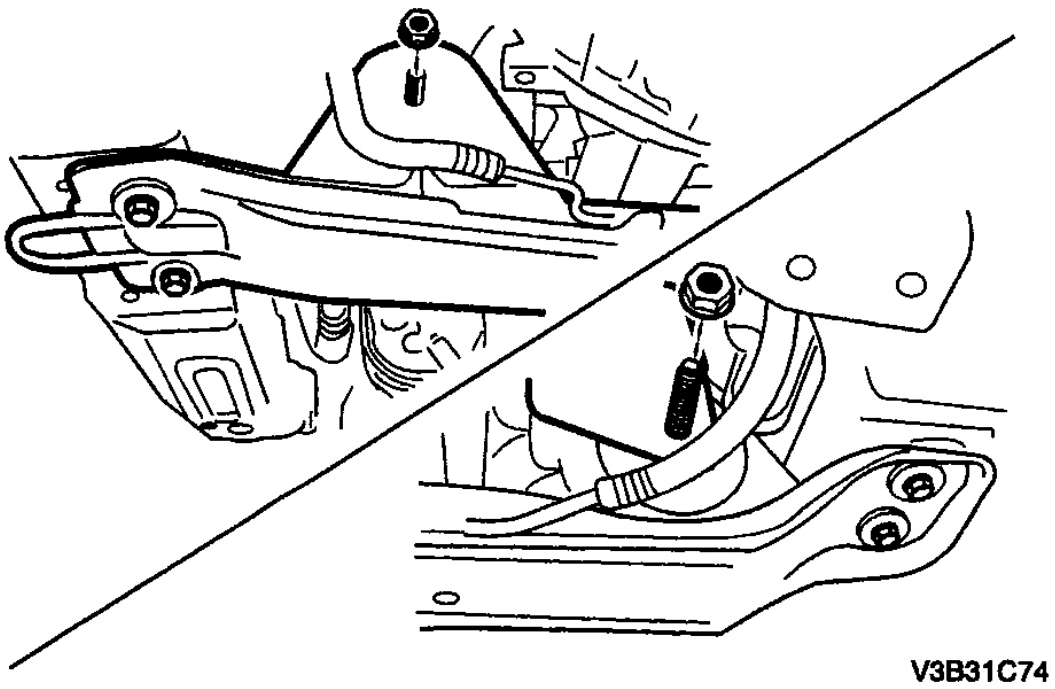

Fig. 59: Removing Front And Rear Engine Mount Bracket-To-Damper Bush Bolt/Nut
Courtesy of SUZUKI OF AMERICA CORP.

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

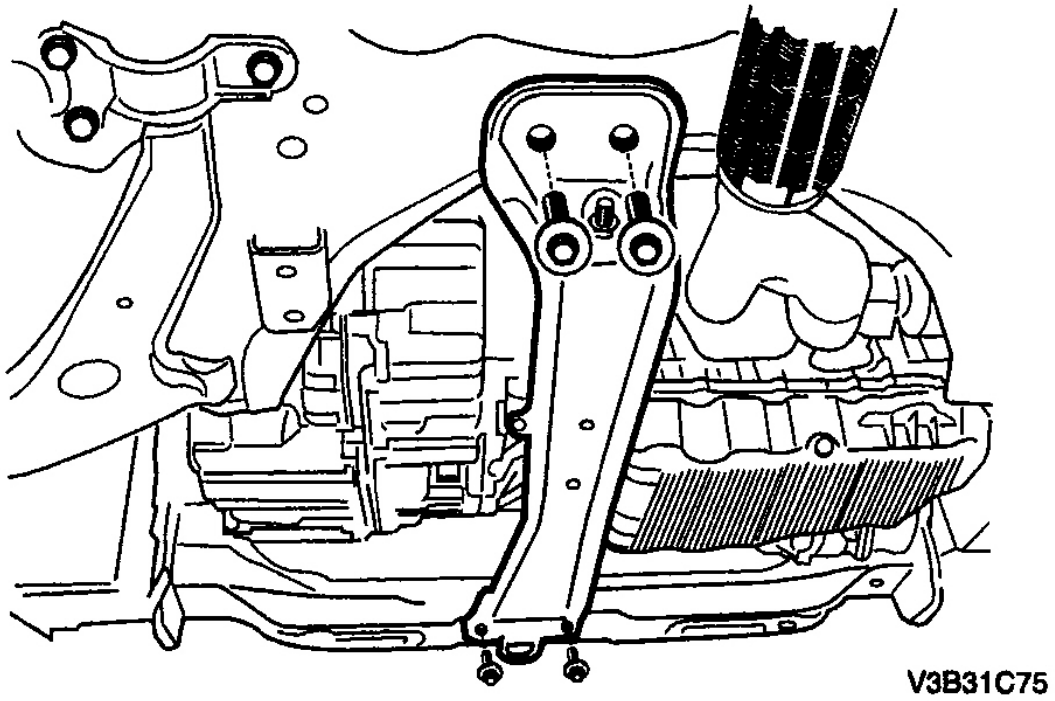

Fig. 60: Removing Center Front Suspension Member Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

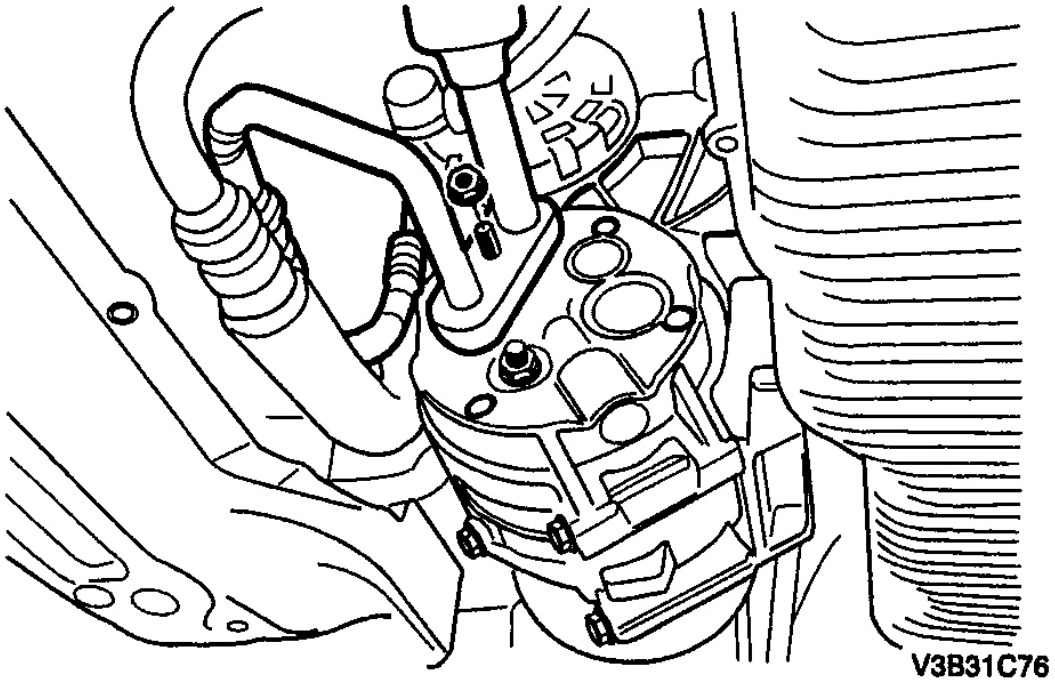

Fig. 61: Disconnecting Refrigerant Suction And Discharge Pipe Block From Compressor
Courtesy of SUZUKI OF AMERICA CORP.

37. Remove the oil filter.

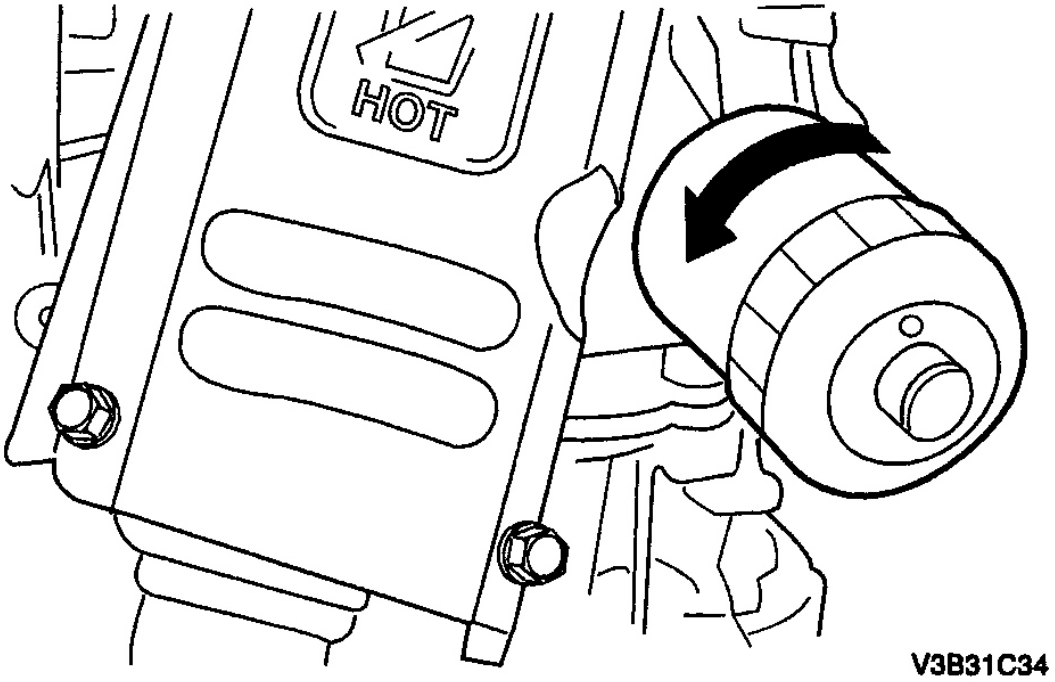

Fig. 62: Removing Oil Filter
Courtesy of SUZUKI OF AMERICA CORP.

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

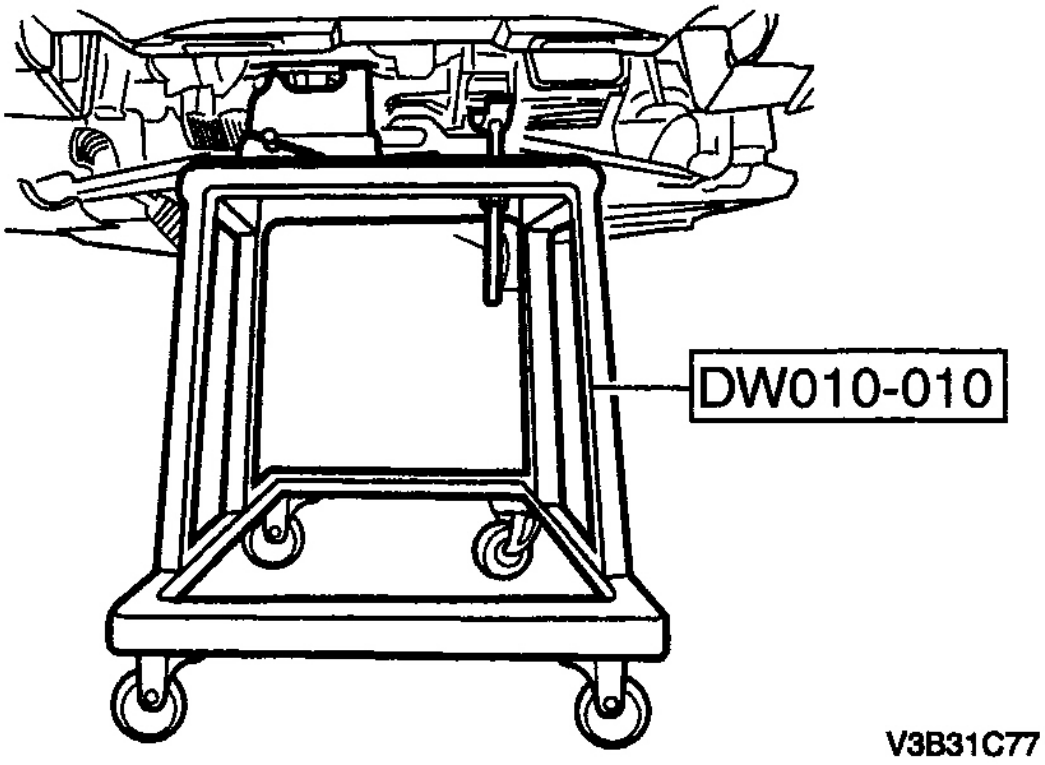

Fig. 63: Supporting Engine And Transaxle With Power Pack Stand DW010-010
Courtesy of SUZUKI OF AMERICA CORP.

39. Remove the engine mount bracket (RH). Refer to "**ENGINE MOUNT (RH) REMOVAL**".

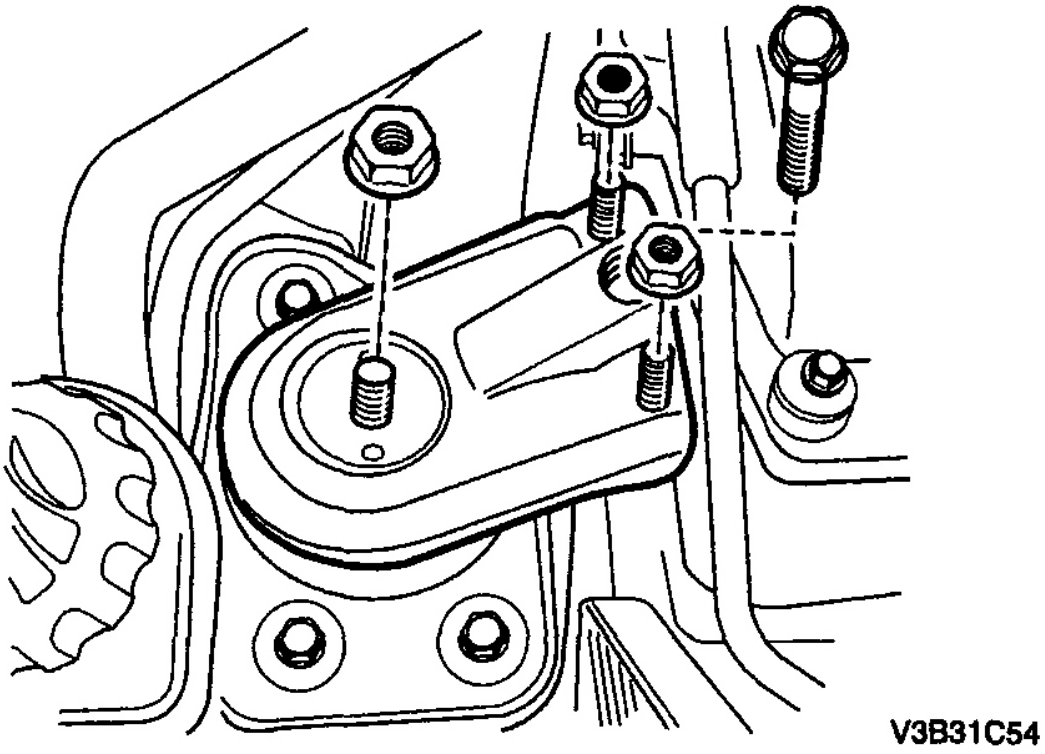

Fig. 64: Removing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

40. Remove the engine mount bracket (LH). Refer to "**ENGINE MOUNT (LH) REMOVAL**".
41. Separate the engine and transaxle assembly from the engine compartment.

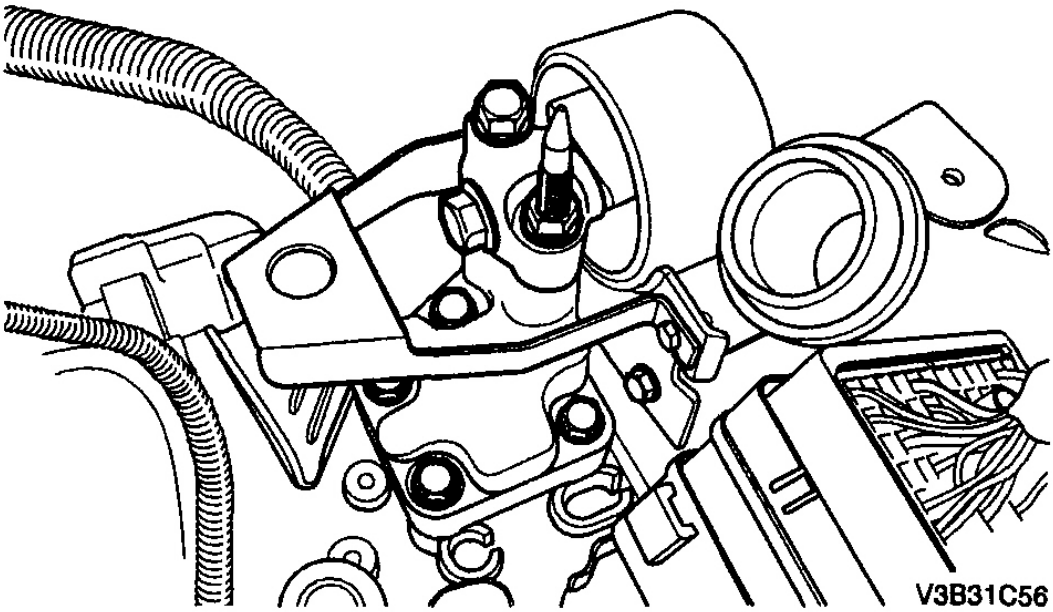

Fig. 65: Removing Engine Mount Bracket (LH)
Courtesy of SUZUKI OF AMERICA CORP.

42. Remove the starter. Refer to "**STARTER REMOVAL** ".

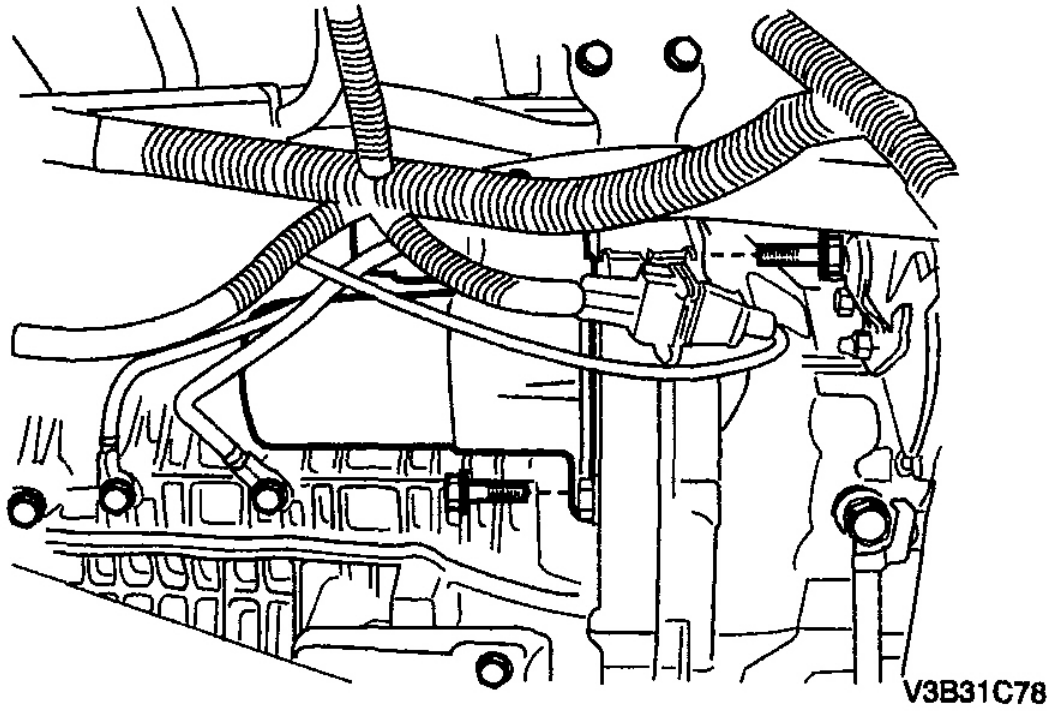

Fig. 66: Removing Starter
Courtesy of SUZUKI OF AMERICA CORP.

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

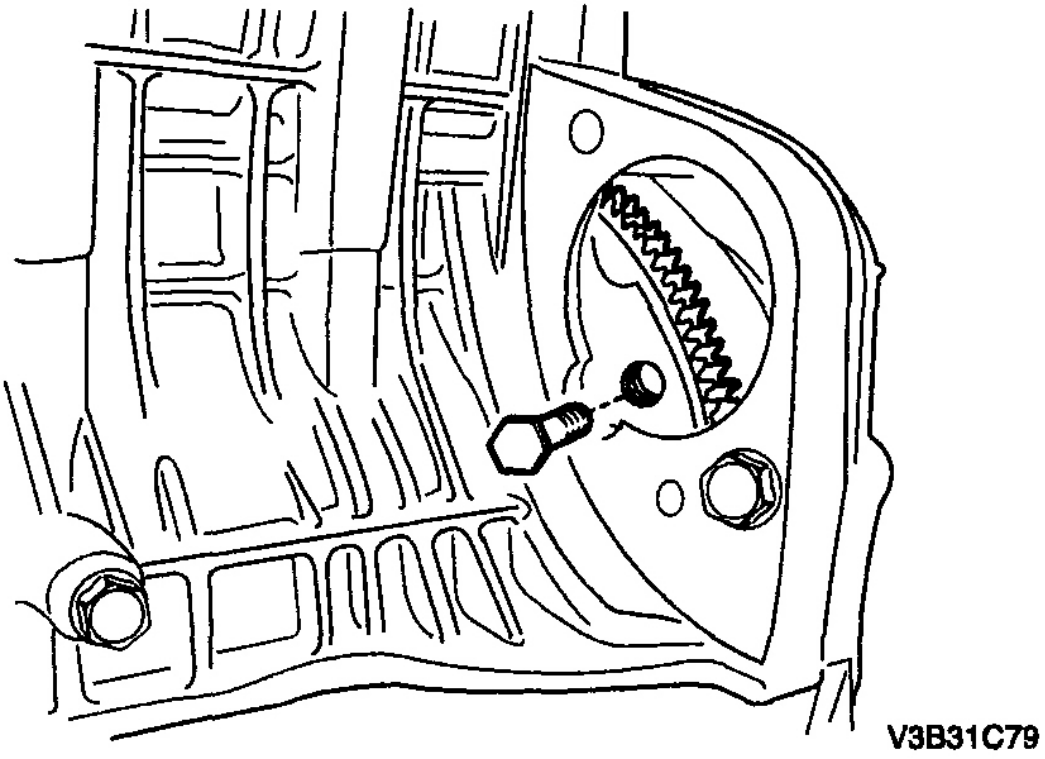

Fig. 67: Removing Transaxle Torque Converter Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

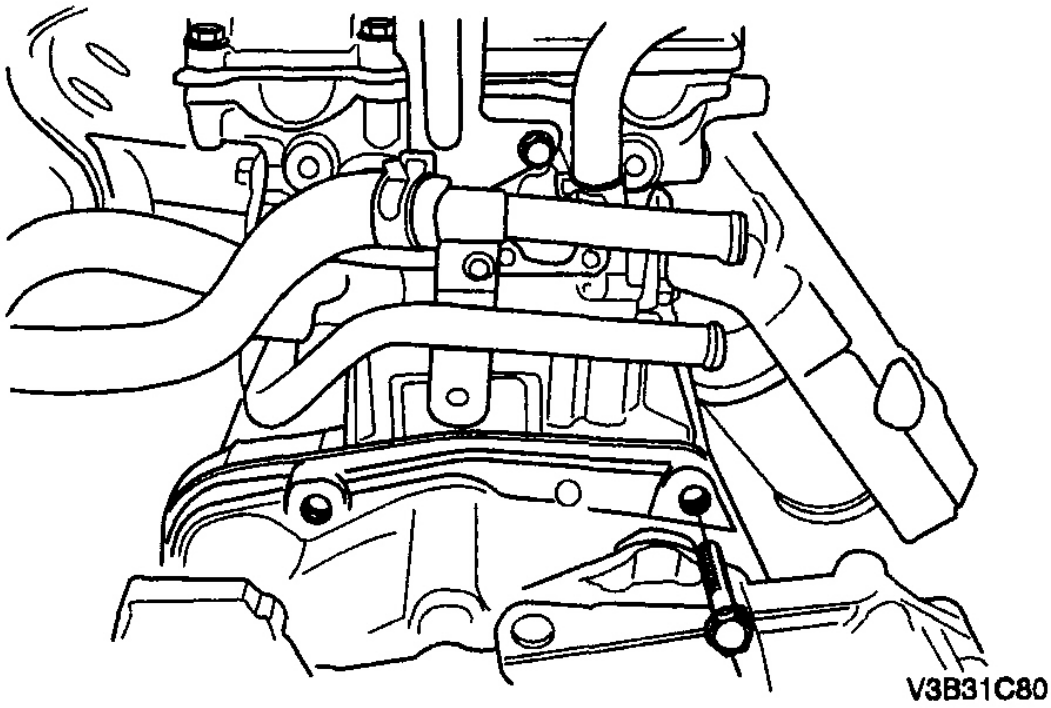

Fig. 68: Removing Transaxle-To-Engine Block Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

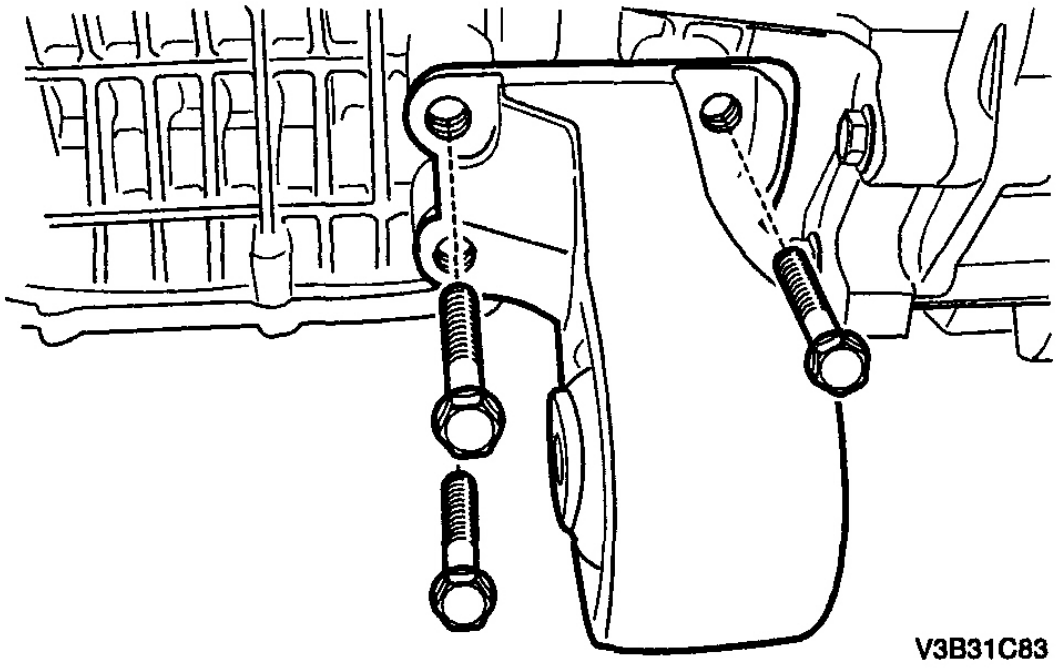

Fig. 69: Removing Front Damper Bush Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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

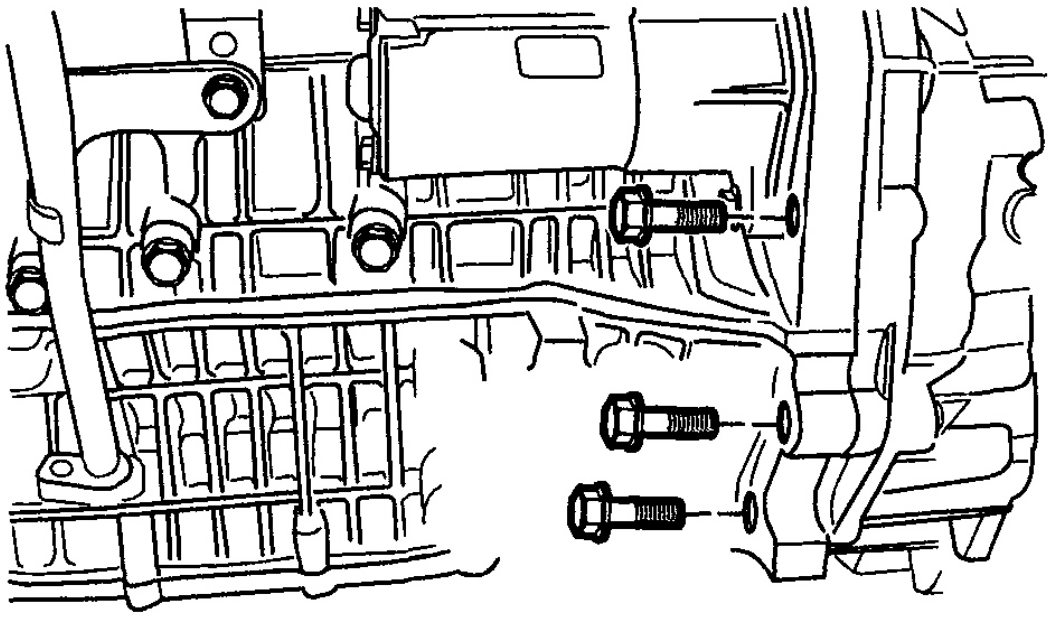

Fig. 70: Removing Engine Block-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

48. Remove the engine assembly from the transaxle.

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

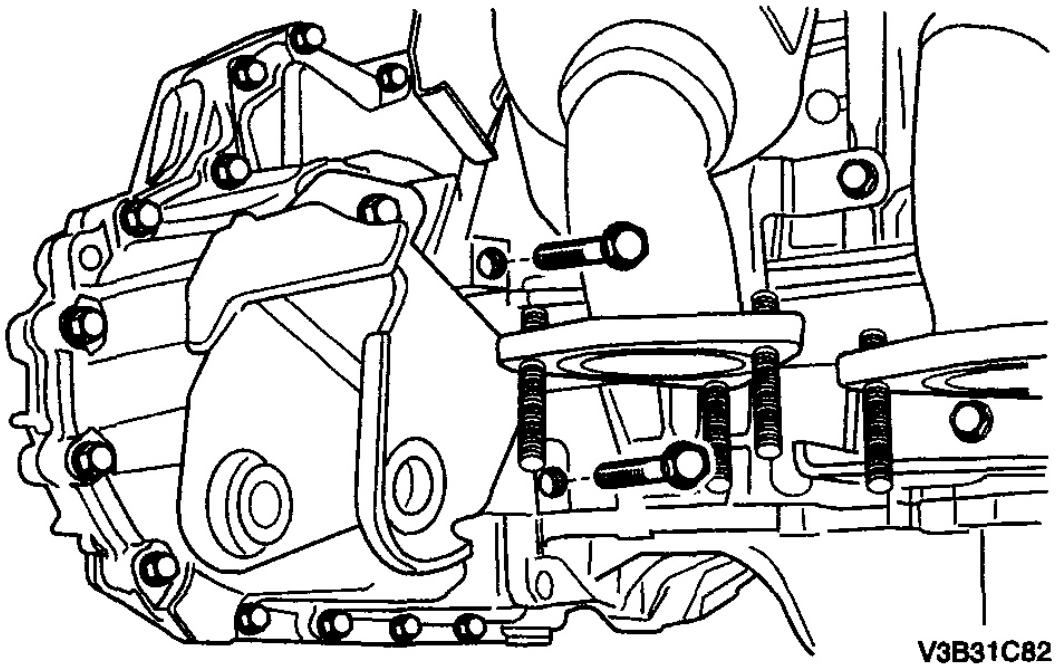

Fig. 71: Removing Engine Assembly From Transaxle
Courtesy of SUZUKI OF AMERICA CORP.

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).

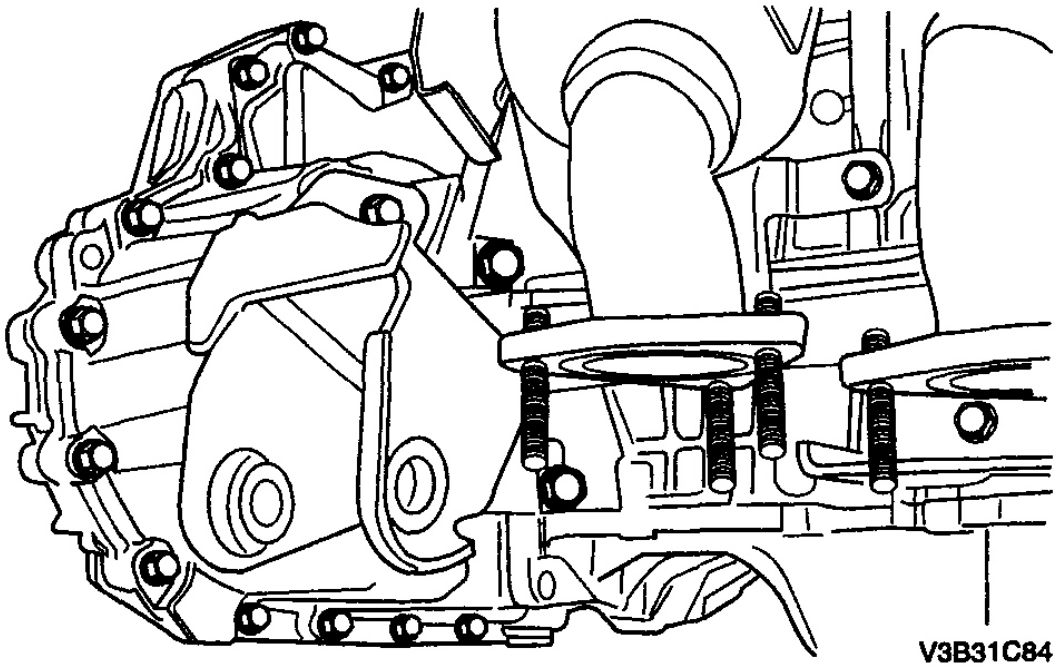

Fig. 72: Tightening Engine Block-To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

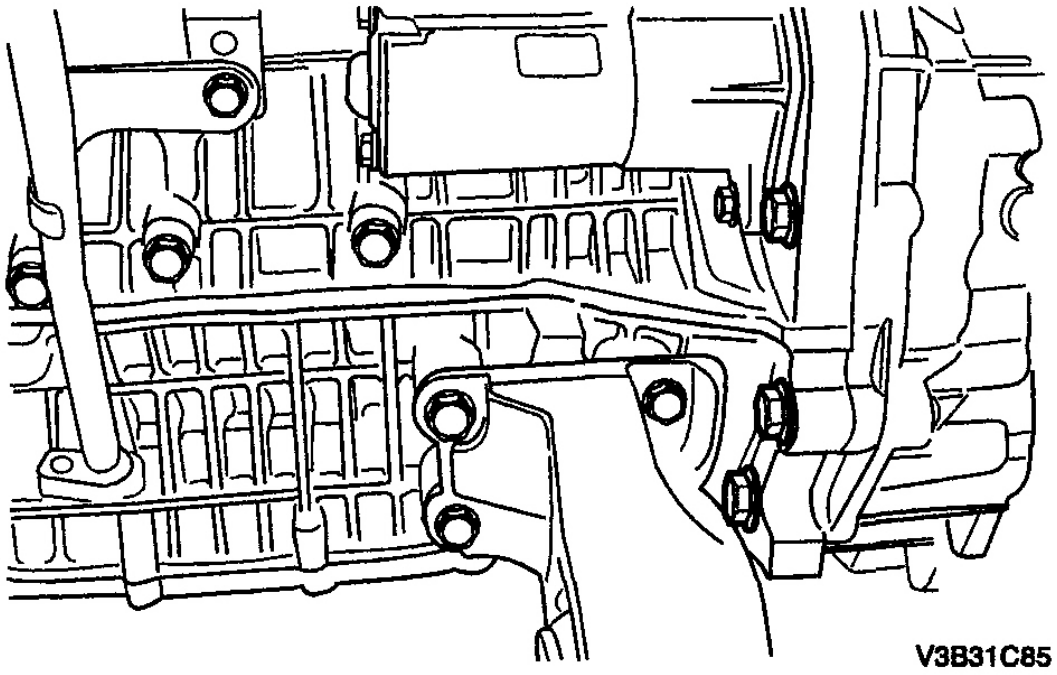

Fig. 73: Tightening Engine Block- To-Transaxle Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

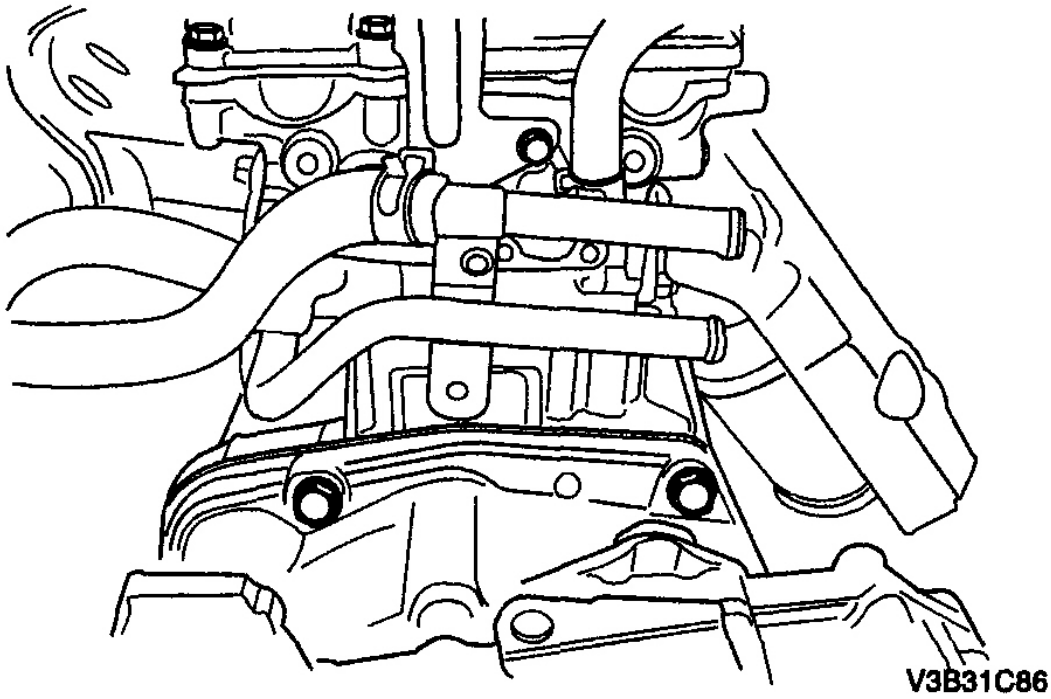

Fig. 74: Tightening Transaxle-To-Engine Block Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

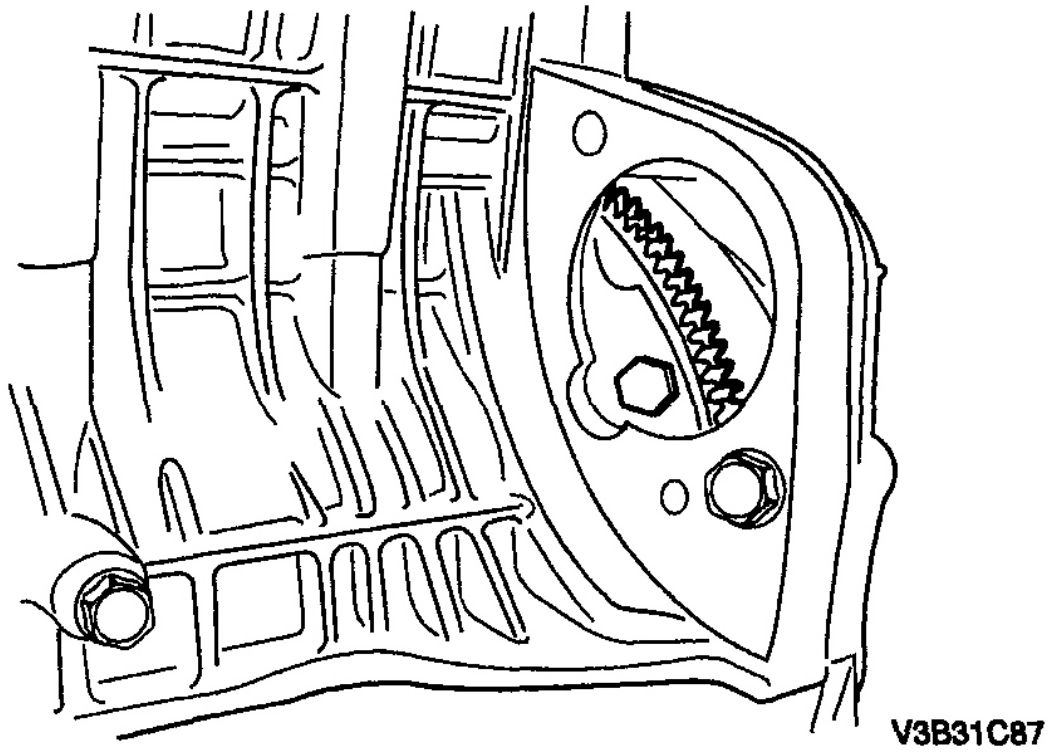

Fig. 75: Tightening Transaxle Torque Converter Bolts
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the rear transaxle mount bracket.

Tighten

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

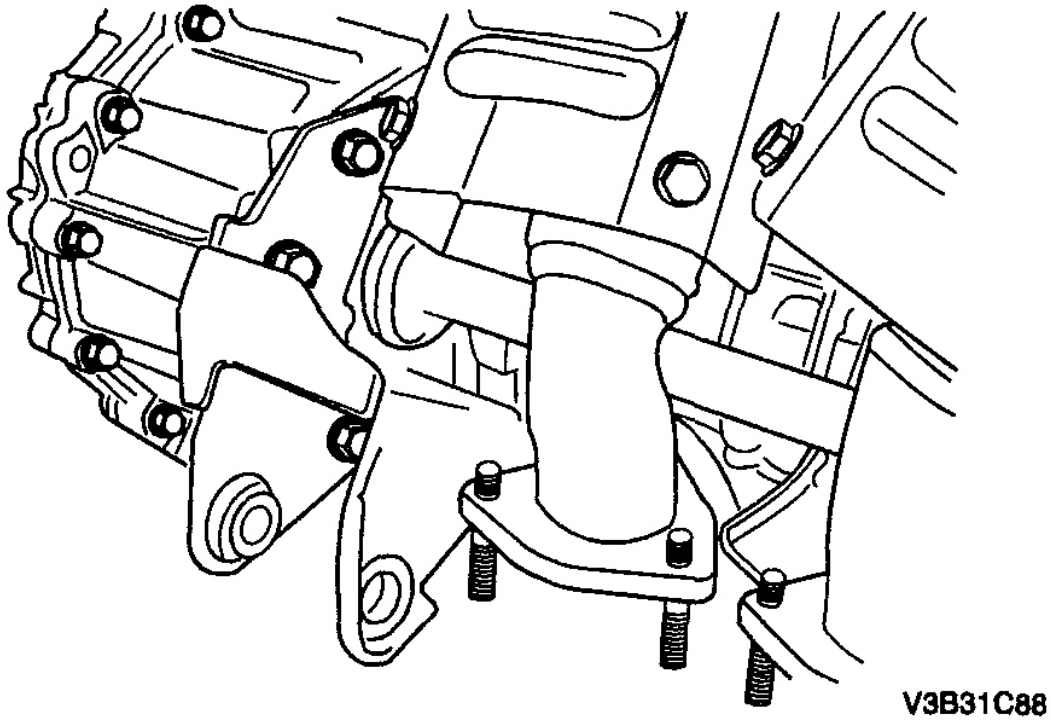

Fig. 76: Installing Rear Transaxle Mount Bracket
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the front damper bush bracket.

Tighten

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

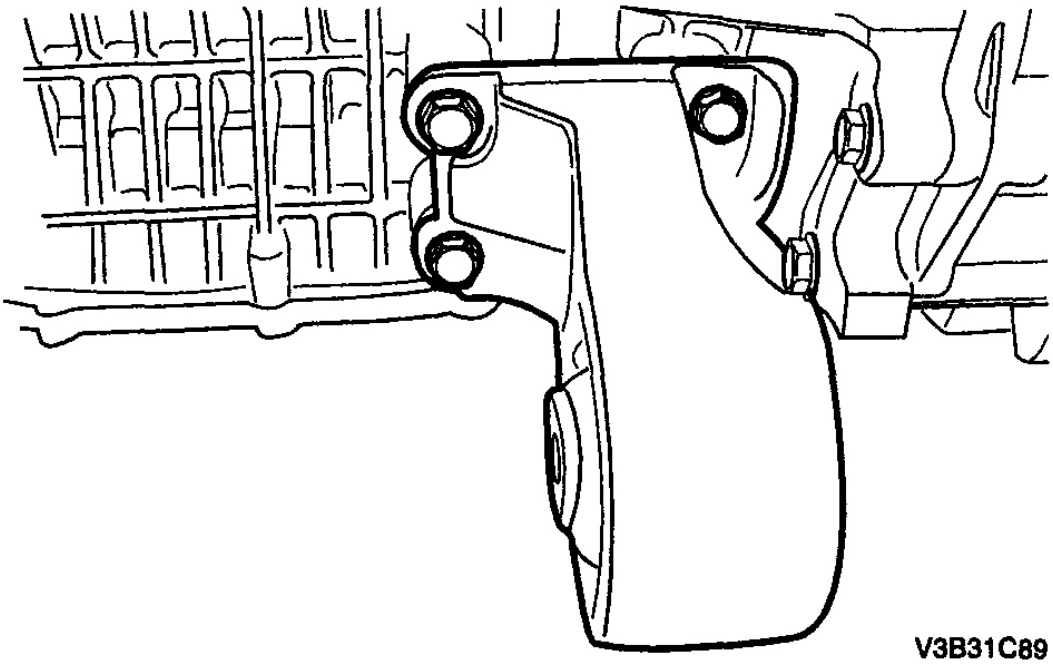

Fig. 77: Installing Front Damper Bush Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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

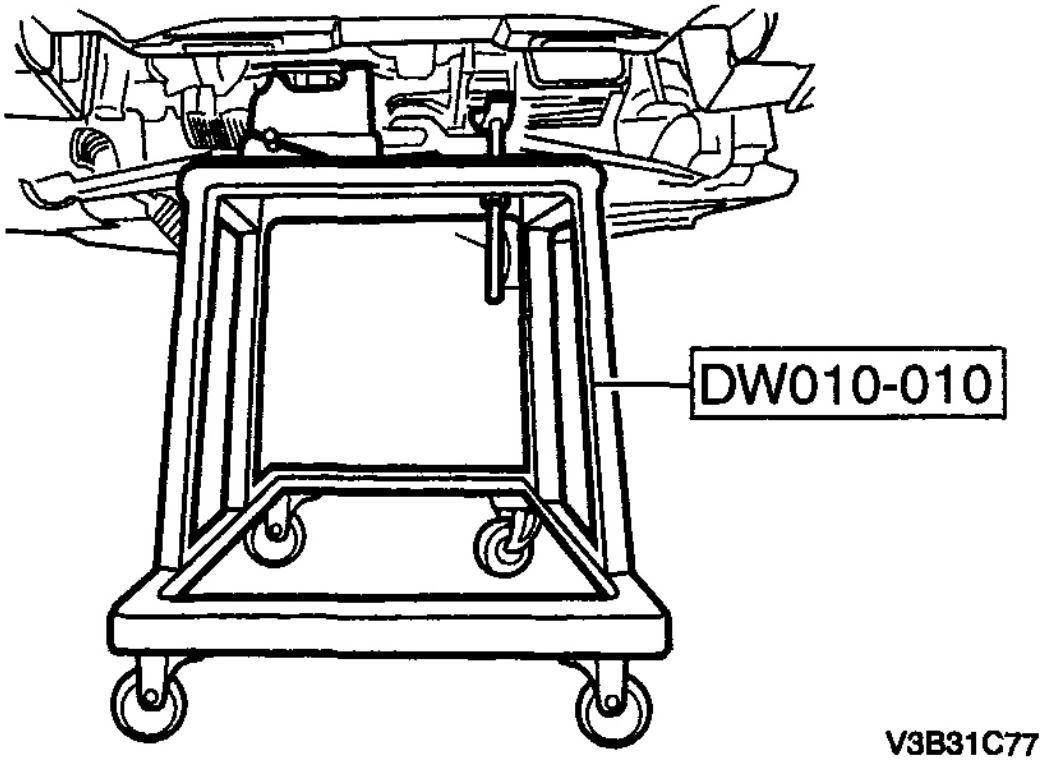

Fig. 78: Installing Engine And Transaxle Assembly Using Power Pack Stand DW010-010
Courtesy of SUZUKI OF AMERICA CORP.

10. Install the engine mount bracket (LH). Refer to "**ENGINE MOUNT (LH) INSTALLATION**".

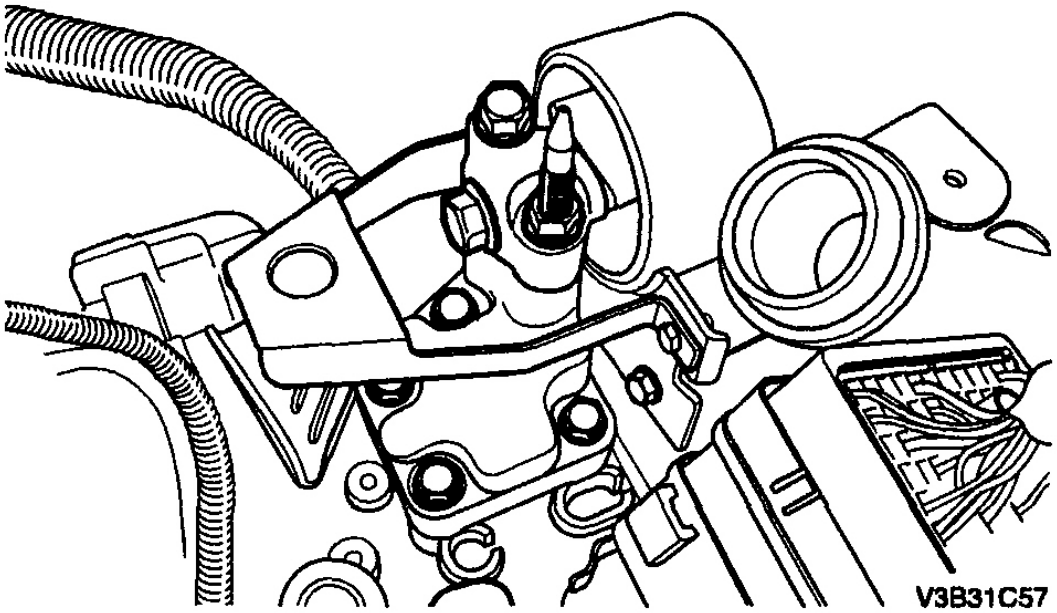

Fig. 79: Installing Engine Mount Bracket (LH)
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the engine mount bracket (RH). Refer to "**ENGINE MOUNT (RH) INSTALLATION**".

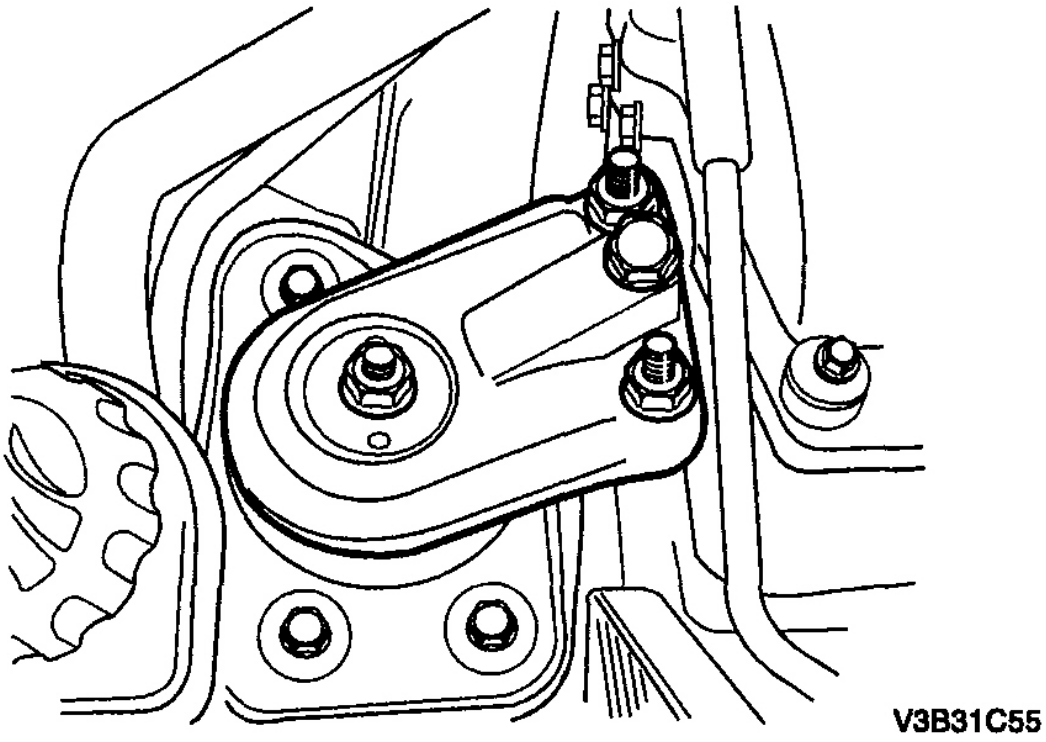

Fig. 80: Installing Engine Mount Bracket (RH)
Courtesy of SUZUKI OF AMERICA CORP.

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

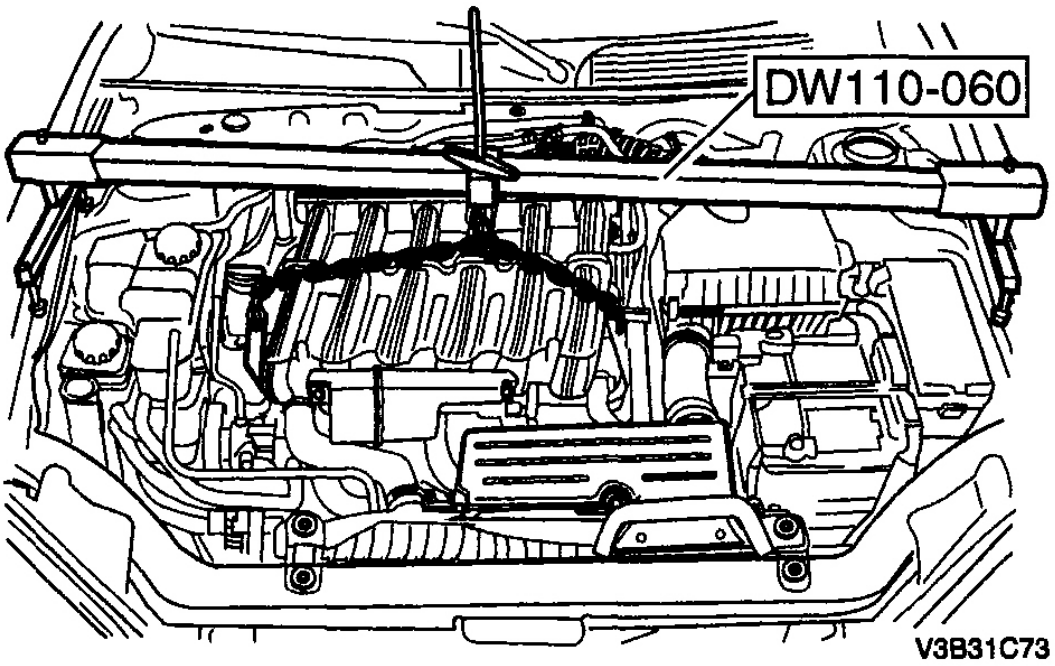

Fig. 81: Supporting Engine And Transaxle Assembly Using Engine Assembly Lift Support DW110-060
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the oil filter.

Tighten

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

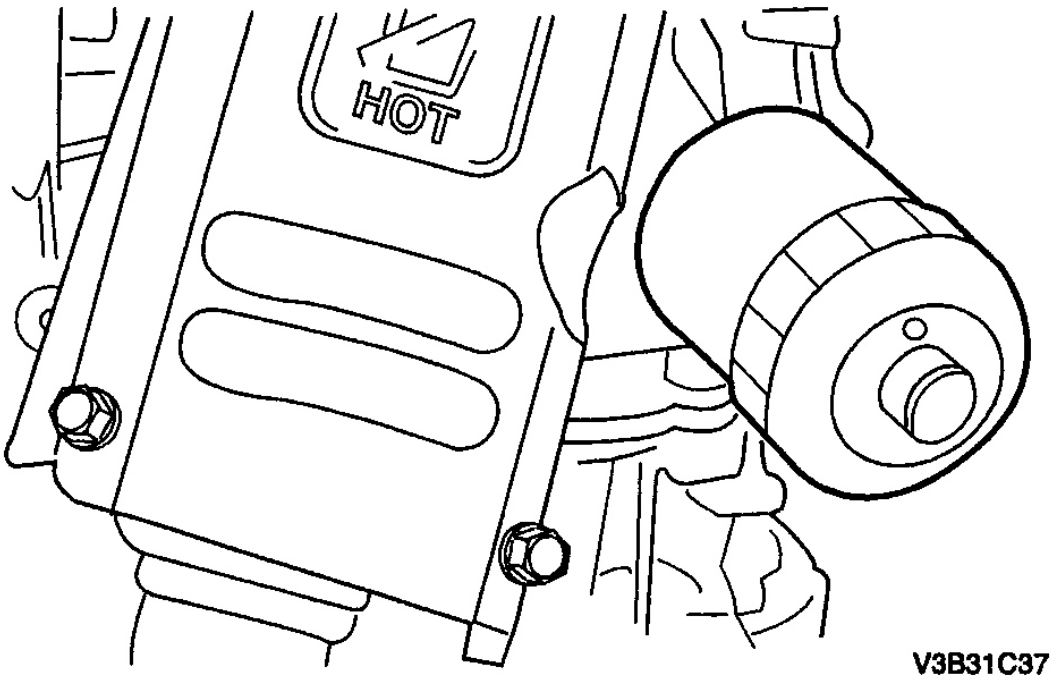

Fig. 82: Installing Oil Filter
Courtesy of SUZUKI OF AMERICA CORP.

15. Install the center front suspension member.

Tighten

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

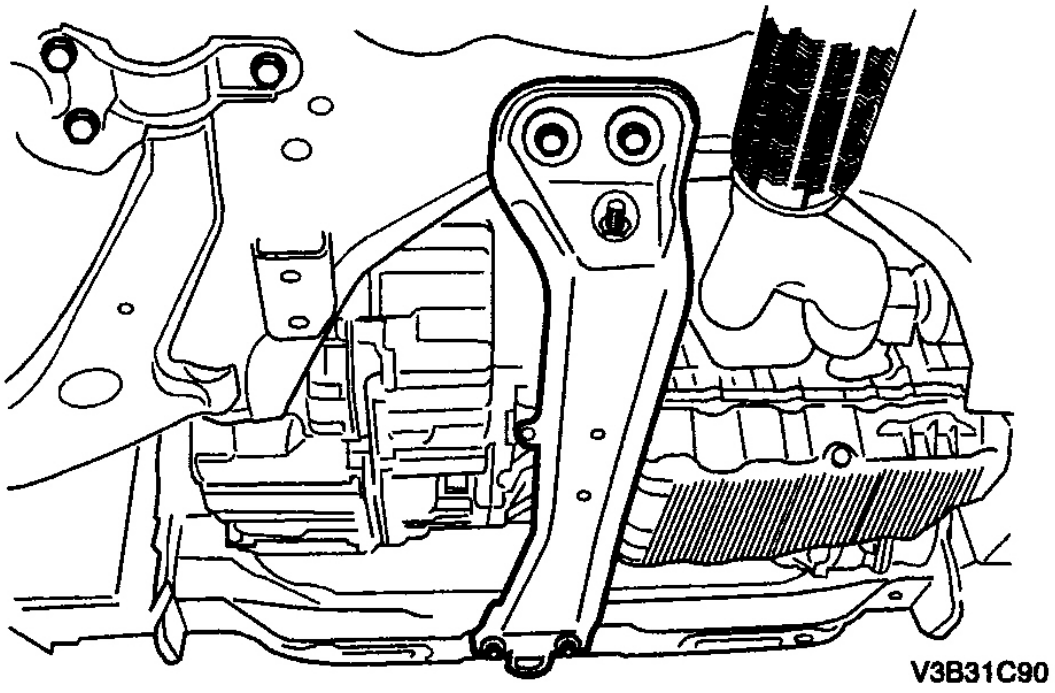

Fig. 83: Installing Center Front Suspension Member
Courtesy of SUZUKI OF AMERICA CORP.

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).

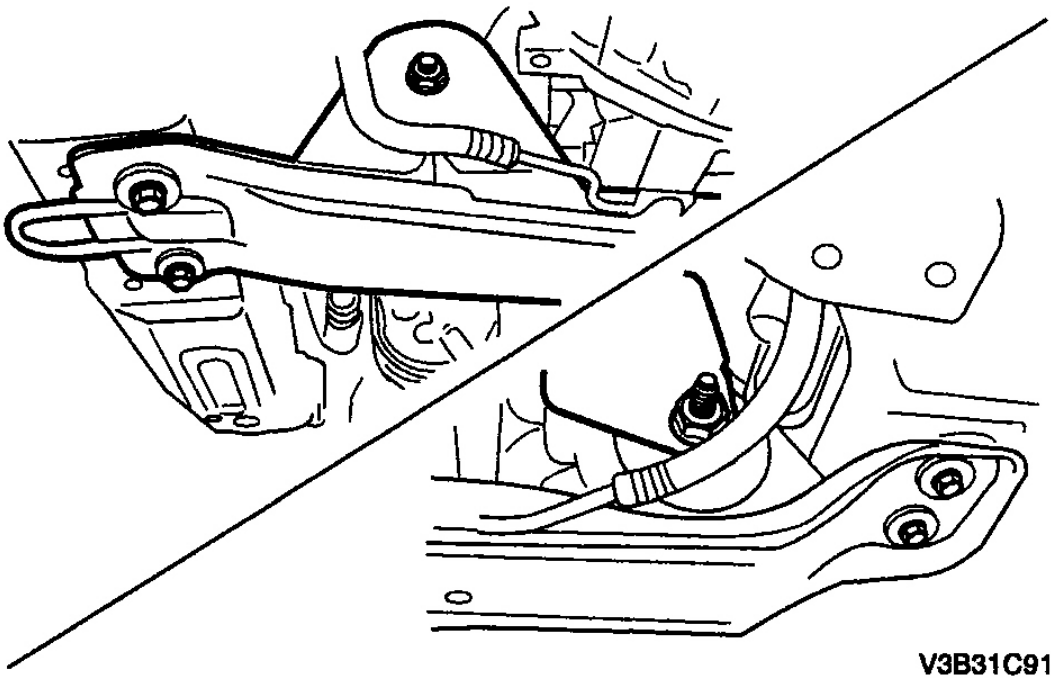

Fig. 84: Tightening Front And Rear Engine Mount Bracket-To-Damper Bush Bolt/Nut
Courtesy of SUZUKI OF AMERICA CORP.

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

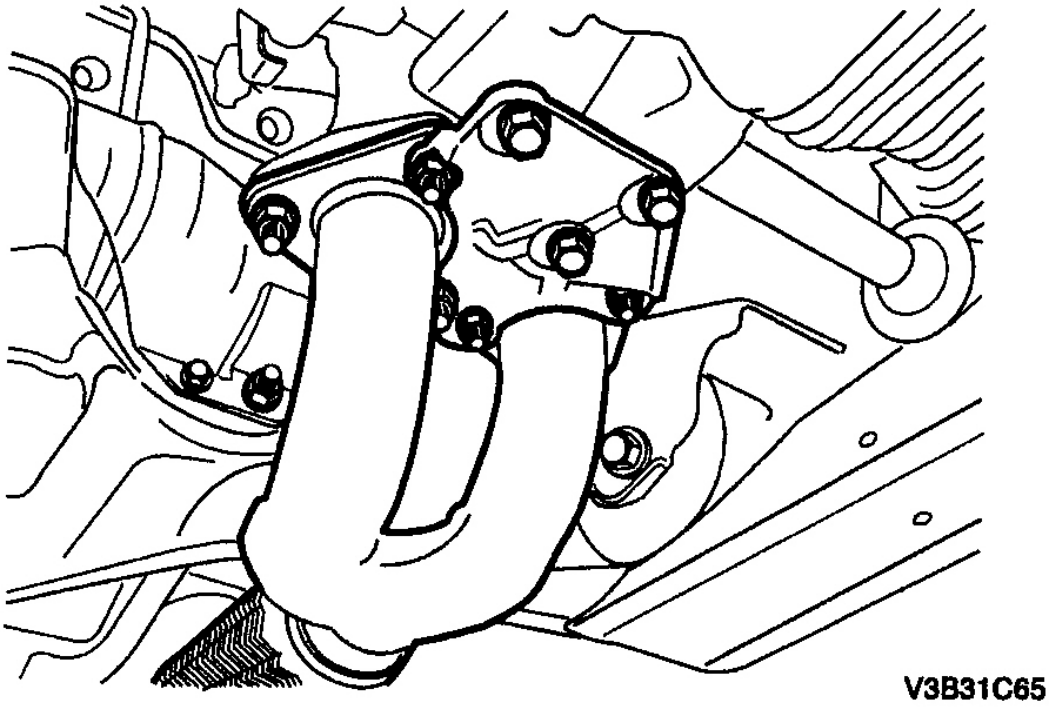

Fig. 85: Installing Front Muffler
Courtesy of SUZUKI OF AMERICA CORP.

18. Install the axle shaft. Refer to "**DRIVE AXLE ASSEMBLY INSTALLATION** ".
19. Install the engine under cover.

Tighten

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

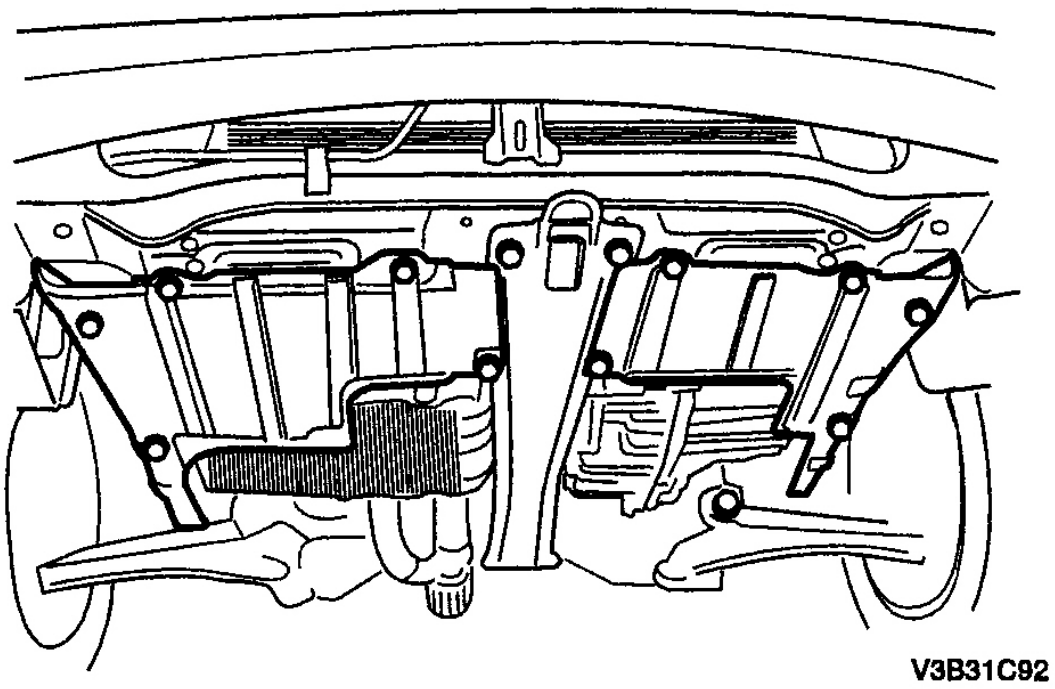

Fig. 86: Installing Engine Under Cover
Courtesy of SUZUKI OF AMERICA CORP.

20. Connect the connectors and cables on the transaxle. Refer to "**TRANSAXLE ASSEMBLY INSTALLATION** ".
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).

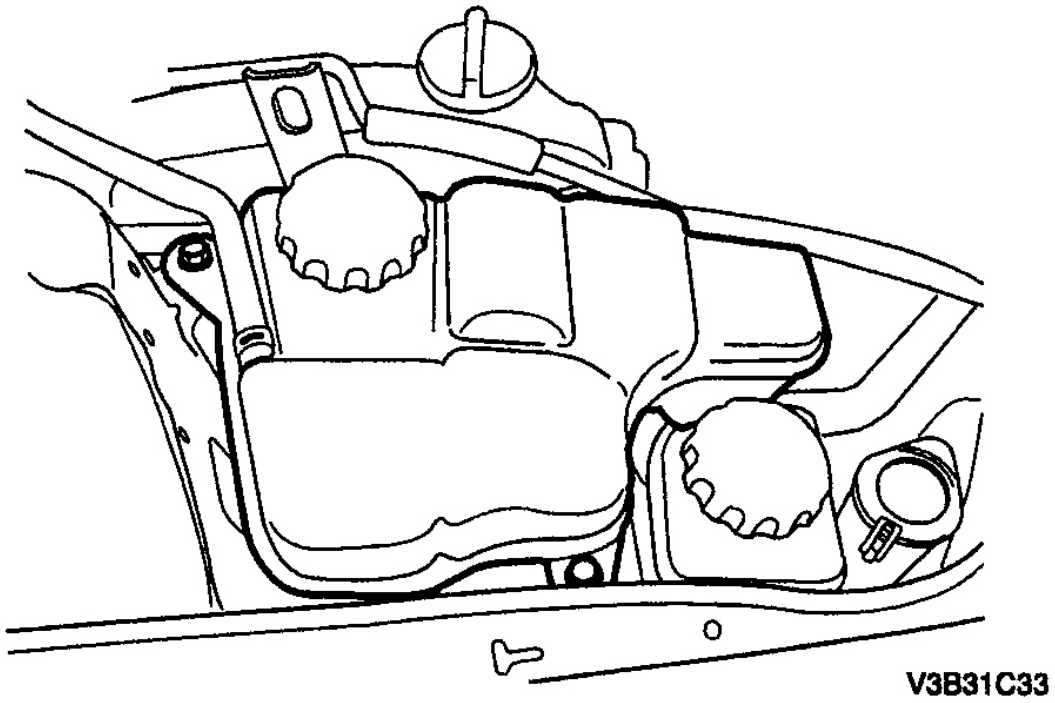

Fig. 87: Installing Coolant Reservoir
Courtesy of SUZUKI OF AMERICA CORP.

23. Install the air filter housing.

Tighten

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

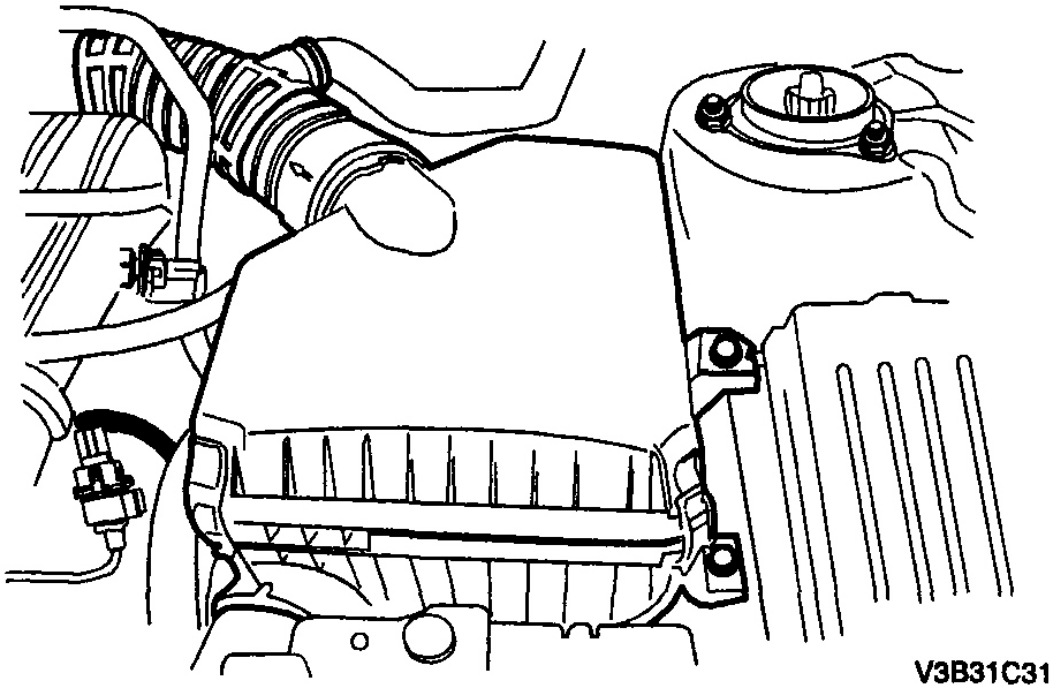

Fig. 88: Installing Air Filter Housing
Courtesy of SUZUKI OF AMERICA CORP.

24. Install the air filter snorkel.

Tighten

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

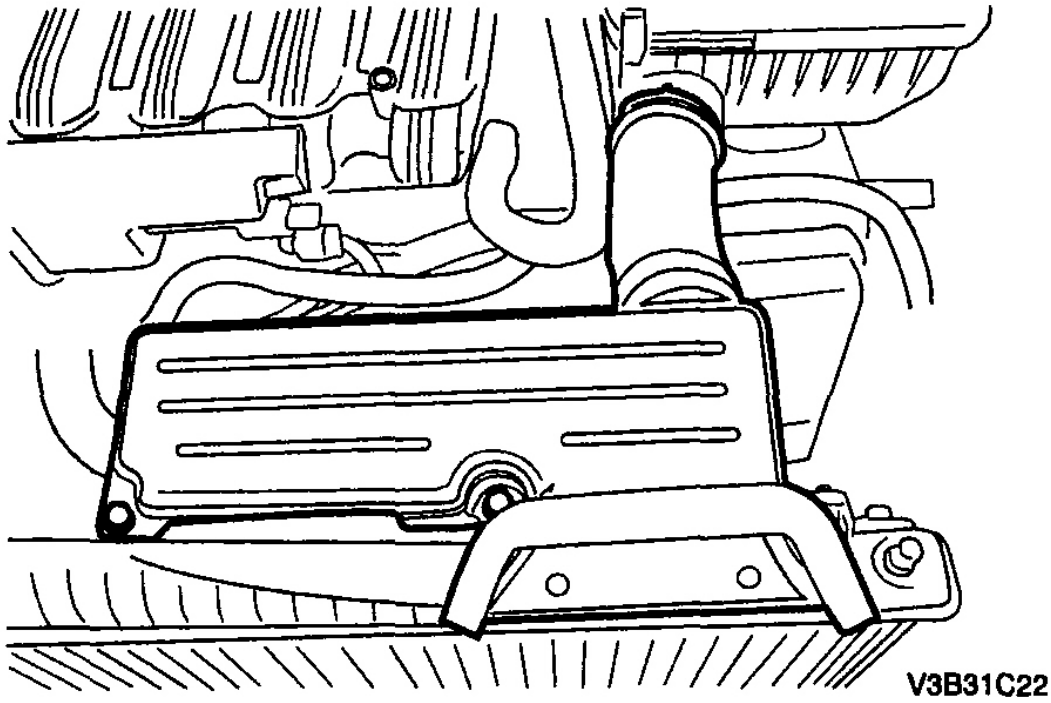

Fig. 89: Installing Air Filter Snorkel
Courtesy of SUZUKI OF AMERICA CORP.

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 "**DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEM** ".
28. Fill the power steering oil.
29. Fill the transaxle oil.
30. Fill the engine oil.

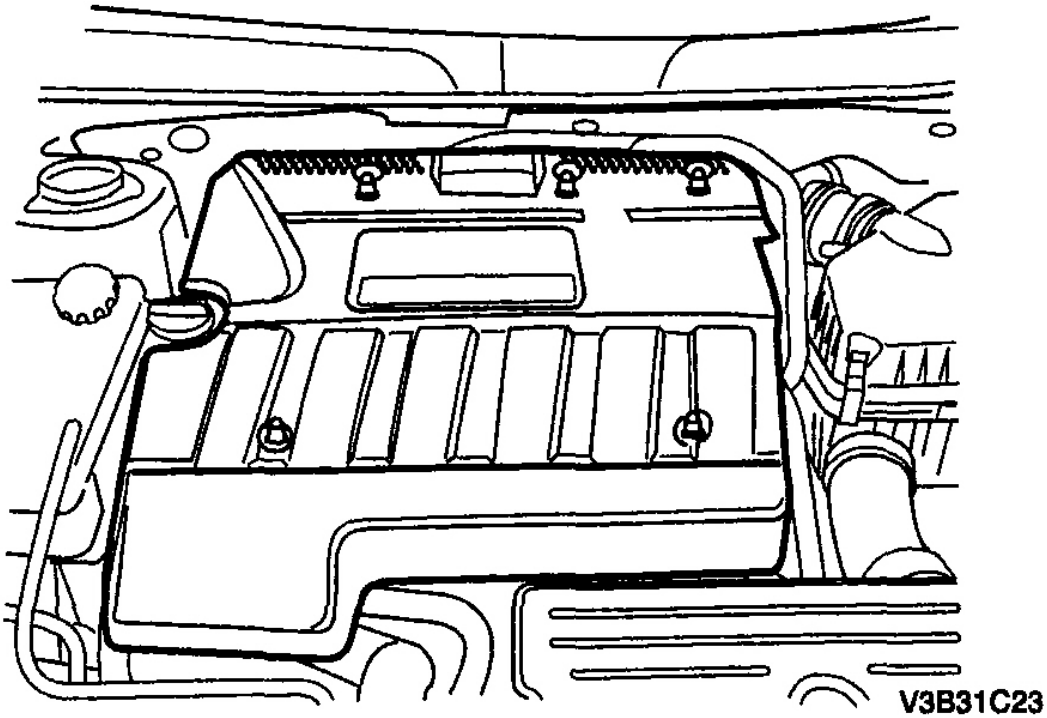

Fig. 90: Installing Engine Beautification Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.

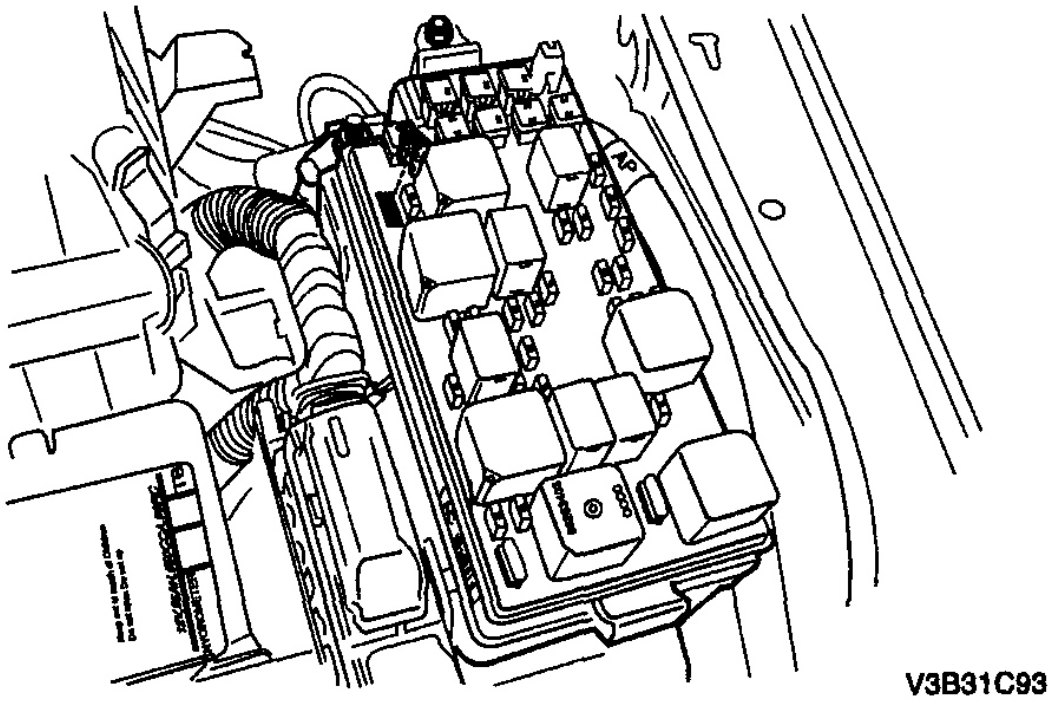

Fig. 91: Identifying Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

7. Drain the power steering oil.
8. Recover the refrigerant.
9. Remove the engine assembly. Refer to "**ENGINE ASSEMBLY REMOVAL**".

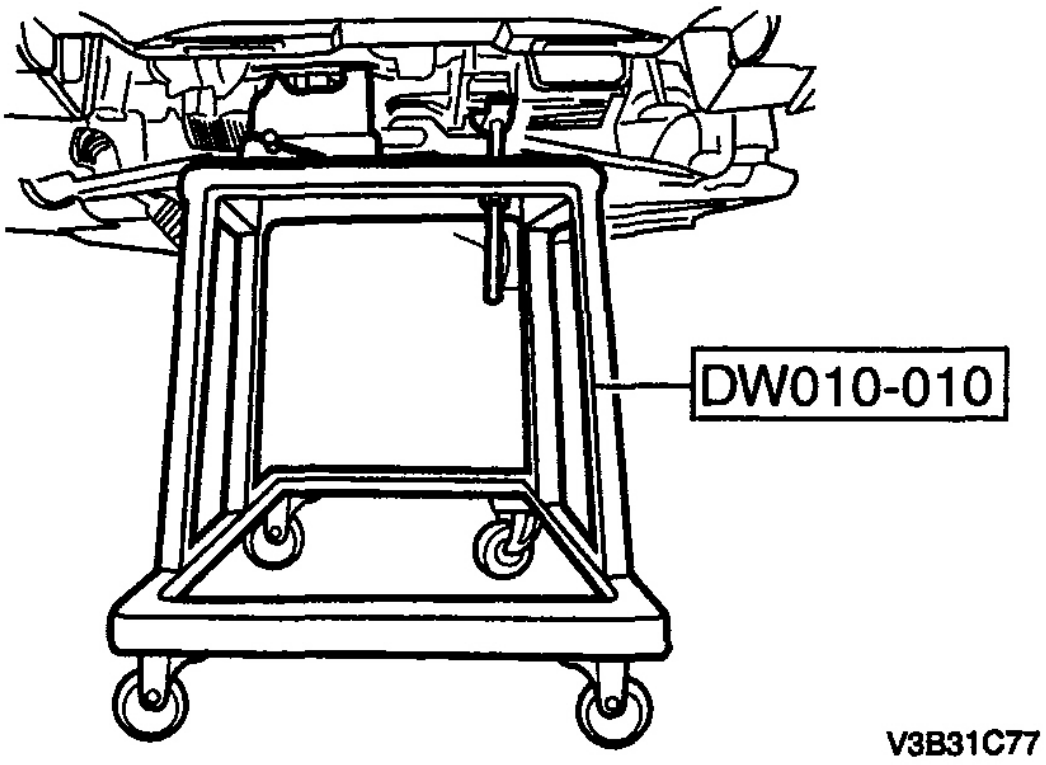

Fig. 92: Supporting Engine Assembly With Engine Overhaul Stand DW010-010
Courtesy of SUZUKI OF AMERICA CORP.

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

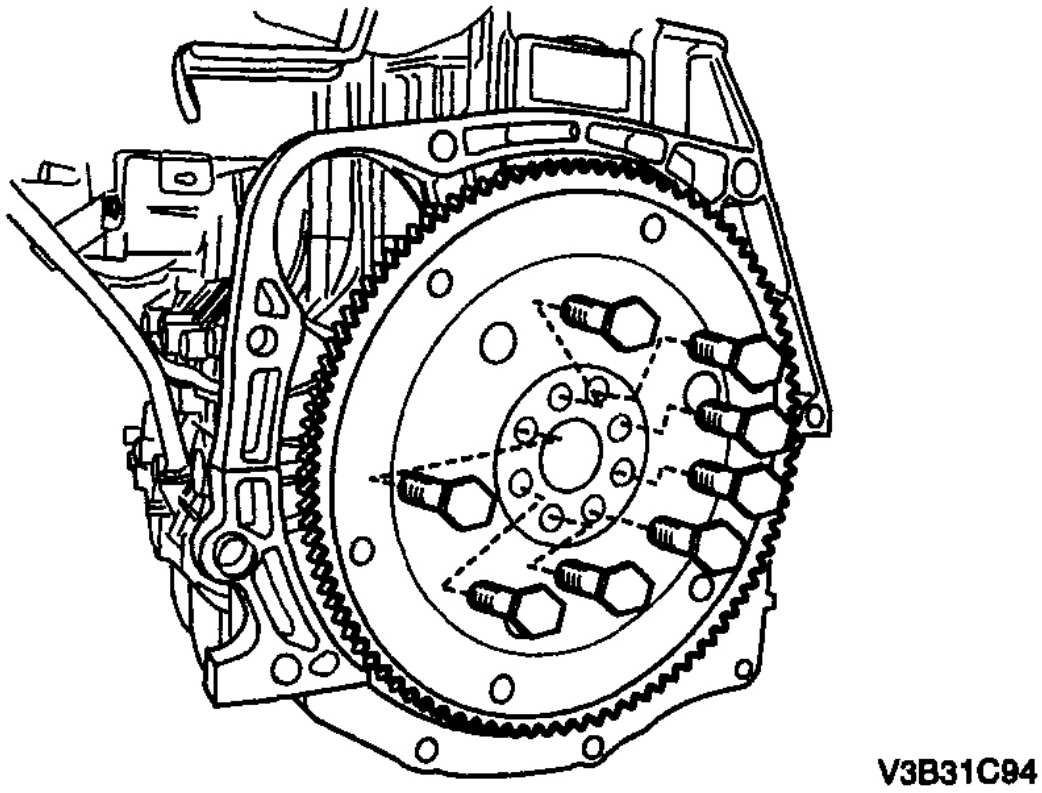

Fig. 93: Removing Flexible Plate Bolts
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the intake manifold. Refer to "**INTAKE MANIFOLD REMOVAL**".

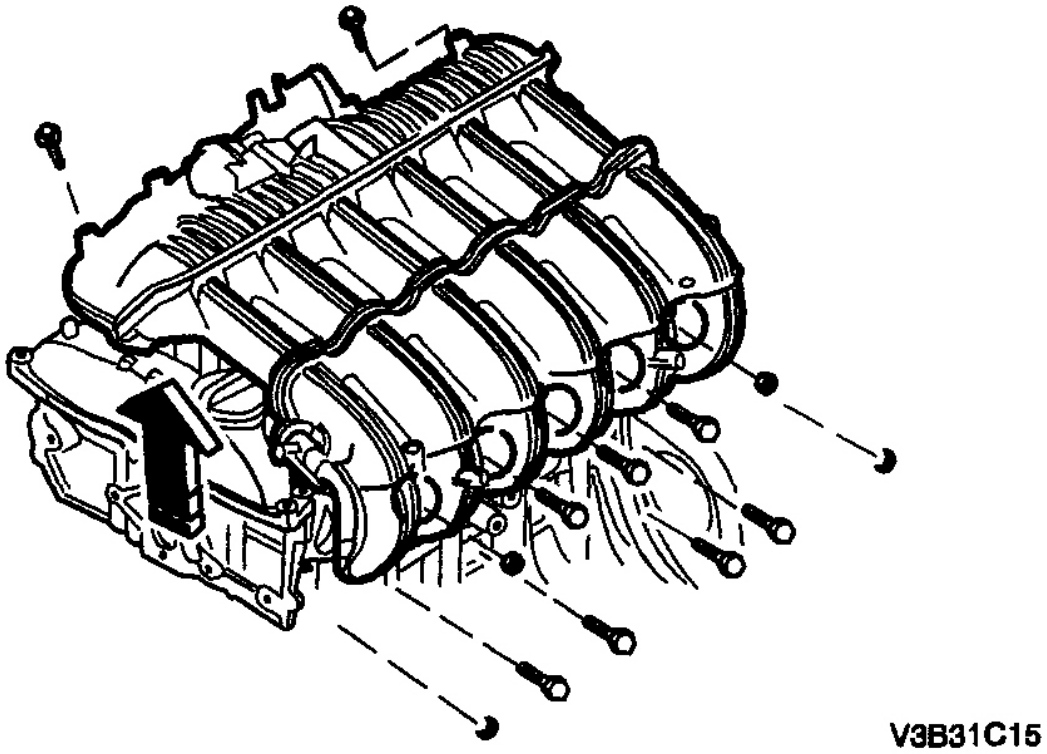

Fig. 94: Removing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

13. Remove the cylinder head cover. Refer to "**CYLINDER HEAD COVER REMOVAL**".

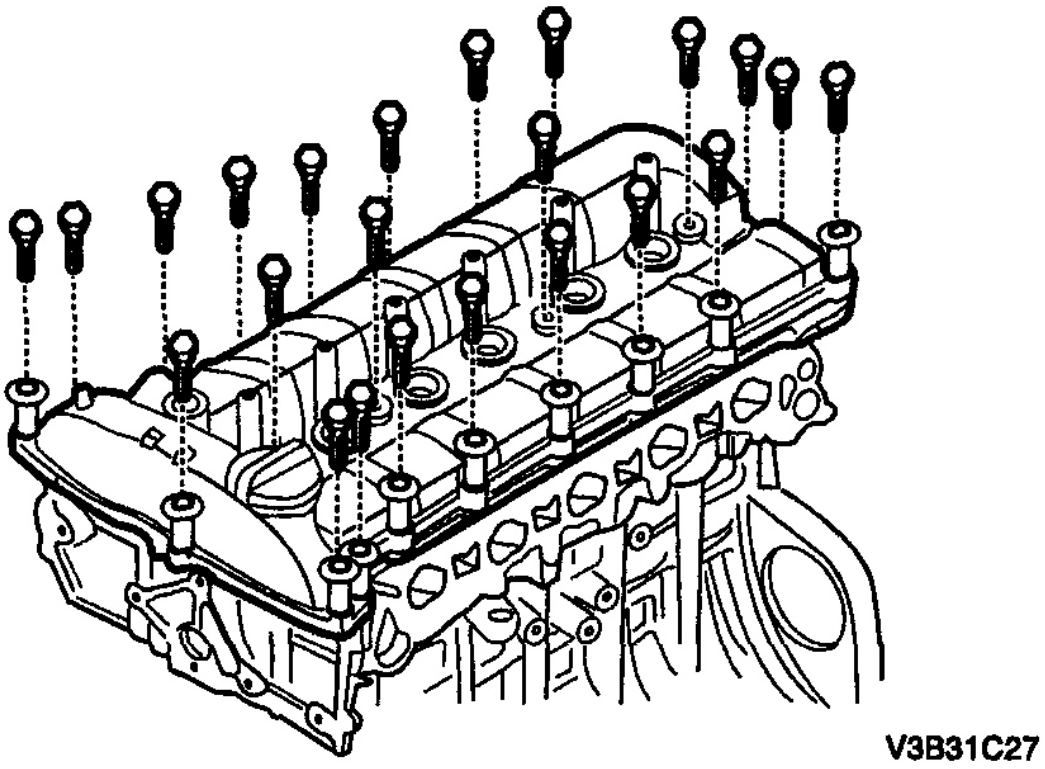

Fig. 95: Removing Cylinder Head Cover
Courtesy of SUZUKI OF AMERICA CORP.

14. Remove the drive belt.

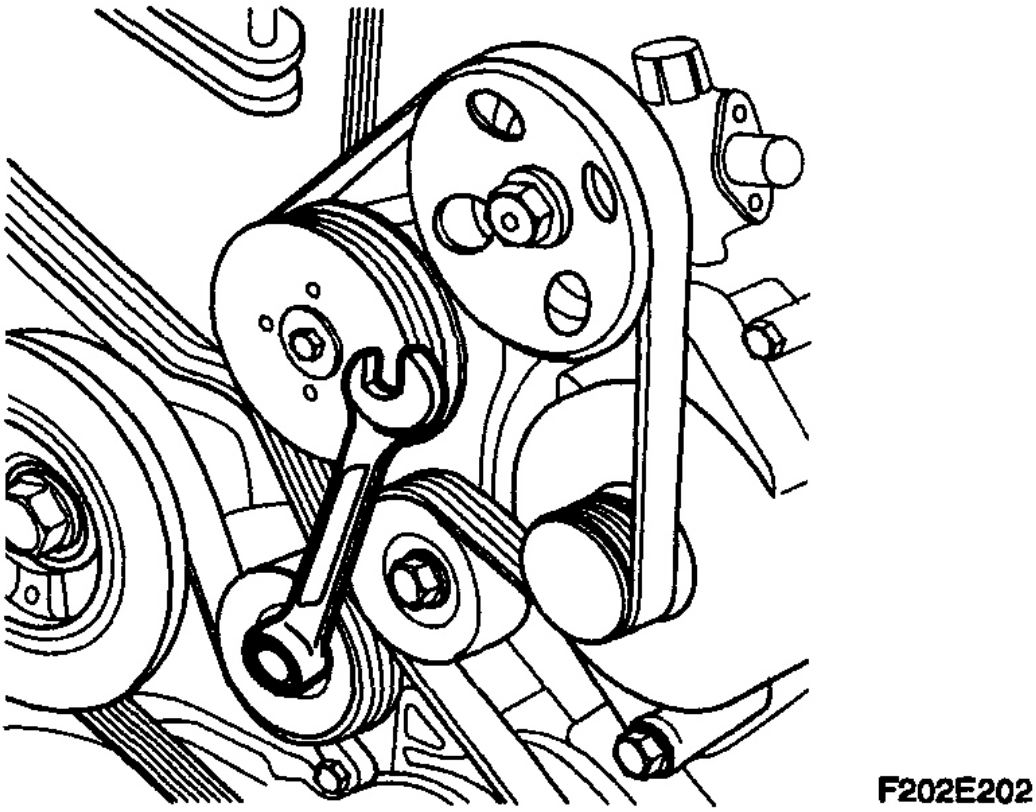

Fig. 96: Removing Drive Belt
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove the oil pan. Refer to "**OIL PAN / OIL PUMP REMOVAL** ".

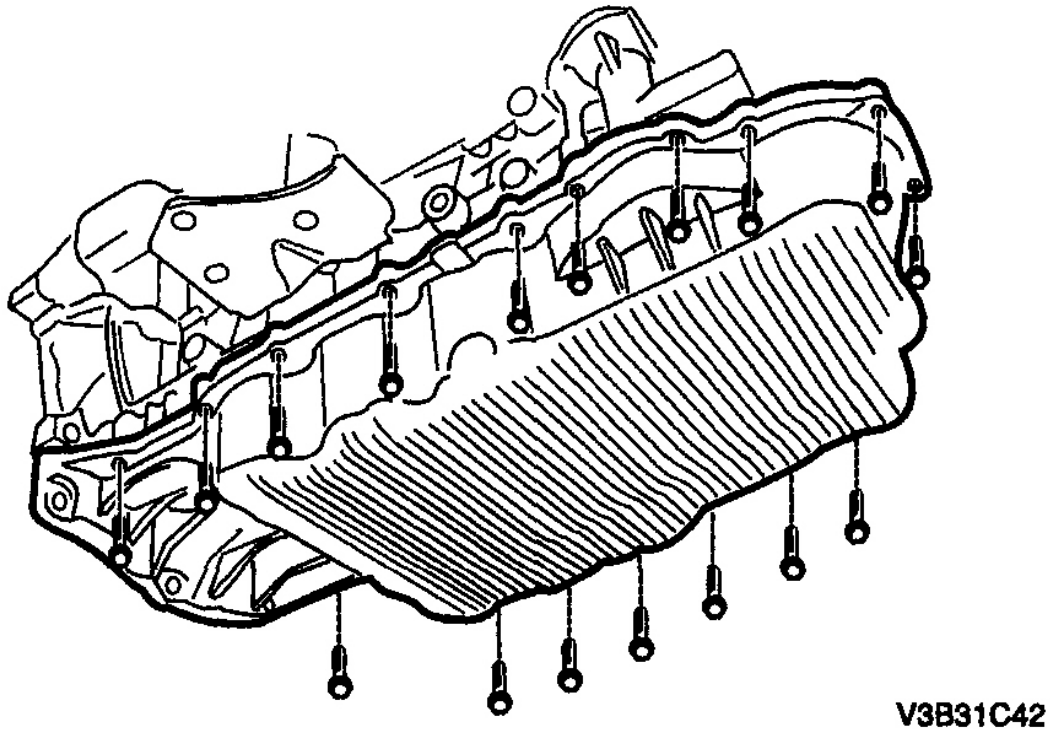

Fig. 97: Removing Oil Pan
Courtesy of SUZUKI OF AMERICA CORP.

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.

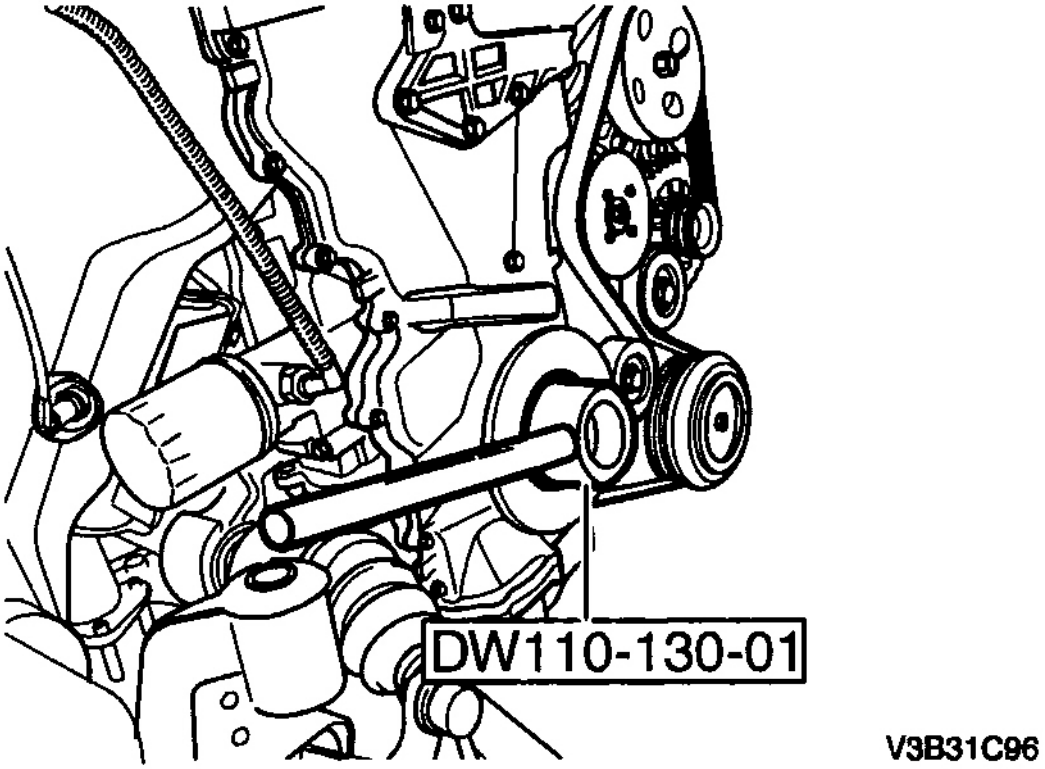

Fig. 98: Installing Crankshaft Pulley Holder DW110-130-01 To Crankshaft Pulley Bolt
Courtesy of SUZUKI OF AMERICA CORP.

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

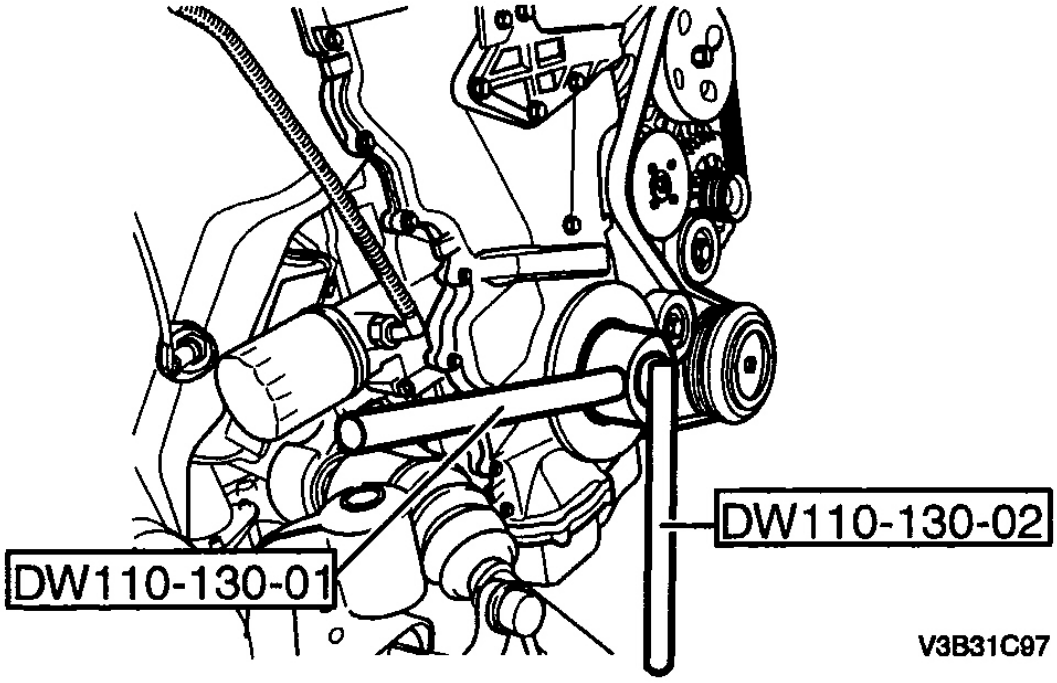

Fig. 99: Removing Crankshaft Pulley Bolt Using Crankshaft Pulley Installer/Remover DW110-130-02
Courtesy of SUZUKI OF AMERICA CORP.

18. Remove the engine mount bracket support.

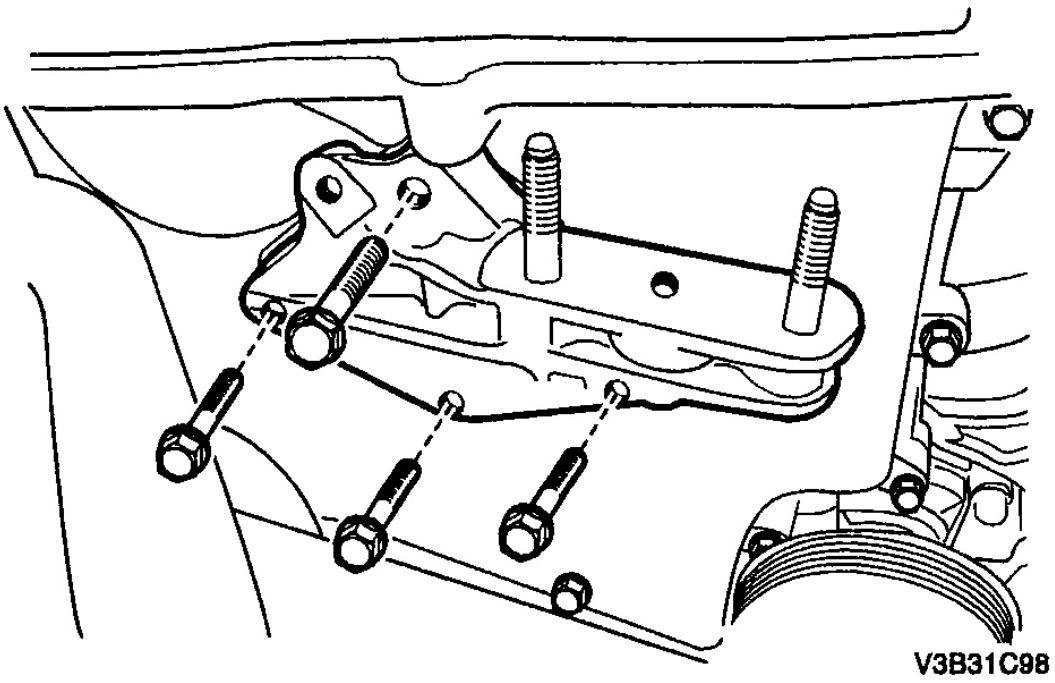

Fig. 100: Removing Engine Mount Bracket Support
Courtesy of SUZUKI OF AMERICA CORP.

19. Remove the water pump pulley.

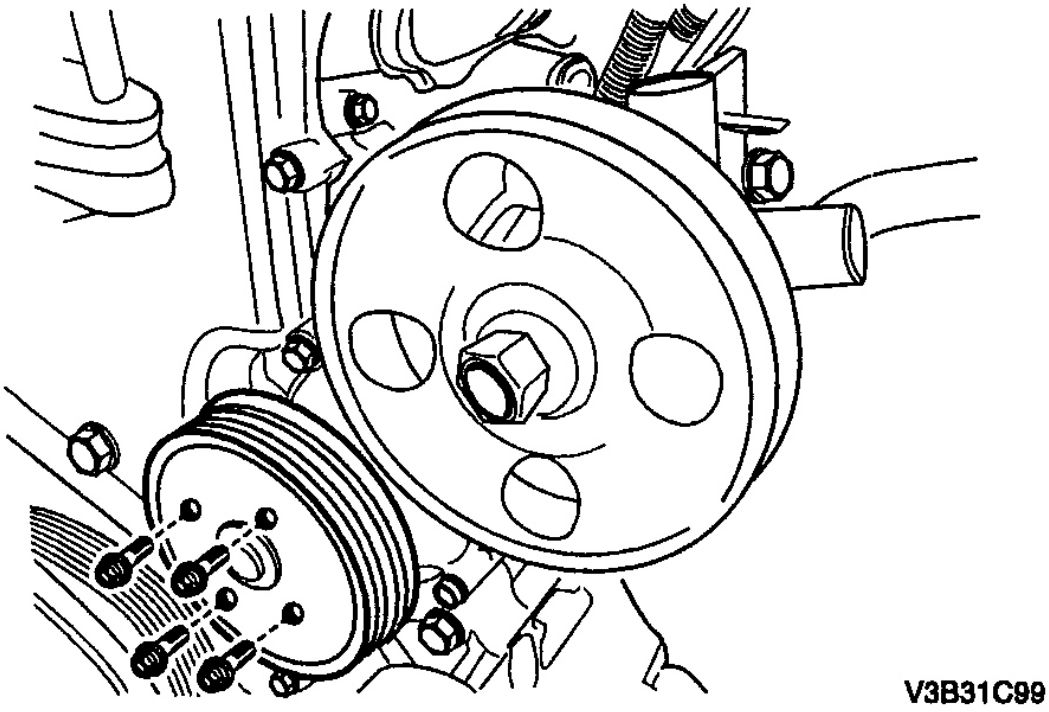

Fig. 101: Removing Water Pump Pulley
Courtesy of SUZUKI OF AMERICA CORP.

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

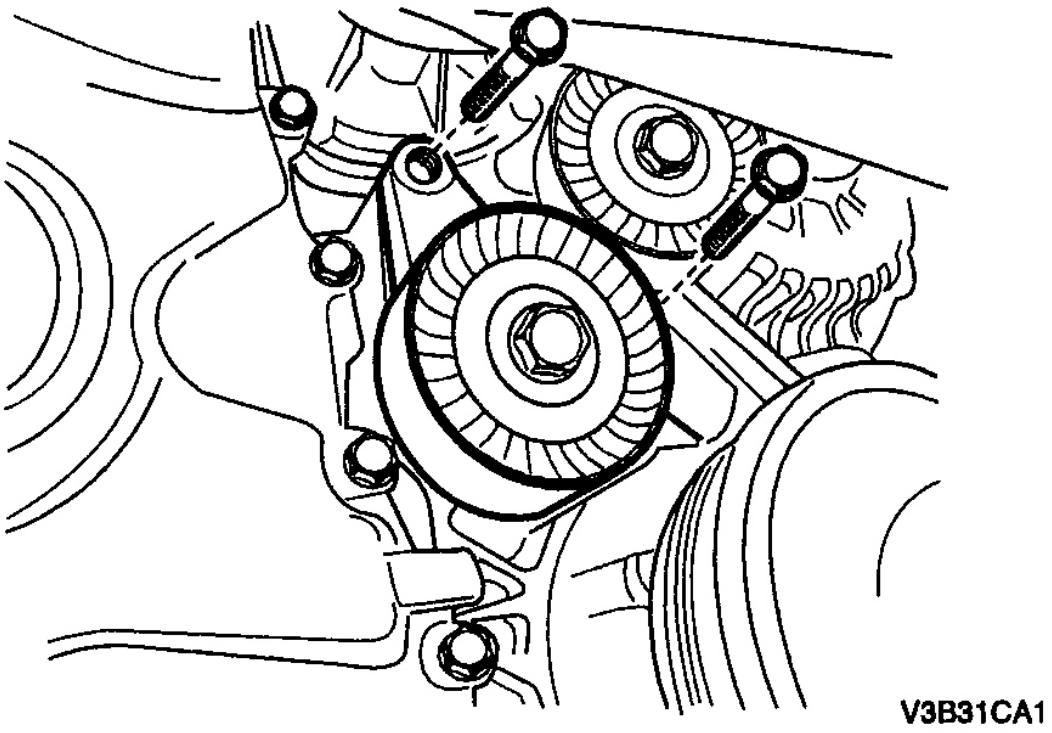

Fig. 102: Removing Drive Belt Automatic Tensioner Retaining Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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

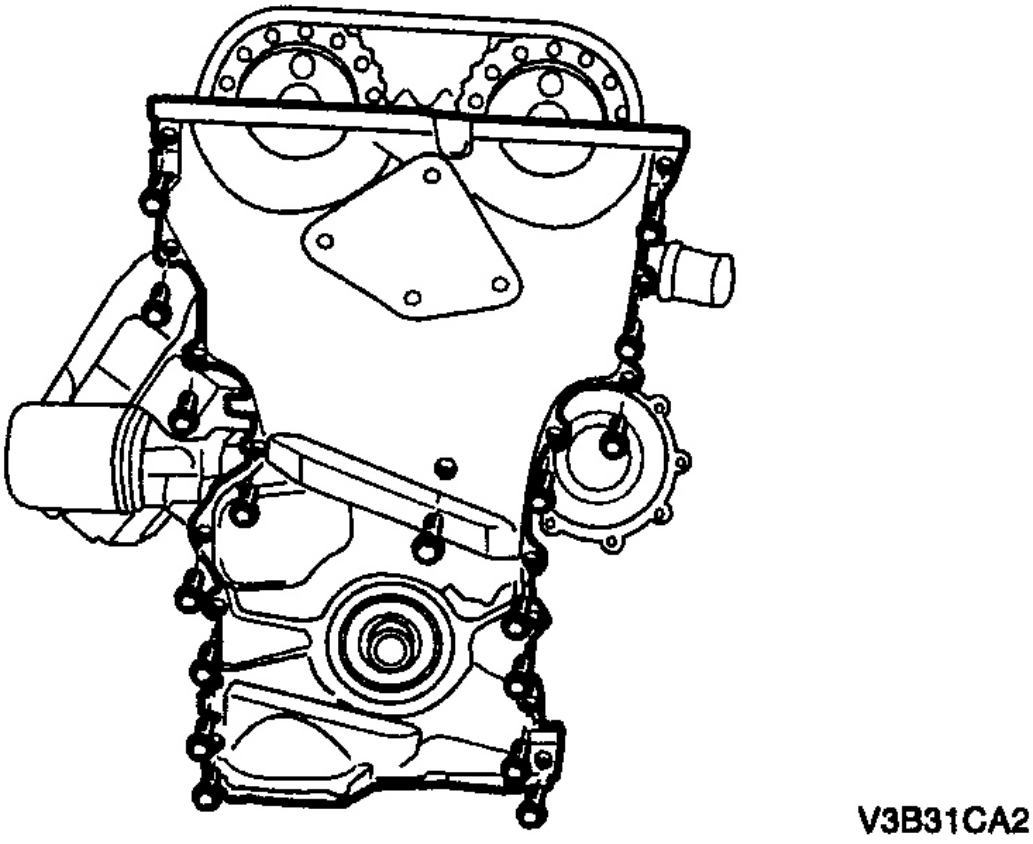

Fig. 103: Removing Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

23. Remove the timing chain tensioner.

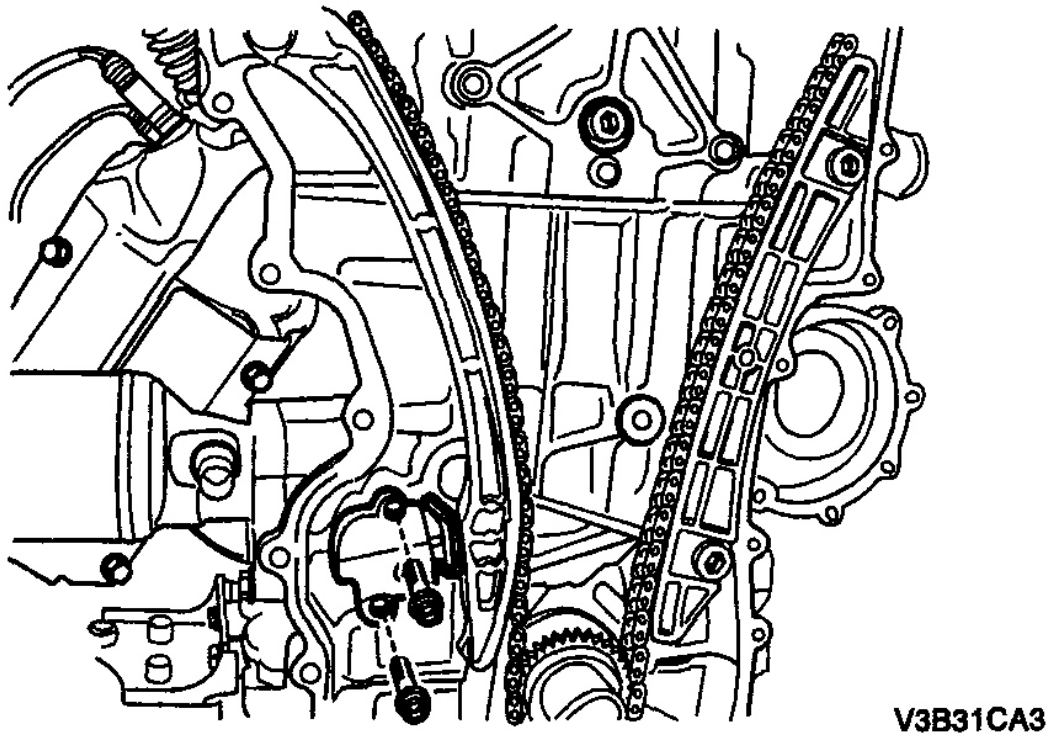

Fig. 104: Removing Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

24. Remove the fixed timing chain guide.

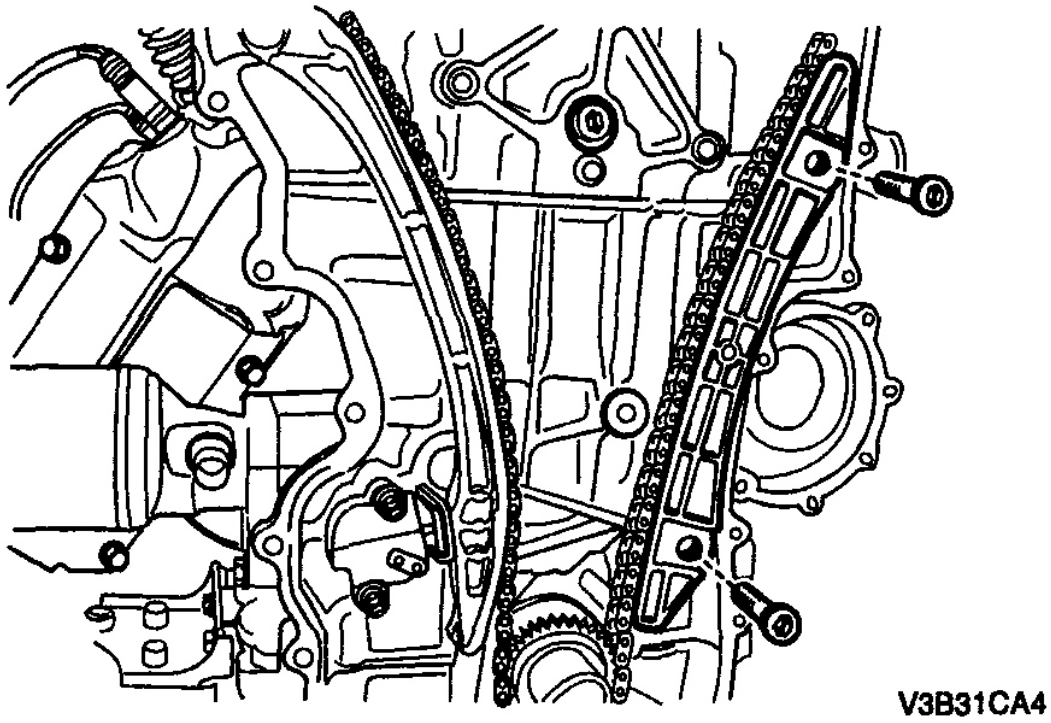

Fig. 105: Removing Fixed Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

25. Remove the timing chain lever.

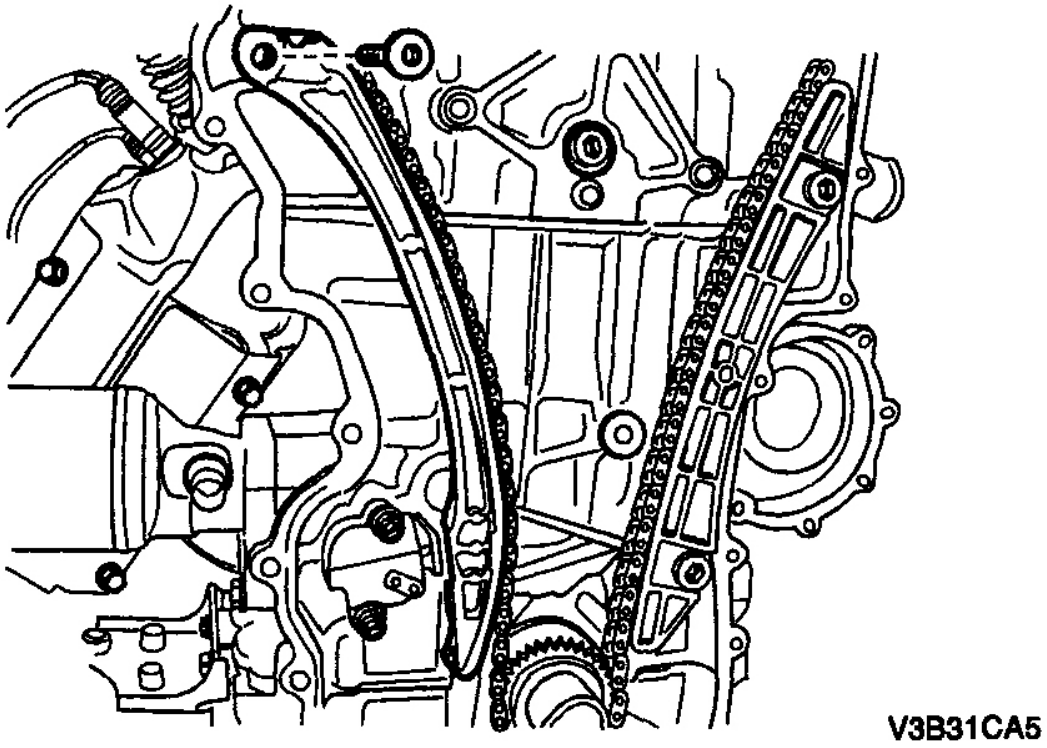

Fig. 106: Removing Timing Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

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

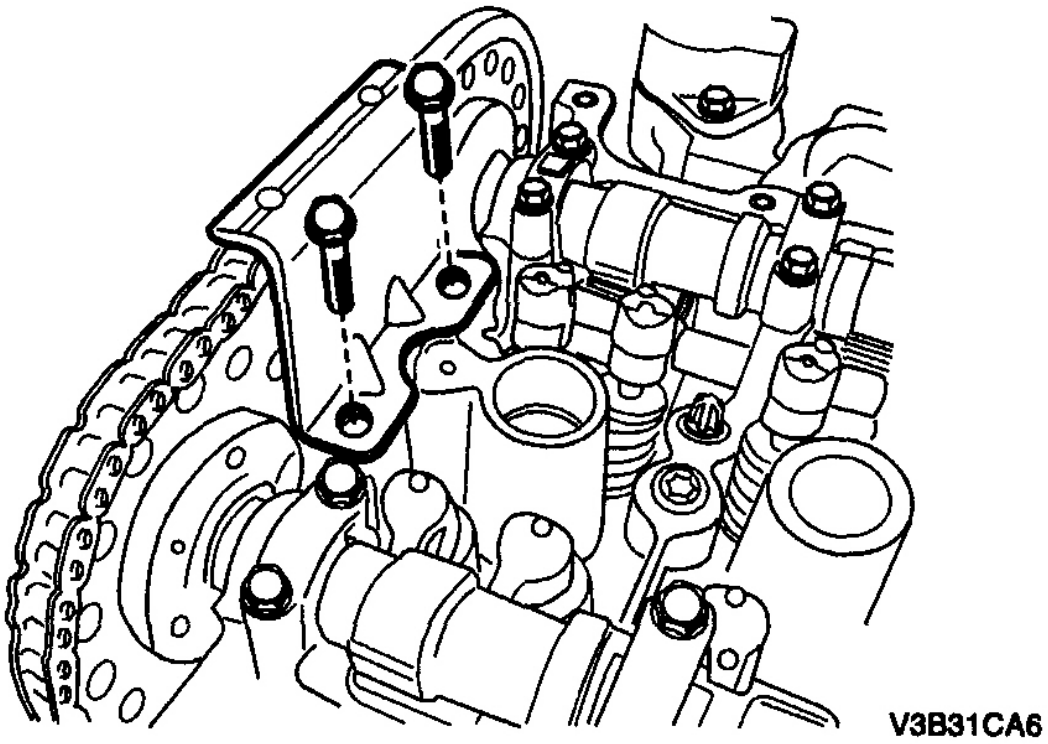

Fig. 107: Removing Top Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

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.

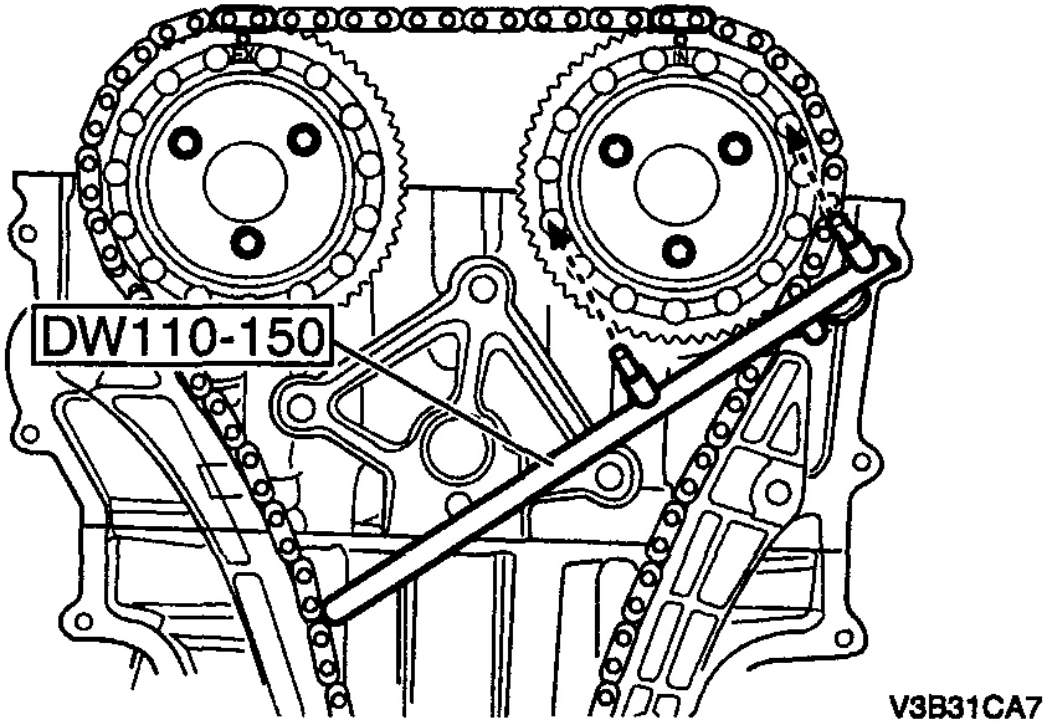

Fig. 108: Installing Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

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.

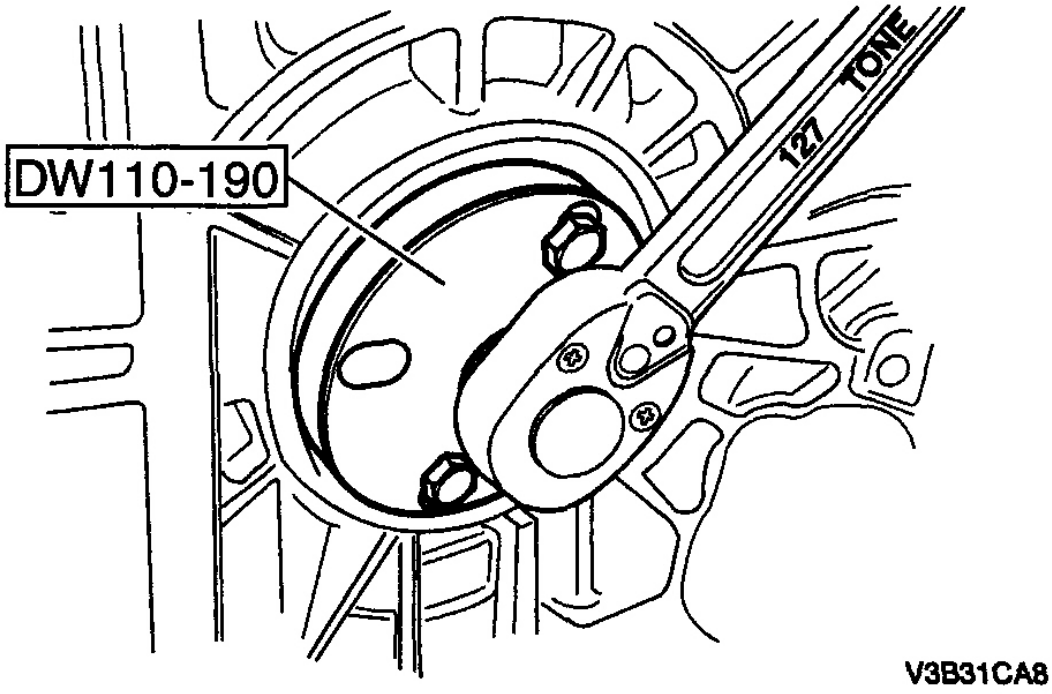

Fig. 109: Adjusting Crankshaft Using Crankshaft Adjuster DW110-190
Courtesy of SUZUKI OF AMERICA CORP.

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.

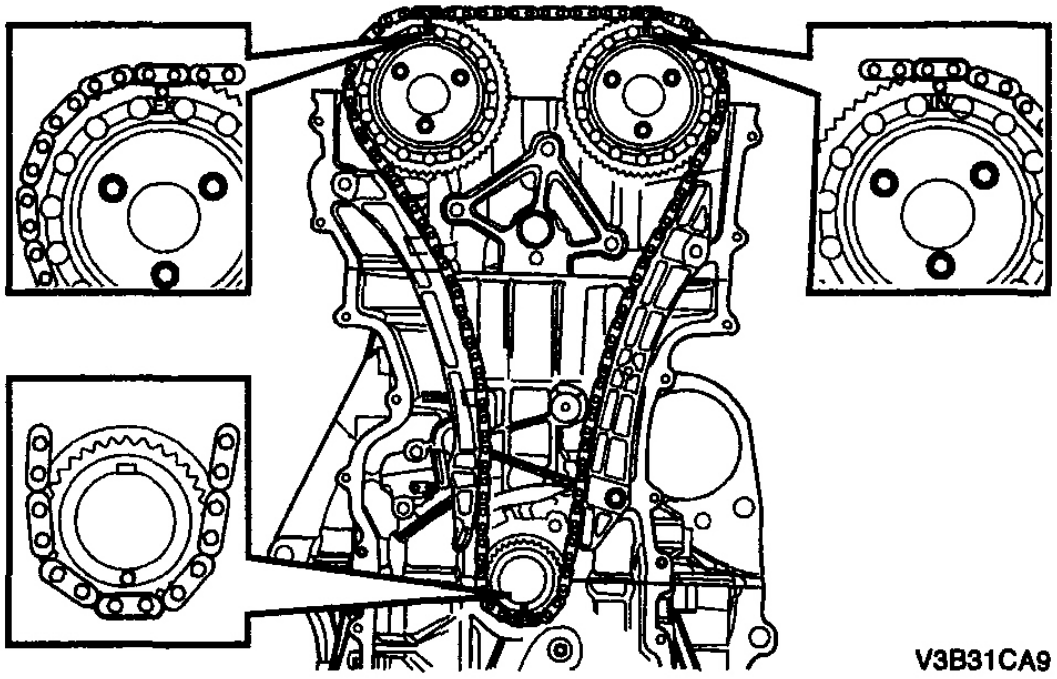

Fig. 110: Identifying Three Timing Marks On Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

6. Install the fixed timing chain guide.

Tighten

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

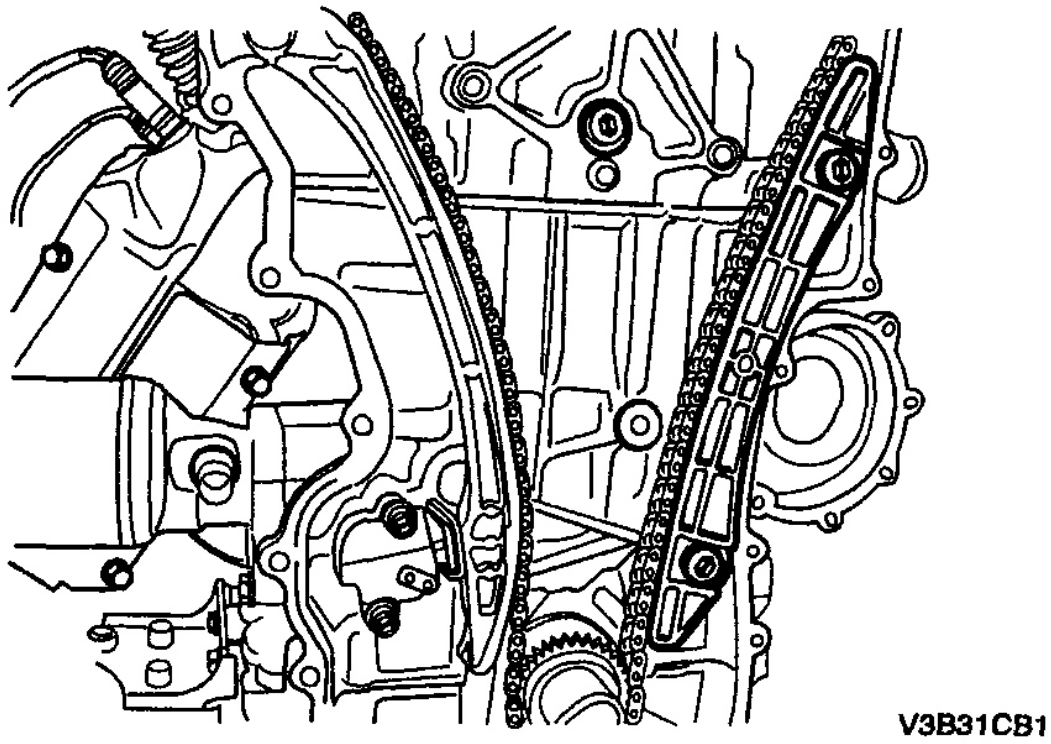

Fig. 111: Installing Fixed Timing Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

7. Install the timing chain lever.

Tighten

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

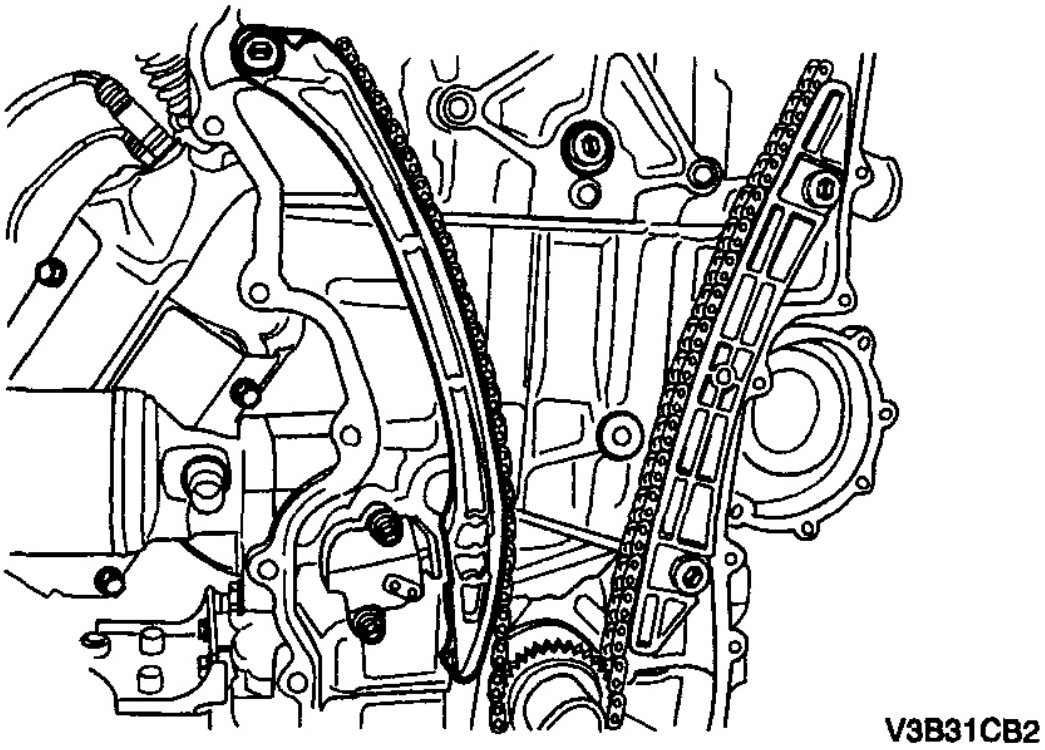

Fig. 112: Installing Timing Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the timing chain tensioner.

   Tighten

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

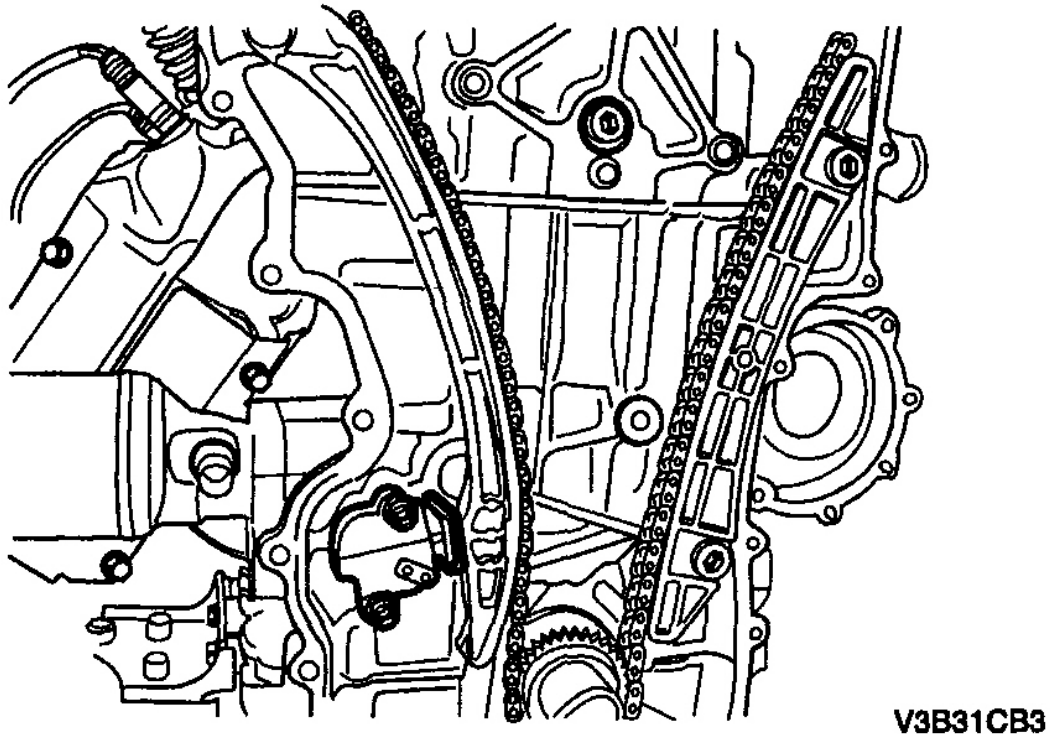

Fig. 113: Installing Timing Chain Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

9. Install the top chain guide.

Tighten

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

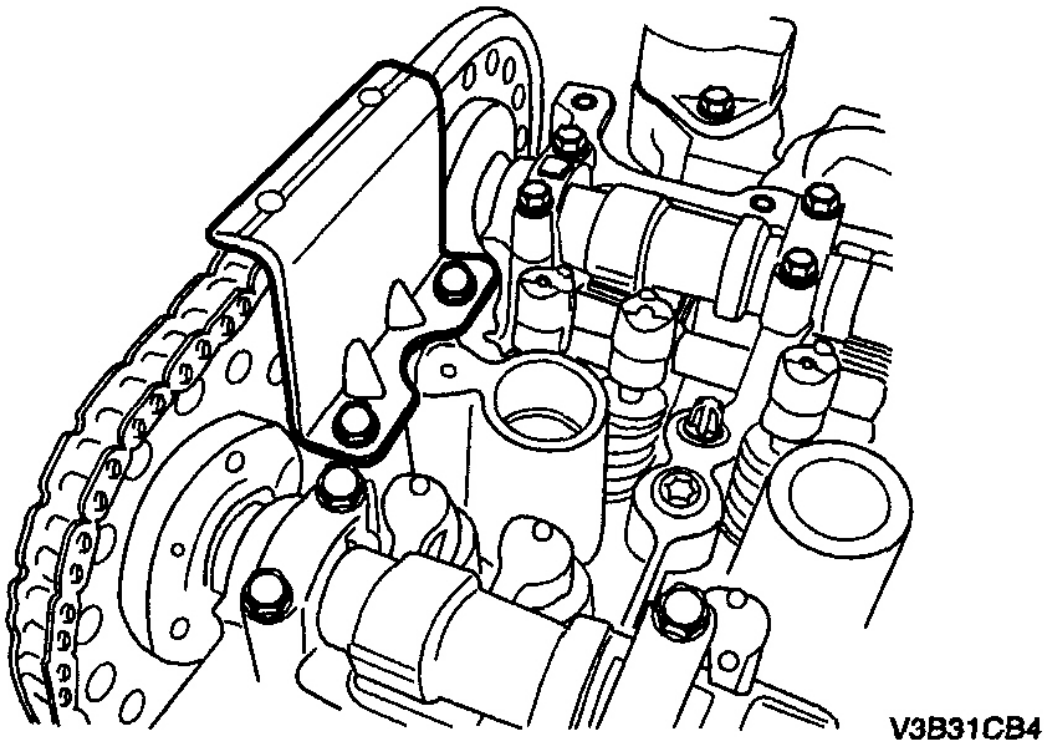

Fig. 114: Installing Top Chain Guide
Courtesy of SUZUKI OF AMERICA CORP.

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

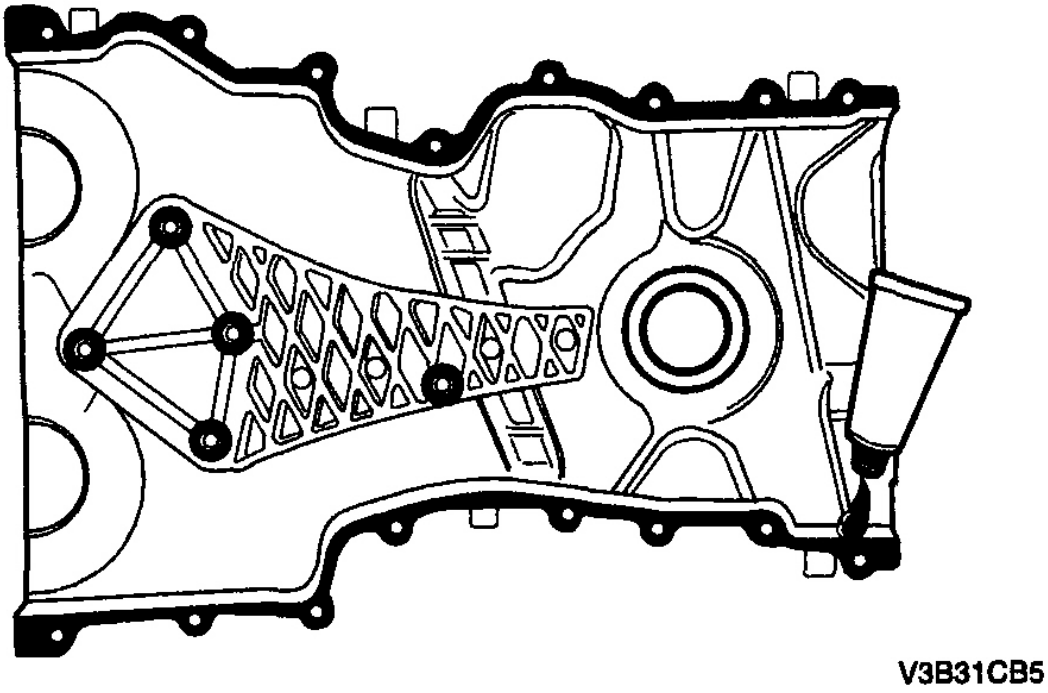

Fig. 115: Applying Liquid Gasket On Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.

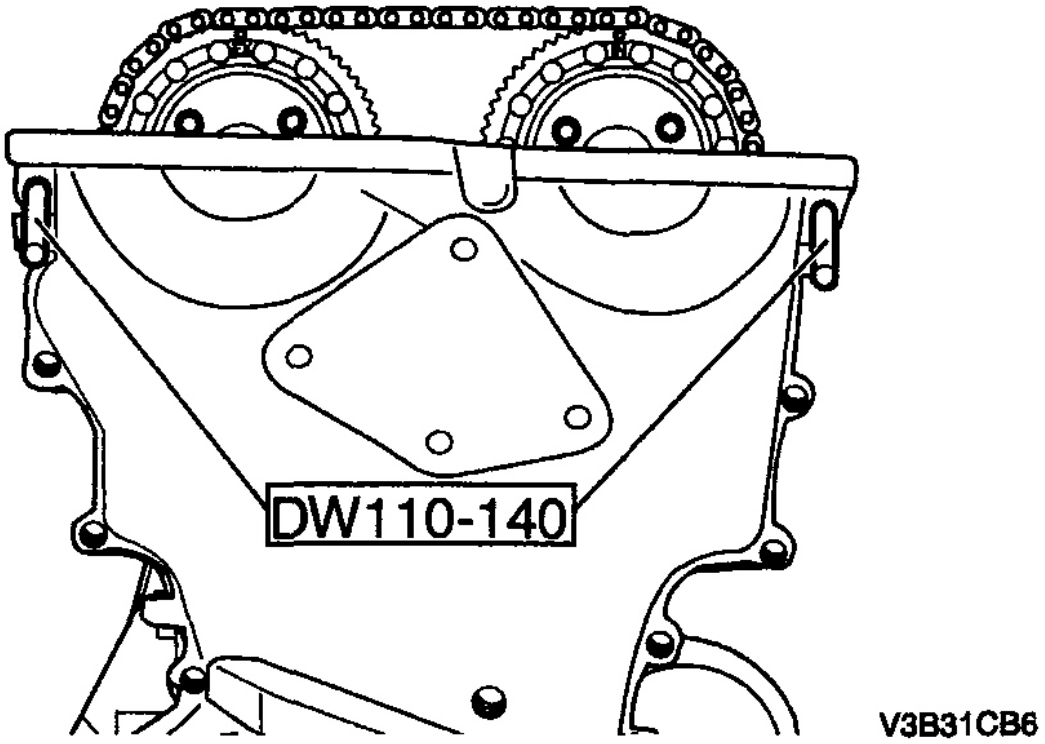

Fig. 116: Installing Guide Pin DW110-140
Courtesy of SUZUKI OF AMERICA CORP.

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)).

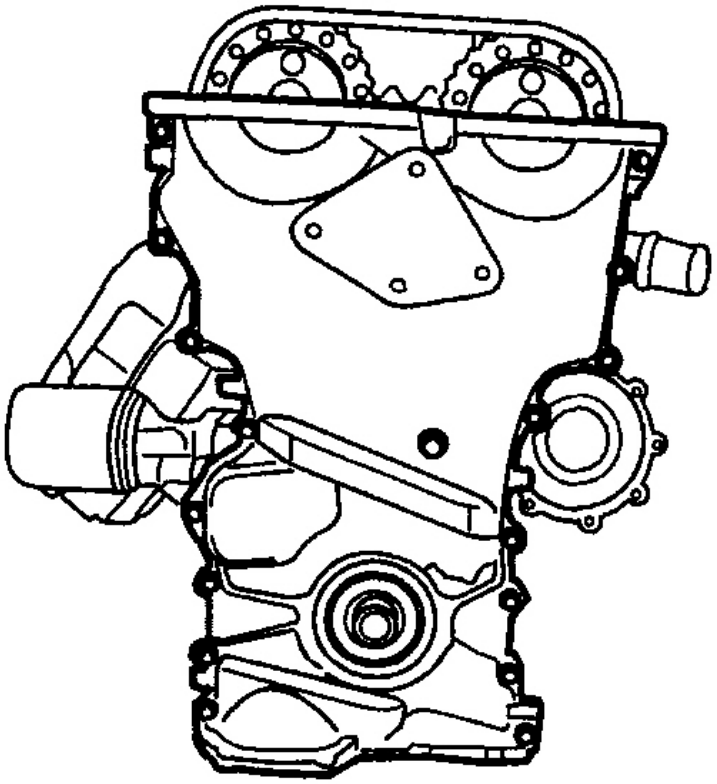

Fig. 117: Installing Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

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).

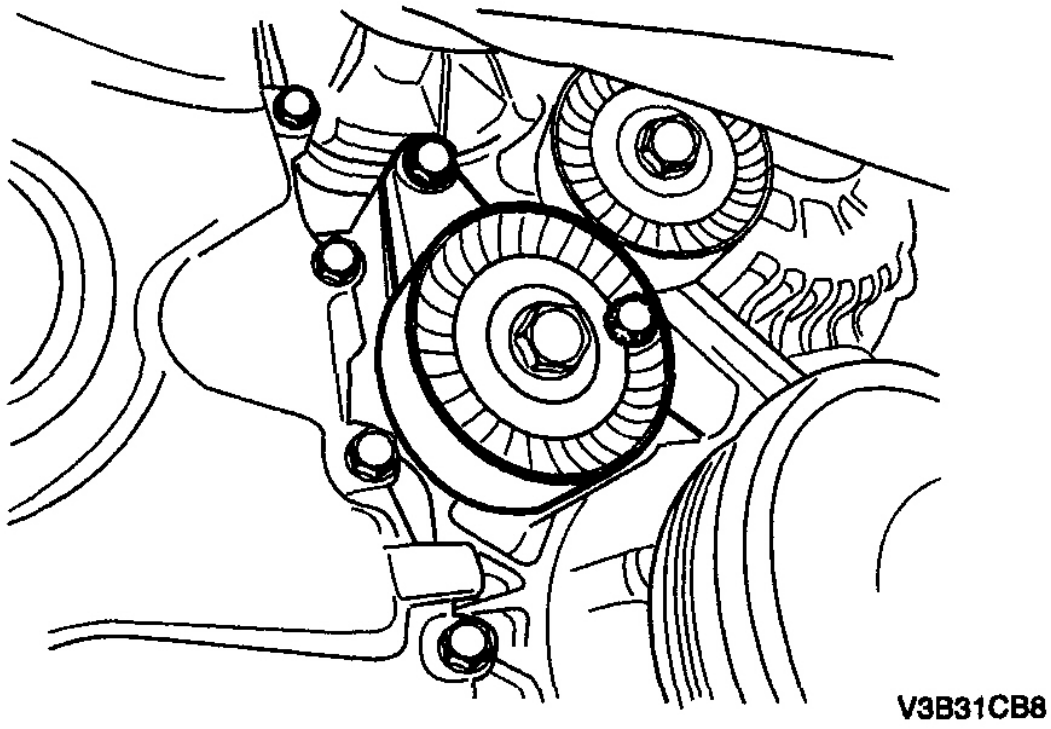

Fig. 118: Installing Drive Belt Automatic Tensioner
Courtesy of SUZUKI OF AMERICA CORP.

15. Install the water pump pulley.

Tighten

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

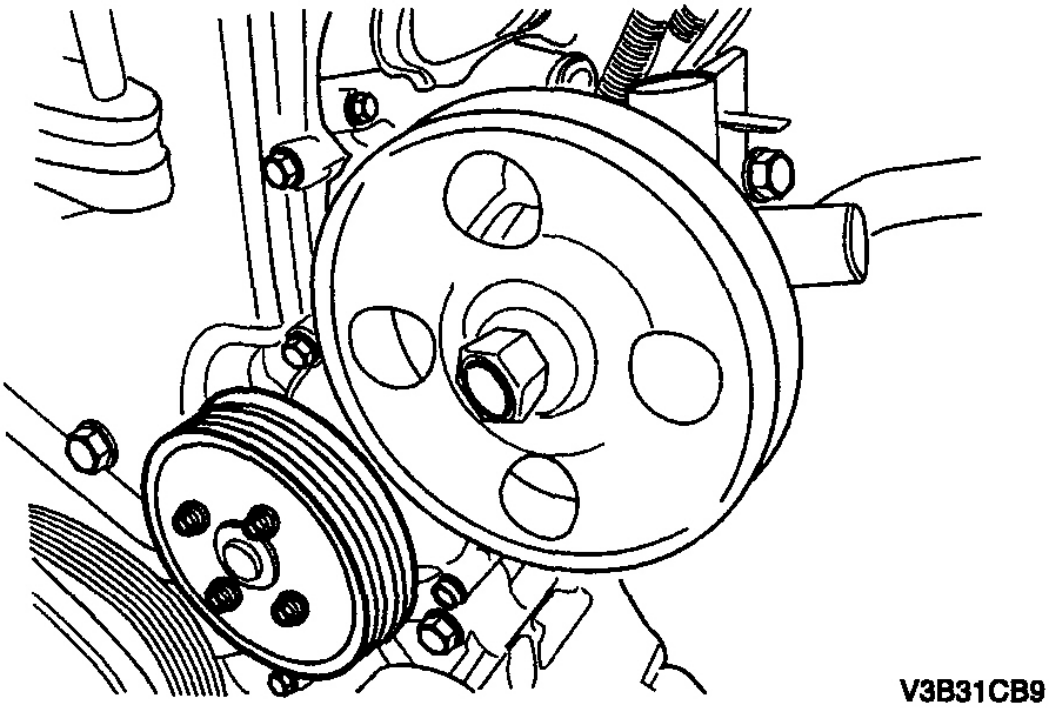

Fig. 119: Installing Water Pump Pulley
Courtesy of SUZUKI OF AMERICA CORP.

16. Install the engine mount bracket support.

Tighten

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

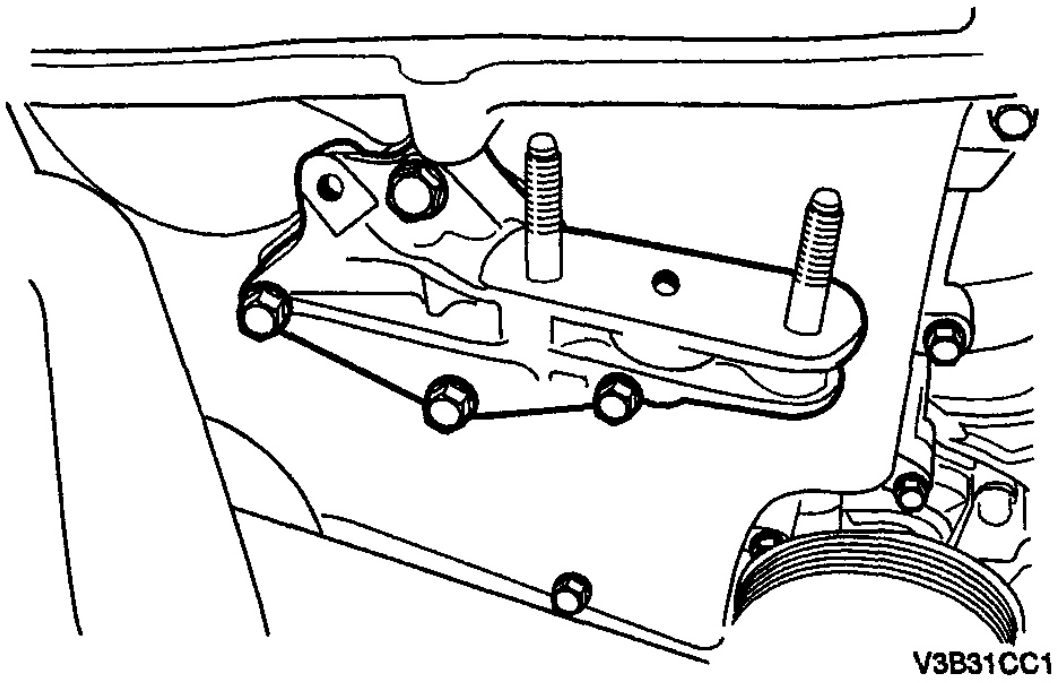

Fig. 120: Installing Engine Mount Bracket Support
Courtesy of SUZUKI OF AMERICA CORP.

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).

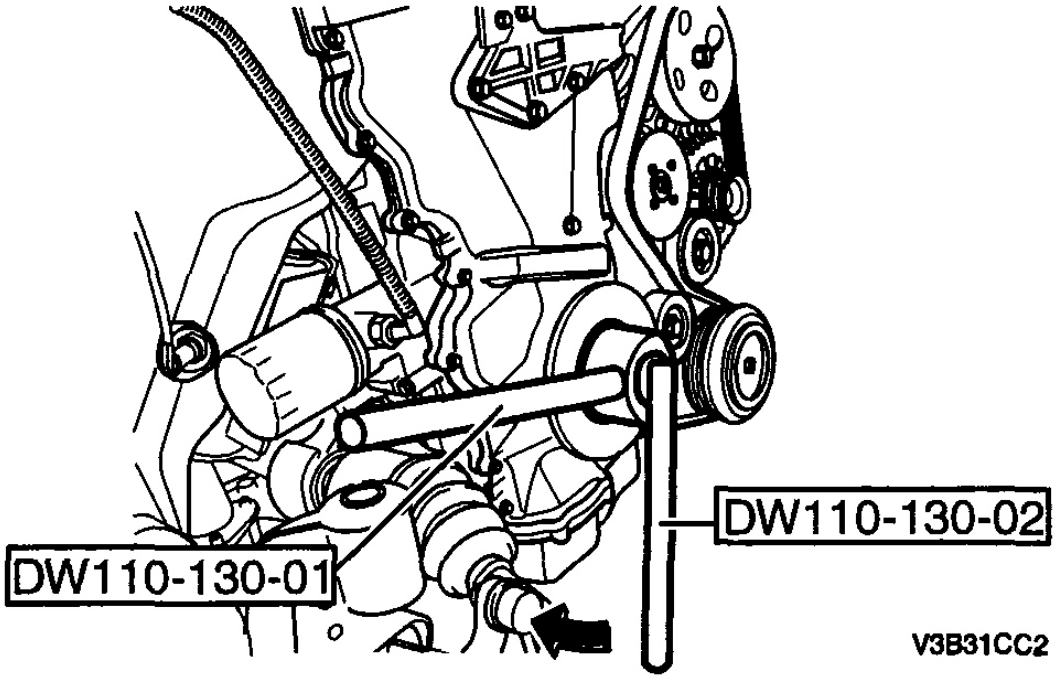

Fig. 121: Installing Crankshaft Pulley
Courtesy of SUZUKI OF AMERICA CORP.

18. Install the oil pan. Refer to "**OIL PAN / OIL PUMP INSTALLATION** ".

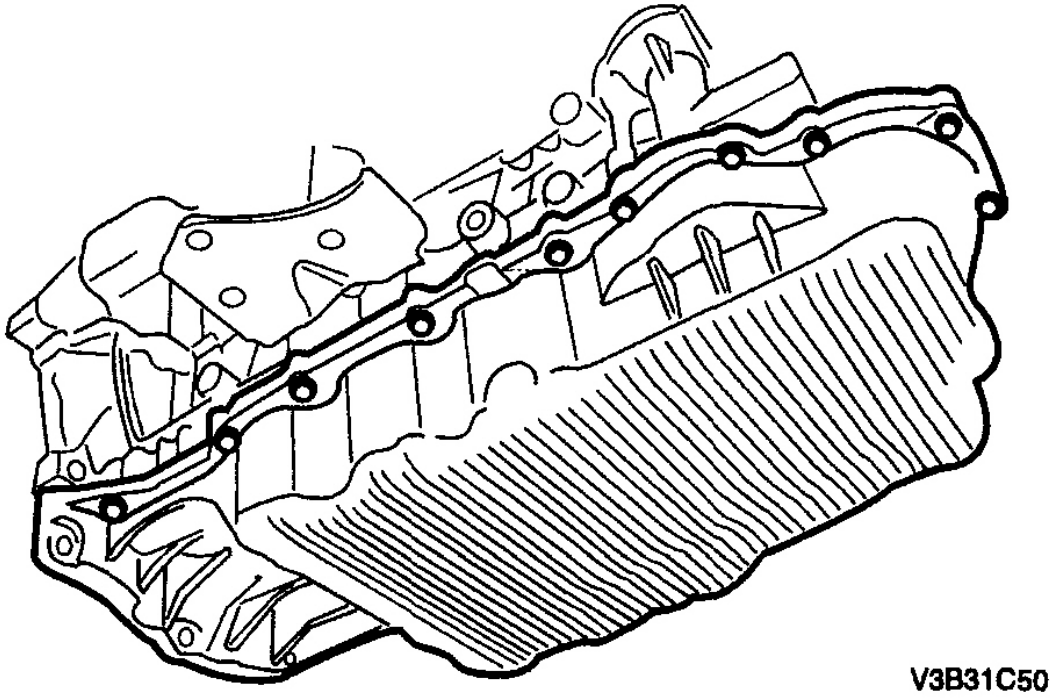

Fig. 122: Installing Oil Pan
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the cylinder head cover. Refer to "**CYLINDER HEAD COVER INSTALLATION**".

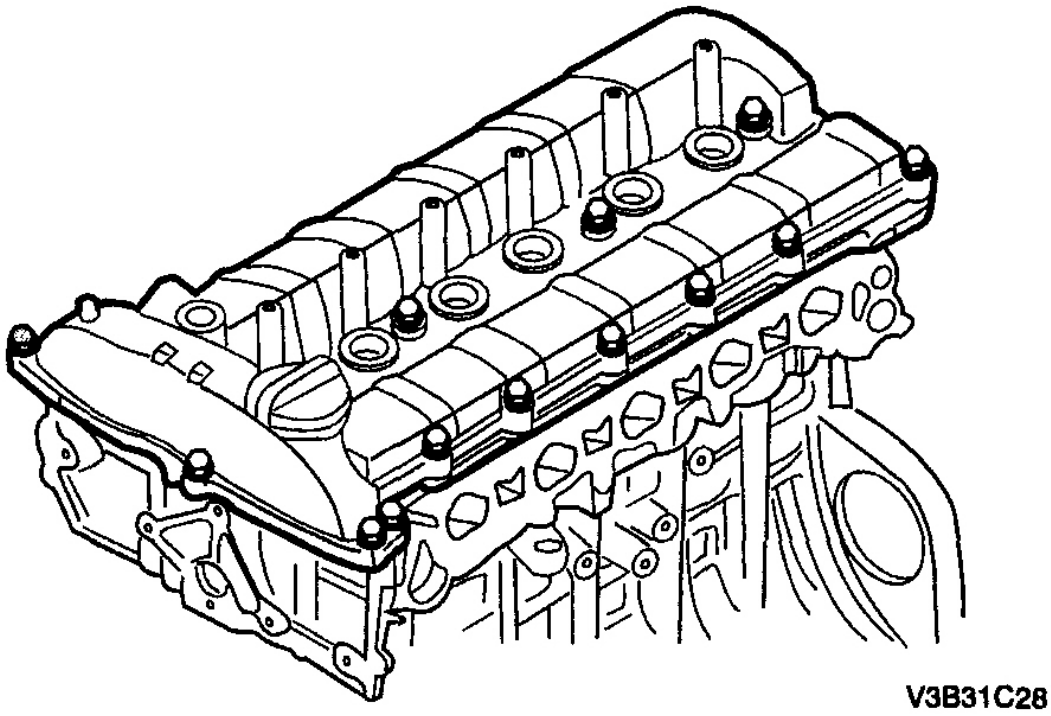

Fig. 123: Installing Cylinder Head Cover
Courtesy of SUZUKI OF AMERICA CORP.

20. Install the intake manifold. Refer to "**INTAKE MANIFOLD INSTALLATION**".

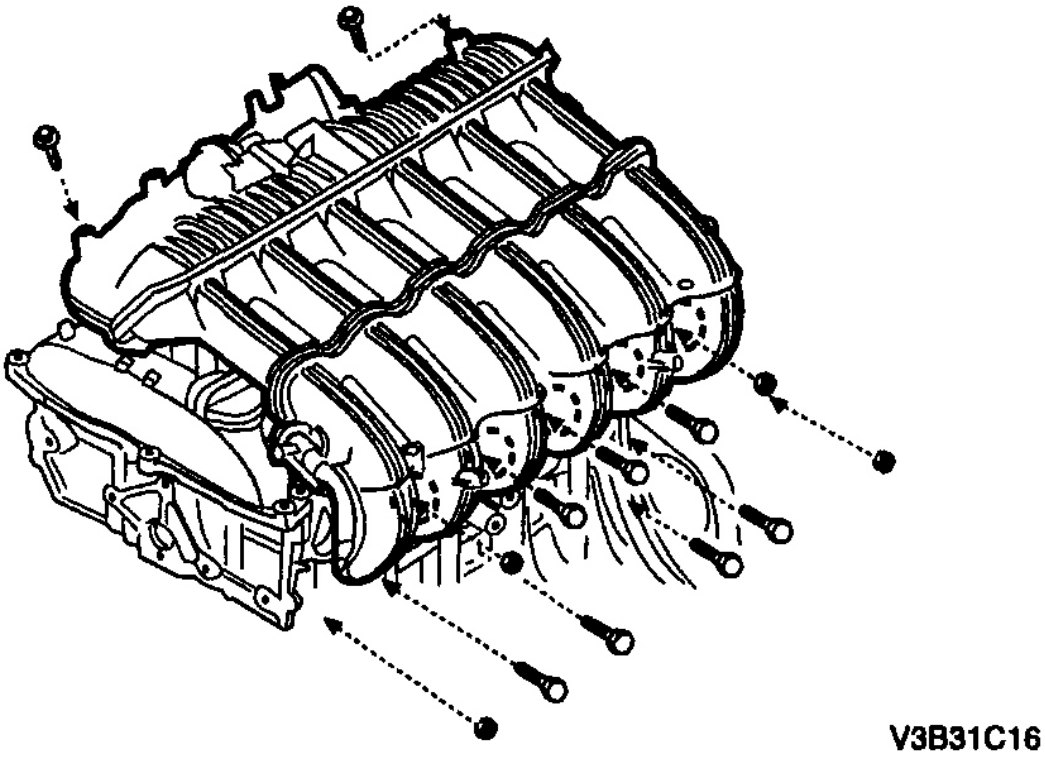

Fig. 124: Installing Intake Manifold
Courtesy of SUZUKI OF AMERICA CORP.

21. Install the flexible plate.

Tighten

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

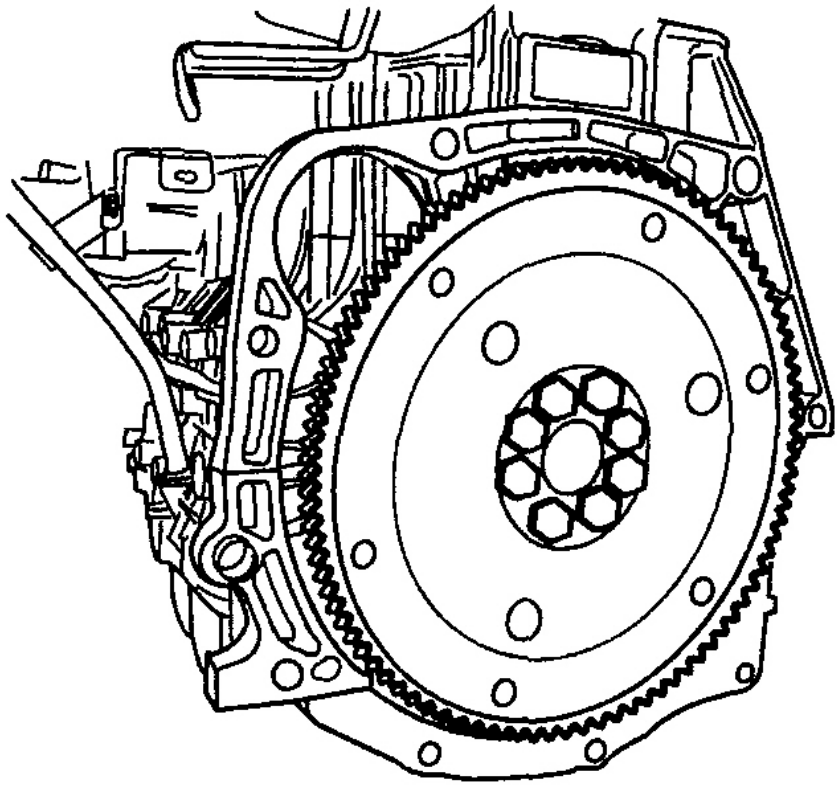

Fig. 125: Installing Flexible Plate
Courtesy of SUZUKI OF AMERICA CORP.

22. Install the transaxle to the engine assembly.
23. Install the engine and transaxle assembly. Refer to "**ENGINE ASSEMBLY INSTALLATION**".

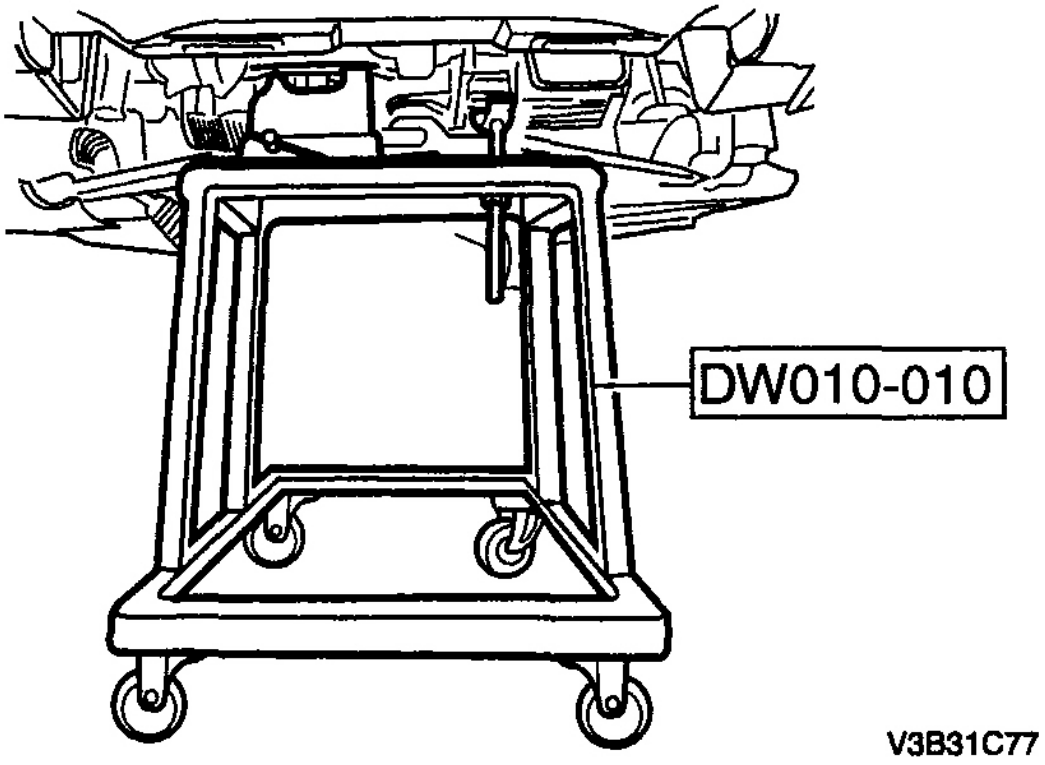

Fig. 126: Installing Engine And Transaxle Assembly
Courtesy of SUZUKI OF AMERICA CORP.

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.

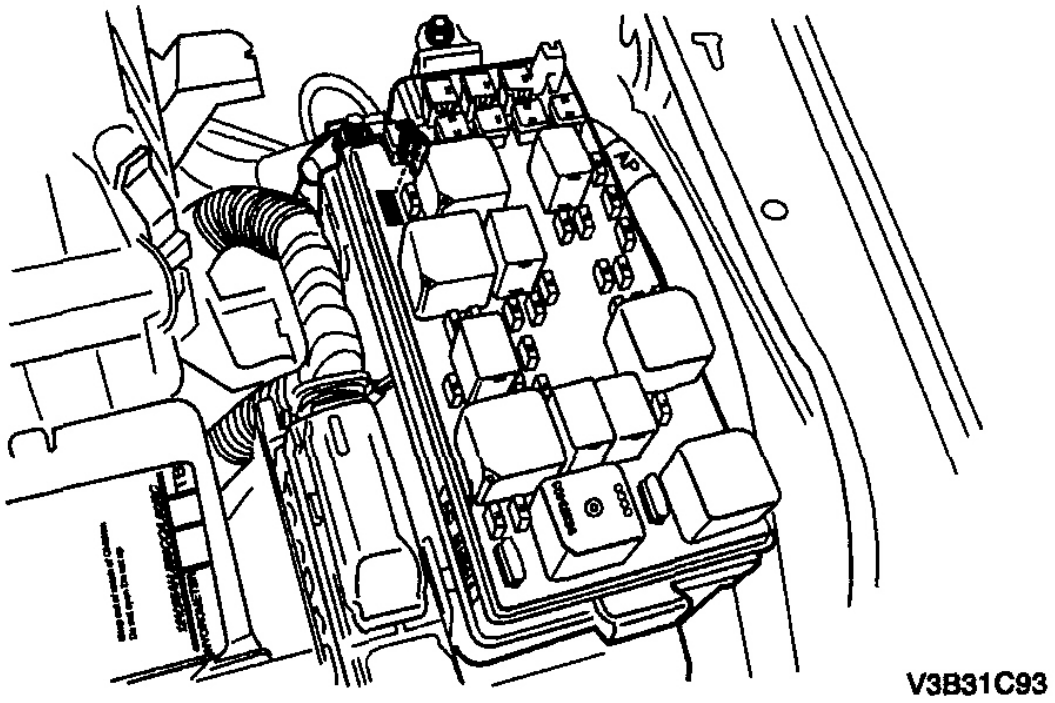

Fig. 127: Removing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

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.

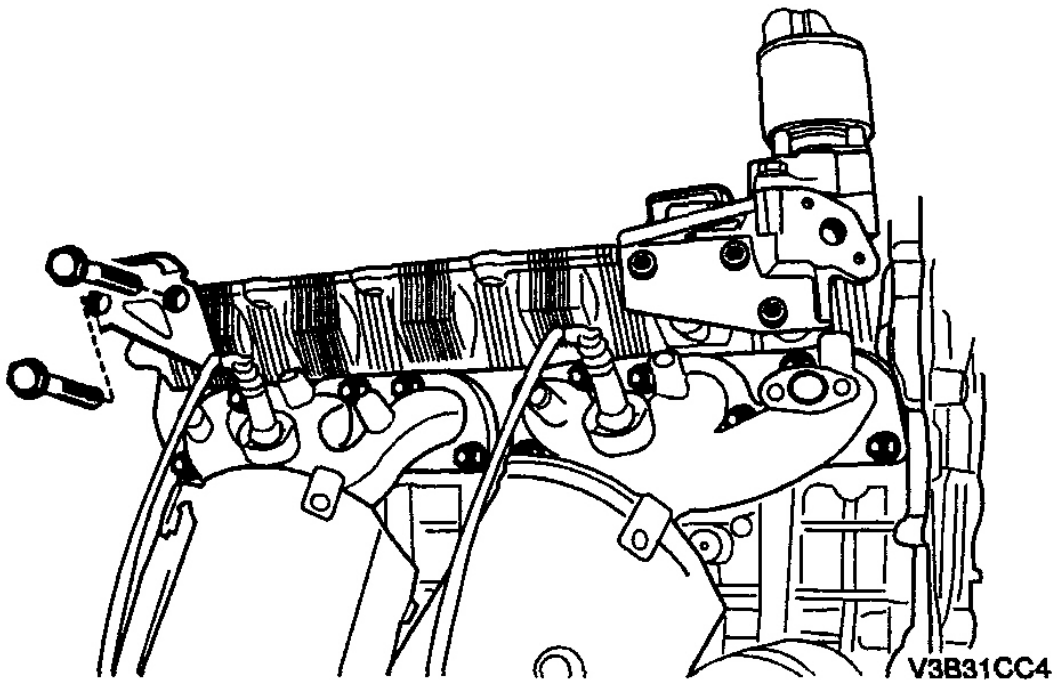

Fig. 128: Removing Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the power steering pump.

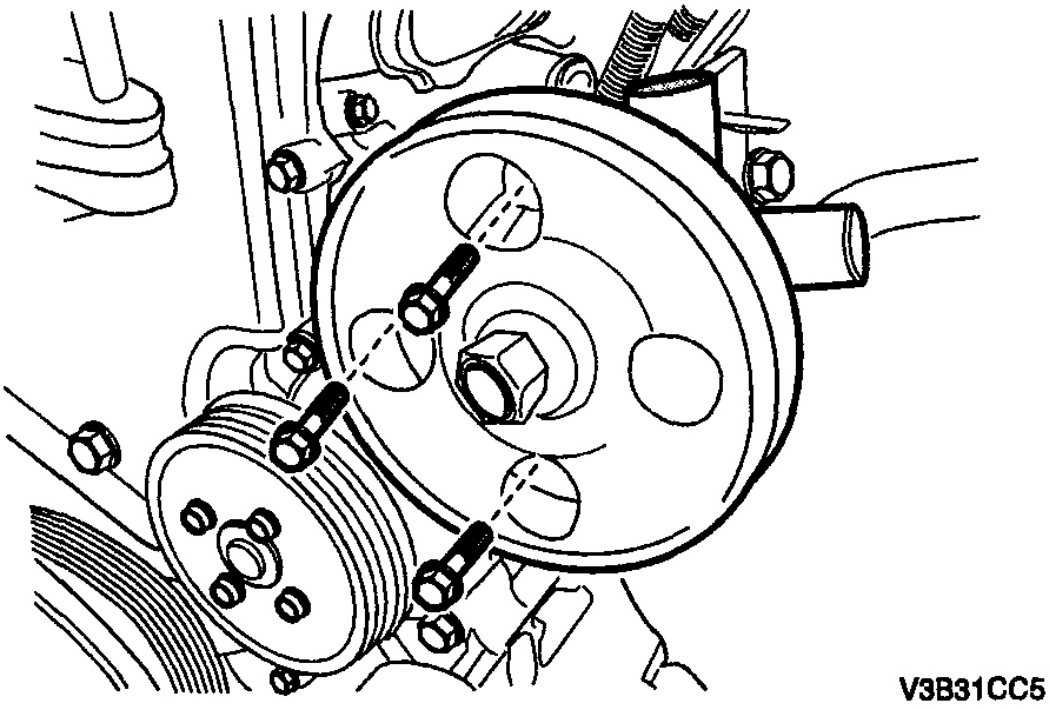

Fig. 129: Removing Power Steering Pump
Courtesy of SUZUKI OF AMERICA CORP.

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

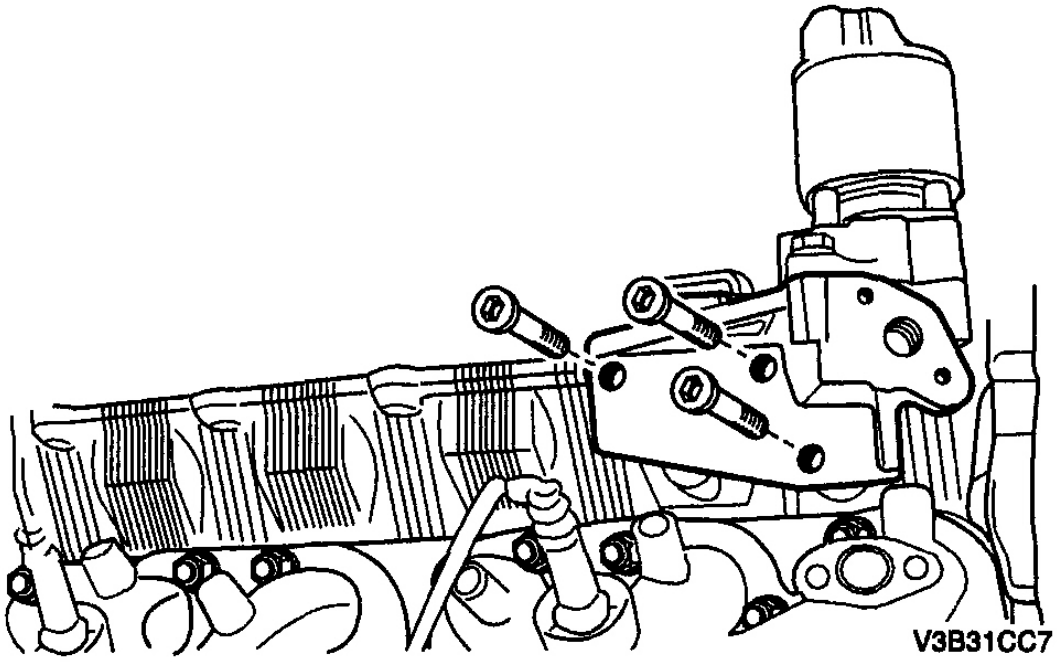

Fig. 130: Removing EGR Valve
Courtesy of SUZUKI OF AMERICA CORP.

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

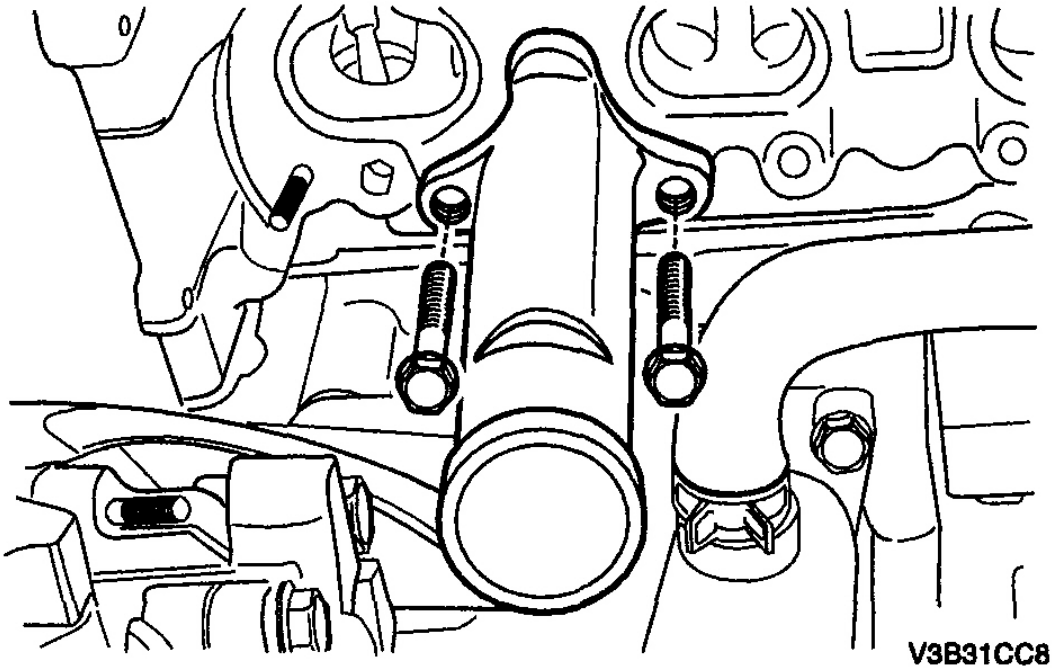

Fig. 131: Removing Heater Pipe
Courtesy of SUZUKI OF AMERICA CORP.

22. Remove the cylinder head bolts in the sequence shown and the cylinder head.
23. Remove the cylinder head gasket.
24. Remove the liquid gasket.

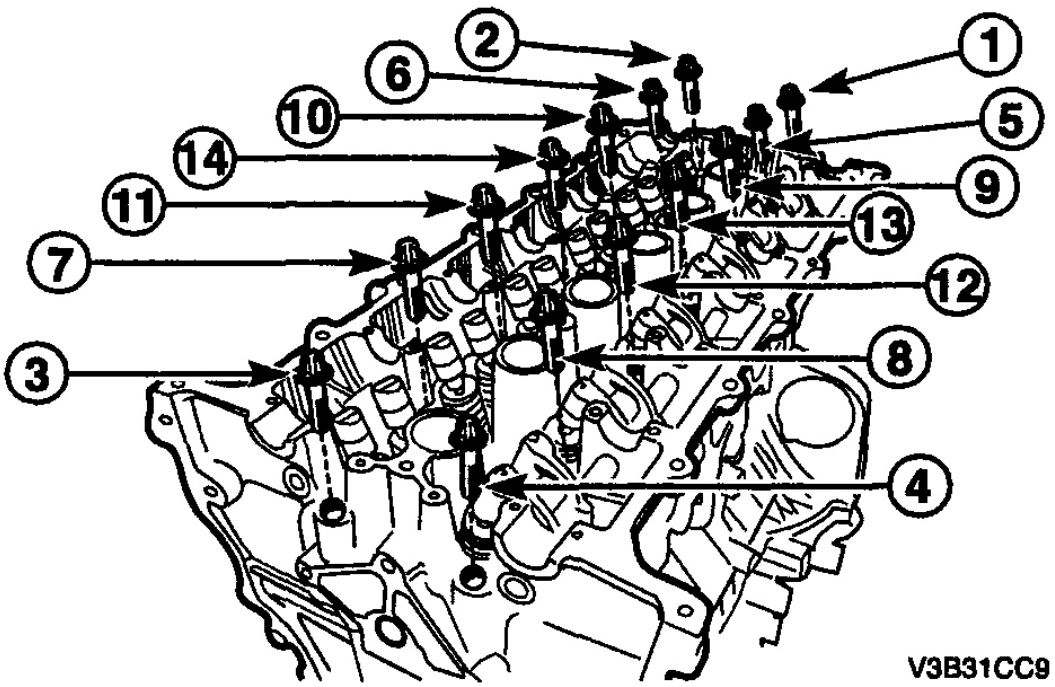

Fig. 132: Identifying Cylinder Head Bolts Removing Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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.

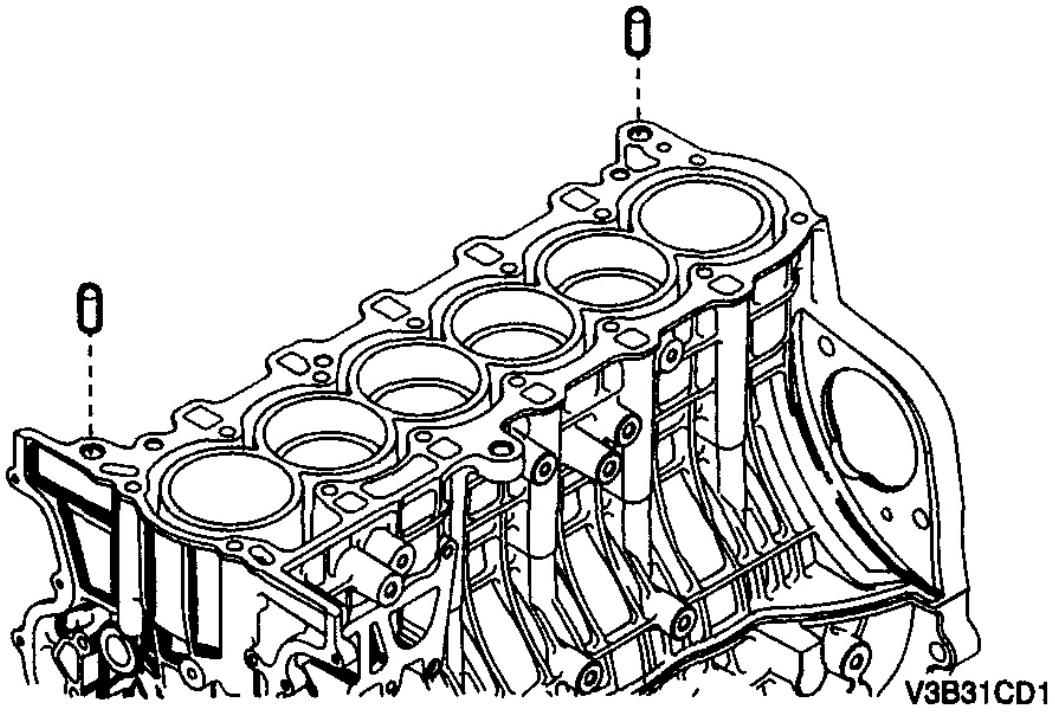

Fig. 133: Installing Dowel Pin
Courtesy of SUZUKI OF AMERICA CORP.

4. Apply the liquid gasket (Loctite(R) 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(R) 5900-M8585) on the upper surface of the cylinder head gasket as described in the illustration

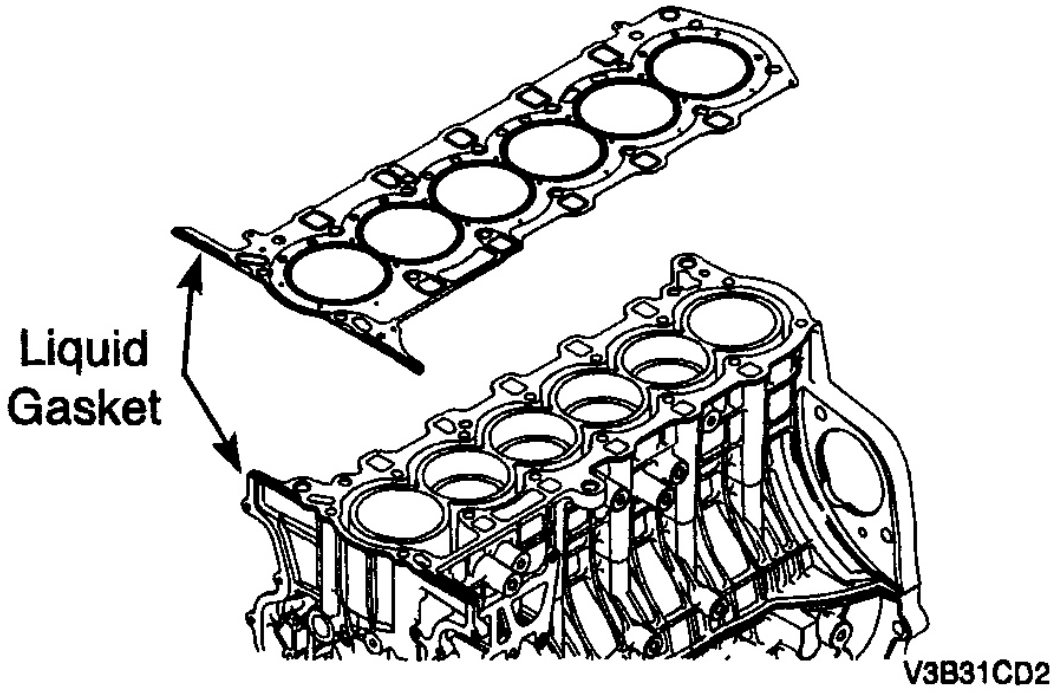

Fig. 134: Applying Liquid Gasket
Courtesy of SUZUKI OF AMERICA CORP.

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°.

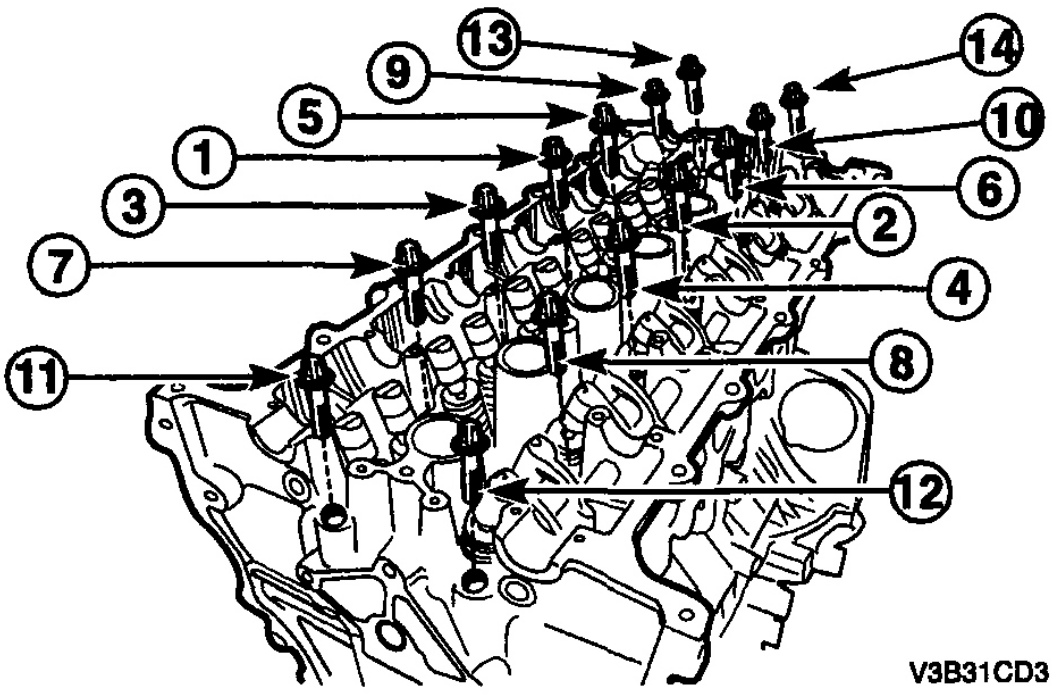

Fig. 135: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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 REMOVAL** ".
13. Install the heater pipe.

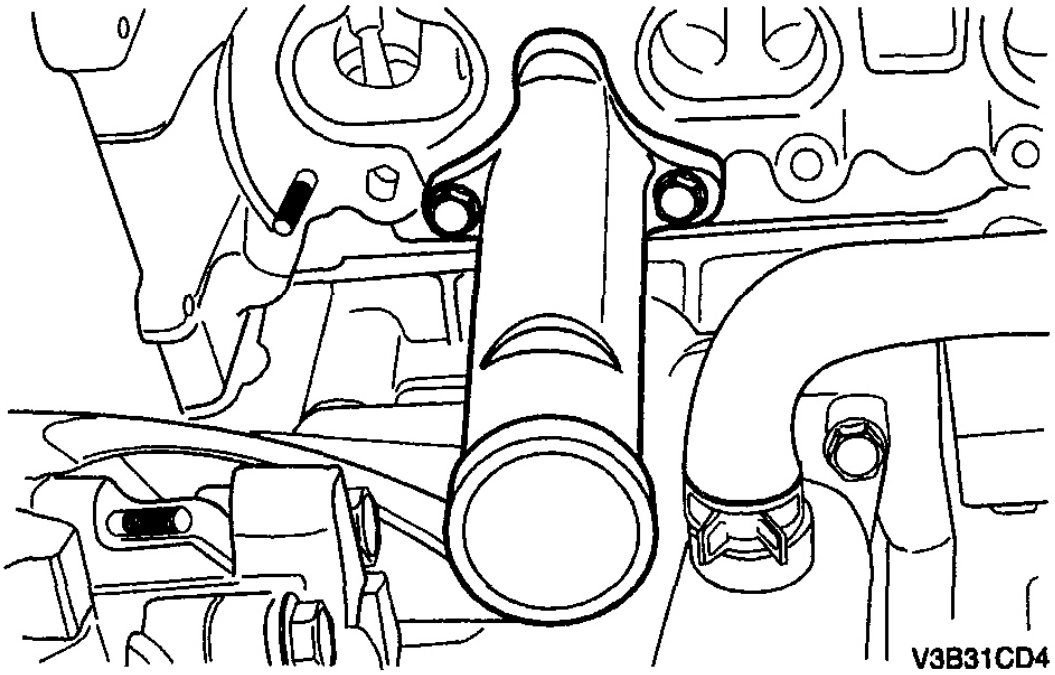

Fig. 136: Installing Heater Pipe
Courtesy of SUZUKI OF AMERICA CORP.

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** ".

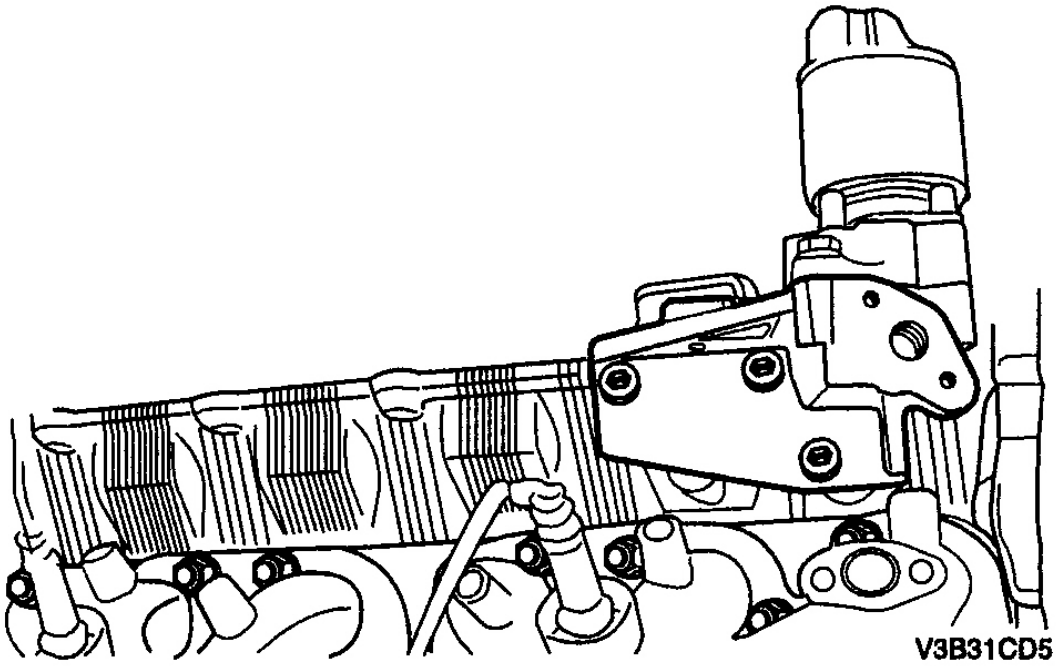

Fig. 137: Installing EGR Valve
Courtesy of SUZUKI OF AMERICA CORP.

17. Install the power steering pump.

Tighten

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

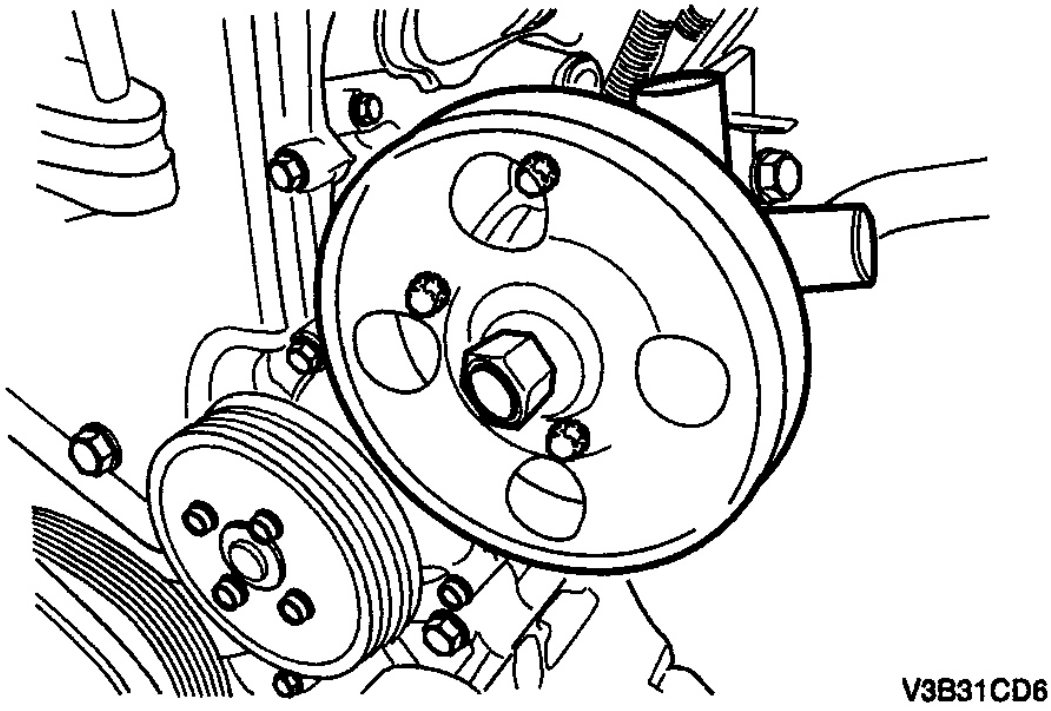

Fig. 138: Installing Power Steering Pump
Courtesy of SUZUKI OF AMERICA CORP.

18. install the intake manifold support bracket.

Tighten

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

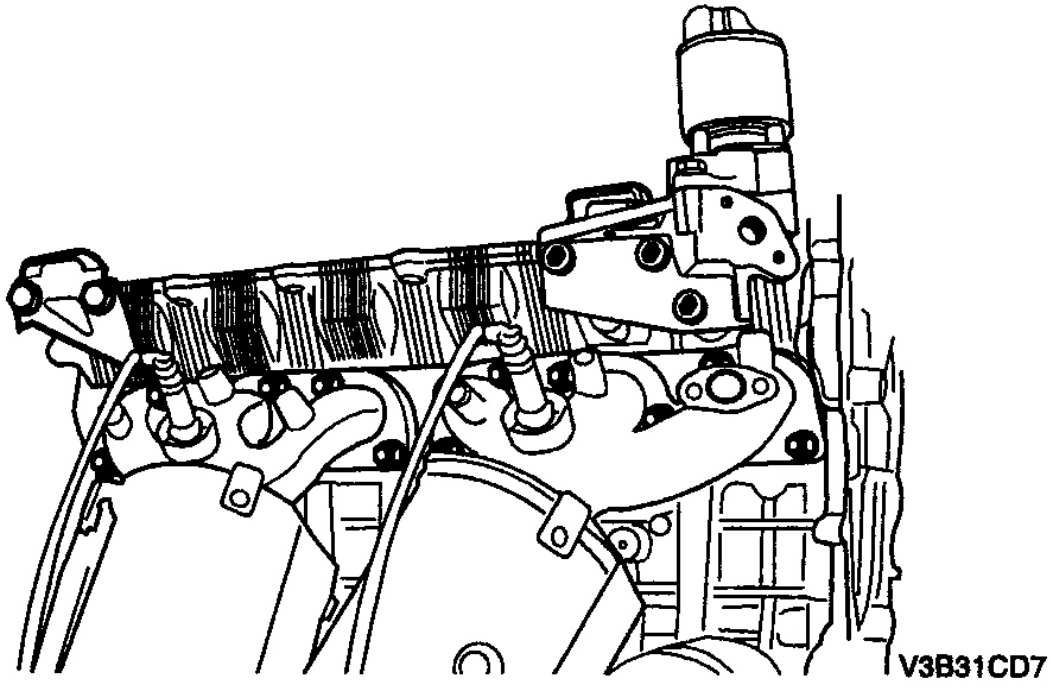

Fig. 139: Installing Intake Manifold Support Bracket
Courtesy of SUZUKI OF AMERICA CORP.

19. Install the timing chain and the timing chain cover. Refer to "**TIMING CHAIN INSTALLATION**".
20. Install the cylinder head cover. Refer to "**CYLINDER HEAD COVER INSTALLATION**".
21. Install the oil pan. Refer to "**OIL PAN / OIL PUMP INSTALLATION** ".
22. Install the engine assembly. Refer to "**ENGINE ASSEMBLY INSTALLATION**".

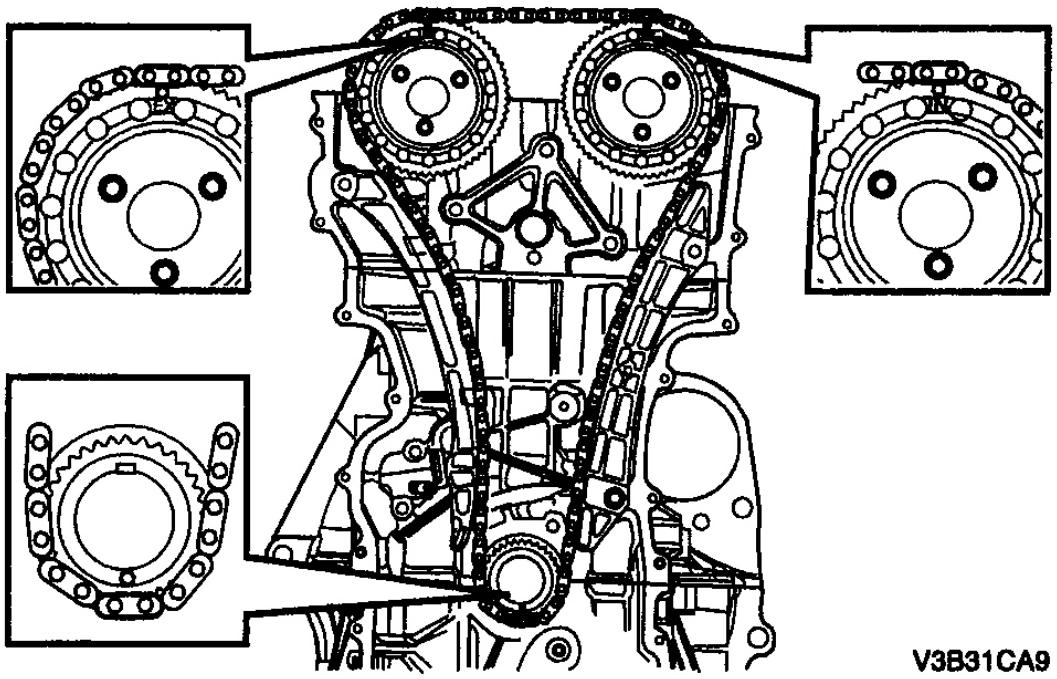

Fig. 140: Installing Timing Chain
Courtesy of SUZUKI OF AMERICA CORP.

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.

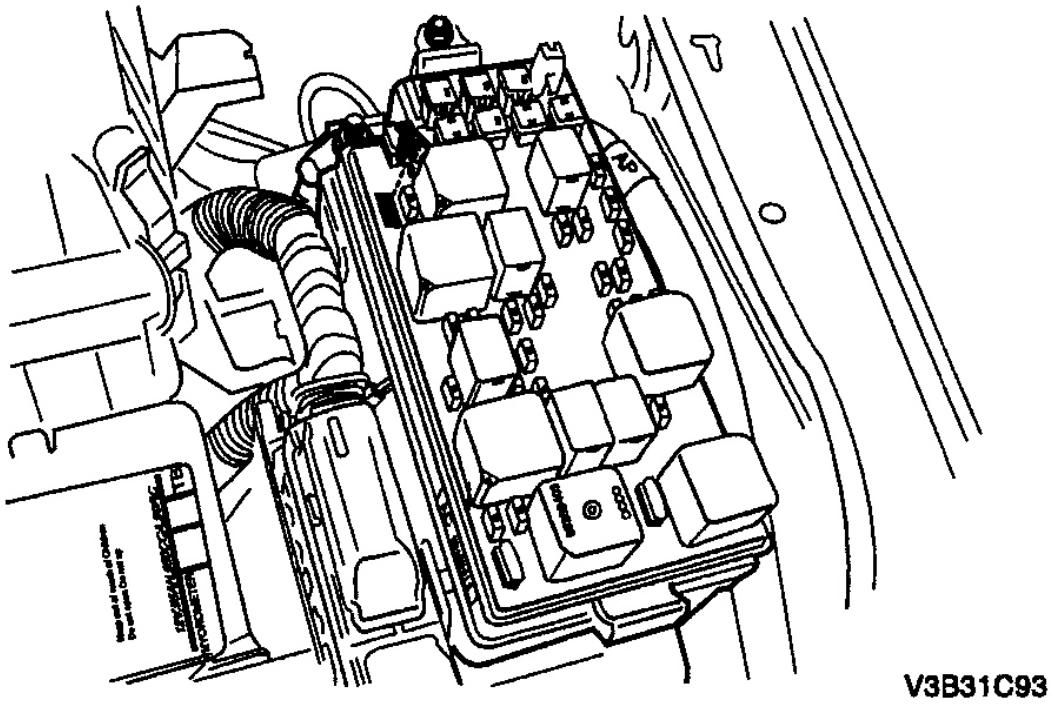

Fig. 141: Removing Fuel Pump Fuse
Courtesy of SUZUKI OF AMERICA CORP.

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.

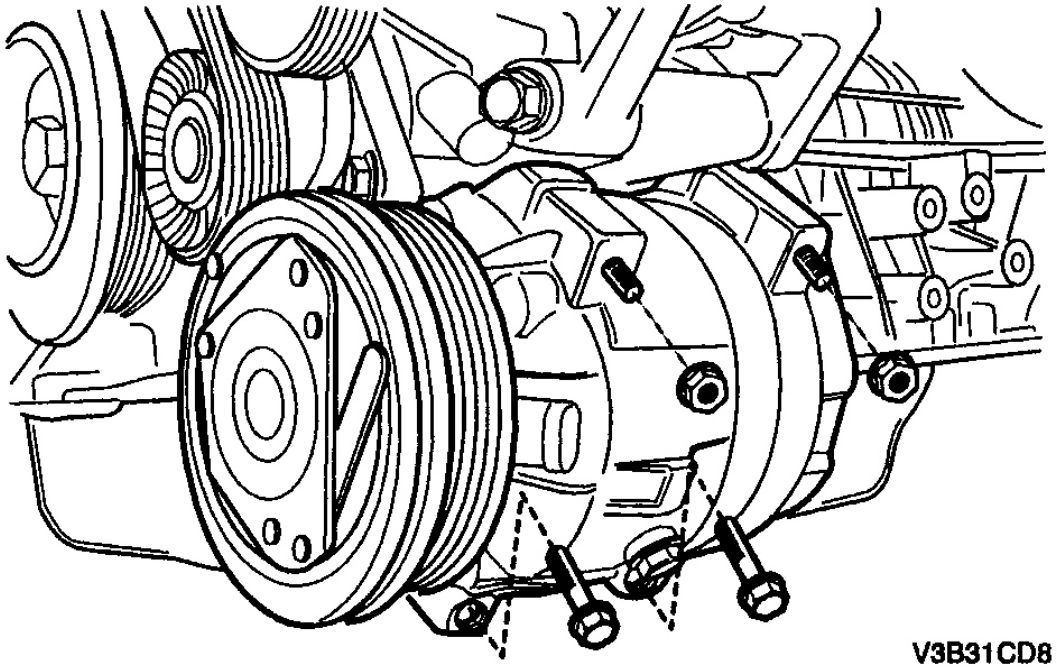

Fig. 142: Removing Compressor
Courtesy of SUZUKI OF AMERICA CORP.

12. Remove the power steering pump.
13. Remove the alternator. Refer to "**GENERATOR REMOVAL** ".
14. Remove the idler retaining bolt, upper pad-to-lower pad bracket bolt, and the idler. Refer to "**TIMING CHAIN REMOVAL**".

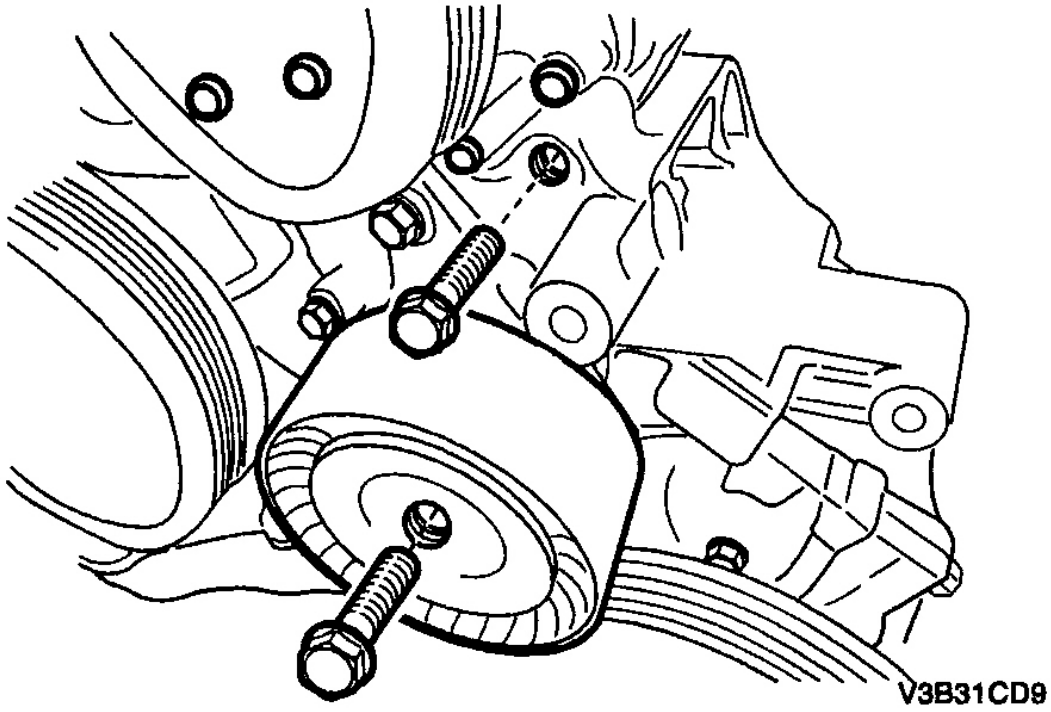

Fig. 143: Removing Idler Retaining Bolt
Courtesy of SUZUKI OF AMERICA CORP.

15. Remove the bracket.

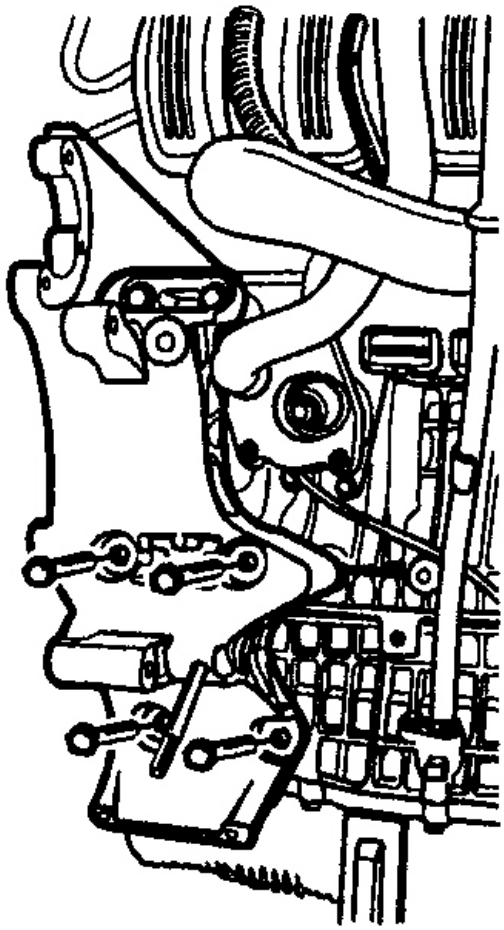

Fig. 144: Removing Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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

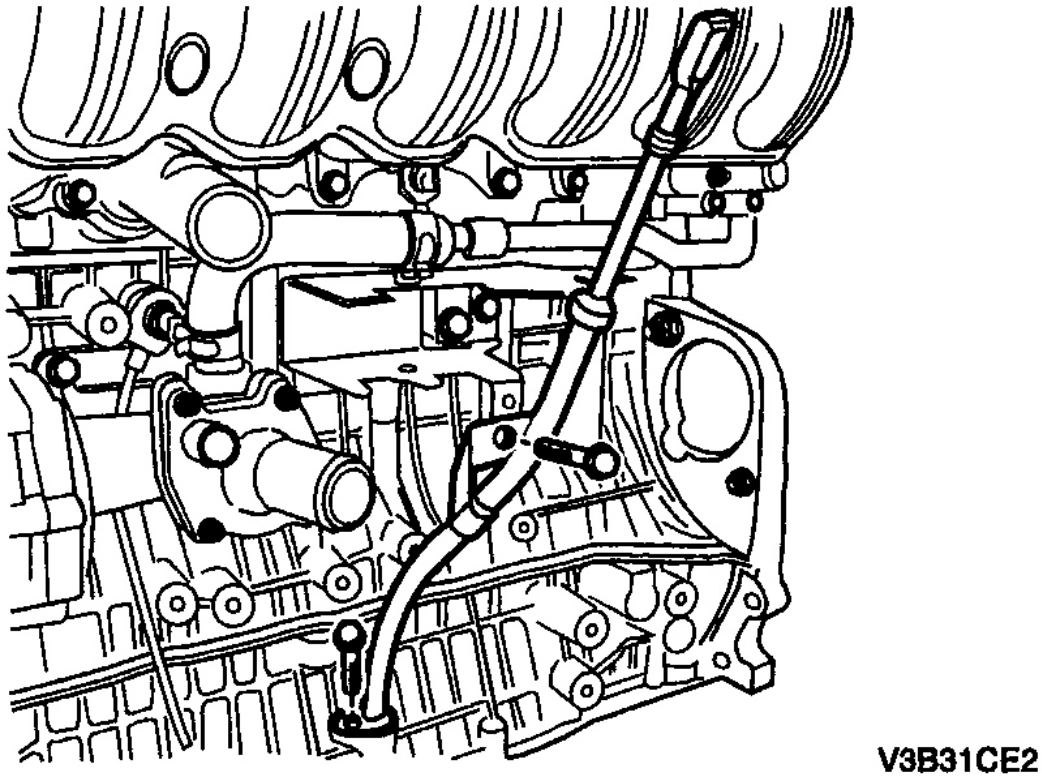

Fig. 145: Removing Engine Oil Dipstick Tube
Courtesy of SUZUKI OF AMERICA CORP.

18. Remove the bed plate baffle.

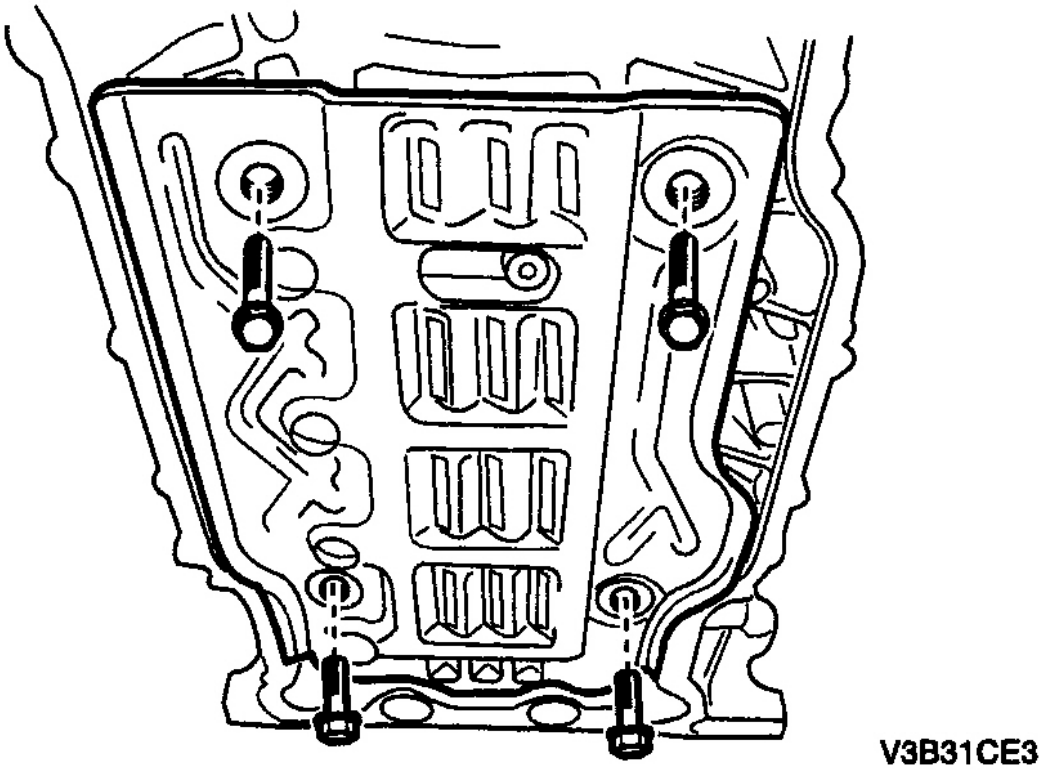

Fig. 146: Removing Bed Plate Baffle
Courtesy of SUZUKI OF AMERICA CORP.

19. Remove the oil pump chain lever.

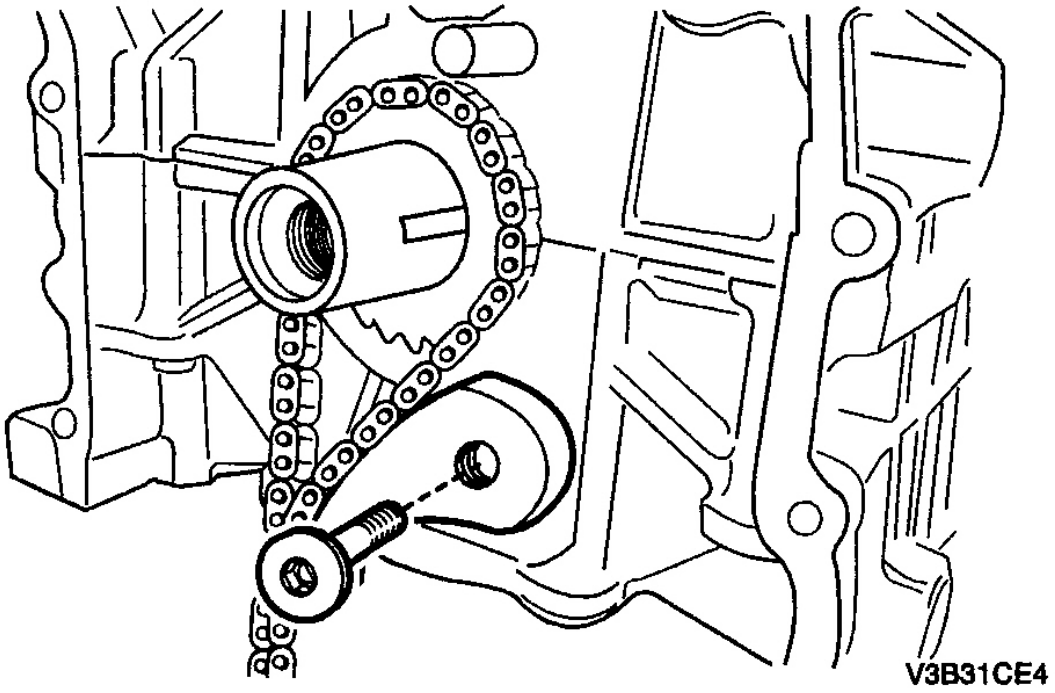

Fig. 147: Removing Oil Pump Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

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

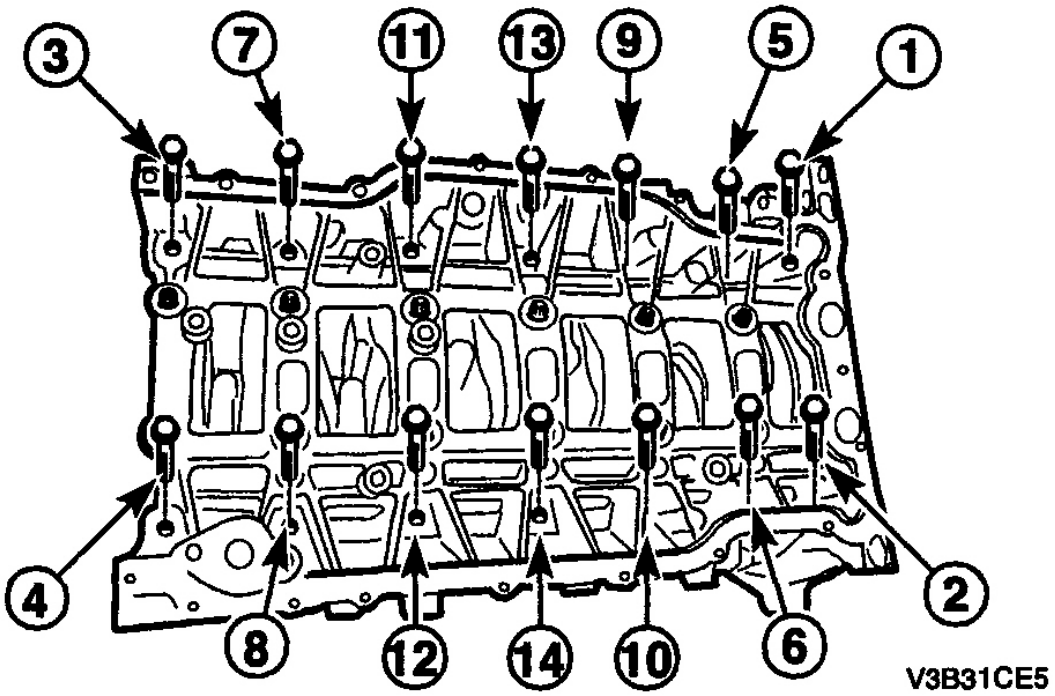

Fig. 148: Identifying Bed Plate Outer Bolts Removing Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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

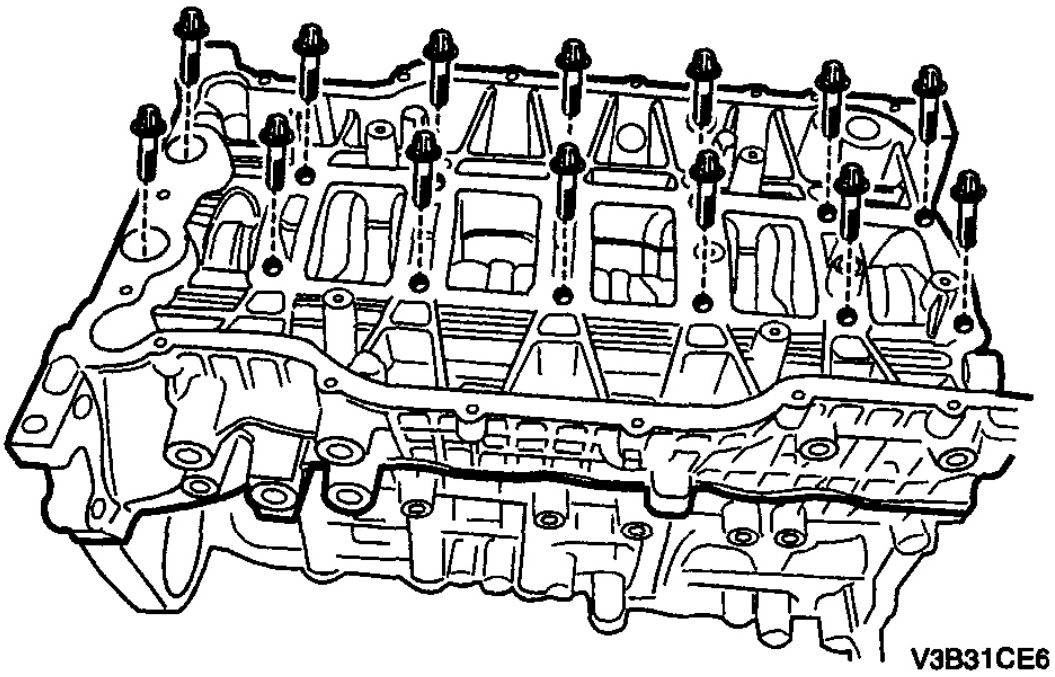

Fig. 149: Identifying Bed Plate Inner Bolts Removing Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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(R) 5900-M8585) on the bed plate.
4. Install the bed plate.

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.

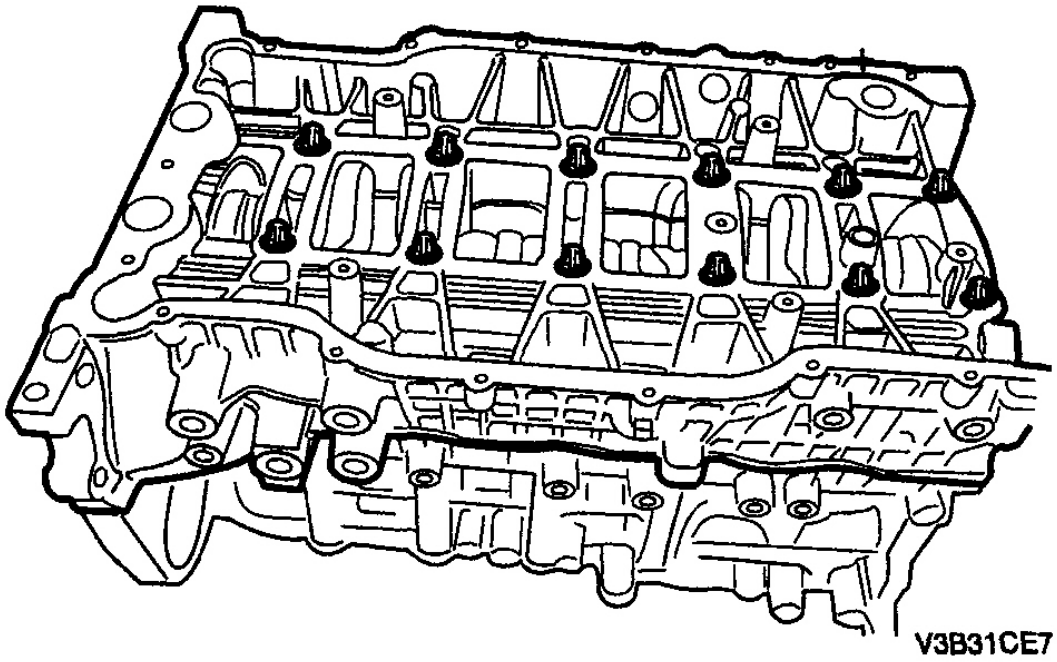

Fig. 150: Tightening Bed Plate Inner Bolts
Courtesy of SUZUKI OF AMERICA CORP.

5. Tighten the bed plate outer bolts.

Tighten

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

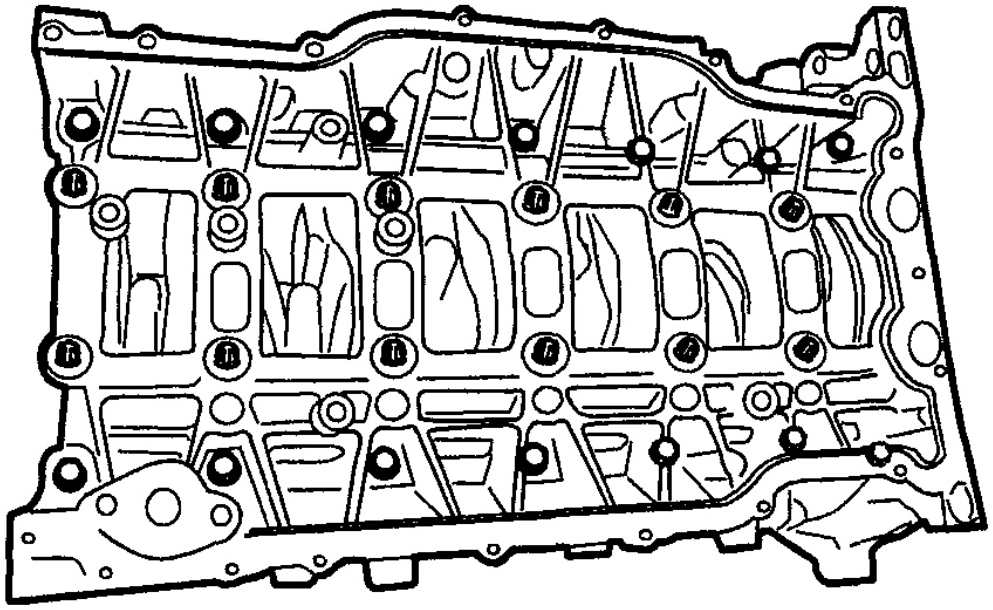

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Fig. 151: Tightening Bed Plate Outer Bolts
Courtesy of SUZUKI OF AMERICA CORP.

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).

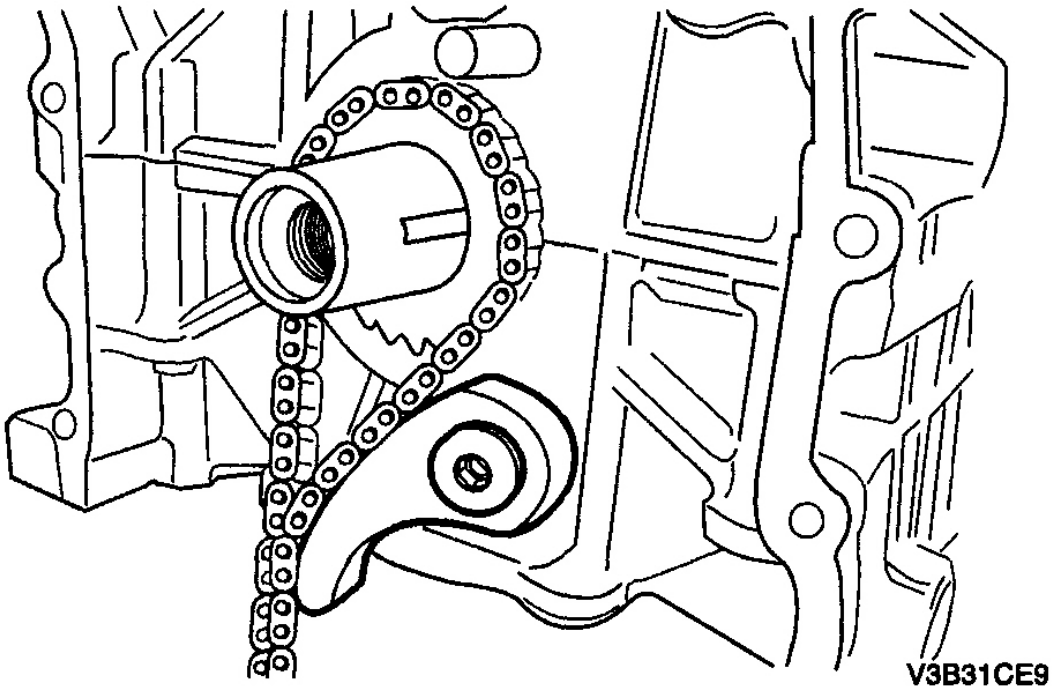


Fig. 152: Installing Oil Pump Chain Lever
Courtesy of SUZUKI OF AMERICA CORP.

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** ".

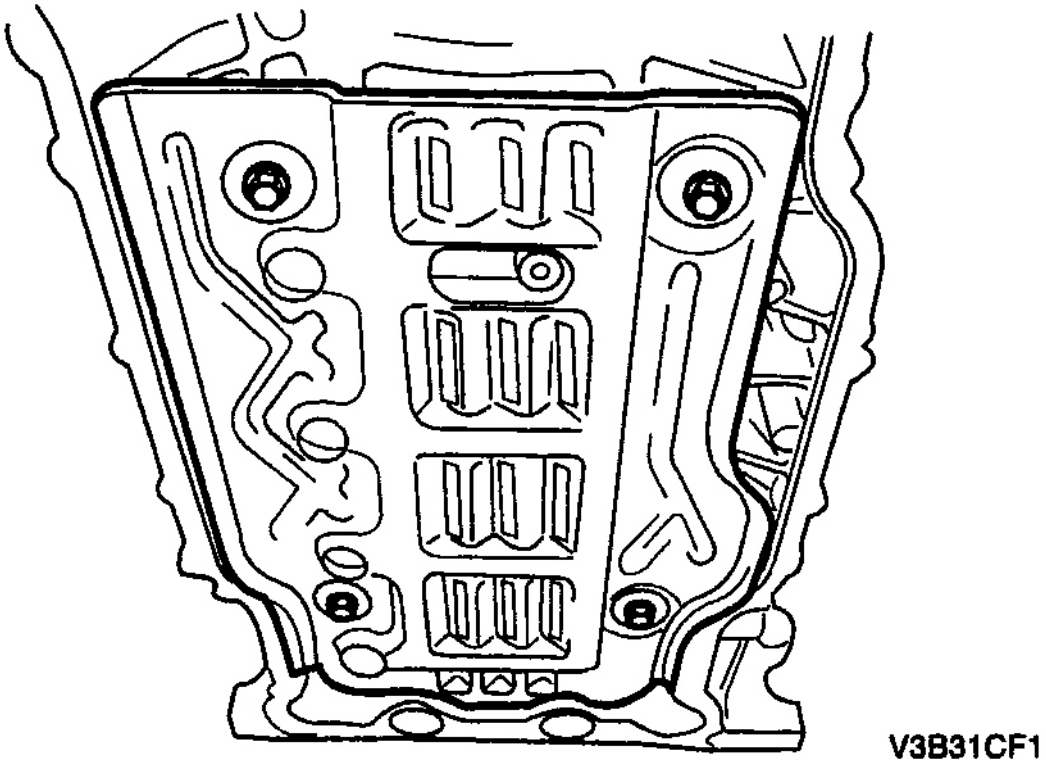


Fig. 153: Installing Oil Pan
Courtesy of SUZUKI OF AMERICA CORP.

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).

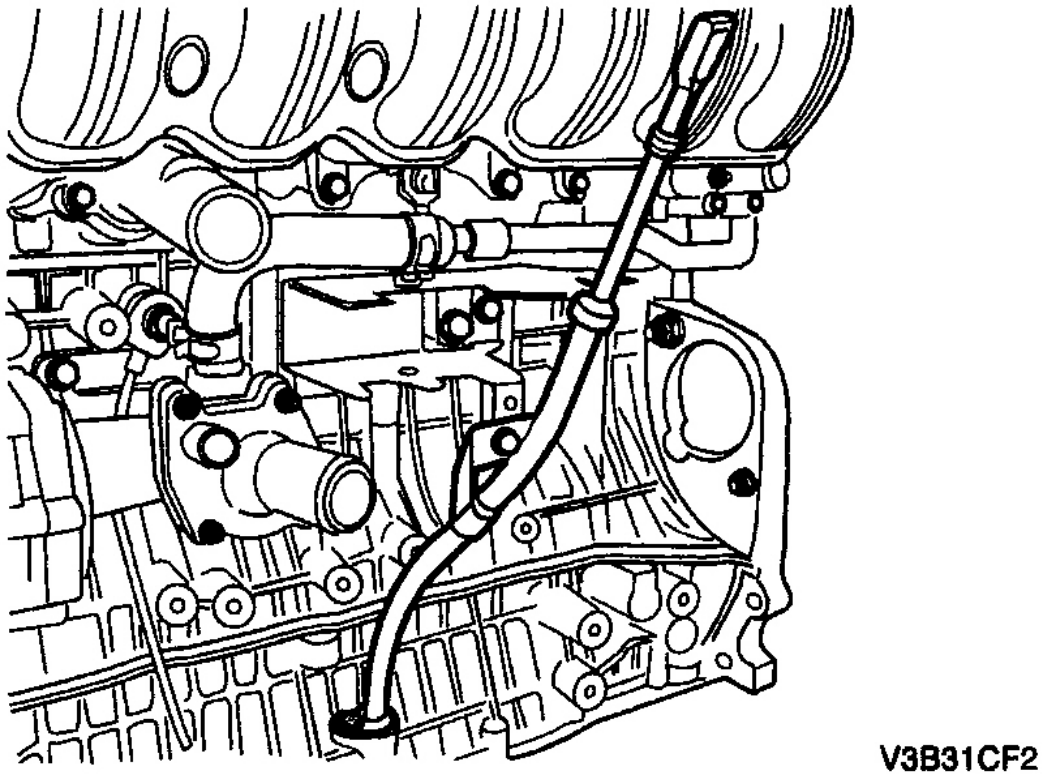


Fig. 154: Installing Engine Oil Dipstick Tube
Courtesy of SUZUKI OF AMERICA CORP.

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

Tighten

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

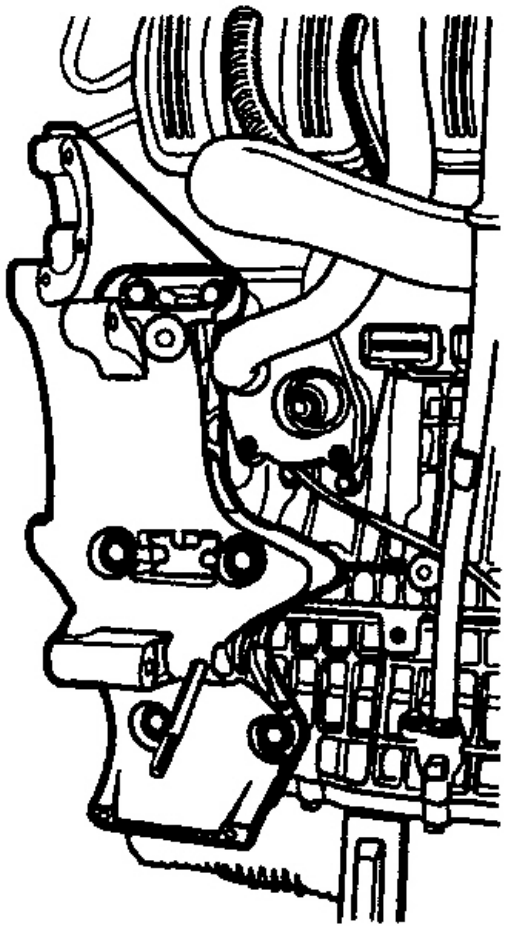


Fig. 155: Installing Bracket
Courtesy of SUZUKI OF AMERICA CORP.

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).

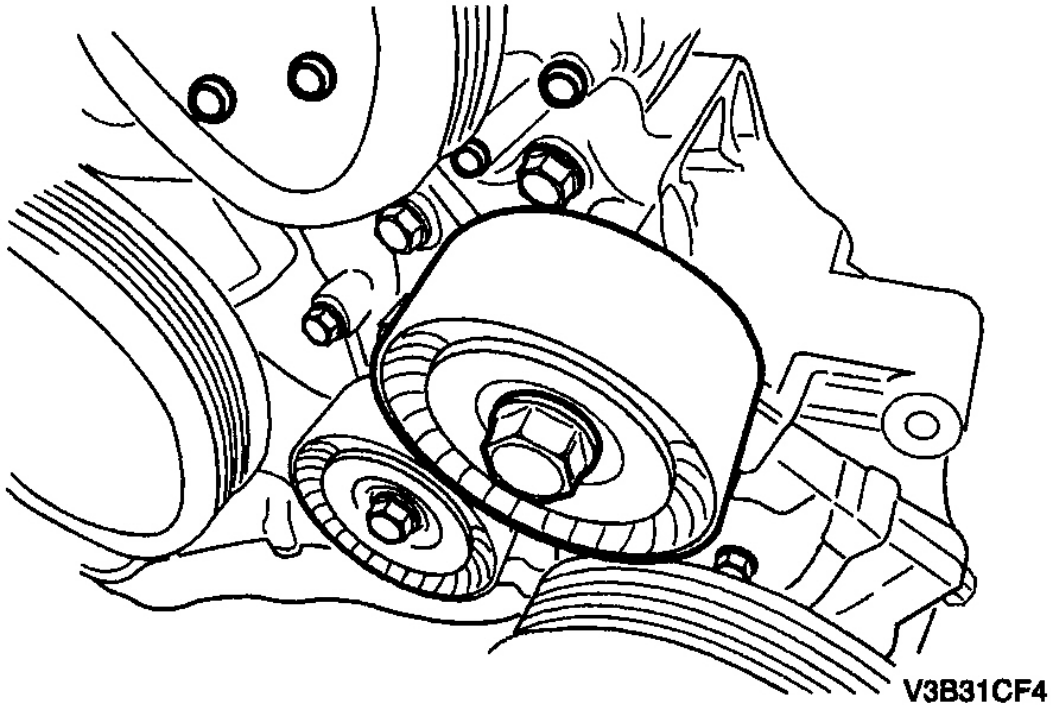


Fig. 156: Installing Idler
Courtesy of SUZUKI OF AMERICA CORP.

14. Install the compressor.

Tighten

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

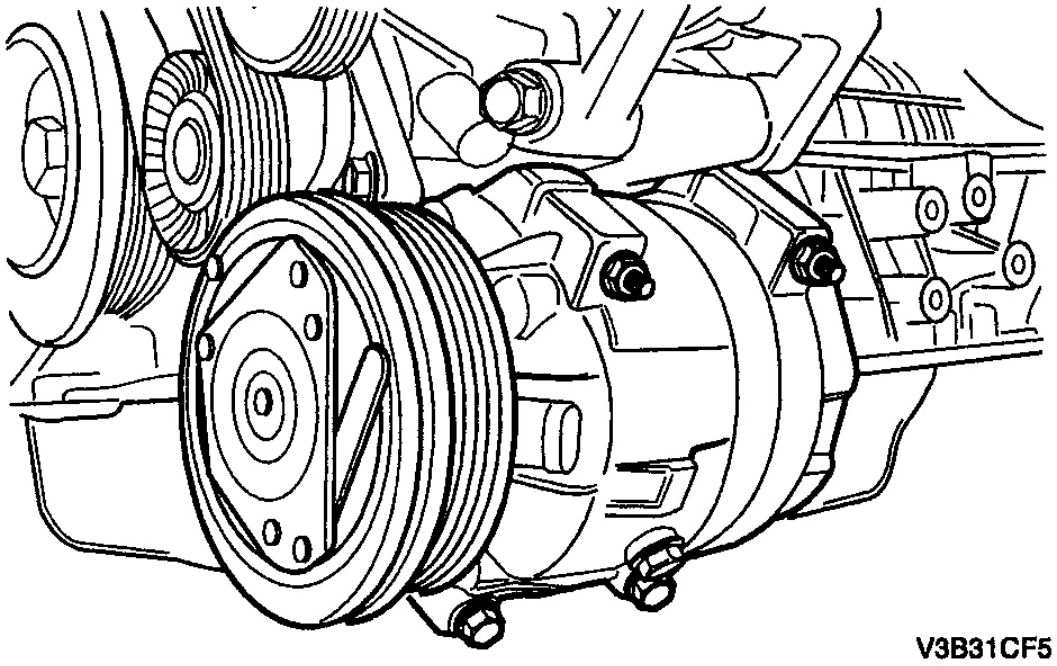


Fig. 157: Installing Compressor
Courtesy of SUZUKI OF AMERICA CORP.

15. Install the alternator.
16. Install the power steering pump.
17. Install the timing chain and timing chain cover. Refer to "**TIMING CHAIN INSTALLATION**".
18. Install the cylinder head cover. Refer to "**CYLINDER HEAD COVER INSTALLATION**".
19. Install the engine assembly. Refer to "**ENGINE ASSEMBLY INSTALLATION**".

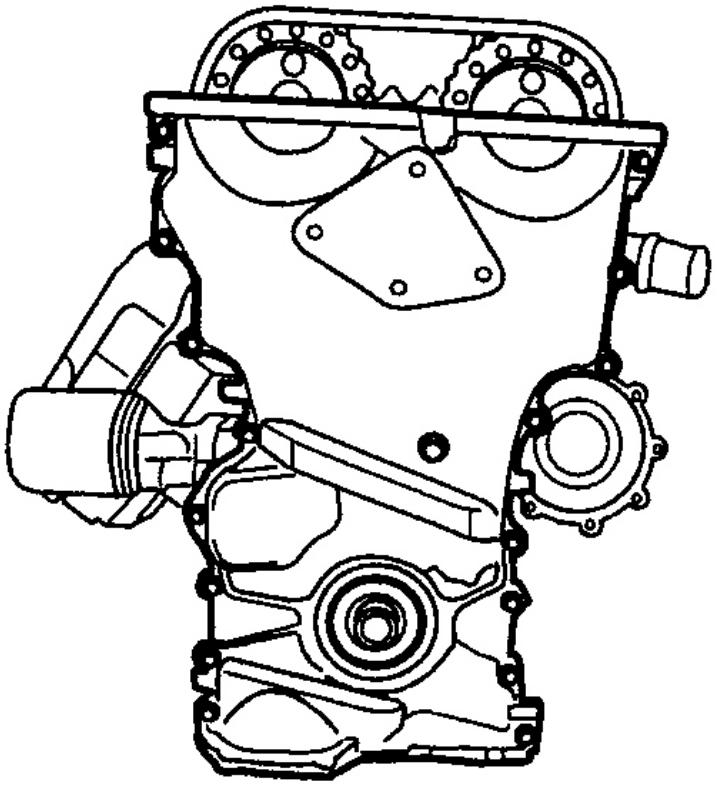


Fig. 158: Installing Timing Chain Cover
Courtesy of SUZUKI OF AMERICA CORP.

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.

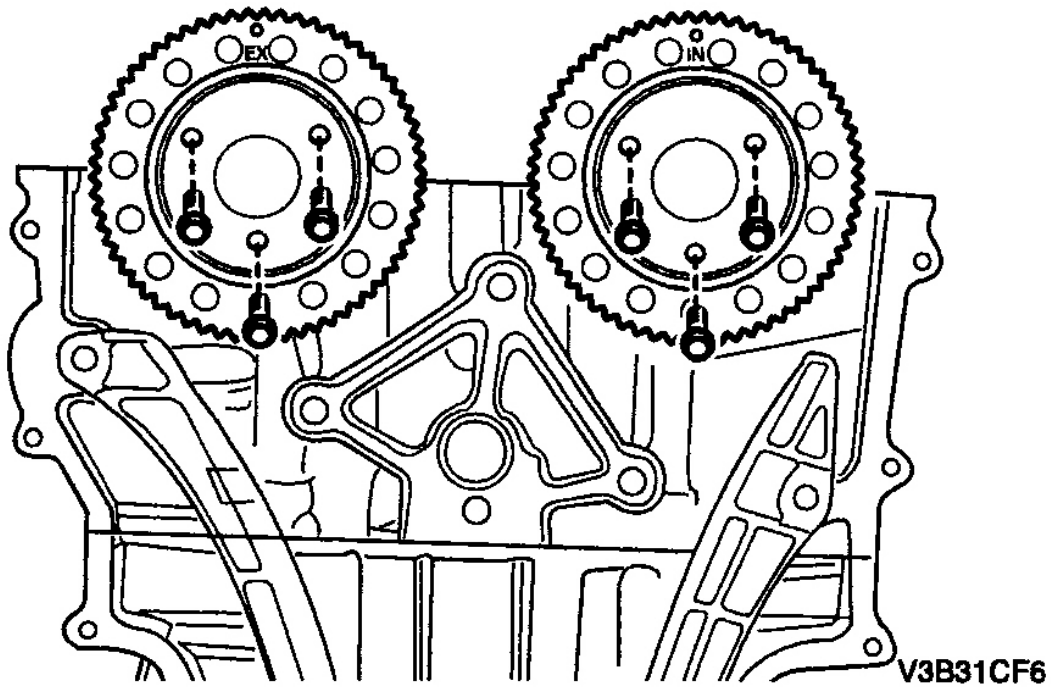


Fig. 159: Removing Intake And Exhaust Cam Sprocket
Courtesy of SUZUKI OF AMERICA CORP.

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.

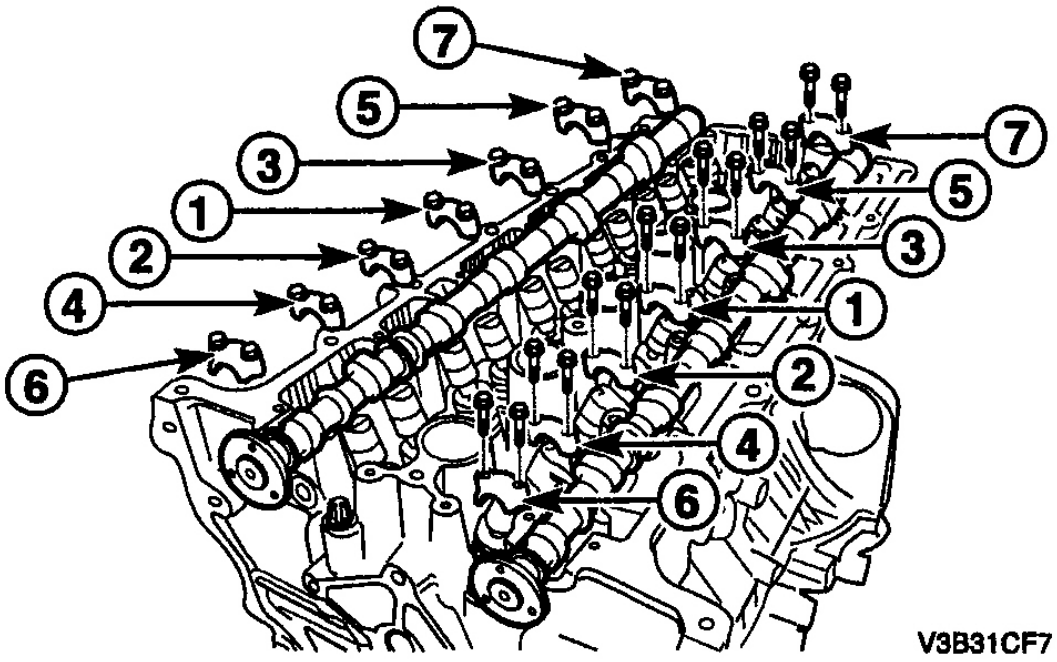


Fig. 160: Identifying Camshaft Cap Bolts Removing Sequence
Courtesy of SUZUKI OF AMERICA CORP.

4. Remove the intake camshaft and the exhaust camshaft.
5. Remove the rocker arm shaft plugs at both ends of the cylinder block.

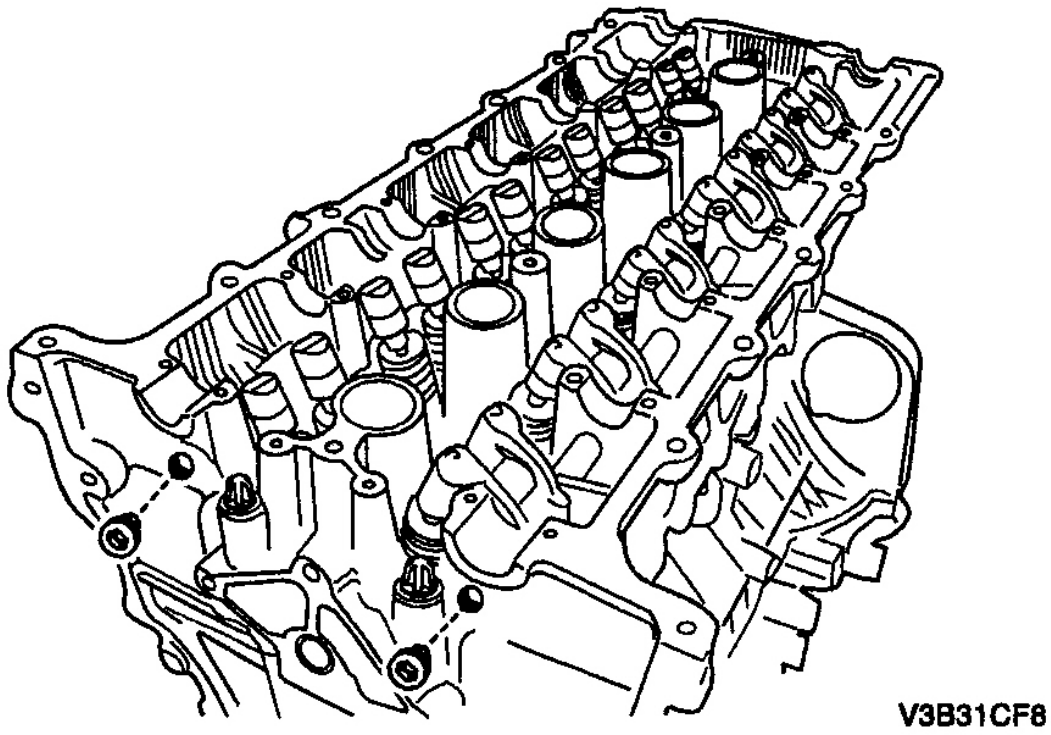


Fig. 161: Removing Rocker Arm Shaft Plugs
Courtesy of SUZUKI OF AMERICA CORP.

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.

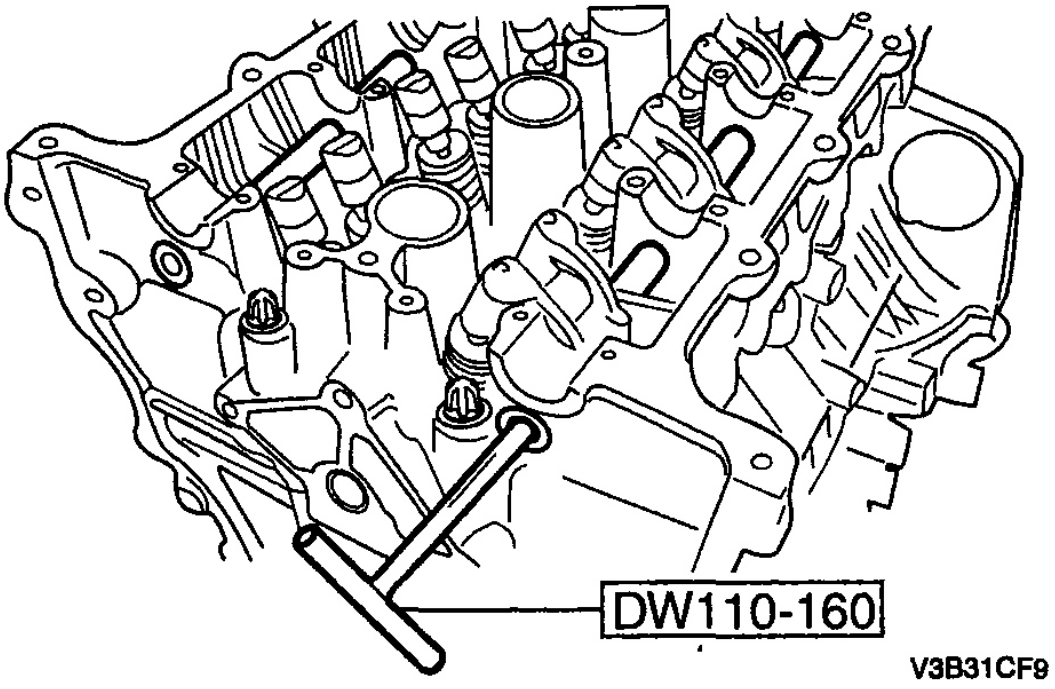


Fig. 162: Removing Front And Rear Rocker Arm Shafts Using Rocker Arm Shaft Installer / Remover DW110-160
Courtesy of SUZUKI OF AMERICA CORP.

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.

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.

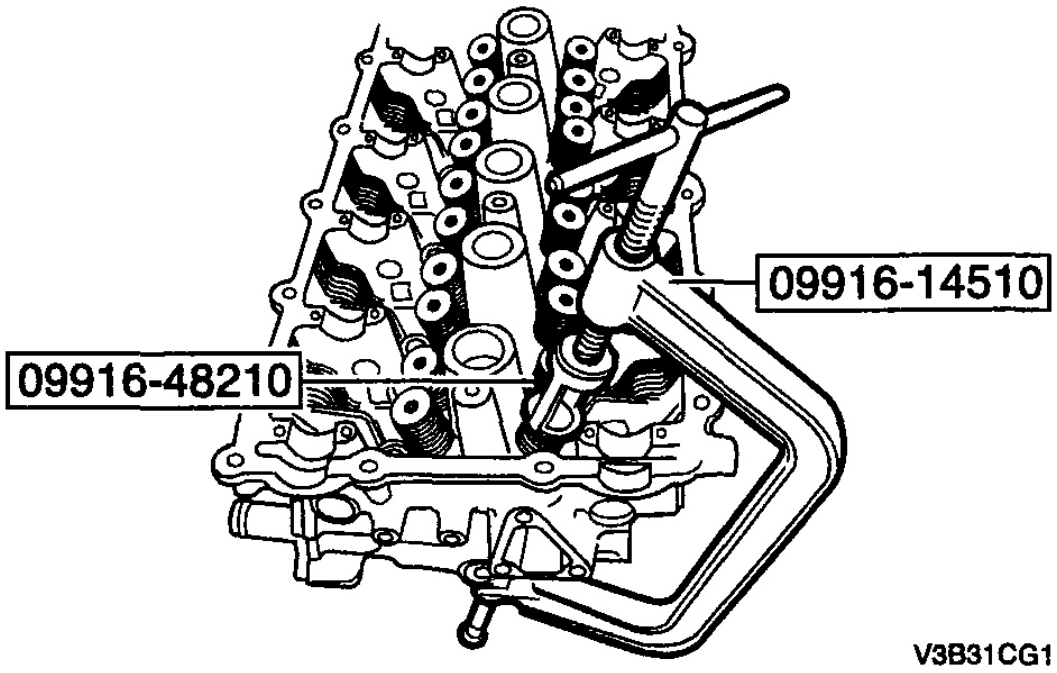


Fig. 163: Removing Valve Spring Retainer
Courtesy of SUZUKI OF AMERICA CORP.

9. Remove the intake and exhaust valves.

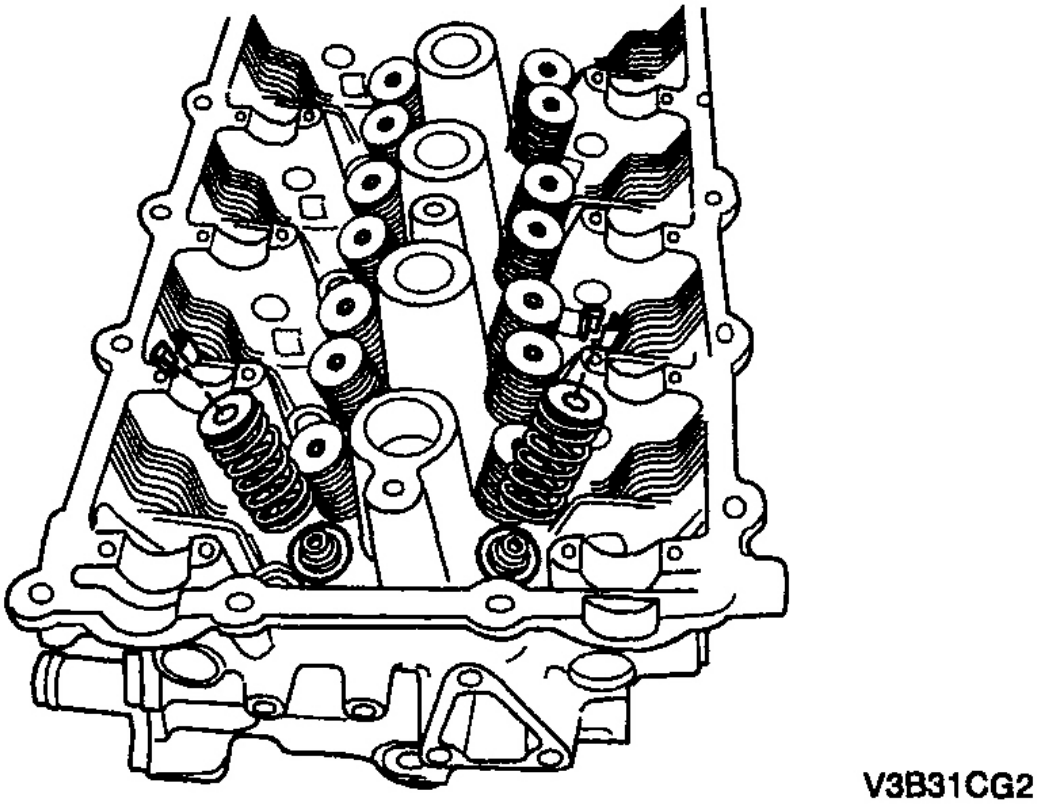


Fig. 164: Removing Intake And Exhaust Valves
Courtesy of SUZUKI OF AMERICA CORP.

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.

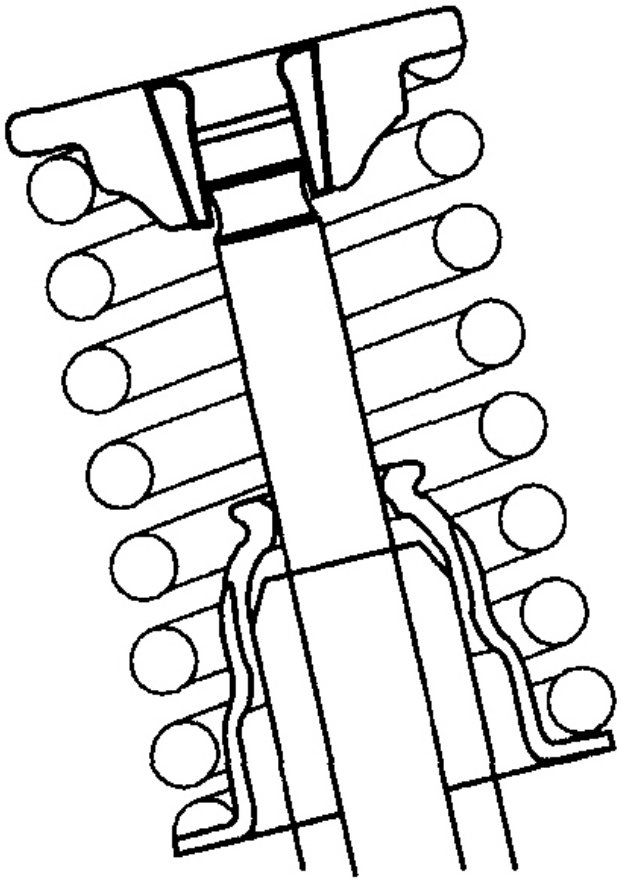


Fig. 165: Installing Valve Spring
Courtesy of SUZUKI OF AMERICA CORP.

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.

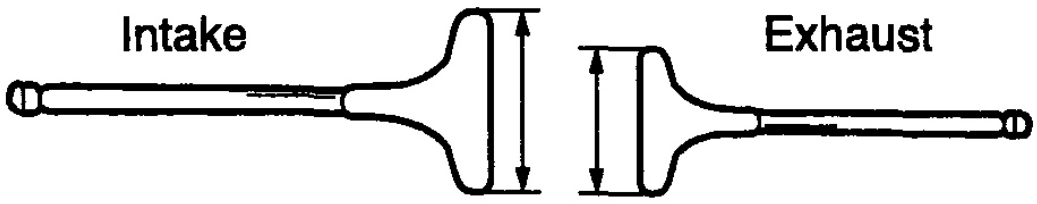


Fig. 166: Identifying Diameter Of Intake And Exhaust Valves
Courtesy of SUZUKI OF AMERICA CORP.

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.

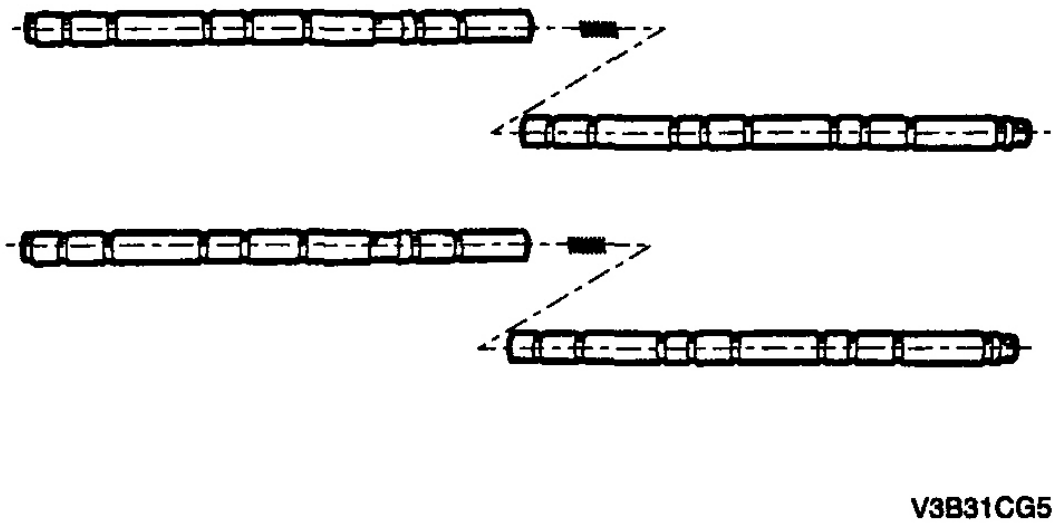


Fig. 167: Installing Rocker Arm Shafts
Courtesy of SUZUKI OF AMERICA CORP.

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).

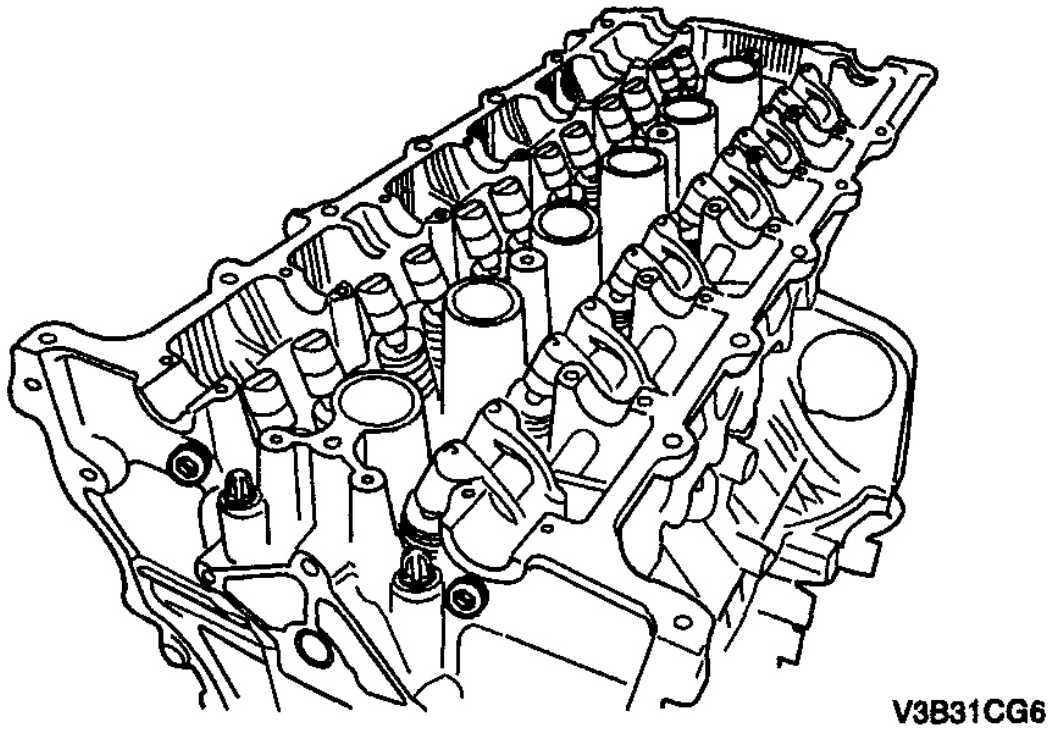


Fig. 168: Installing Rocker Arm Shaft Plugs
Courtesy of SUZUKI OF AMERICA CORP.

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.

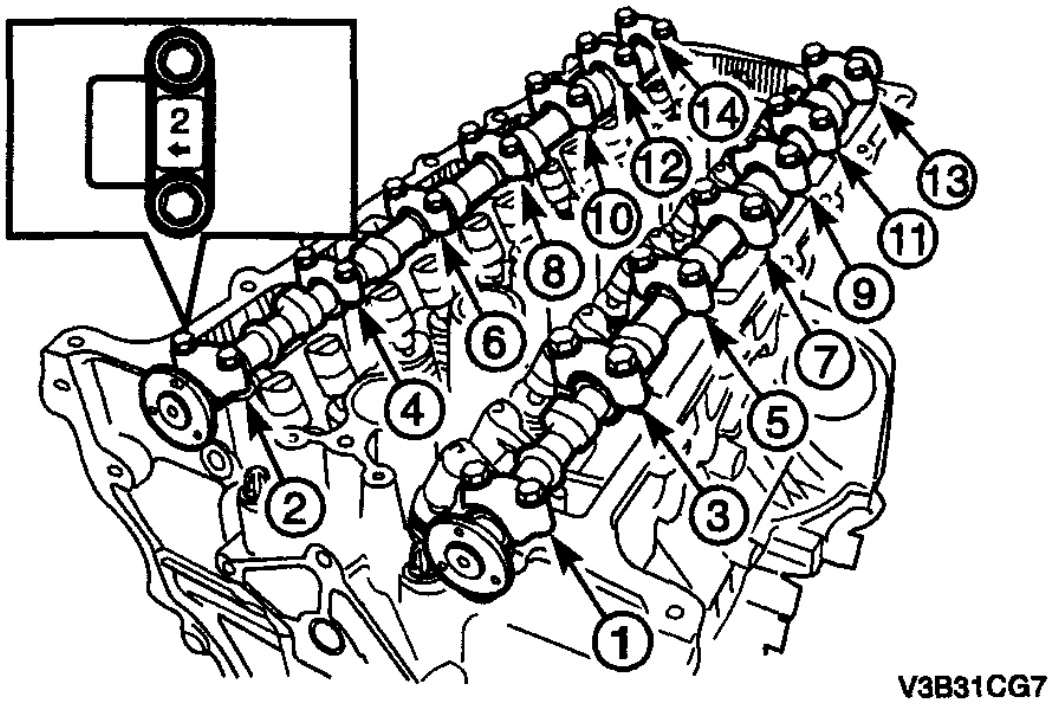


Fig. 169: Identifying Camshaft Caps Installing Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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).

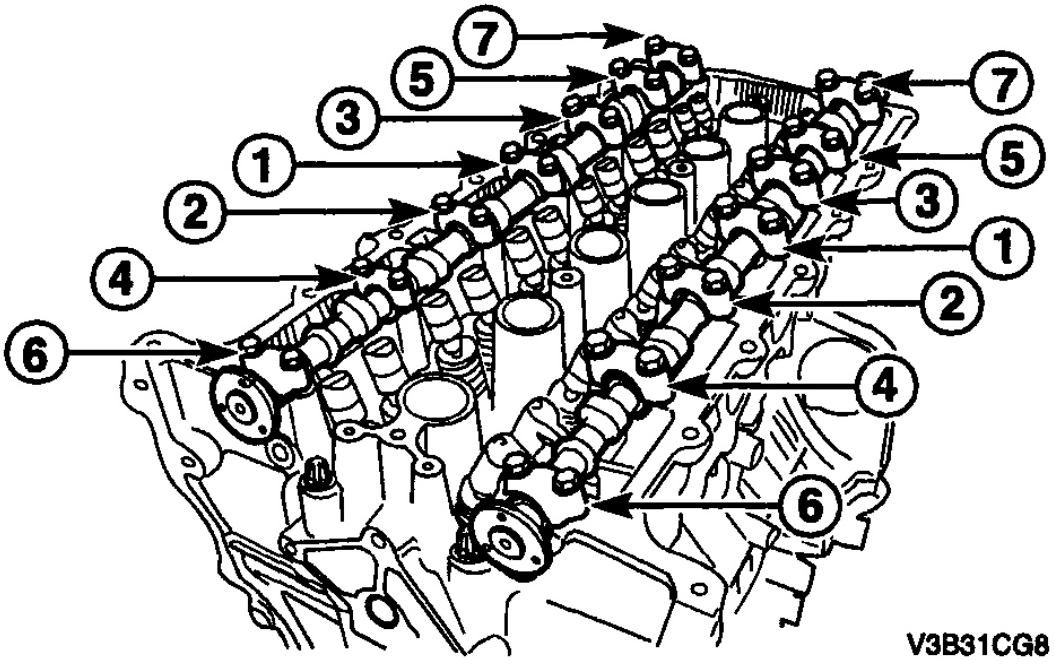


Fig. 170: Identifying Camshaft Cap Bolts Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

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).

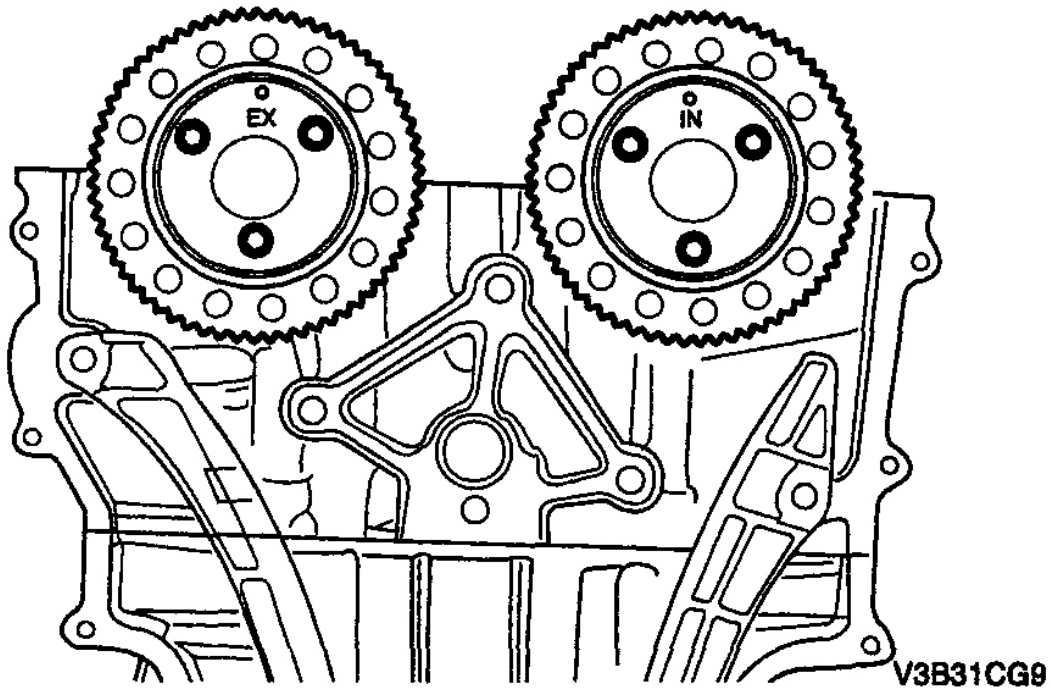


Fig. 171: Installing Cam Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

Crankshaft Bearings and Connecting Rod Bearings Removal

Tools Required

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

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

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.

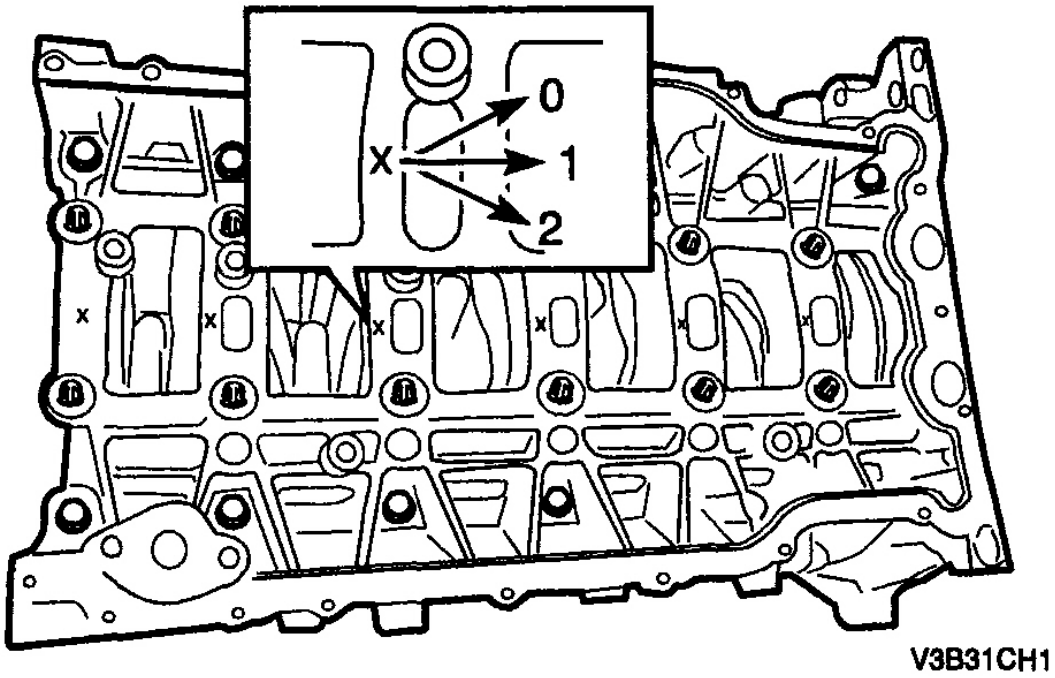


Fig. 172: Removing Bed Plate
Courtesy of SUZUKI OF AMERICA CORP.

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).

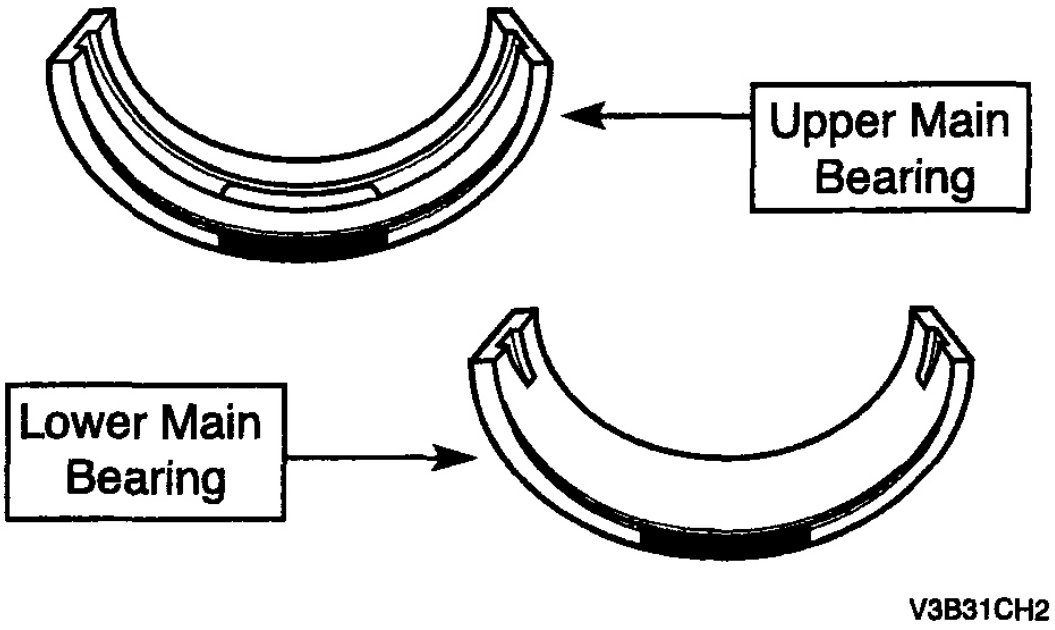


Fig. 173: Removing Lower Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

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.

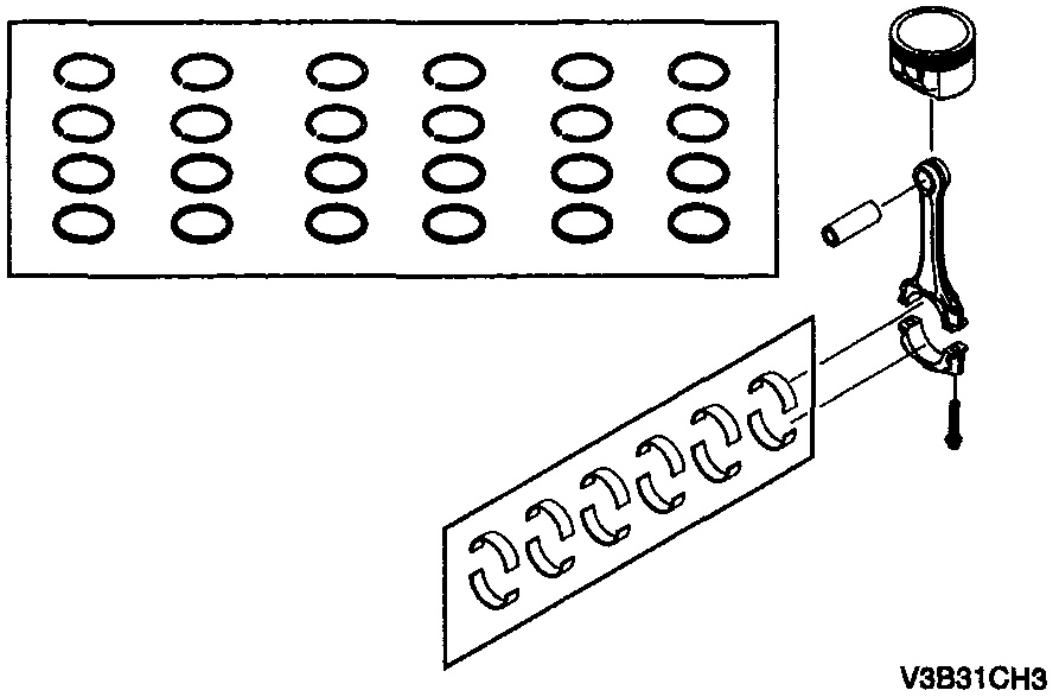


Fig. 174: Removing Connecting Rod Caps And Bearings
Courtesy of SUZUKI OF AMERICA CORP.

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.

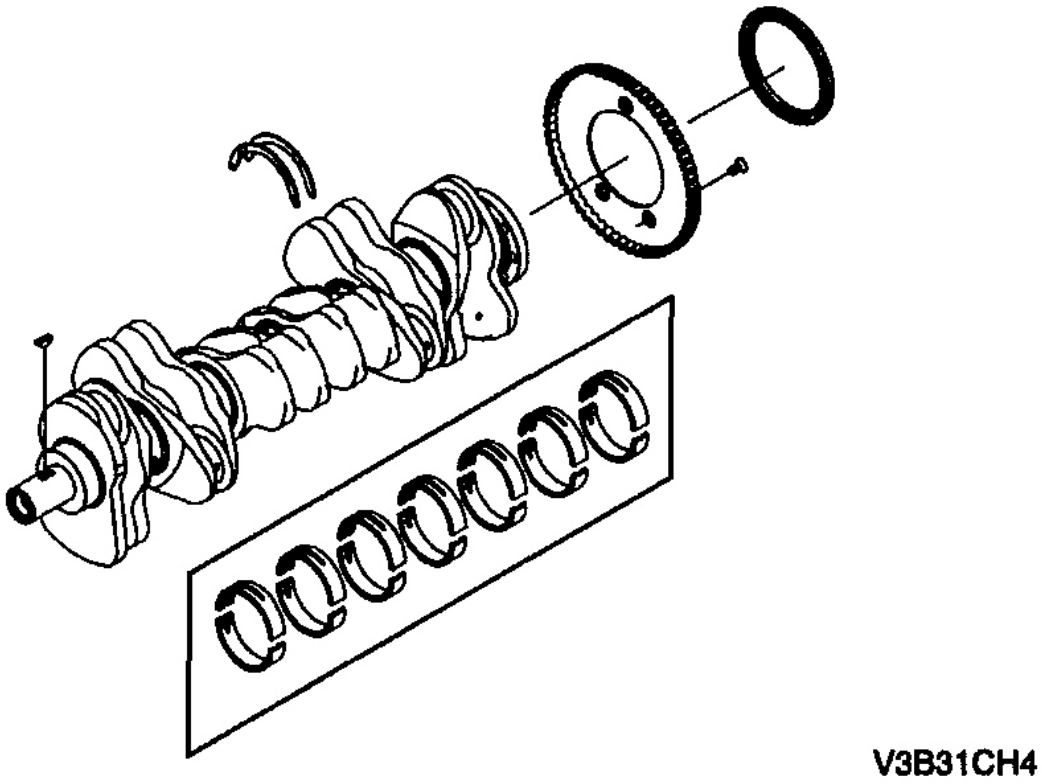


Fig. 175: Removing Rear Crankshaft Seal
Courtesy of SUZUKI OF AMERICA CORP.

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).

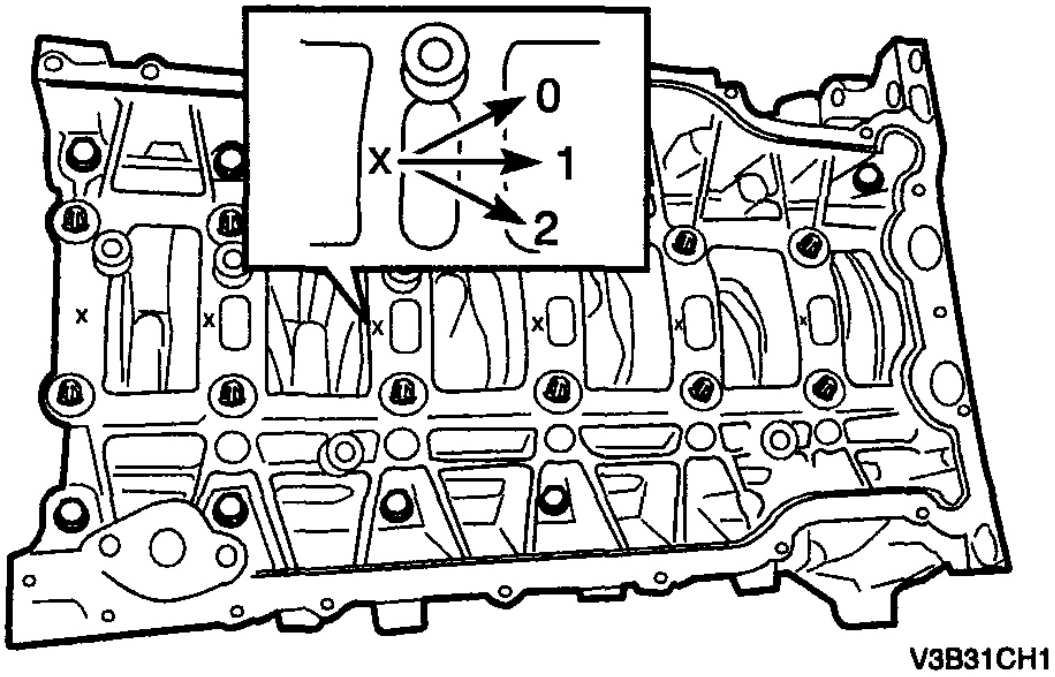


Fig. 176: Installing Upper Crankshaft Bearings
Courtesy of SUZUKI OF AMERICA CORP.

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

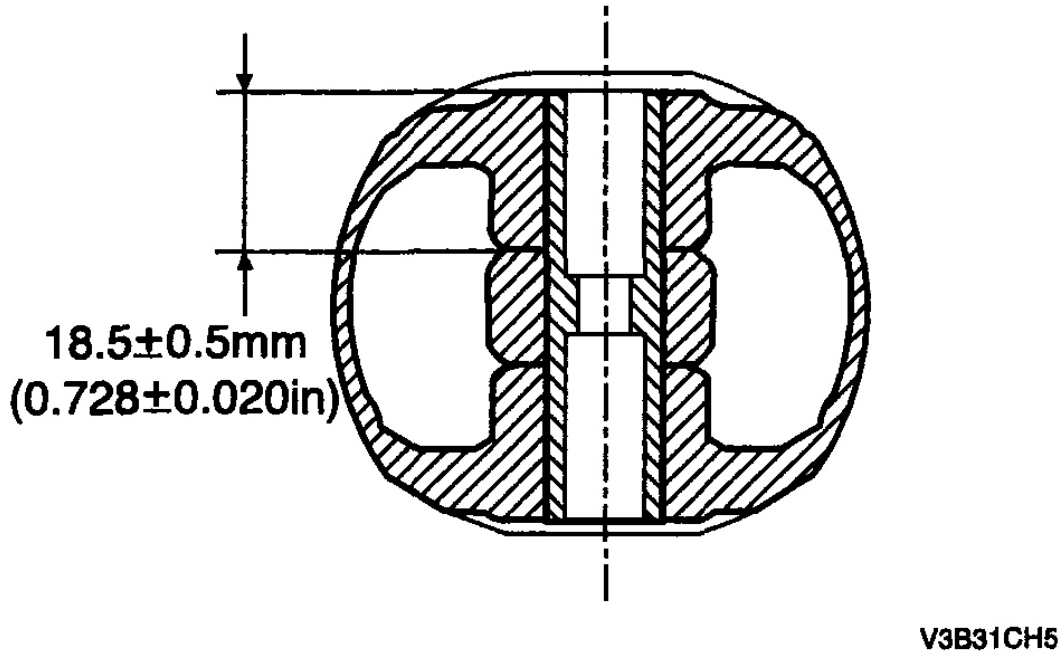


Fig. 177: Installing Piston Pin
Courtesy of SUZUKI OF AMERICA CORP.

5. Install the piston rings.

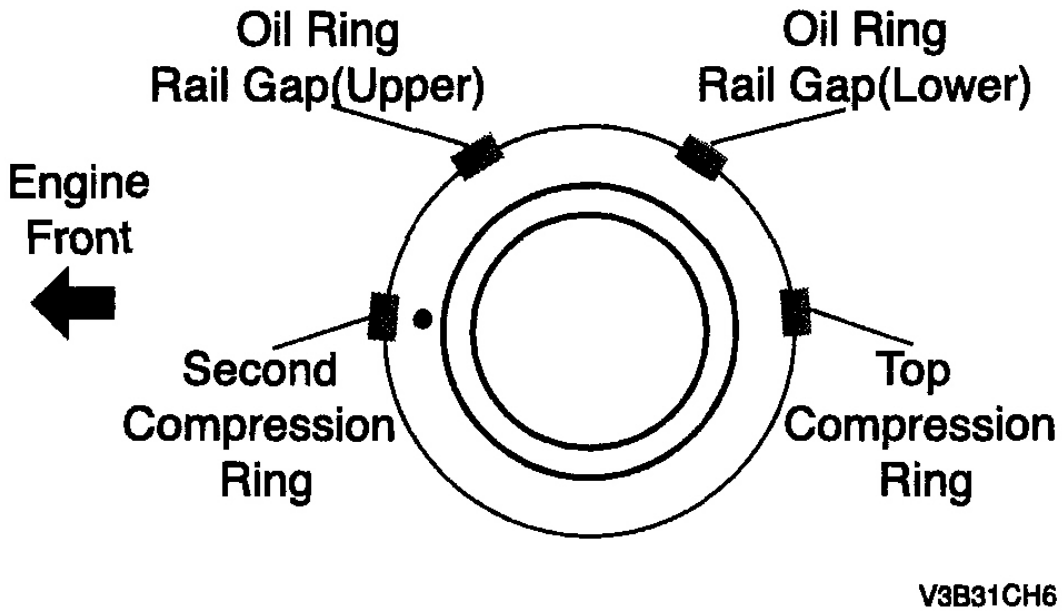


Fig. 178: Installing Piston Rings
Courtesy of SUZUKI OF AMERICA CORP.

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

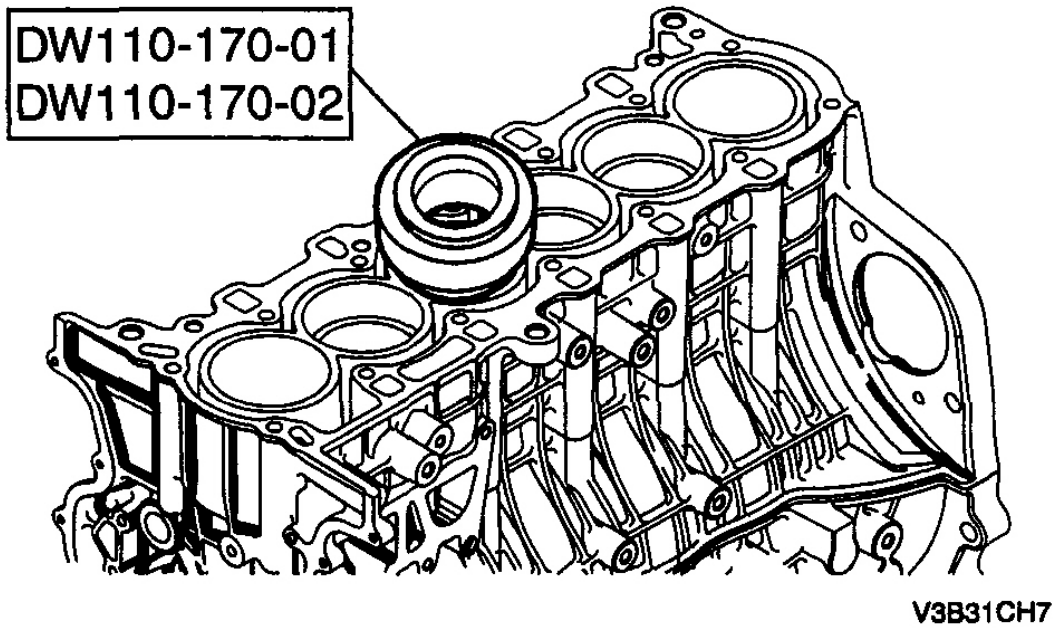


Fig. 179: Installing Piston Using Piston Ring Compressor DW110-170-01
Courtesy of SUZUKI OF AMERICA CORP.

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).

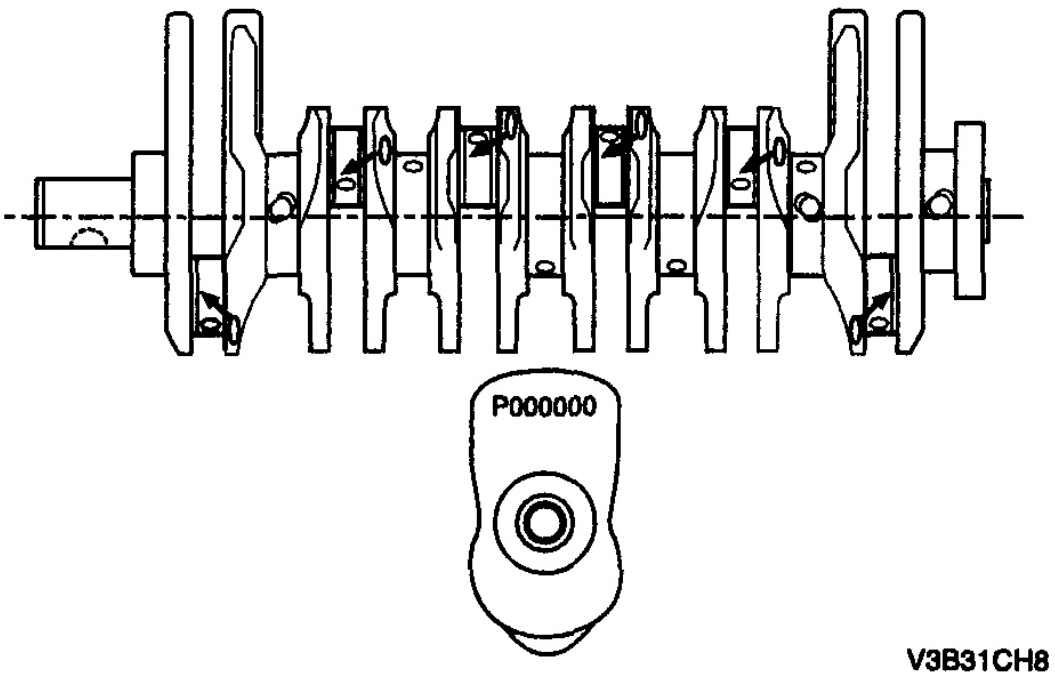


Fig. 180: Seating Connecting Rod Bearings
Courtesy of SUZUKI OF AMERICA CORP.

8. Install the thrust bearing.

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

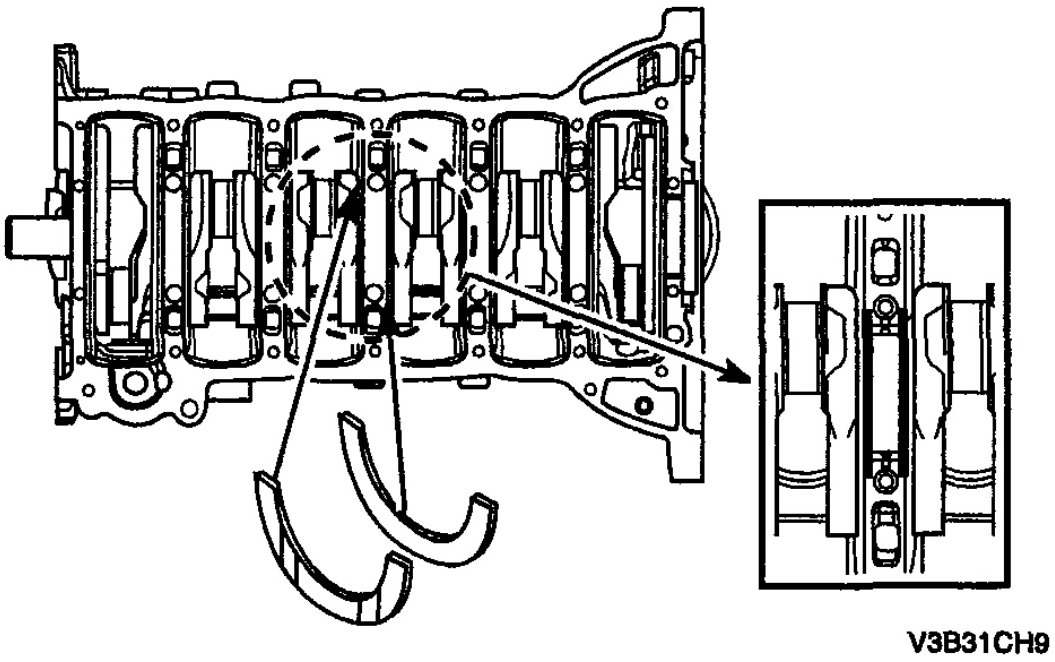


Fig. 181: Installing Thrust Bearing
Courtesy of SUZUKI OF AMERICA CORP.

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 20 N.m (15 lb-ft). After finishing the initial tightening, turn the bolts by 45° then another 90°.

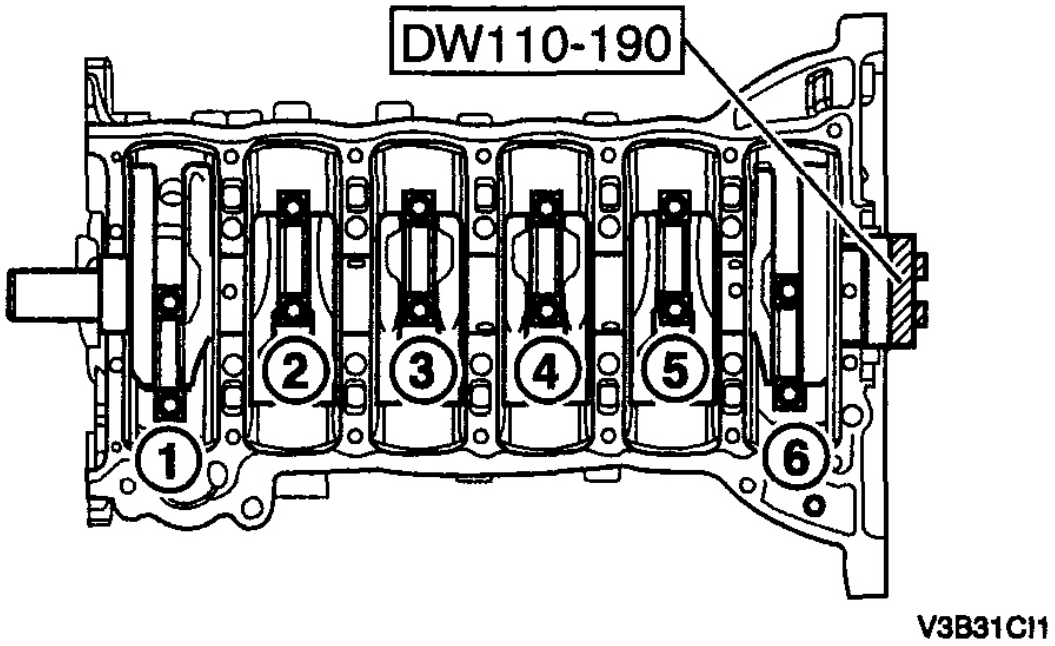


Fig. 182: Tightening Connecting Rod Cap Bolts Using Crankshaft Adjuster DW110-190
Courtesy of SUZUKI OF AMERICA CORP.

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).**

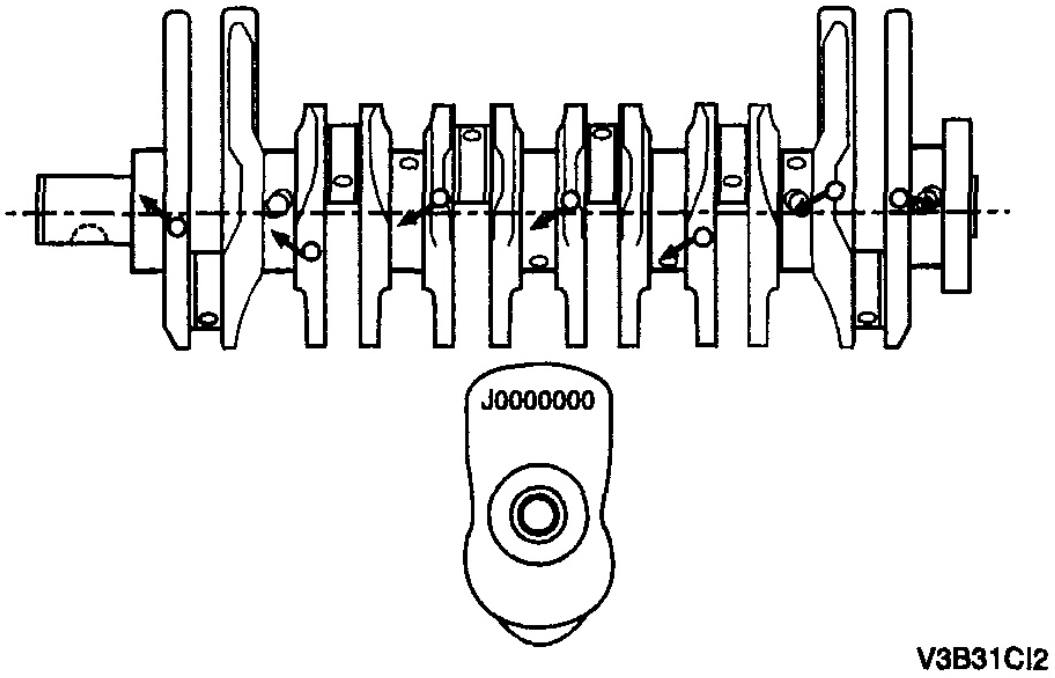


Fig. 183: Installing Lower Crankshaft Bearing
Courtesy of SUZUKI OF AMERICA CORP.

11. Install the bed plate. Refer to "**BED PLATE INSTALLATION**".

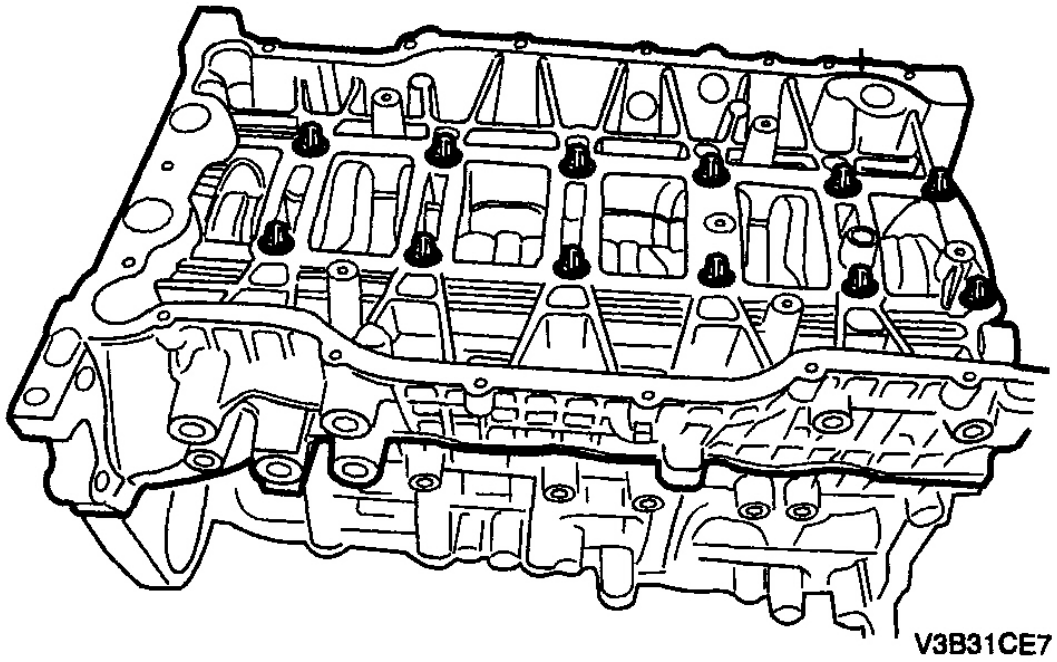


Fig. 184: Installing Bed Plate
Courtesy of SUZUKI OF AMERICA CORP.

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

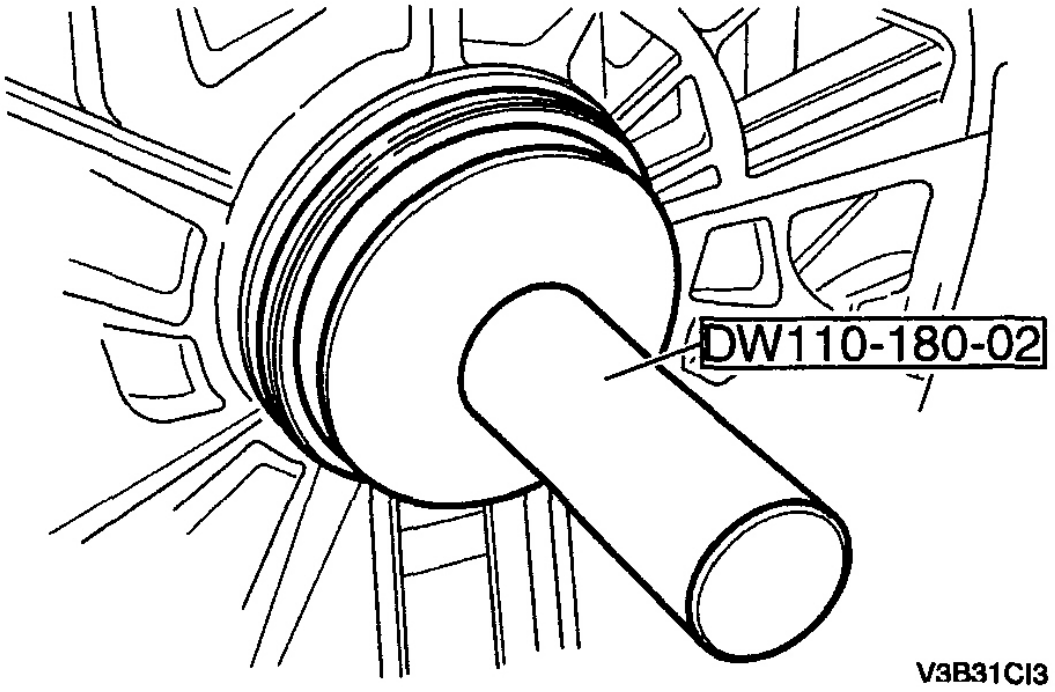


Fig. 185: Installing Crankshaft Rear Oil Seal Using Crankshaft Rear Oil Seal Installer DW110-180-02
Courtesy of SUZUKI OF AMERICA CORP.

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.

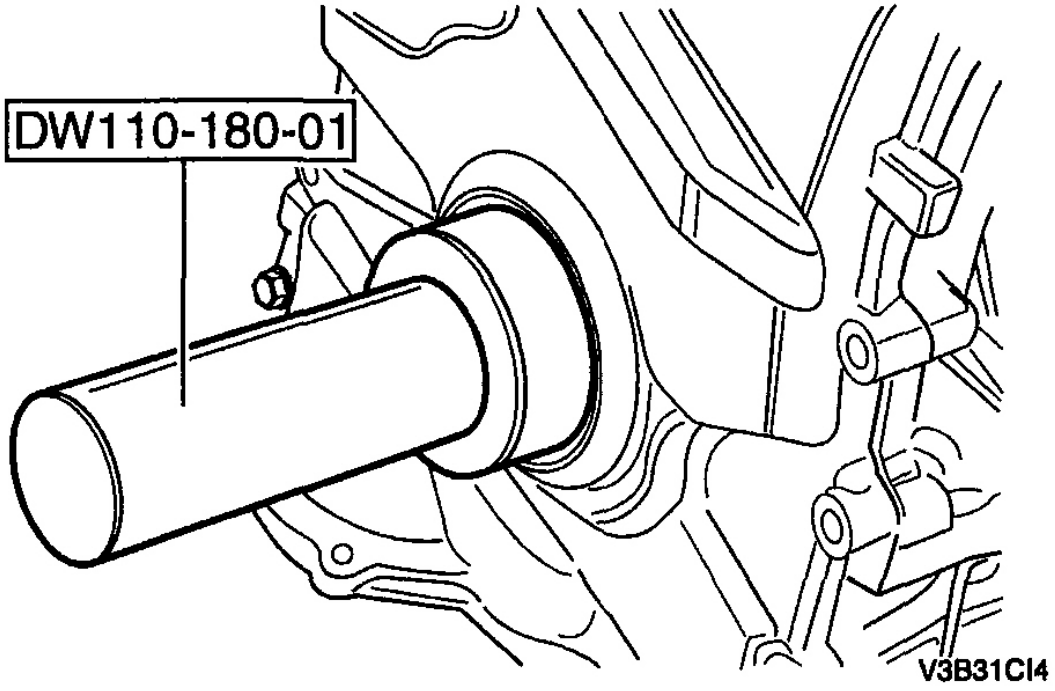


Fig. 186: Installing Crankshaft Front Oil Seal Using Crankshaft Front Oil Seal Installer DW110-180-01
Courtesy of SUZUKI OF AMERICA CORP.

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**".

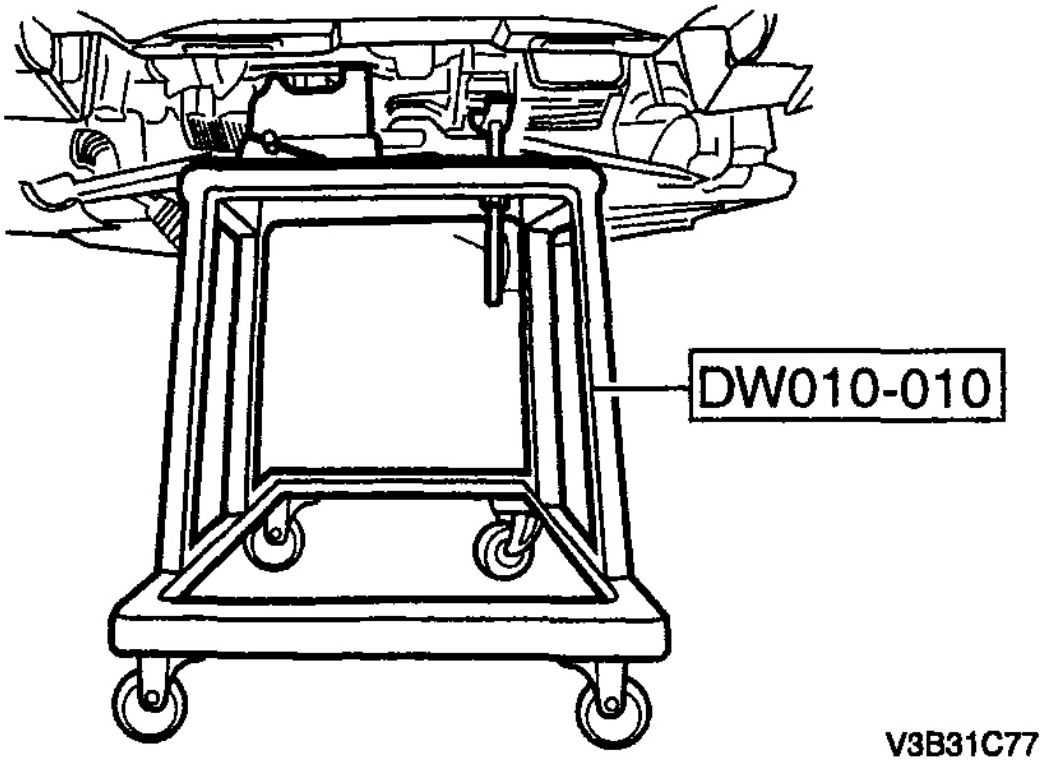


Fig. 187: Installing Engine Assembly
Courtesy of SUZUKI OF AMERICA CORP.

SPECIFICATIONS

Engine Specifications

ENGINE SPECIFICATIONS

Application	Description
General Data:	
Engine Type	6 Cylinder (In-Line)
Displacement	2,492 cm3 (152 in3)
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)
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)
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 Bedplate)	Loctite(R) 5900
Oil Gallery Plug	Loctite(R) 242
Coolant Jacket Caps and Plugs (Freeze Plugs)	Dry seal-lock coated in plug

Tightening Torque Specifications

TIGHTENING TORQUE SPECIFICATIONS

Application	N.m	Lb-Ft	Lb-In
Intake Manifold Retaining Bolt/Nut	10~14	-	89~124
Engine Beautification Cover Bolt	8~12	-	71~106
Front Support Bracket Bolt	15~25	11~18	-
Rear Support Bracket Bolt (Intake-side)	8~12	-	71~106
Rear Support Bracket Bolt (Exhaust-side)	18~25	13~18	-
Cylinder Head Cover Bolt	12~14	-	106~124
Air Filter Housing Bolt	8~12	-	71~106
Oil Filter Adapter Retaining Bolt	20~26	15~19	-
Connecting Piece	17~23	13~17	-
Oil Filter	12~16	9~12	-
Oil Pump Sprocket Retaining Nut	18~22	13~16	-
Oil Pump Bolt	18~22	13~16	-
Oil Suction Pipe-to-Oil Pump Retaining Bolt	8~12	-	71~106
Oil Suction Pipe Bracket Bolt	8~12	-	71~106
Oil Pump Sprocket Cover Bolt	5~7	-	44~62
Oil Pan Retaining Bolt	8~12	-	71~106
Oil Pan Flange-to-Transaxle Bolt	27~35	20~26	-
Oil Pan Drain Plug	35~45	26~33	-
Engine Mount Bracket-to-Hydro Mount Nut	55~70	41~52	-
Engine Mount Bracket Nut	42~60	31~44	-
Engine Mount Bracket Bolt	42~60	31~44	-
Transaxle Mount Cage-to-Longitudinal Member Bolt	55~75	41~55	-
Transaxle Mount Cage-to-Transaxle Mount Bracket Bolt	55~75	41~55	-
Transaxle Mount Cage-to-Transaxle Mount Bracket Nut	55~75	41~55	-
Transaxle Mount Cage Through Bolt	100~120	74~89	-
Exhaust Manifold Retaining Nut	27~30	20~22	-
Exhaust Manifold Heat Shield Bolt	18~22	13~16	-
Engine Block-to-Transaxle Bolt	60~85	44~63	-
Center Front Suspension Member Bolt	80~100	59~74	-
Transaxle Torque Converter Bolt	40~50	30~37	-
Front Engine Mount Bracket-to-Damper Bush Bolt	70~90	52~66	-
Engine Under Cover Retaining Bolt	17~27	13~20	-

Fixed Timing Chain Guide Bolt	18~22	13~16	-
Timing Chain Lever Bolt	18~22	13~16	-
Timing Chain Tensioner Bolt	18~22	13~16	-
Top Chain Guide Bolt	9~11	-	80~97
Timing Chain Cover Bolt	6~10	-	53~89
Timing Chain Cover Bolt (Center)	18~22	13~16	-
Drive Belt Automatic Tensioner	20~30	15~22	-
Water Pump Pulley Bolt	8~12	-	71~106
Engine Mount Bracket Support Bolt	25~31	18~23	-
Crankshaft Pulley Bolt	500~600	369~443	-
Flexible Plate Bolt	70~80	52~59	-
Cylinder Head Bolt	20, 25 +70° +70°	15, 18 +70° +70°	-
Upper Pad Bracket Bolt	35~55	26~41	-
Coolant Outlet Port Retaining Bolt	8~12	-	71~106
EGR Adapter Retaining Bolt	18~22	13~16	-
Power Steering Pump Retaining Bolt	20~30	15~22	-
Intake Manifold Support Bracket Bolt	20~30	15~22	-
Bed Plate Inner Bolt	33+135°	24+135°	-
Bed Plate Outer Bolt	20~26	15~19	-
Oil Pump Chain Lever Bolt	6~10	-	53~89
Engine Oil Dipstick Tube Bracket Bolt	18~22	13~16	-
Engine Oil Dipstick Tube Bolt	8~10	-	71~89
Bed Plate Baffle Bolt	7~9	-	62~80
Lower Pad Bracket Bolt	35~45	26~33	-
Idler Retaining Bolt	35~55	26~41	-
Upper Pad-to-Lower Pad Bracket Bolt	30~40	22~30	-
Compressor Retaining Bolt/Nut	20~30	15~22	-
Rocker Arm Shaft Plug	35~45	26~33	-
Camshaft Cap Bolt	10~14	-	89~124
Cam Sprocket Bolt	18~22	13~16	-
Connecting Rod Cap Bolt	20 +45° +90°	15 +45° +90°	-
Front Damper Bush Bracket Bolt	55~75	26~55	-
Rear Transaxle Mount Bracket Bolt	55~75	26~55	-
Target Wheel Bolt	7~11	-	62~97
Heater Adapter Bolt	18~22	13~16	-
Engine Block Ground Bolt	15~25	11~18	-
PCV Valve Bolt	8~12	-	71~106
Spark Plug	20~30	15~22	-
Wiring Harness Bracket Bolt	8~12	-	71~106
IAT (Intake Air Temperature) Sensor	20~30	15~22	-
MAP (Manifold Absolute Pressure) Sensor Bolt	6~10	-	53~89
ECTS (Engine Coolant Temperature Sensor)			

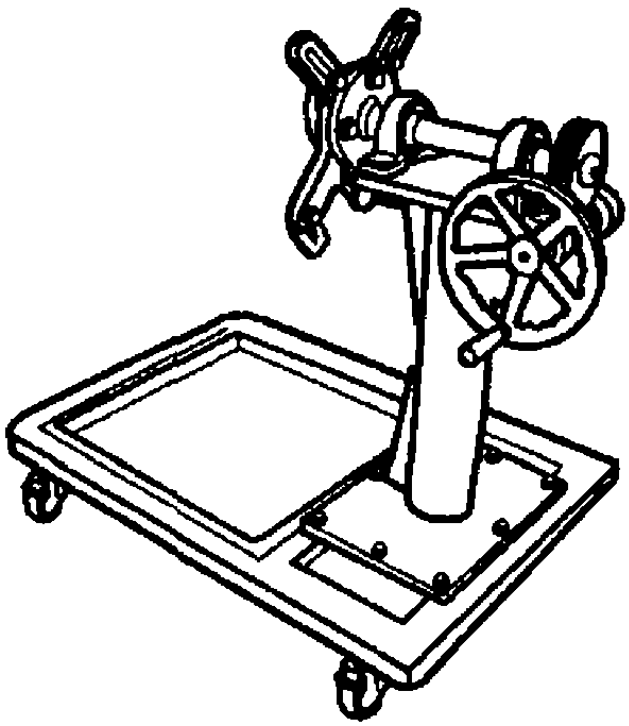
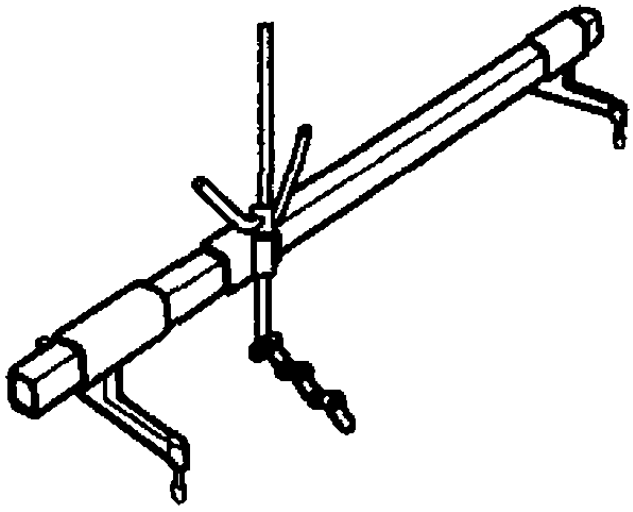
	15~20	11~15	-
CMP (Camshaft Position) Sensor	10~14	-	89~124
O2S (Oxygen Sensor)	34~44	25~32	-
CKP (Crankshaft Position) Sensor Bolt	5~8	-	44~71
Knock Sensor	18~20	13~15	-
Throttle Body Bolt	8~18	6~13	-
Ignition Coil Bolt	6~8	-	53~71
EGR Bolt	20~30	15~22	-
Water Pump Bolt	20~26	15~19	-
Thermostat Housing Bolt	8~12	-	71~106
Cooling Fan Assembly Bolt	3.5~4.5	-	31~40
Radiator Bracket Bolt	10~8	7~13	-
Coolant Reservoir Bolt	3.5~4.5	-	31~40
Front Exhaust Pipe Nut	32~48	24~35	-
Front Exhaust Pipe Lower Bracket Bolt	32~48	24~35	-
Front Exhaust Pipe-to-Front Muffler Nut	25~35	18~26	-
Front Muffler-to-Rear Muffler Nut	32~48	24~35	-
Catalytic Converter Heat Shield Nut	2~3	-	18~27
Front Muffler Heat Shield Nut	2~3	-	18~27
Rear Muffler Heat Shield Nut	2~3	-	18~27
Alternator Upper Bolt	30~40	22~30	-
Alternator Lower Bolt	30~45	22~33	-
Starter Motor Mount-to-Engine Block Bolt	40~50	30~37	-
Starter Motor Mount-to-Transaxle Bolt	45~55	33~41	-
Battery Rod Clamp Nut	4	-	35

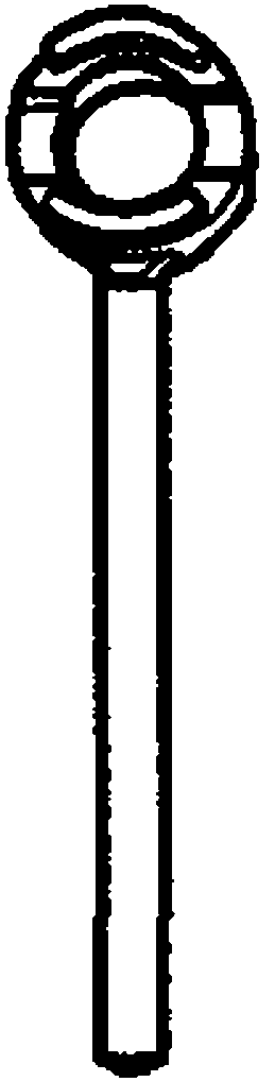
SPECIAL TOOLS AND EQUIPMENT

Special Tool

SPECIAL TOOLS AND EQUIPMENT

	DW110-030

 F202C301	Engine Overhaul Stand
 F202C312	DW110-060 Engine Assembly Lift Support

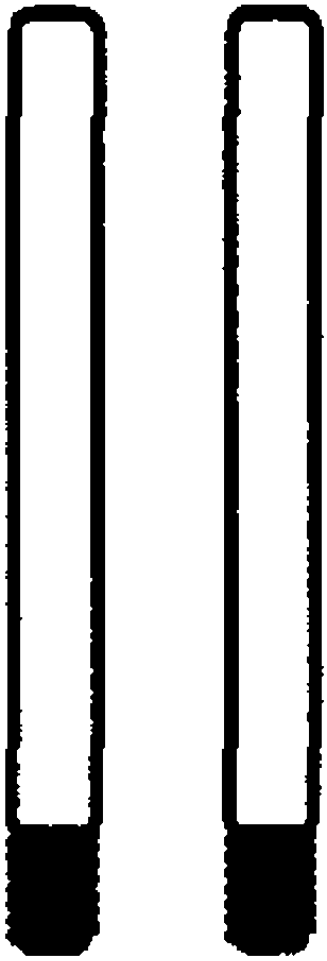


F202C302

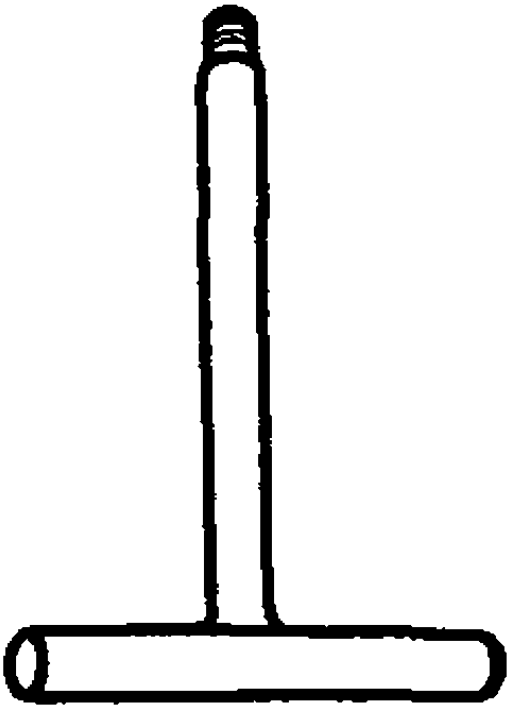
DW110-130-01
Crankshaft Pulley Holder

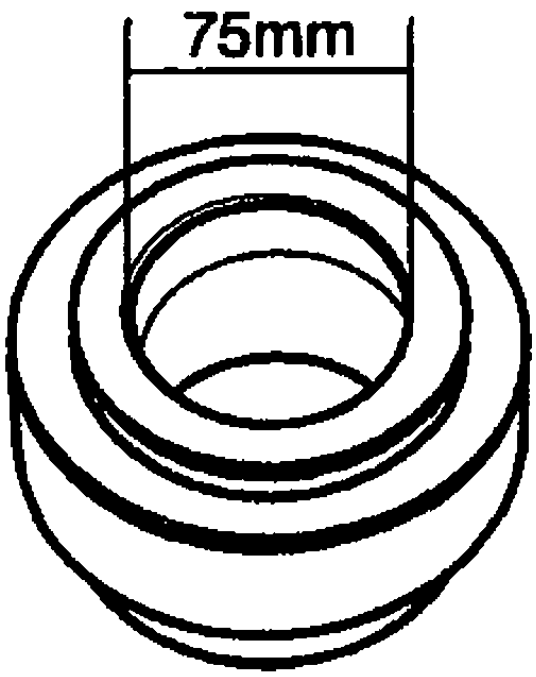
F202C303

DW110-130-02
Crankshaft Pulley Installer/Remover

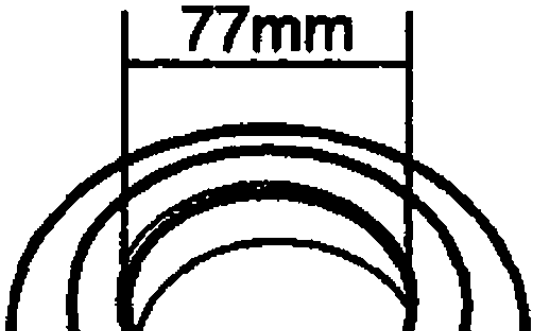
 F202C304	DW110-140 Timing Chain Cover Install Guide Pin

 F202C305	DW110-150 Camshaft Sprocket Holder

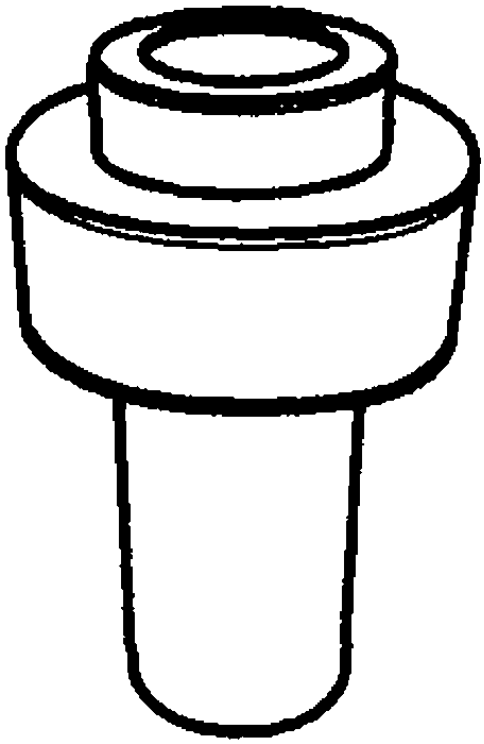
 F202C306	DW110-160 Rocker Arm Shaft Installer/Remover
	DW110-170-01 Piston Ring Compressor (2.0 L)

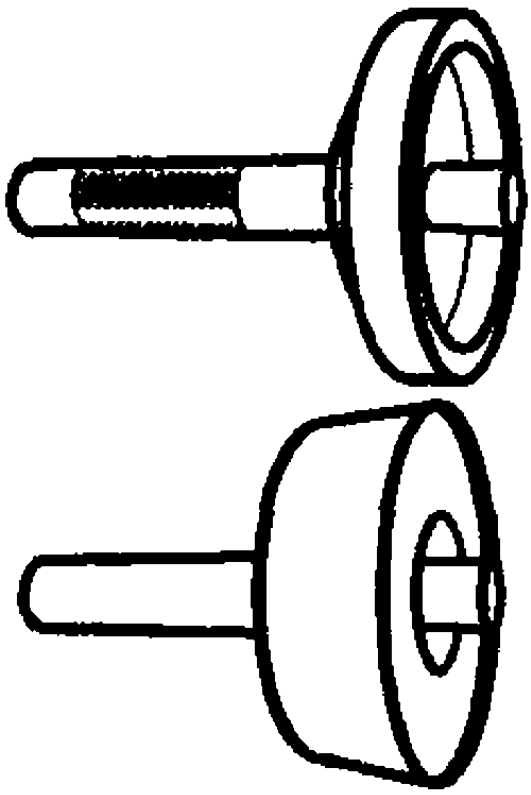


F202C307

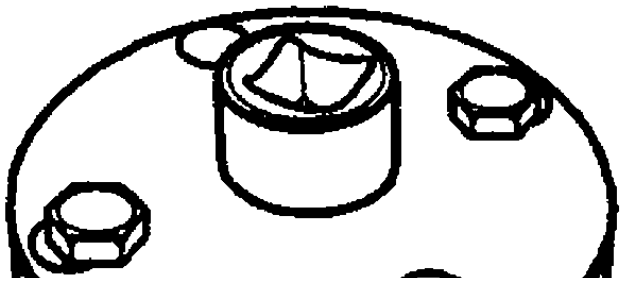


DW110-170-02
Piston Ring Compressor (2.5 L)

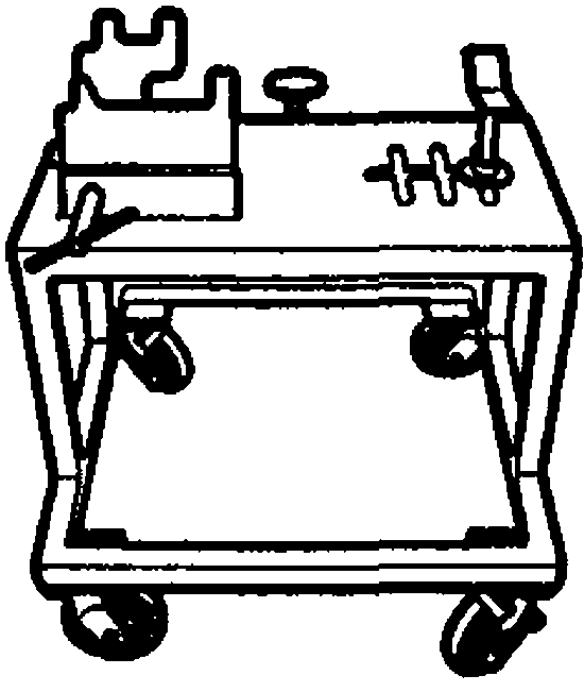
 F202C309	DW110-180-01 Crankshaft Front Oil Seal Installer
	DW110-180-02 Crankshaft Rear Oil Seal Installer

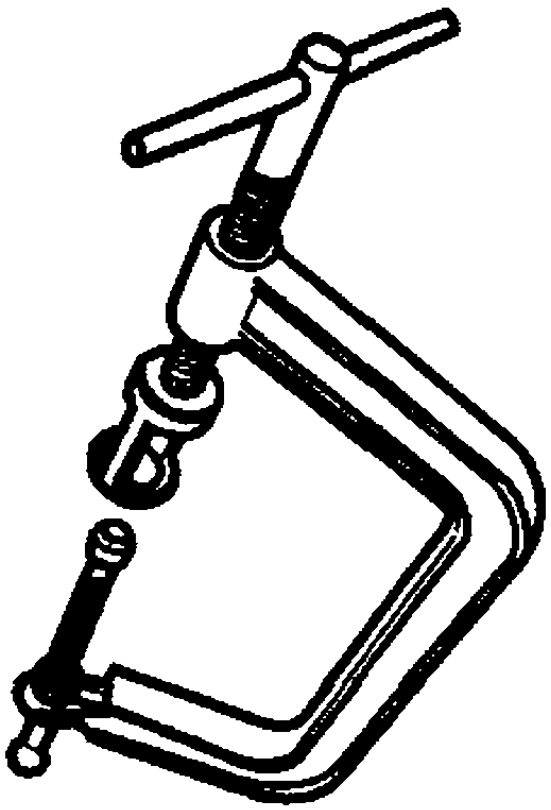


F202C310



DW110-190
Crankshaft Adjuster

 G102B101	DW010-010 Power Pack Stand
	09916-14510 Valve Lifter 09916-48210 Valve Lifter Attachment



F202C313

