

2005 Toyota RAV4

2005 ENGINE Emission Control - RAV4

2005 ENGINE

Emission Control - RAV4

EMISSION CONTROL SYSTEM

PURPOSE

The emission control systems are installed to reduce the amount of CO, HC and NOx exhausted from the engine (3 and 4). They prevent blow-by gas containing HC from being released into the air (1) and evaporated fuel containing HC from being released from the fuel tank (2).

The functions of each system are shown:

Systems	Abbreviations	Function
1. Positive Crankcase Ventilation	PCV	Reduces HC
2. Evaporative Emission Control	EVAP	Reduces evaporated HC
3. Three-Way Catalytic Converter	TWC	Reduces HC, CO and NOx
4. Sequential Multi - port Fuel Injection*	SFI	Injects a precisely timed, optimum amount of fuel for reduced exhaust emissions

*: Refer to the inspection and repair of the SFI system.

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Fig. 1: Description - Emission Control Systems

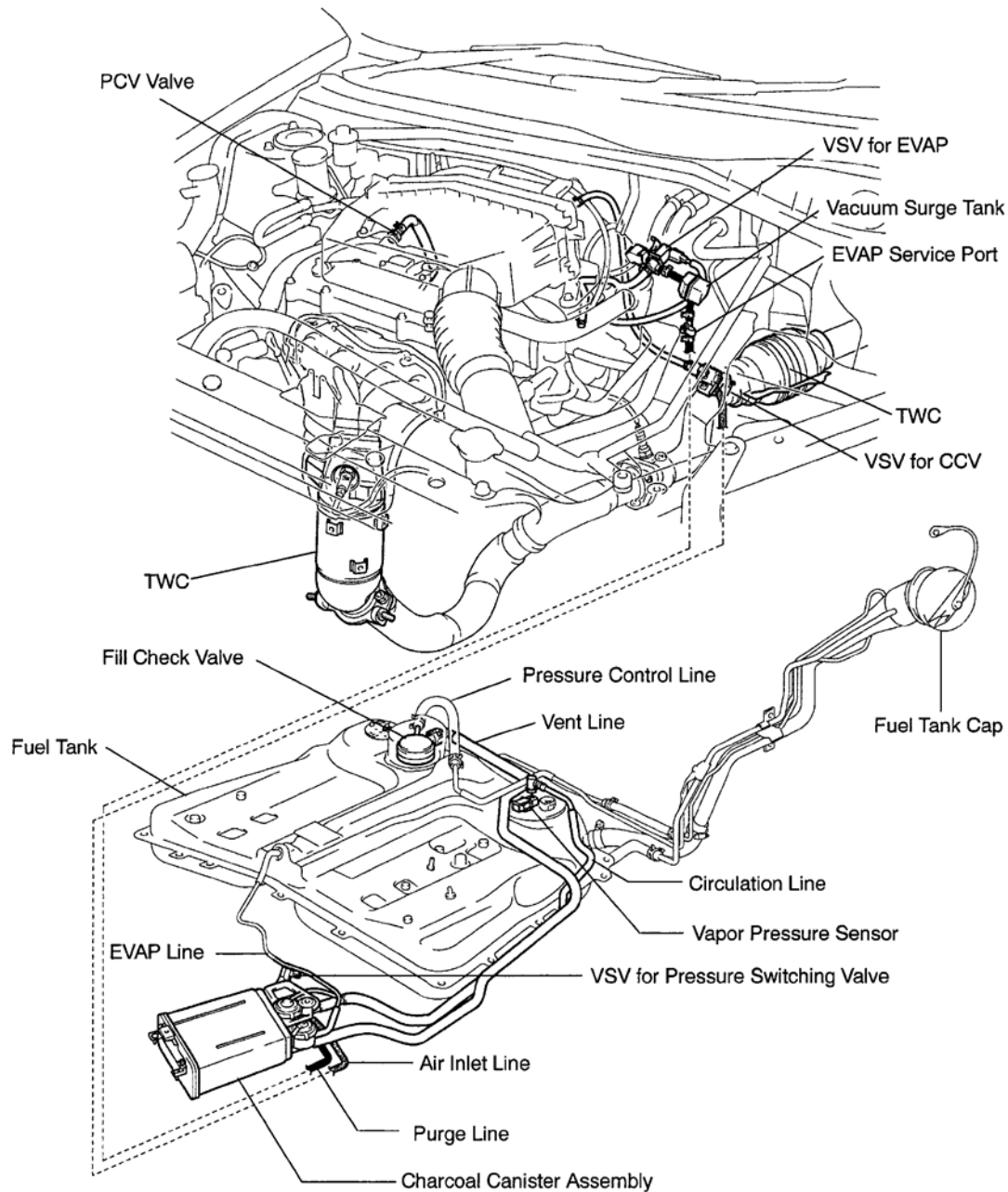
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PARTS LAYOUT AND SCHEMATIC DRAWING

LOCATION

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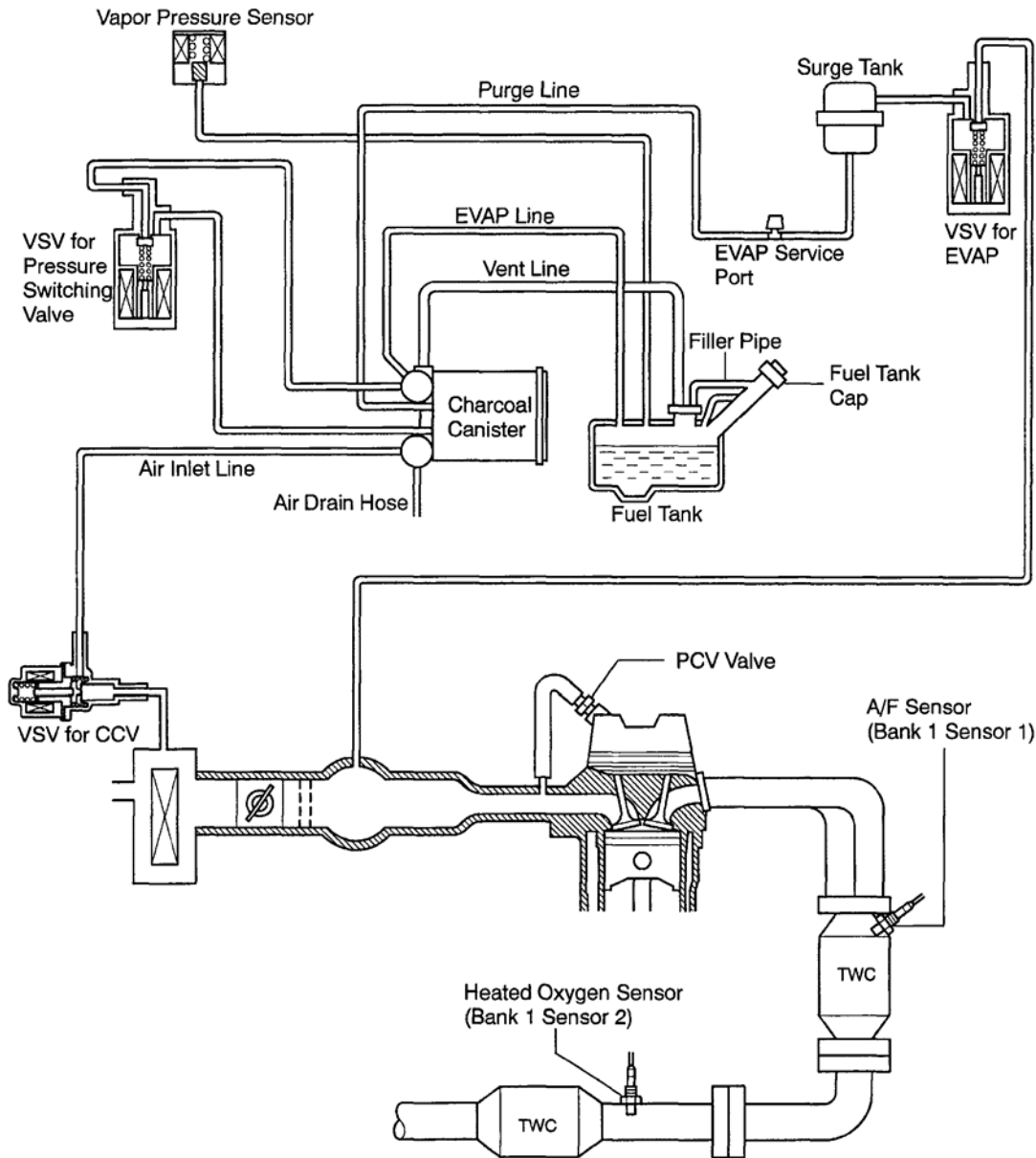
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Fig. 2: Identifying Emission Control System Components
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DRAWING

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Fig. 3: Drawing - Emission Control Systems
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

INSPECTION

1. INSPECT PCV VALVE

- a. Disconnect the PCV hose from the PCV valve.
- b. Remove the PCV valve.

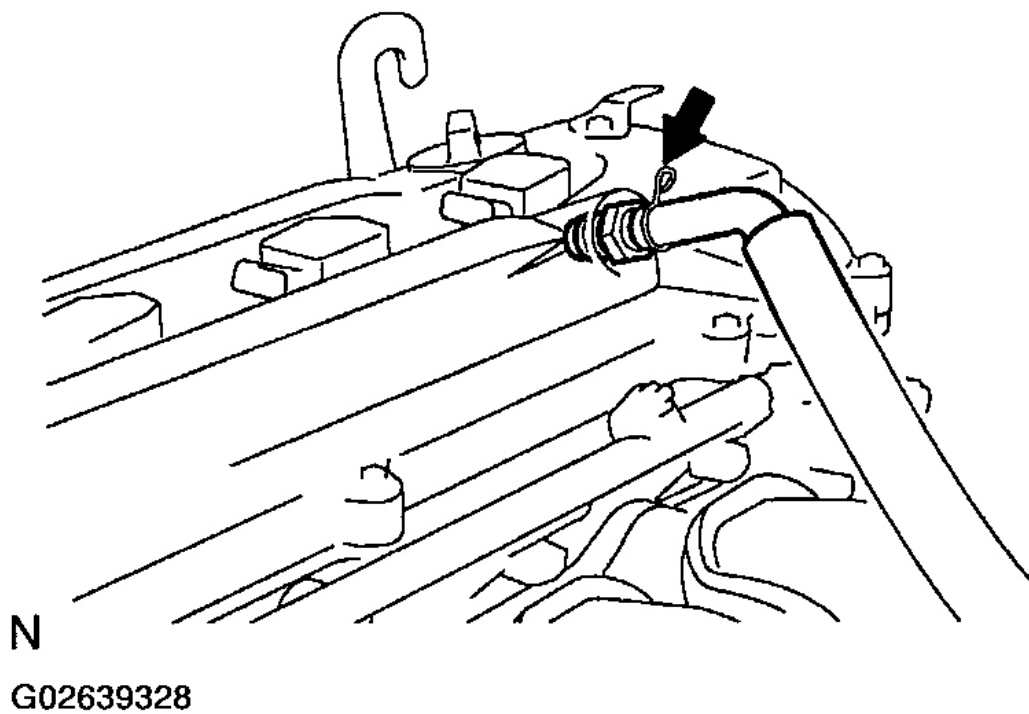
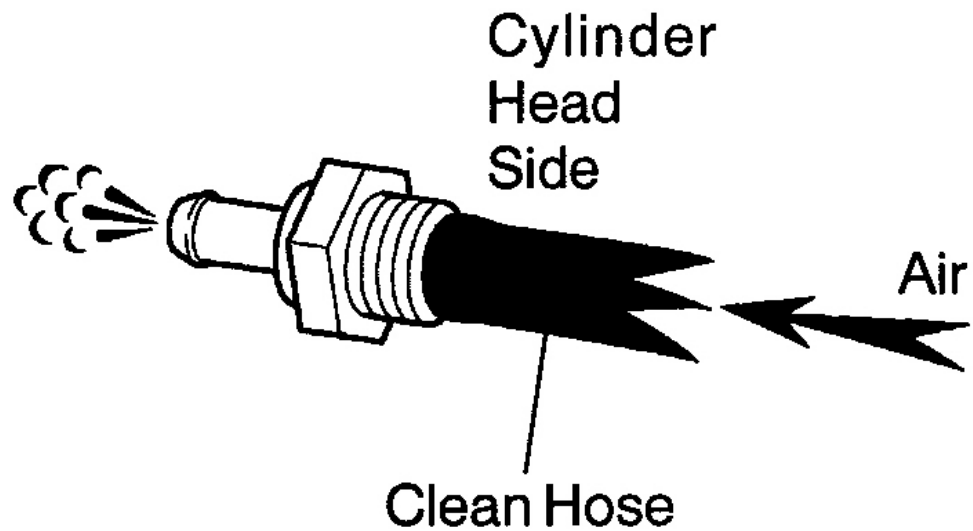


Fig. 4: Identifying PCV Valve

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- c. Connect a clean hose to the PCV valve.
- d. Inspect the PCV valve operation.
 1. Blow air from the cylinder head side, and check that air passes through smoothly.

CAUTION: Do not suck air through the valve. Petroleum substances inside the valve are harmful.



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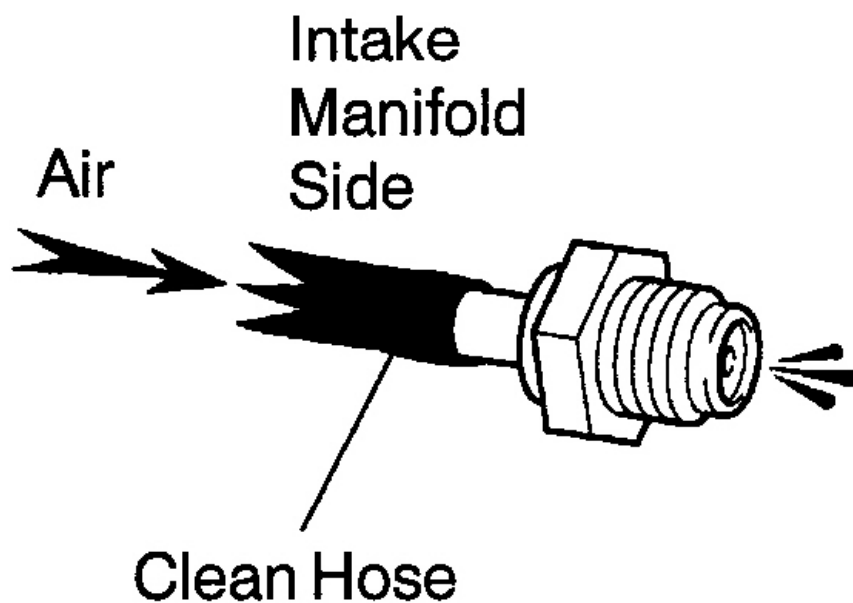
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Fig. 5: Inspecting PCV Valve Operation (Cylinder Head Side)
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2. Blow air from the intake manifold side, and check that air passes through with difficulty.

If operation is not as specified, replace the PCV valve.

- e. Disconnect the clean hose from the PCV valve.



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Fig. 6: Inspecting PCV Valve Operation (Intake Manifold Side)

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- f. Reinstall the PCV valve.
 - 1. Apply adhesive to 2 or 3 threads.

Adhesive:

Part No. 08833-00070, THREE BOND 1324 or equivalent

- 2. Reinstall the PCV valve.

Torque: 19 N.m (193 kgf.cm, 14 ft.lbf)

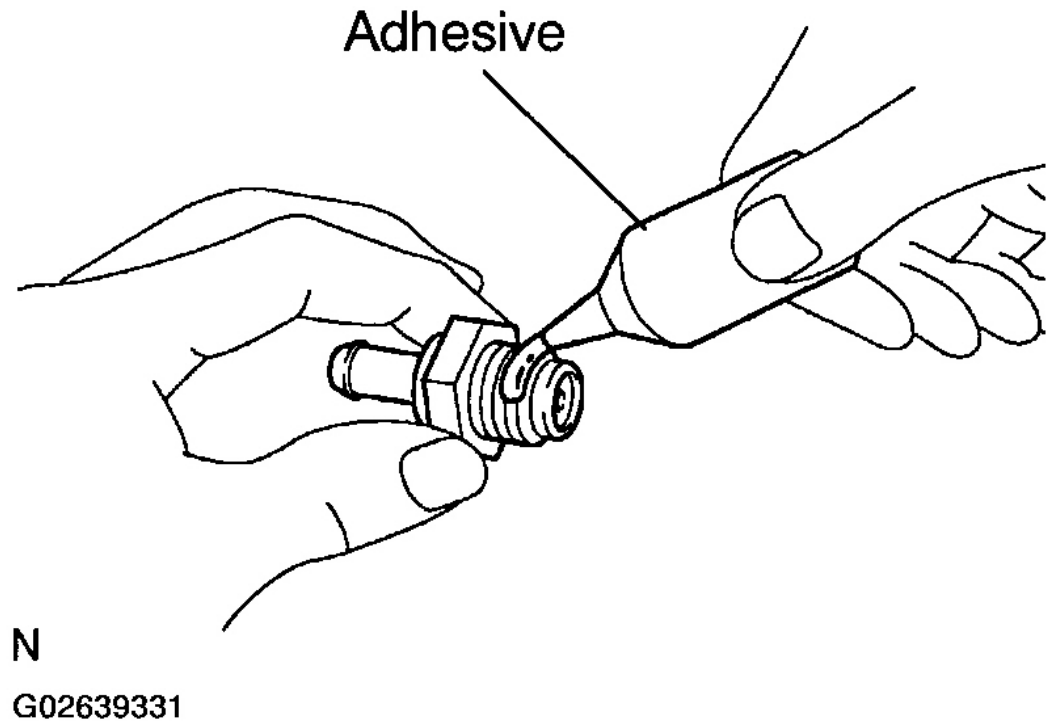
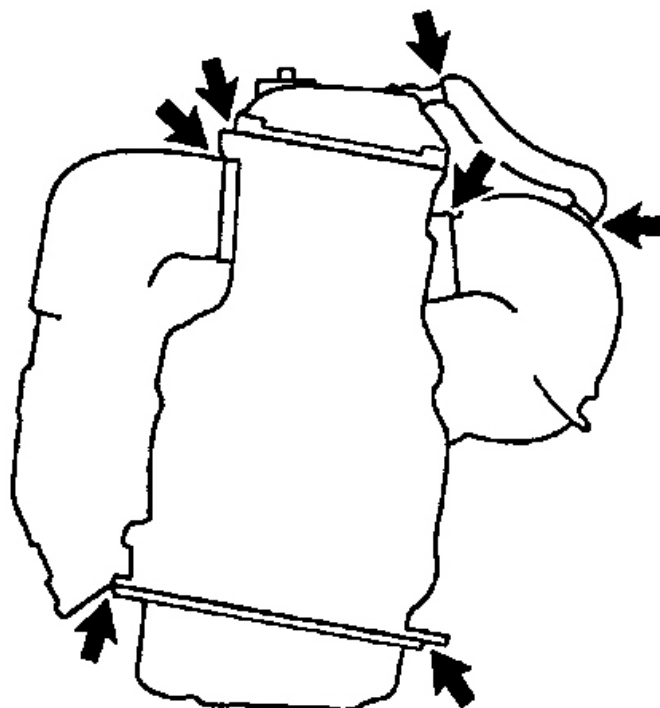


Fig. 7: Applying Adhesive To Threads
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2. INSPECT PCV HOSES AND CONNECTIONS

Visually check for cracks, leaks or damage.

If the PCV valve and connections are damaged, repair or replace it.



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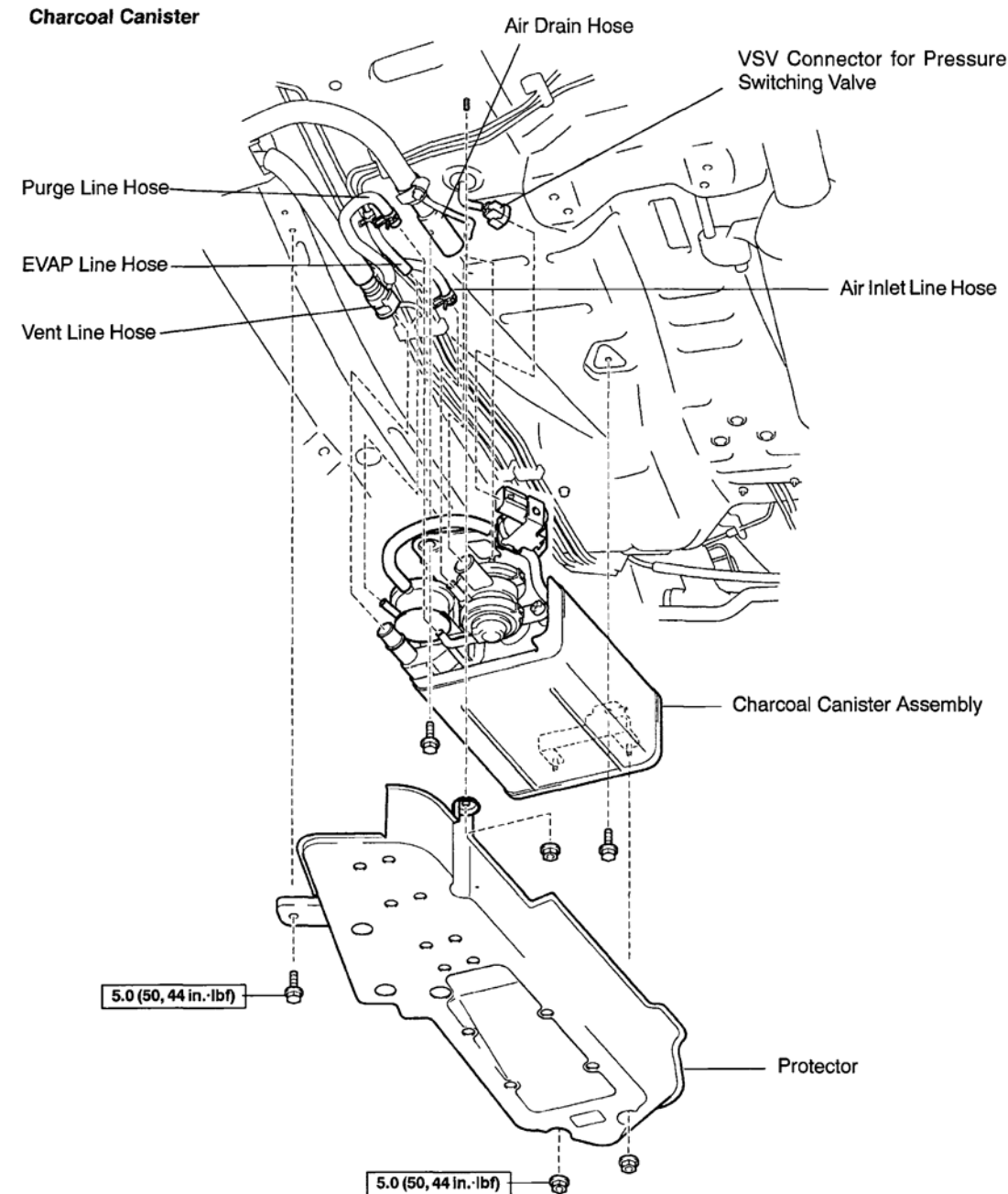
Fig. 8: Inspecting PCV Hoses And Connections
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM

COMPONENTS

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N·m (kgf·cm, ft·lbf) : Specified torque

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Fig. 9: Identifying Evaporative Emission (EVAP) Control System Components & Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT LINES AND CONNECTORS

Visually check hoses for loose connections, bends or damage. If necessary, repair or replace the hoses.

2. INSPECT FUEL TANK FILLER PIPE

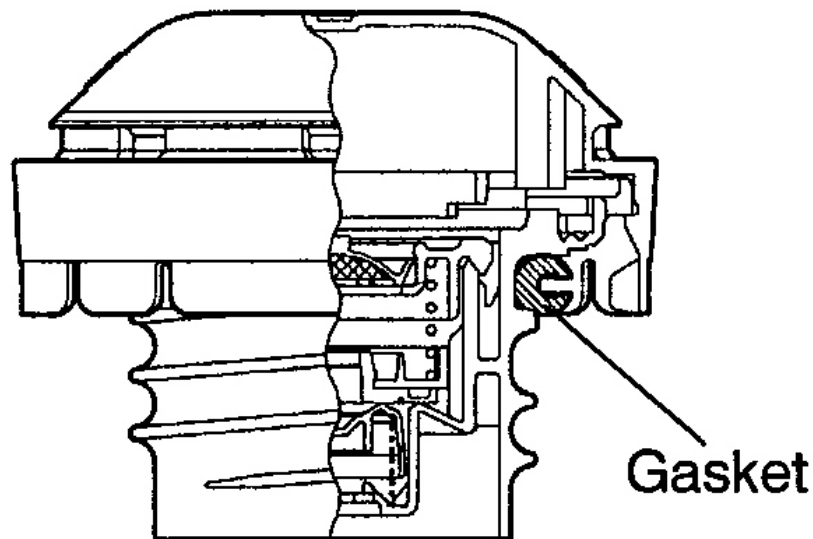
Visually check the fuel tank filler pipe for deformation, cracks or fuel leak.

If necessary, repair or replace the fuel tank filler pipe.

3. INSPECT FUEL TANK CAP

Visually check if the cap and/or gasket are deformed or damaged.

If necessary, repair or replace the cap and/or gasket.



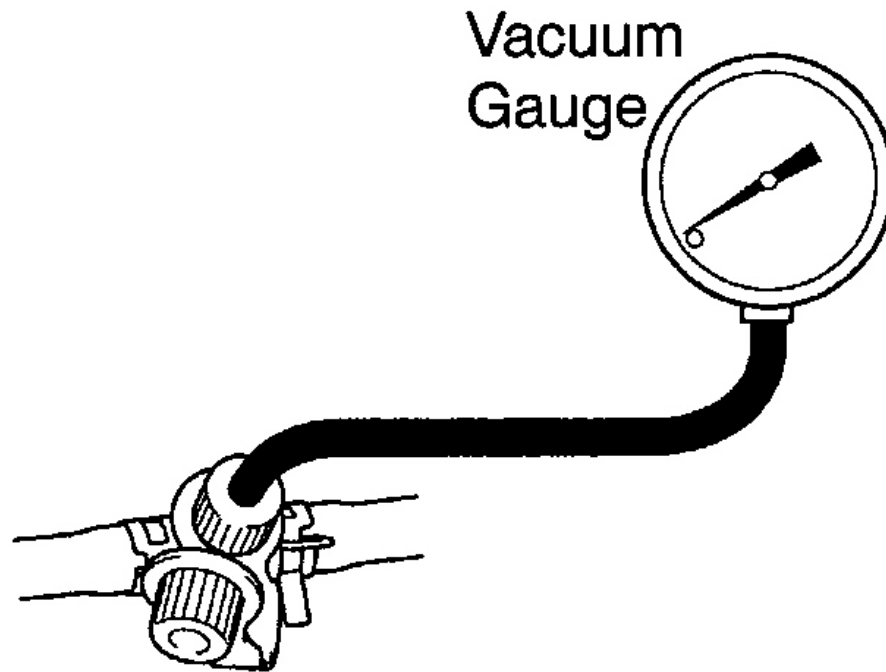
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Fig. 10: Checking Cap And Gasket Are Not Deformed Or Damaged
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4. INSPECT EVAP SYSTEM LINE

- a. Warm up the engine to the normal operating temperature, then stop the engine.
- b. Install a vacuum gauge (EVAP control system test equipment vacuum gauge) to the EVAP service port on the purge line.



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Fig. 11: Installing Vacuum Gauge To EVAP Service Port On Purge Line
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- c. When using the hand-held tester:

Forced driving of the VSV for the EVAP.

1. Connect the hand-held tester to the DLC3.
2. Start the engine.
3. Push the hand-held tester main switch ON.
4. Use the hand-held tester ACTIVE TEST to operate the VSV for EVAP.

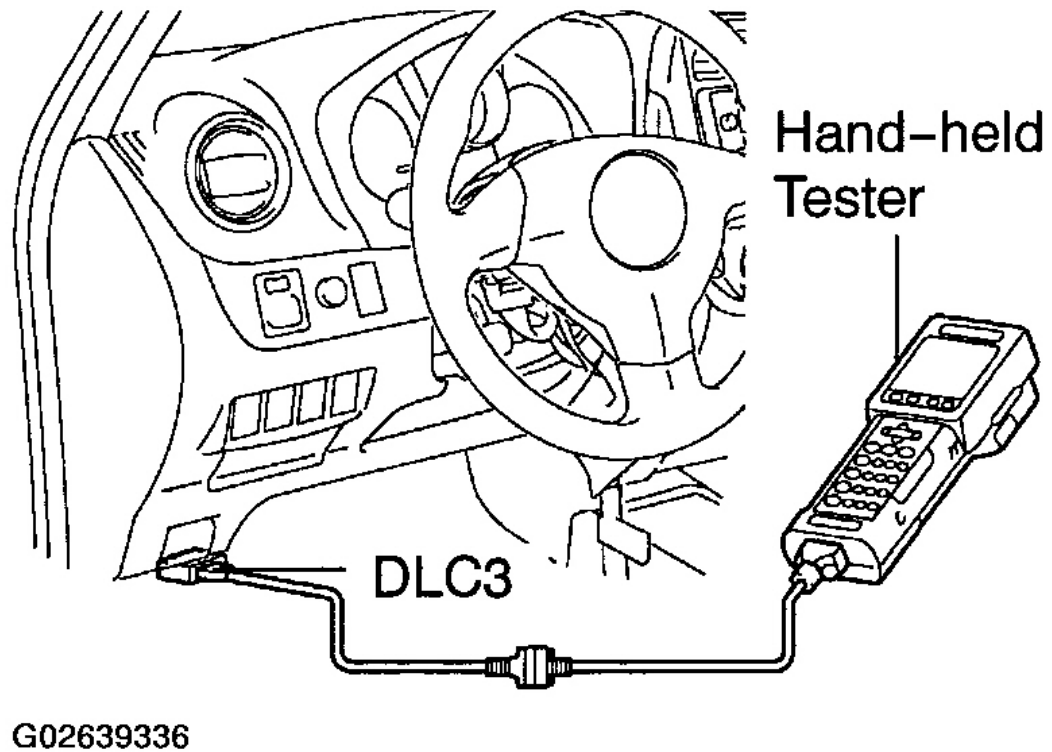


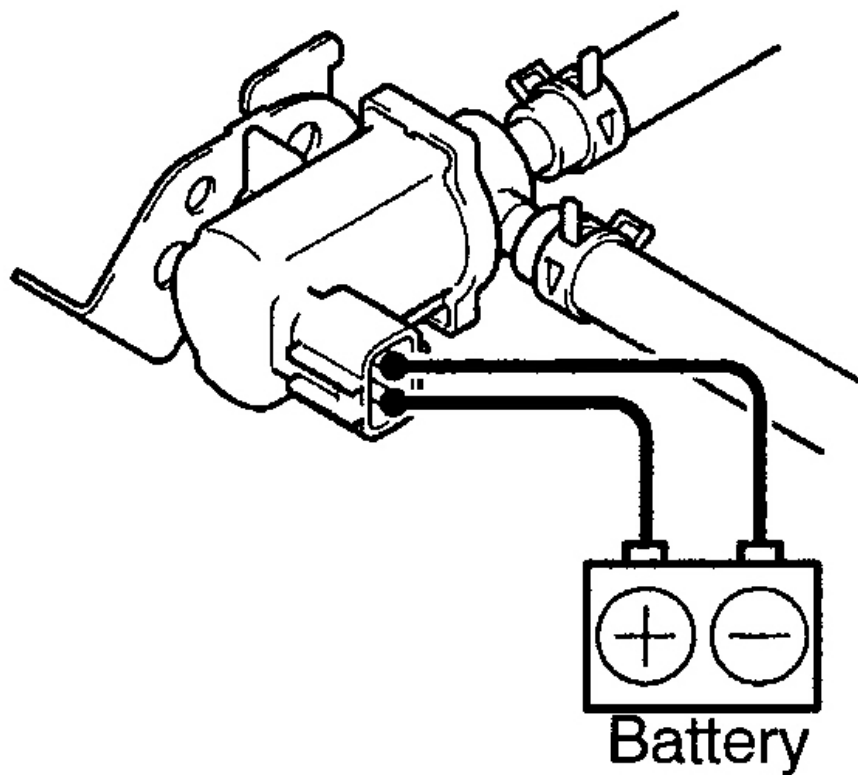
Fig. 12: Connecting Hand-Held Tester To DLC3

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. When not using the hand-held tester:

Forced driving of the VSV for the EVAP.

1. Disconnect the VSV connector for the EVAP.
2. Connect the battery's positive (+) and negative (-) to the VSV terminals for the EVAP.
3. Start the engine.



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Fig. 13: Connecting Battery Positive And Negative To VSV Terminals For EVAP
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- e. Check the vacuum at idle.

Vacuum:

0.368 to 3.678 in.Hg (5 to 50 in.Aq) should be maintained for more than 5 seconds

HINT:

If the vacuum does not change, there is a possibility that the hose connecting the VSV to the service port may be loose or blocked, or the VSV may have a malfunction.

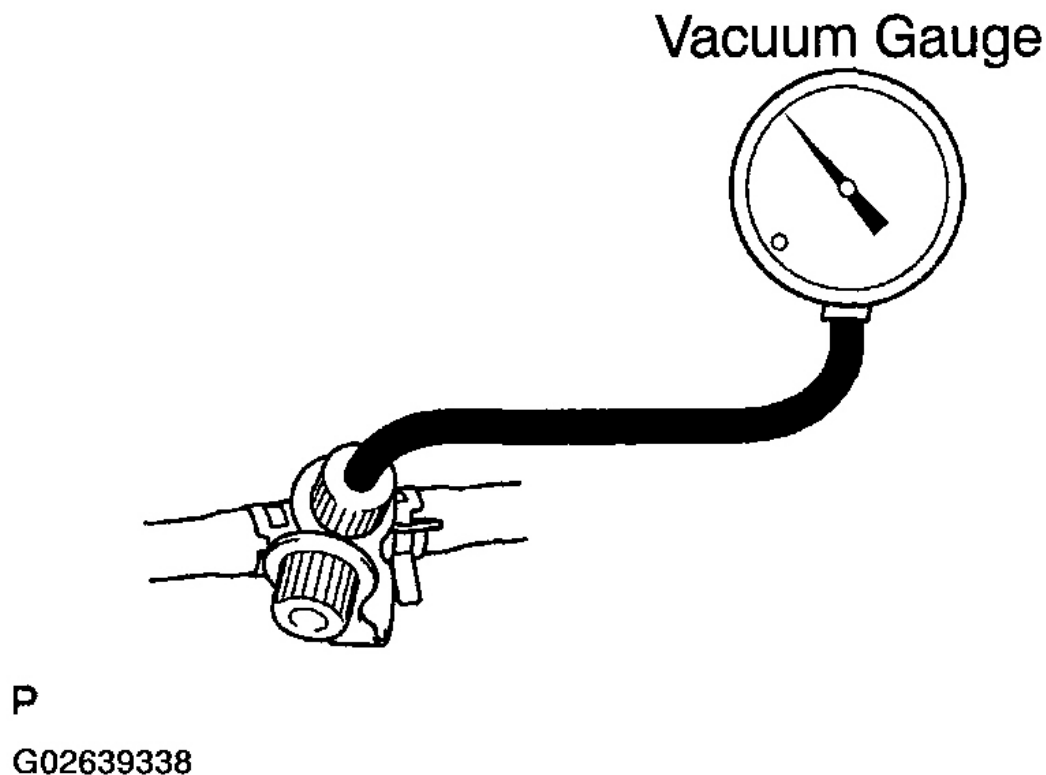


Fig. 14: Checking Vacuum At Idle

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- f. When using the hand-held tester:

Forced driving of the VSV for EVAP.

1. Stop the engine.
2. Disconnect the hand-held tester from the DLC3.

- g. When not using the hand-held tester:

Forced driving of the VSV for EVAP.

1. Stop the engine.
2. Disconnect the battery's positive (+) and negative (-) leads from the VSV terminals for the EVAP.
3. Connect the VSV connector for the EVAP.

- h. Disconnect the vacuum gauge from the EVAP service port on the purge line.

- i. Connect a pressure gauge to the EVAP service port on the purge line.
- j. Check the pressure.
 1. Using a hose clipper or similar instrument, pinch the air drain hose at the position shown to close the hose.

HINT:

Insert the hose clipper through the clearance of the front engine under cover and pinch the yellow marked portion of the air drain hose.

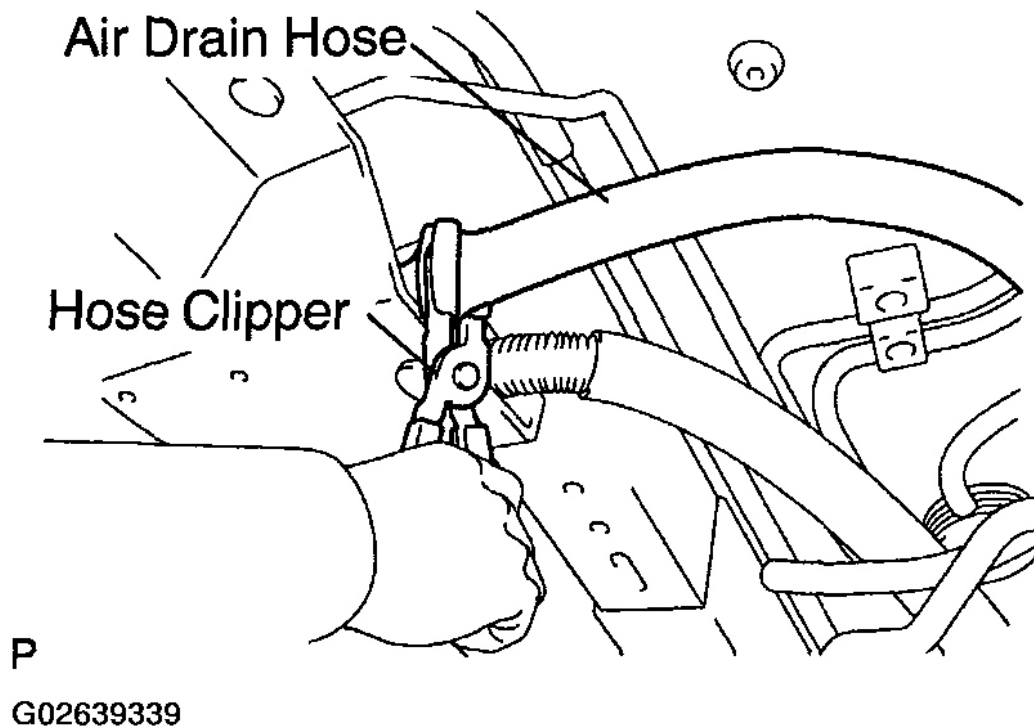


Fig. 15: Pinching Air Drain Hose Using Hose Clipper
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2. Apply pressure (13.5 to 15.5 in.Aq) from the EVAP service port.

Pressure:

2 minutes after the pressure is applied, the gauge should be over 7.7 to 8.8 in.Aq.

HINT:

If no more pressure can be applied, the hose connecting among the VSV, canister and fuel tank may be slipped off or the VSV may be open.

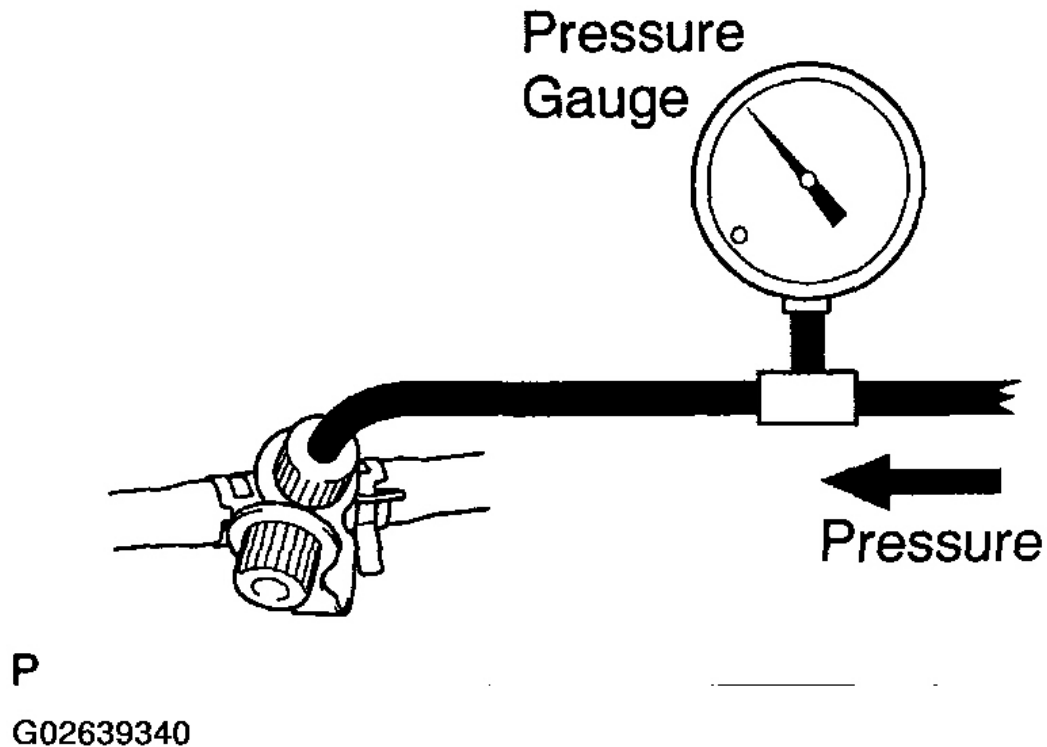


Fig. 16: Applying Pressure From EVAP Service Port
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3. Check if the pressure decreases when the fuel tank cap is removed while applying pressure.

HINT:

If the pressure does not decrease when the fuel tank cap is removed, there is a possibility that the hose connecting the service port to the fuel tank may be blocked.

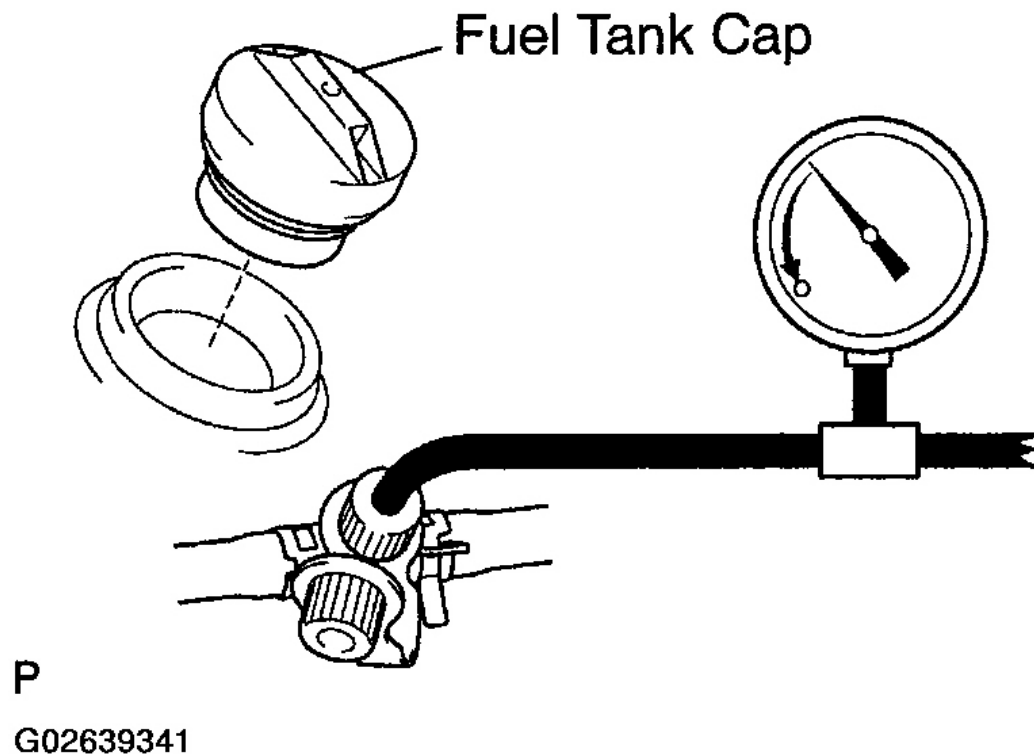


Fig. 17: Checking Pressure Decreases When Fuel Tank Cap Is Removed While Applying Pressure

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

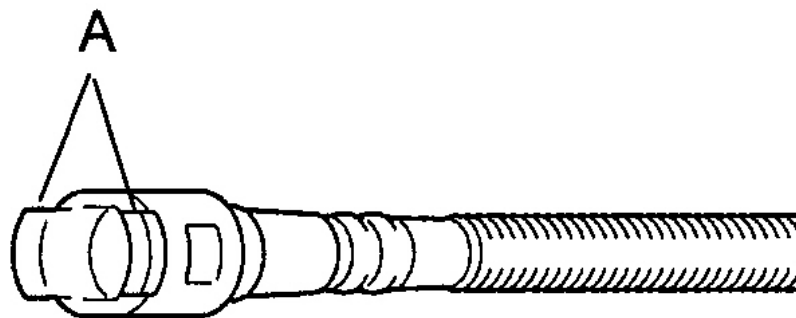
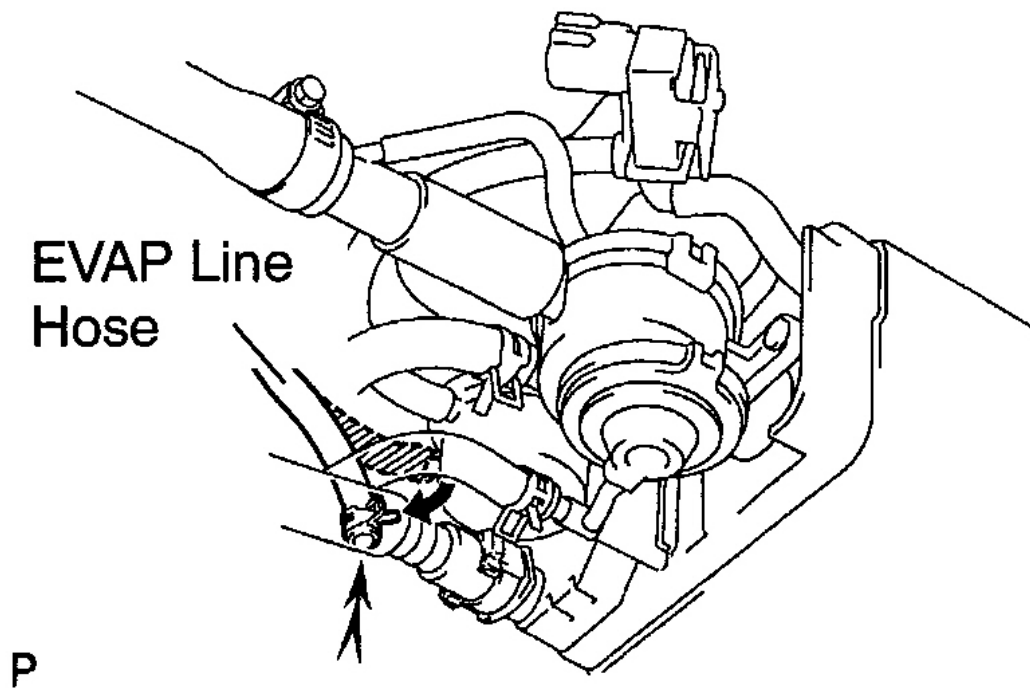
- k. Disconnect the pressure gauge from the EVAP service port on the purge line.
- 5. **CHECK AIR TIGHTNESS IN FUEL TANK AND FILLER PIPE**
 - a. Disconnect the EVAP line hose from the charcoal canister.
 - 1. Pinch portion A.
 - 2. Pull the connector out.
 - b. Pressurize the internal fuel tank at 4 kPa (41 gf/cm² , 0.58 psi).
 - c. Check that the internal pressure of the fuel tank can be maintained for 1 minute.
 - d. Check the connections of the hoses and pipes.
 - e. Check the installed parts on the fuel tank.

If there is abnormality, replace the fuel tank and filler pipe.

- f. Reconnect the EVAP line hose to the charcoal canister.

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Fig. 18: Disconnecting EVAP Line Hose From Charcoal Canister
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6. INSPECT FUEL CUTOFF VALVE AND FILL CHECK VALVE

- a. Disconnect the purge line hose and EVAP line hose from the charcoal canister.
- b. Disconnect the drain hose from the charcoal canister and plug the drain port with a cap.

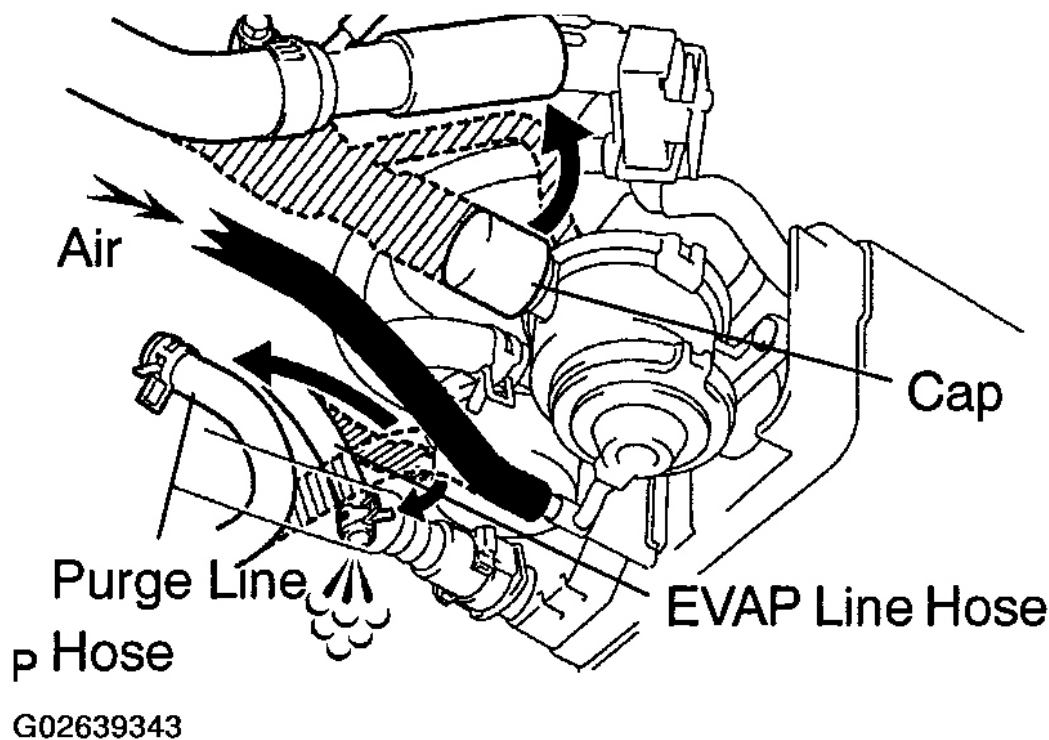


Fig. 19: Locating Purge Line Hose, EVAP Line Hose & Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Pressurize the purge port at 4 kPa (41 gf/cm², 0.58 psi) and check that it is ventilated through the EVAP line hose.

HINT:

It is necessary to check the amount of fuel in the fuel tank. When the fuel tank is full, the float valve of the fill check valve is closed and no air can pass through.

1. If air can flow freely from the purge port through to the EVAP line hose, the fuel cutoff valve and fill check valve are operating normally. Go to step (d).

2. If air cannot flow freely from the purge port through to the EVAP line hose, disconnect the vent line hose and EVAP line hose and check if they are clogged or not. If clogged, replace as necessary.
3. If the vent line hose and EVAP line hose are operating normally and air still cannot flow freely from the purge port through to the EVAP line hose, replace the fuel cutoff valve and fill check valve.
- d. Reconnect the purge line hose and EVAP line hose to the charcoal canister.

7. CHECK AIR INLET LINE HOSE

- a. Disconnect the air inlet line hose from the charcoal canister.
- b. Check that there is ventilation in the air inlet line.

If the air inlet line is clogged, repair or replace the hose.

- c. Reconnect the air inlet line hose to the charcoal canister.

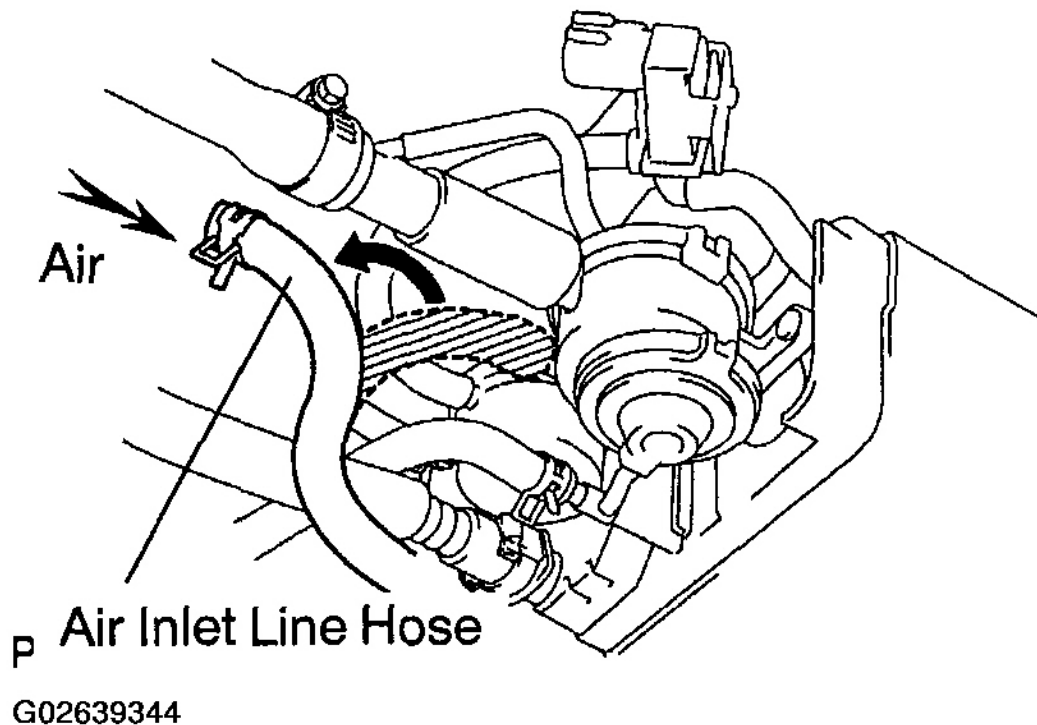


Fig. 20: Checking Air Inlet Line Hose
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

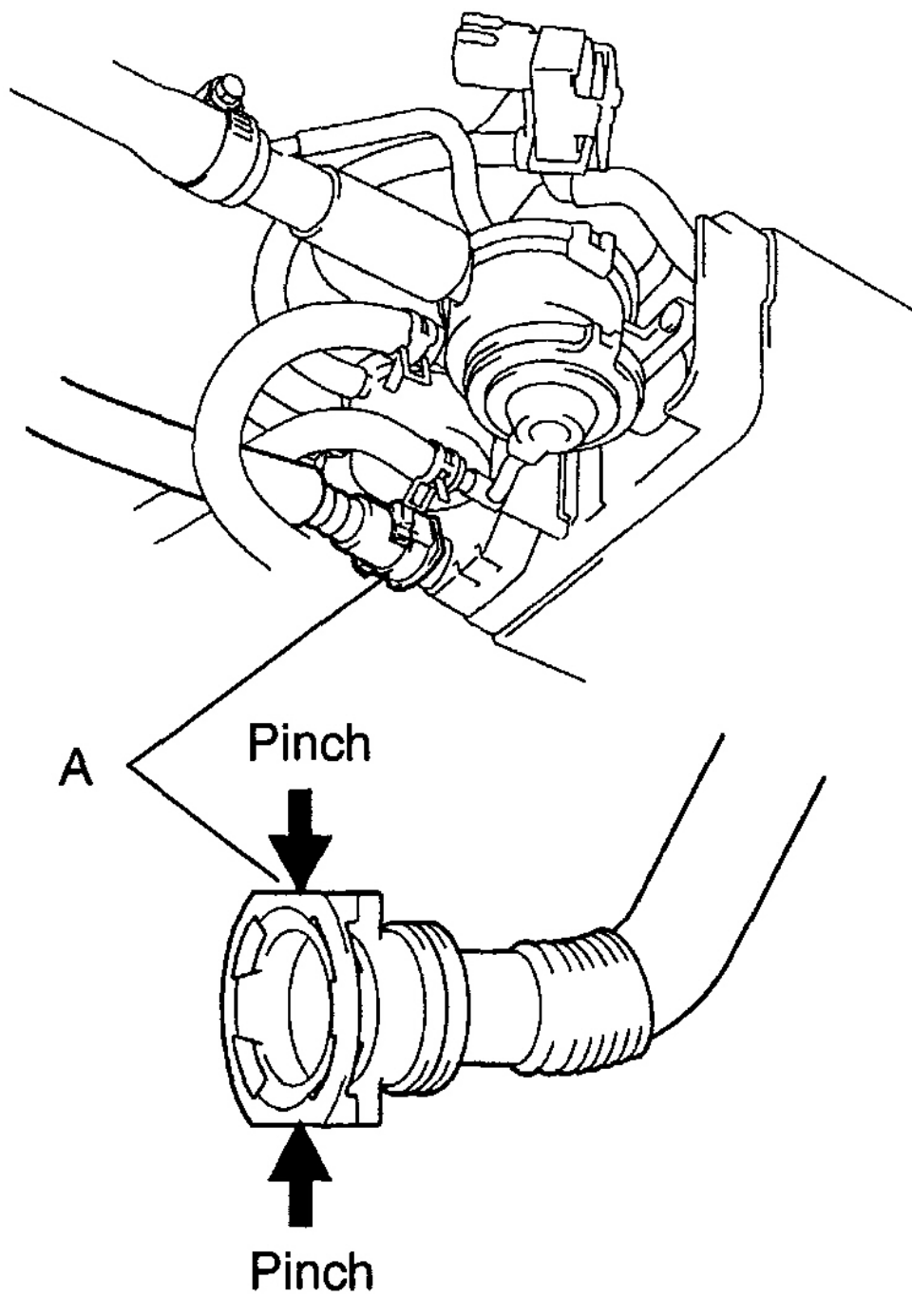
8. REMOVE CHARCOAL CANISTER ASSEMBLY

- a. Remove the bolt, 3 nuts and protector from the body.

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- b. Disconnect the VSV connector.
- c. Disconnect the purge line hose, EVAP line hose and air inlet line hose from the charcoal canister.
- d. Disconnect the vent line hose from the charcoal canister.
 - 1. Push the connector deeply.
 - 2. Pinch portion A.
 - 3. Pull out the connector.
- e. Remove the 2 bolts and charcoal canister assembly.



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Fig. 21: Disconnecting Vent Line Hose From Charcoal Canister
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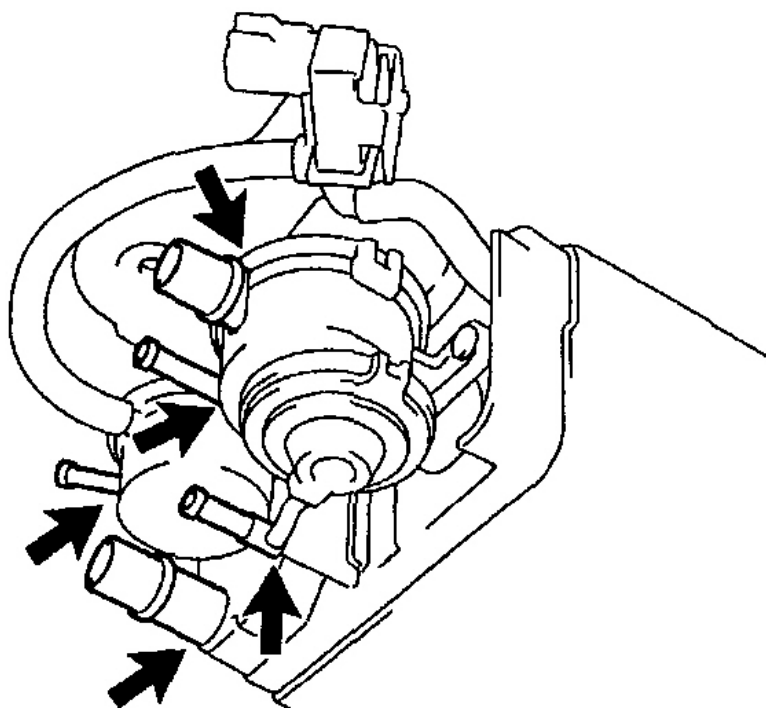
9. INSPECT CHARCOAL CANISTER

- a. Visually check the charcoal canister for cracks or damage.

HINT:

Be sure to check the areas indicated by the arrow marks.

These areas are especially prone to cracking.



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Fig. 22: Checking Charcoal Canister For Cracks Or Damage
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- b. Inspect the charcoal canister operation.
 1. Plug the vent port with a cap.
 2. While holding the purge port closed, blow air (1.76 kPa, 18 gf/cm², 0.26 psi) into the EVAP port and check that air flows from the air drain port.

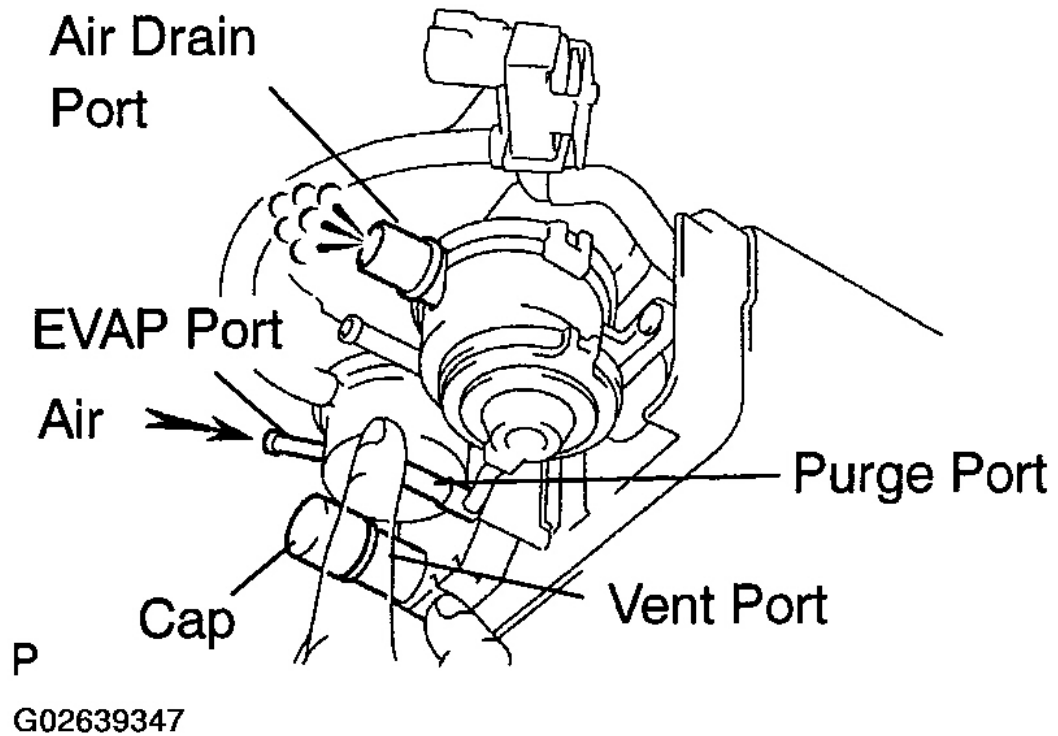


Fig. 23: Plugging Vent Port With Cap

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. While holding the purge port and the air drain port closed, blow air (1.76 kPa, 18 gf/cm², 0.26 psi) into the EVAP port and check that air does not flow from the air inlet port.

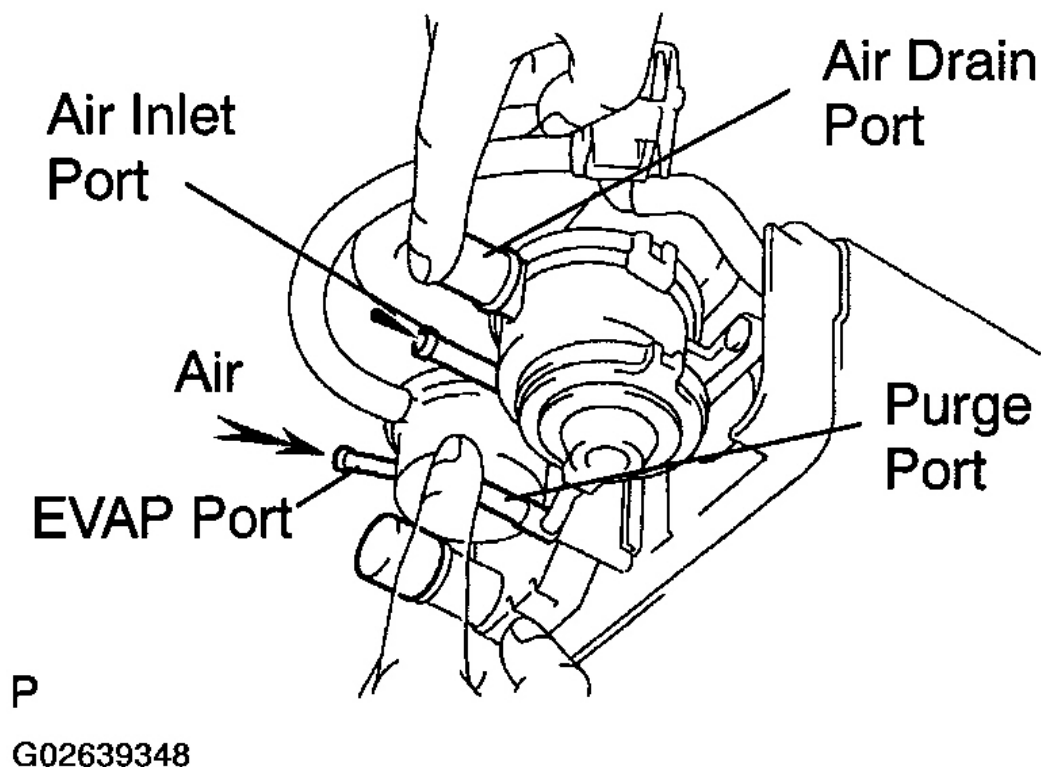
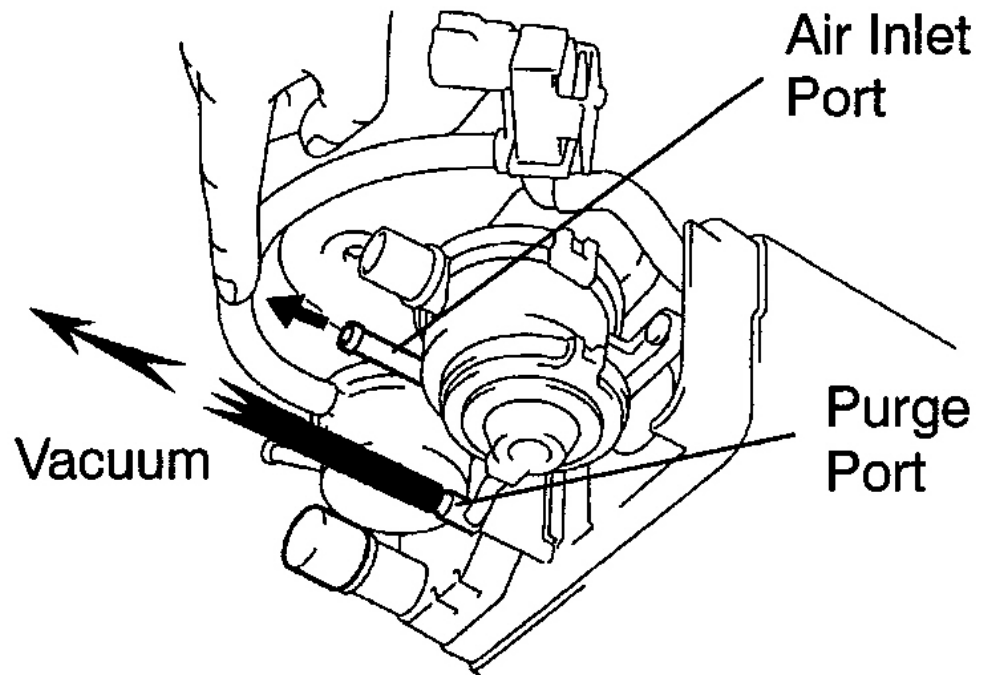


Fig. 24: Checking Air Does Not Flow From Air Inlet Port
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4. Apply vacuum (3.43 kPa, 25.7 mmHg, 1.01 in.Hg) to the purge port and check that the vacuum does not decrease when the air inlet port is closed. Then check that the vacuum decreases when the air inlet port is released.



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Fig. 25: Checking Vacuum Decreases When Air Inlet Port Is Released
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5. With the air inlet port closed, apply vacuum (3.43 kPa, 25.7 mmHg, 1.01 in.Hg) to the EVAP port and check that air flows into the purge port.

If there is a problem, replace the charcoal canister.

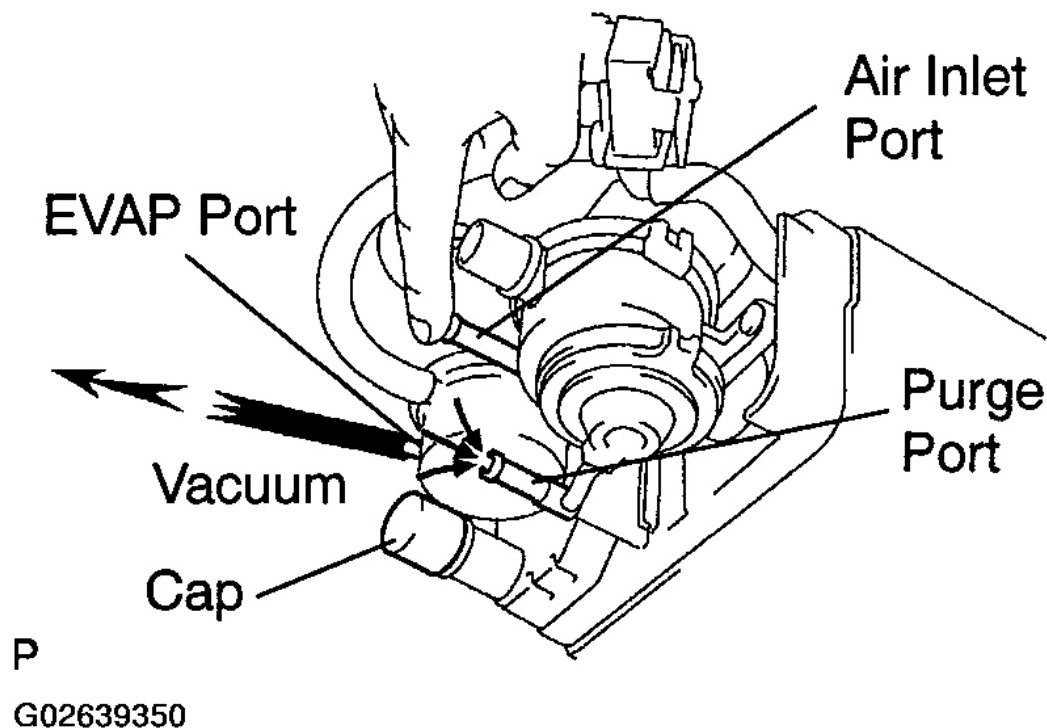


Fig. 26: Checking That Air Flows Into Purge Port
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6. Remove the cap from the vent port.
10. **INSPECT VSV FOR EVAP (See INSPECTION)**
11. **INSPECT VSV FOR CCV (See INSPECTION)**
12. **INSPECT VSV FOR PRESSURE SWITCHING VALVE (See INSPECTION)**
13. **INSPECT VAPOR PRESSURE SENSOR (See INSPECTION)**
14. **REINSTALL CHARCOAL CANISTER ASSEMBLY**
15. **REINSTALL PROTECTOR**

THREE-WAY CATALYTIC CONVERTER (TWC) SYSTEM

ON-VEHICLE INSPECTION

1. **INSPECT EXHAUST PIPE ASSEMBLY**
 - a. Check the connections for looseness or damage.

If the exhaust pipe is loose, tighten it.

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If damaged, replace it.

- b. Check the clamps for wear, cracks or damage.

2. **INSPECT TWC**

Check for dents or damage.

If any part of the protector is damaged or dented for example, the protector comes in contact with the TWC, repair or replace it.

3. **INSPECT HEAT INSULATOR**

- a. Check the heat insulator for damage.

If the heat insulator is damaged, repair or replace it.

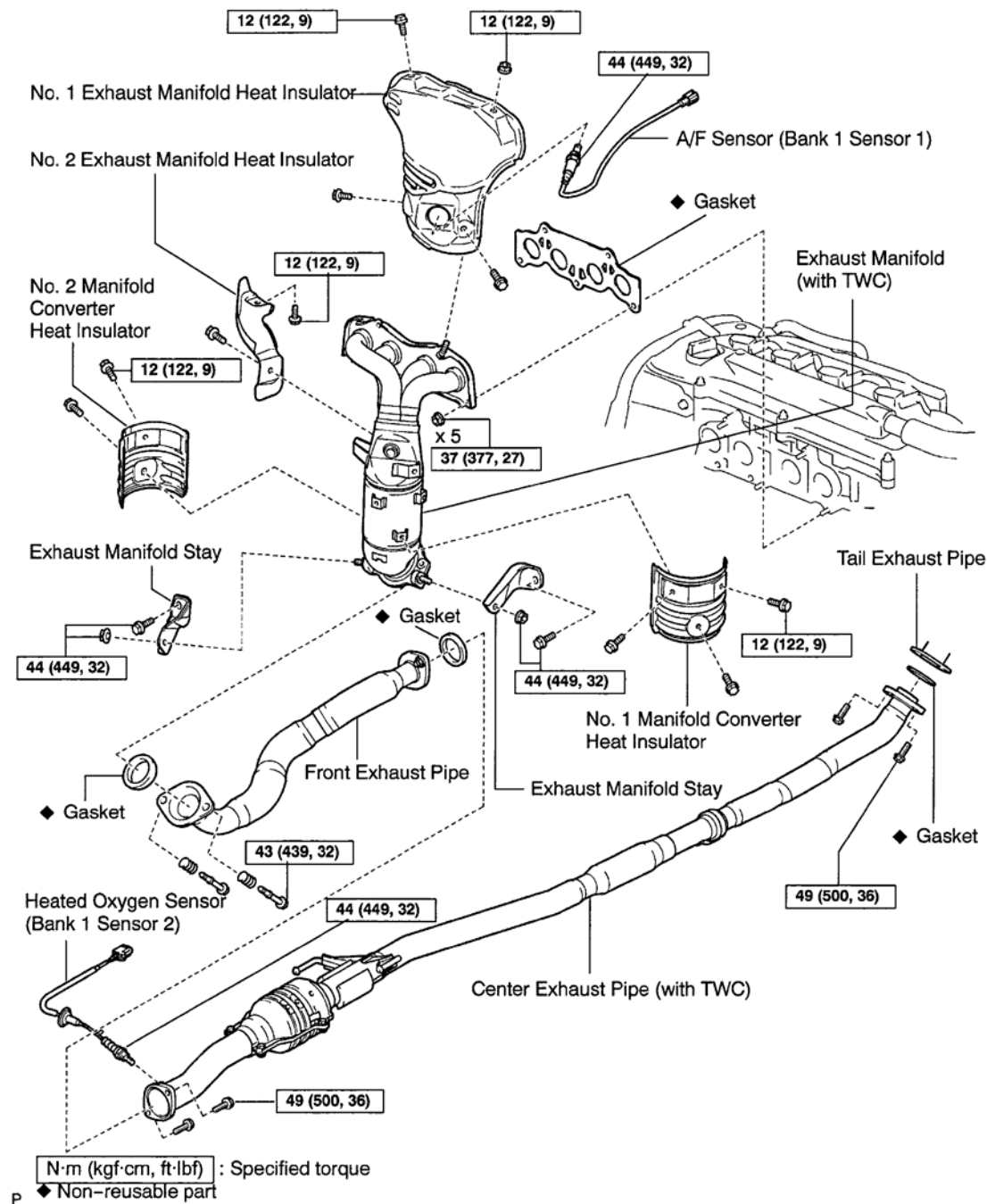
- b. Check that there is adequate clearance between the catalytic converter and heat insulator.

If there is no clearance, repair or replace the heat insulator.

COMPONENTS

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Fig. 27: Exploded View Of Emission Control Components & Torque Specifications
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REPLACEMENT

NOTE: Check if an old gasket still remains on the pipe. If so, remove it. Also, check if

any bolts or nuts are rusted. If so, replace them.

1. REMOVE FRONT EXHAUST PIPE

- a. Remove the 2 bolts and 2 compression springs.
- b. Remove the 2 bolts and exhaust pipe.
- c. Remove the exhaust pipe's gasket and exhaust manifold's gasket.

2. REMOVE CENTER EXHAUST PIPE

- a. Remove the heated oxygen sensor (bank 1 sensor 2).
- b. Remove the 2 bolts from the exhaust pipe.
- c. Remove the exhaust pipe from the 2 rings.
- d. Remove the gasket from the exhaust pipe.

3. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- a. Disconnect the A/F sensor connector (bank 1 sensor 1).
- b. Remove the 3 bolts, nut and No. 1 exhaust manifold heat insulator.
- c. Remove the A/F sensor (bank 1 sensor 1) from the exhaust manifold.

4. REMOVE EXHAUST MANIFOLD (w/TWC)

- a. Remove the 2 bolts, 2 nuts and 2 exhaust manifold stays.
- b. Remove the 5 nuts and exhaust manifold,
- c. Remove the gasket from the cylinder head,

5. INSPECT EXHAUST MANIFOLD (w/ TWC)

Using a precision straight edge and feeler gauge, measure the manifold surface contacting the cylinder head for warpage.

Maximum warpage: 0.70 mm (0.0276 in.)

If the warpage is greater than the maximum, replace the manifold.

6. REMOVE HEAT INSULATORS

- a. Remove the 3 bolts and No. 1 manifold converter heat insulator.
- b. Remove the 2 bolts and No. 2 manifold converter heat insulator.
- c. Remove the 2 bolts and No. 2 exhaust manifold heat insulator.

7. INSTALL HEAT INSULATORS

- a. Install the No. 2 exhaust manifold heat insulator with the 2 bolts.

Torque: 12 N.m (122kgf.cm, 9 ft.lbf)

- b. Install the No. 2 exhaust converter heat insulator with the 2 bolts.

Torque: 12 N.m (122kgf.cm, 9 ft.lbf)

- c. Install the No. 1 manifold converter heat insulator with the 3 bolts.

Torque: 12 N.m (122kgf.cm, 9 ft.lbf)

8. INSTALL EXHAUST MANIFOLD (w/ TWC)

- a. Install a new gasket to the cylinder head.
b. Install the exhaust manifold with the 5 nuts. Uniformly tighten the 5 nuts in the order shown in the illustration.

Torque: 37 N.m (377 kgf.cm, 27 ft.lbf)

- c. Install the 2 exhaust manifold stays with the 2 bolts and 2 nuts.

Torque: 44 N.m (449 kgf.cm, 32 ft.lbf)

9. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- a. Install the A/F sensor (bank 1 sensor 1) to the exhaust manifold.

Torque: 44 N.m (449 kgf.cm, 32 ft.lbf)

- b. Install the No. 1 exhaust manifold heat insulator with the 3 bolts and nut.

Torque: 12 N.m (122 kgf.cm, 9 ft.lbf)

- c. Connect the A/F sensor connector (bank 1 sensor 1).

10. INSTALL CENTER EXHAUST PIPE

- a. Install a new gasket to the exhaust pipe.

NOTE:

- **Do not reuse the gasket.**
- **The gasket must be installed to the exhaust pipe before the pipe is installed to the tailpipe. Do not indirectly use the tailpipe to force the gasket onto the exhaust pipe.**

- b. Install the exhaust pipe to the 2 rings.
c. Install the 2 bolts to the exhaust pipe.

Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)

- d. Install the heated oxygen sensor (bank 1 sensor 2).

Torque: 44 N.m (449 kgf.cm, 32 ft.lbf)

HINT:

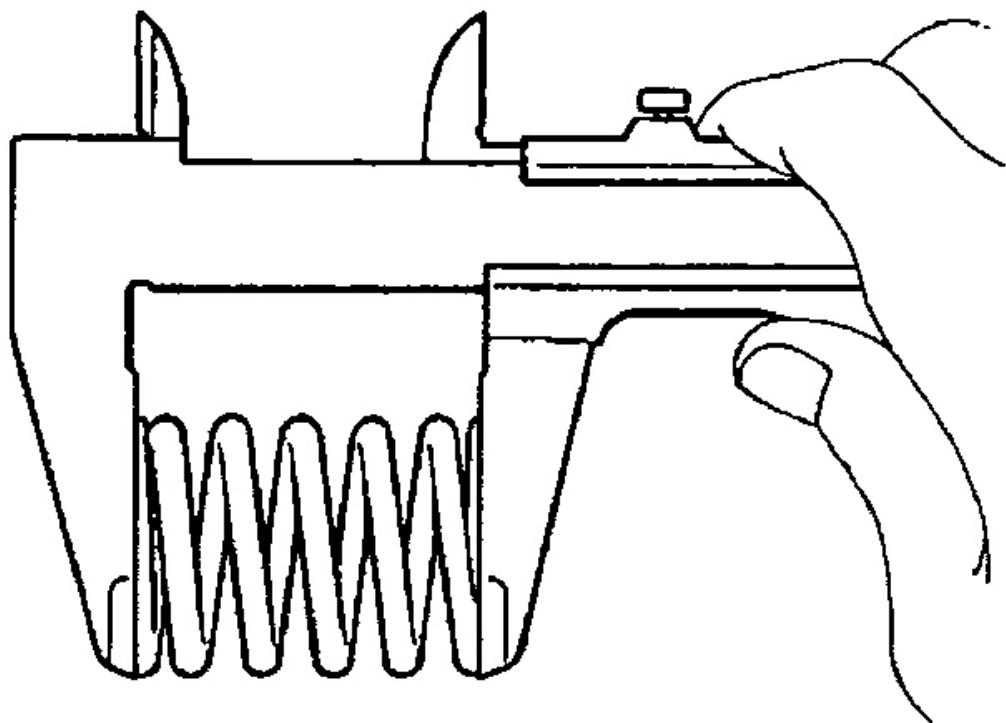
- Before installing the heated oxygen sensor, twist the sensor wire counterclockwise 3 and 1/2 turns.
- After installing the heated oxygen sensor, check that the sensor wire is not twisted. If it is twisted, remove the heated oxygen sensor and reinstall it.

11. INSTALL FRONT EXHAUST PIPE

- a. Using a vernier caliper, measure the free length of the compression spring.

Minimum length: 40 mm (1.57 in.)

If the free length is less than the minimum, replace the compression spring.



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Fig. 28: Measuring Free Length Of Compression Spring Using Vernier Calliper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install a new gasket to the front exhaust pipe.

NOTE:

- Do not reuse the gasket.

- The gasket must be installed to the front exhaust pipe before the pipe is installed to the center exhaust pipe. Do not indirectly use the center exhaust pipe to force the gasket onto the front exhaust pipe.

c. Install a new gasket to the exhaust manifold.

NOTE:

- Using a plastic faced hammer, uniformly strike the gasket so that the gasket and exhaust manifold are properly fit.
- Be careful with the installation direction of the gasket.
- Do not reuse the gasket.
- The gasket must be installed to the exhaust manifold before the manifold is installed to the exhaust pipe. Do not indirectly use the exhaust pipe to force the gasket onto the exhaust manifold.

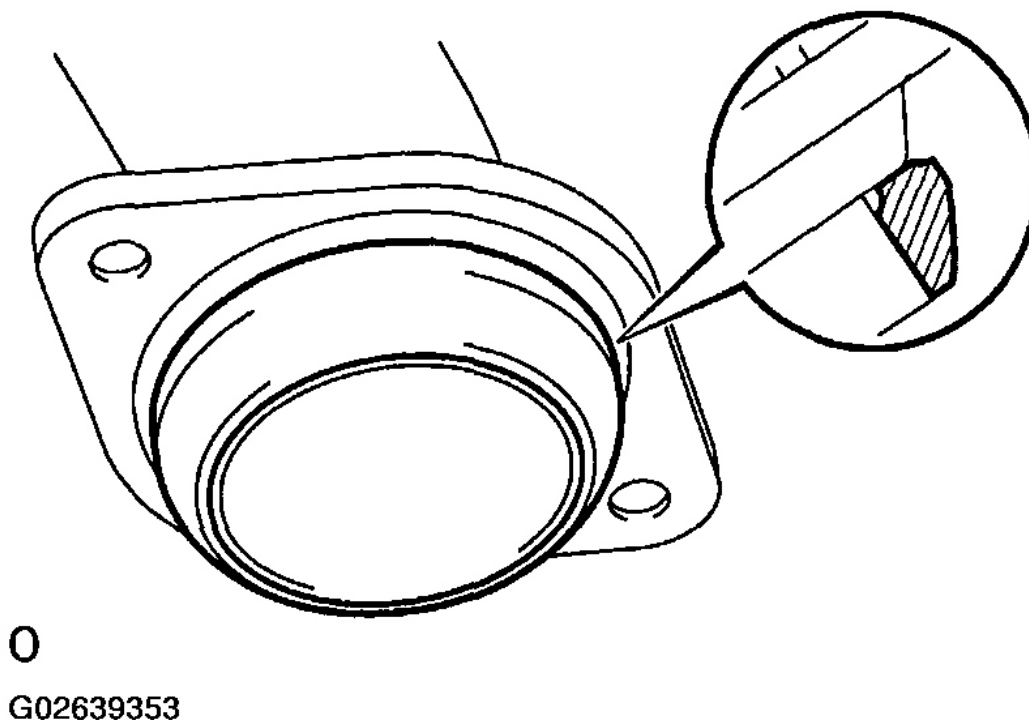


Fig. 29: Installing Gasket To Exhaust Manifold
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Temporarily install the 2 compression springs and 2 bolts holding the exhaust manifold to the front exhaust manifold pipe.

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- e. Install the front exhaust pipe to the center exhaust pipe with the 2 bolts.

Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)

- f. Tighten the 2 compression springs and 2 bolts.

Torque: 43 N.m (439 kgf.cm, 32 ft.lbf)

12. CHECK FOR EXHAUST GAS LEAKS

If gas is leaking, tighten the areas necessary to stop the leak.

Replace damaged parts as necessary.