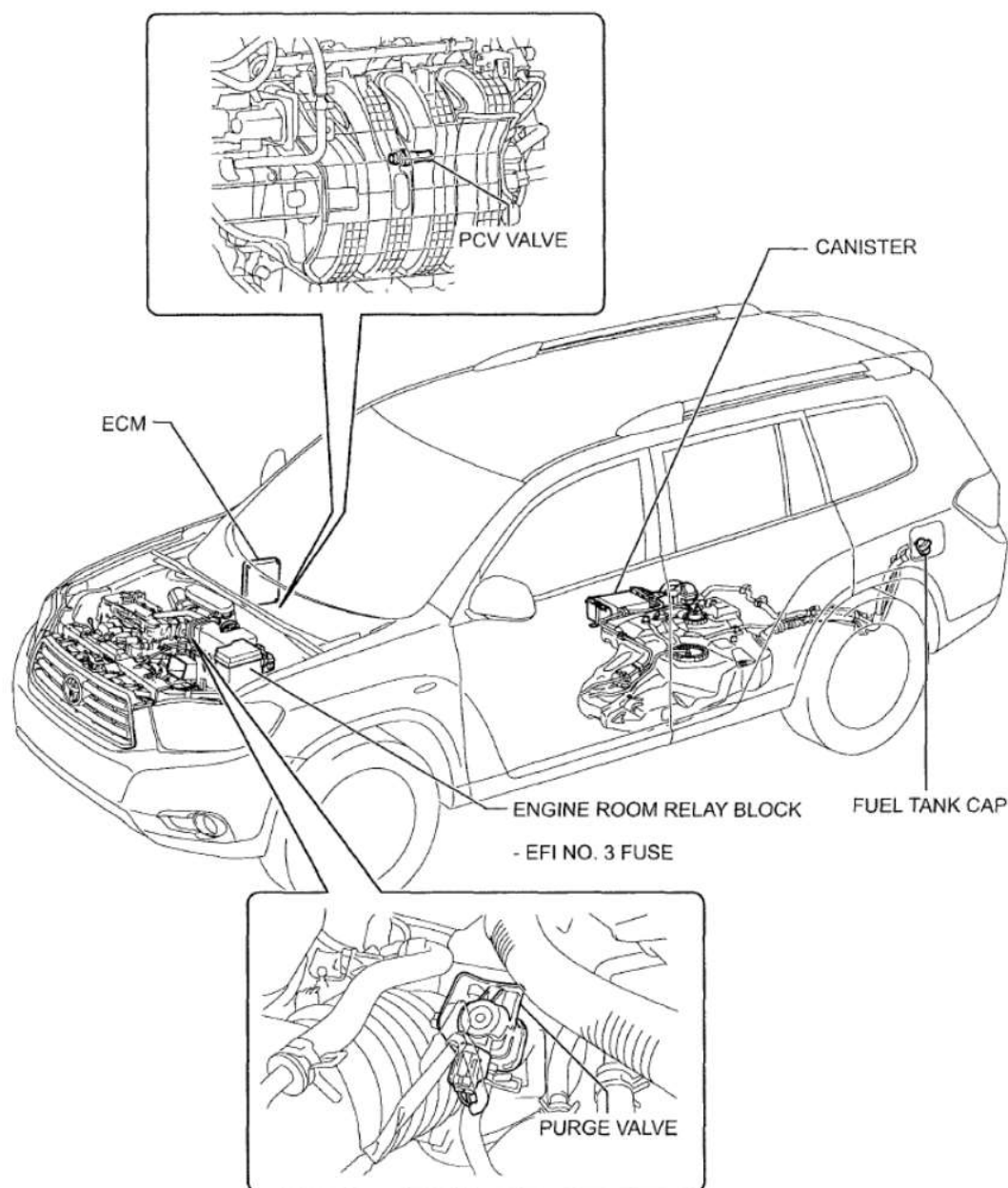


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2009 ENGINE Emission Control (1AR-FE) - Highlander

2009 ENGINE**Emission Control (1AR-FE) - Highlander****EMISSION CONTROL SYSTEM****PARTS LOCATION**

C

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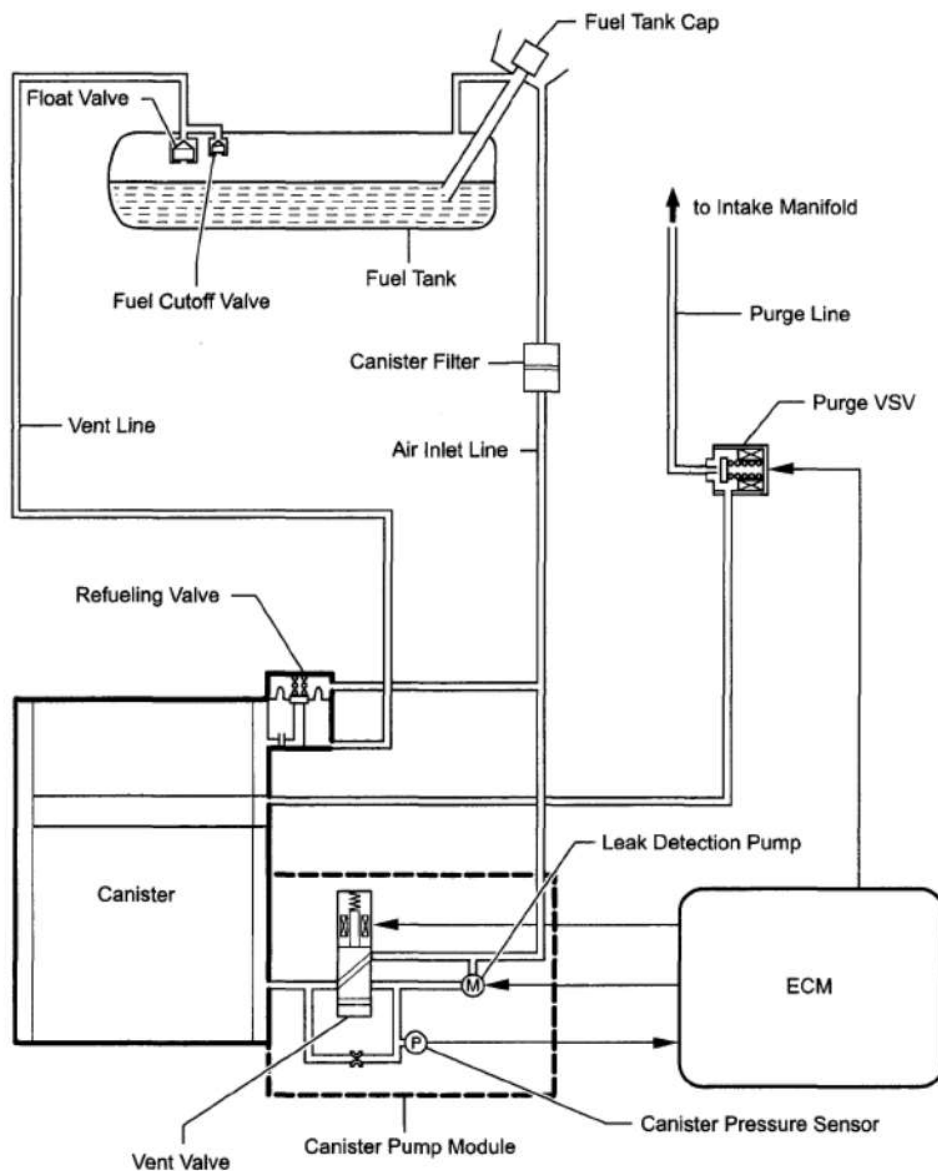
Fig. 1: Identifying Emission Control System Parts Location

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

SYSTEM DIAGRAM



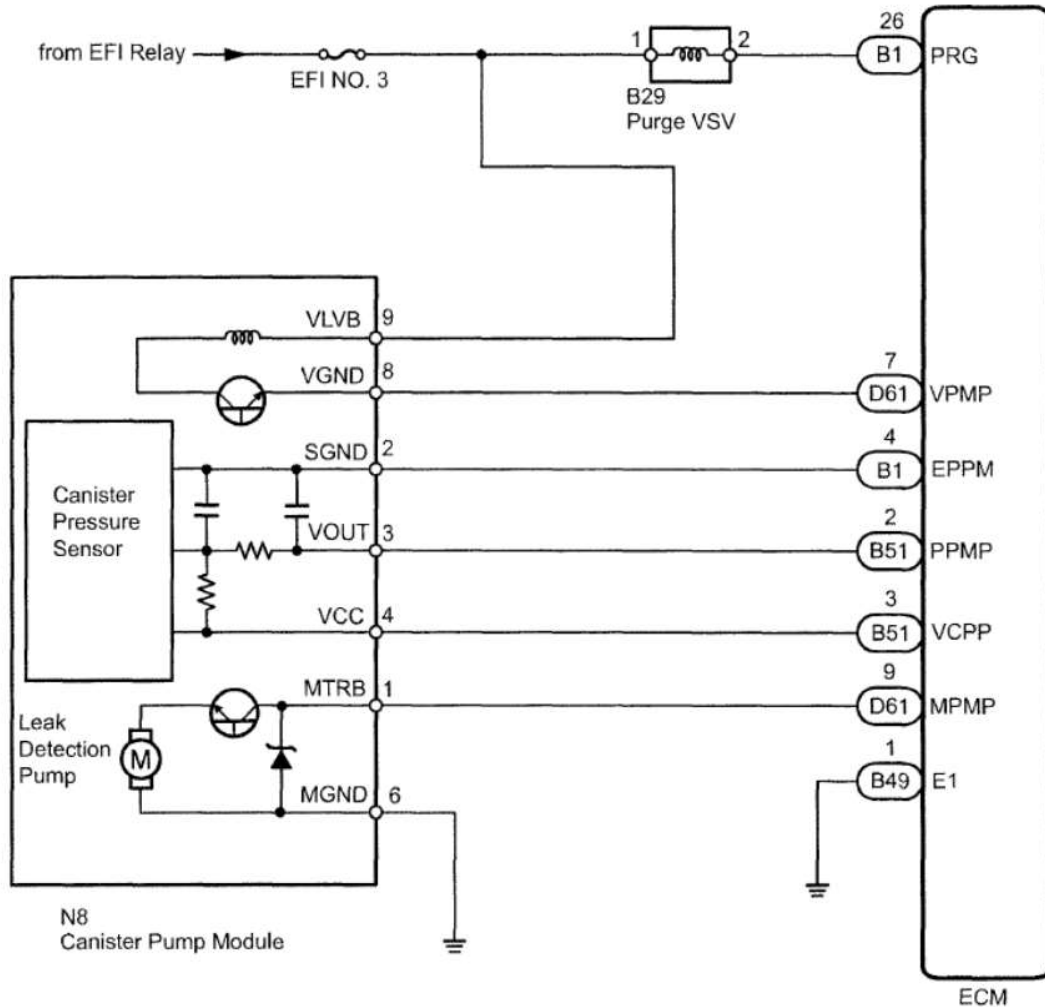
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Fig. 2: Emission Control System Diagram (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 3: Emission Control System Diagram (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. CHECK FUEL CUT-OFF RPM

- Increase the engine speed to at least 3500 rpm.
- Use a sound scope to check for injector operating noise.
- Check that the operating sounds stop momentarily and then resume when the accelerator pedal is released.

HINT:

Measure with the A/C off.

Fuel return rpm:

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1400 rpm

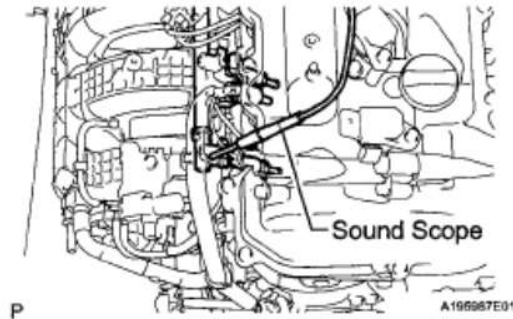


Fig. 4: Checking Fuel Cut-Off RPM

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

2. VISUALLY INSPECT HOSES, CONNECTIONS AND GASKET

- a. Visually check that the hoses, connections and gaskets have no cracks, leaks or damage.

NOTE:

- Detachment or other problems with the engine oil dipstick, filler cap, PCV hose and other components may cause the engine to run improperly.
- Disconnection, looseness or cracks in the parts of the air induction system between the throttle body and cylinder head will allow air suction and cause an engine failure or engine malfunctions.

If the result is not as specified, replace parts as necessary.



Fig. 5: Inspecting Hoses, Connections And Gasket

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

3. INSPECT EVAPORATIVE EMISSION CONTROL SYSTEM

- a. Start the engine.
- b. Disconnect the vacuum hose.
- c. Connect the Techstream to the DLC3.
- d. Turn the ignition switch to ON.

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- e. Turn the Techstream on.
- f. Enter the following menus: Powertrain/Engine/Active Test/Activate the VSV for Evap Control.
- g. Check that vacuum occurs at the VSV port.
- h. Exit Active Test mode and reconnect the vacuum hose.
- i. Enter the following menus: Powertrain/Engine/Data List/EVAP Purge VSV.
- j. Warm up the engine and drive the vehicle.
- k. Confirm that the purge VSV opens.

If the result is not as specified, replace the VSV, wire harness or ECM.



Fig. 6: Locating Vacuum Hose Clip

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

4. INSPECT FUEL TANK AND VENT LINE

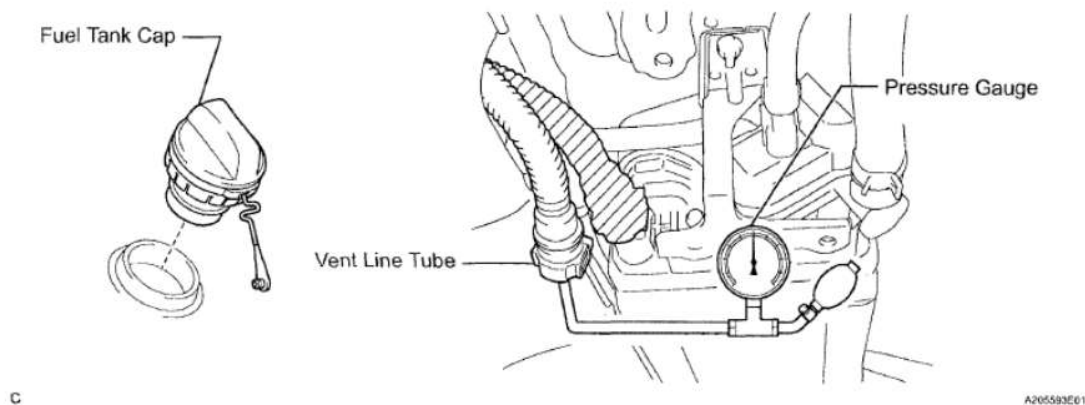


Fig. 7: Inspecting Fuel Tank And Vent Line

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

- a. Disconnect the vent line tube from the canister.
- b. Connect a pressure gauge to the vent line tube.
- c. Apply 4 kPa (0.04 kgf/cm², 0.58 psi) of pressure to the vent line of the fuel tank.

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HINT:

Perform this inspection with the fuel tank less than 90% full. When the fuel tank is full, the fuel cutoff valve closes and pressure is released through the 1.5 mm orifice. As a result, when the fuel tank cap is removed, the pressure does not decrease smoothly.

- d. Check that the fuel tank pressure is maintained for some time, and does not decrease immediately.

HINT:

If the pressure decreases immediately, one of the following may be the cause:

- The fuel tank cap is not completely tightened.
 - The fuel tank cap is damaged.
 - Air is leaking from the vent line.
 - The fuel tank is damaged.
- e. When the fuel tank cap is removed, check that pressure is released smoothly.

HINT:

If the pressure does not drop, replace the fuel tank assembly.

- f. Reconnect the vent line tube to the canister.

5. INSPECT AIR INLET LINE

- a. Disconnect the air inlet line hose from the charcoal canister.
- b. Check that air flows freely into the air inlet line.

HINT:

If air does not flow freely into the air inlet line, repair or replace it.

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

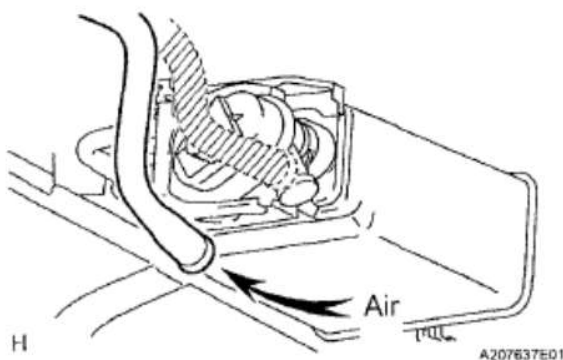


Fig. 8: Inspecting Air Inlet Line

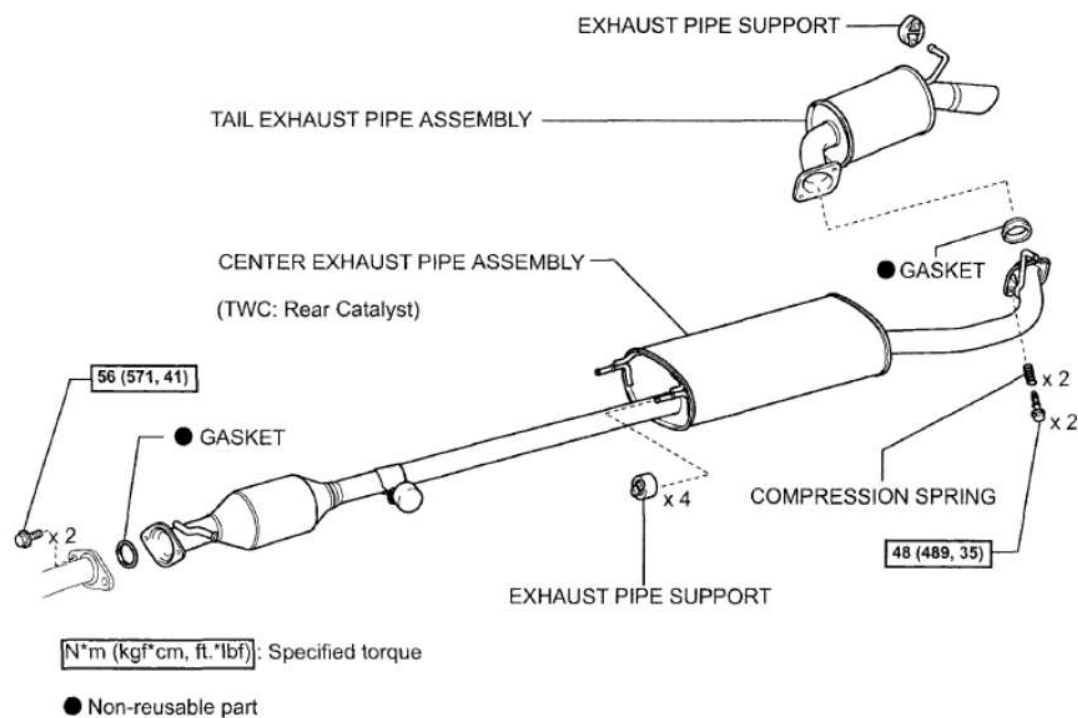
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Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CANISTER

COMPONENTS



H

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Fig. 9: Identifying Canister Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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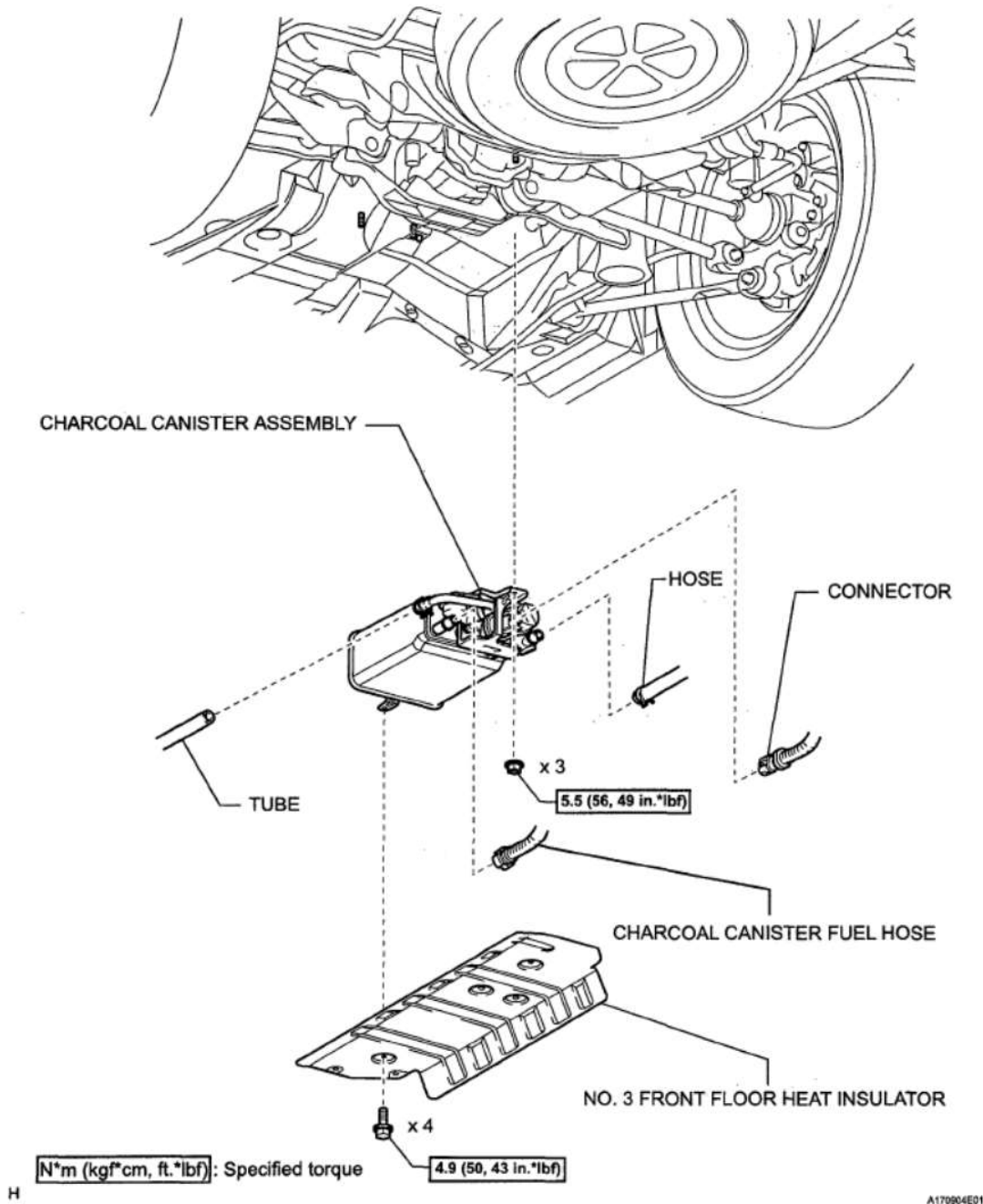


Fig. 10: Identifying Canister Components With Torque Specifications (2 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVE

1. REMOVE TAIL EXHAUST PIPE ASSEMBLY (See INSTALLATION)
2. REMOVE CENTER EXHAUST PIPE ASSEMBLY (See INSTALLATION)
3. REMOVE NO. 3 FRONT FLOOR HEAT INSULATOR

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- a. Remove the 4 bolts and No. 3 front floor heat insulator.

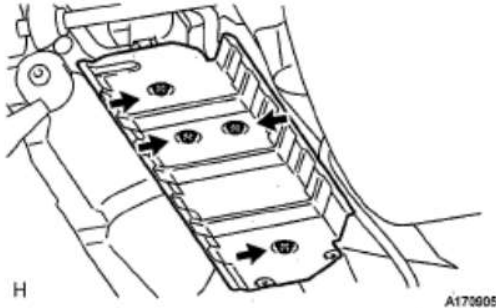


Fig. 11: Locating No. 3 Front Floor Heat Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE CHARCOAL CANISTER ASSEMBLY

- a. Disconnect the hose and connector.



Fig. 12: Locating Hose And Charcoal Canister Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the tube.

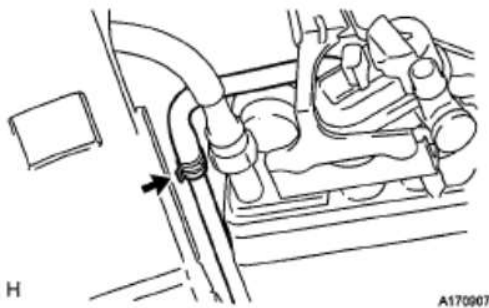


Fig. 13: Locating Charcoal Canister Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Disconnect the charcoal canister fuel hose from the charcoal canister assembly.

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1. Pinch the retainer and pull out the quick connector with the quick connector pushed to the pipe side to disconnect the charcoal canister fuel hose from the charcoal canister assembly.

NOTE:

- Remove dirt or foreign objects on the quick connector before this work.
- Do not allow any scratches or foreign objects on the parts when disconnecting as the fuel hose connector has the O-ring that seals the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, twist or turn the nylon tube.
- Protect the connected part by covering it with a vinyl bag after disconnecting the charcoal canister fuel hose.
- If the quick connector and pipe are stuck, push and pull them to release.

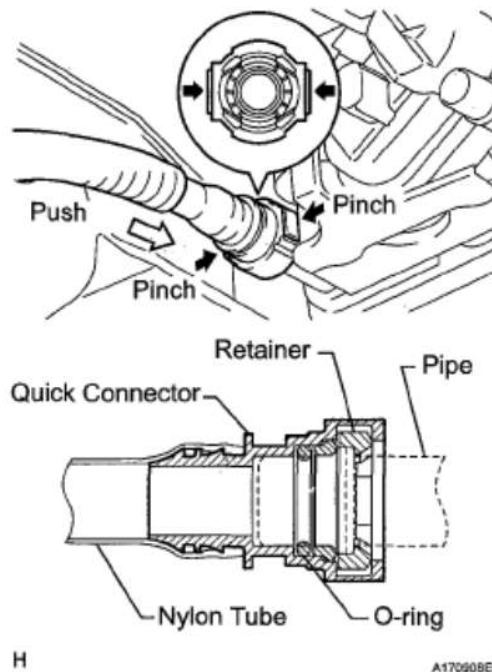


Fig. 14: Pinching Retainer And Pushed To Pipe Side To Disconnect Charcoal Canister Fuel Hose From Charcoal Canister Assembly

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

- d. Remove the 3 nuts and charcoal canister assembly.

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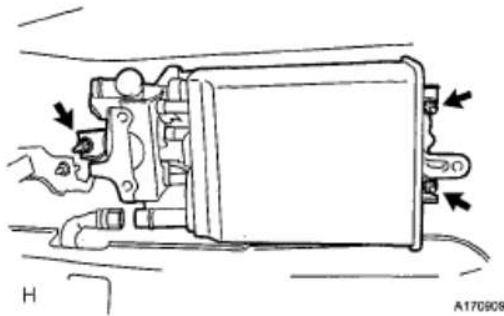


Fig. 15: Locating Charcoal Canister Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CHARCOAL CANISTER ASSEMBLY

- Visually check the charcoal canister for cracks or damage.

If cracks or damage are found, replace the charcoal canister assembly.

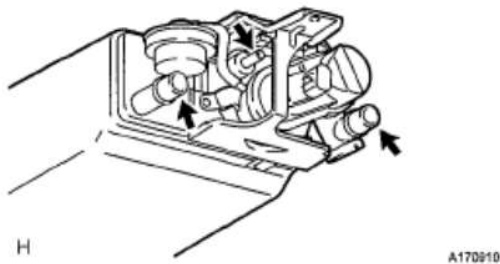
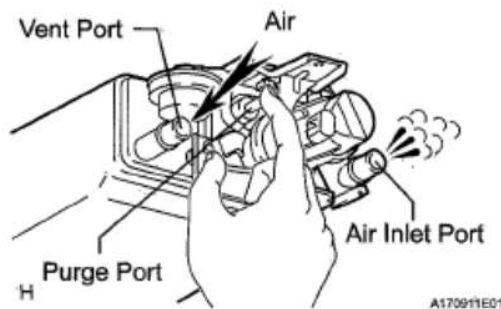


Fig. 16: Checking Charcoal Canister For Cracks Or Damage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Check charcoal canister operation.

- With the purge port closed, blow 1.10 kPa (11.2 gf/cm², 0.16 psi) of air into the vent port, and check that air flows from the air inlet port. If the result is not as specified, replace the charcoal canister assembly.



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Fig. 17: Checking Charcoal Canister Operation - Purge Port Closed
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. With the vent port closed, blow 1.10 kPa (11.2 gf/cm², 0.16 psi) of air into the air inlet port, and check that air flows from the purge port. If the result is not as specified, replace the charcoal canister assembly.

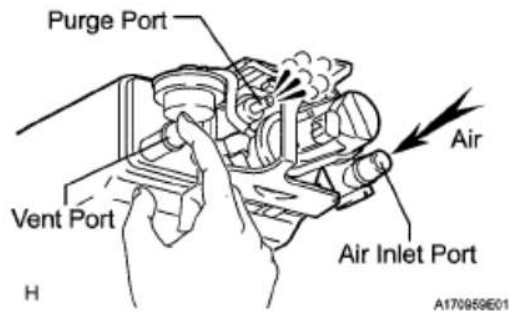


Fig. 18: Checking Charcoal Canister Operation - Vent Port Closed
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

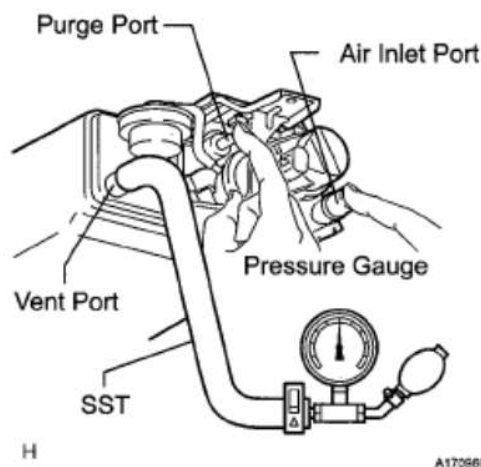
- c. Check for air leakage.
 1. Connect SST (pressure gauge) to the vent port of the charcoal canister assembly.

SST 09992-00242

2. With the purge port and air inlet port closed, apply 20 kPa (150 mmHg, 5.91 in.Hg) of pressurized air into the vent port, then confirm that pressure is retained for 1 minute.

If the result is not as specified, replace the charcoal canister assembly.

- d. Check the canister pump module.
 1. Remove the canister pump module.



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Fig. 19: Checking Canister Pump Module

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

2. Check that air flows from port A to port B and C.

If the result is not as specified, replace the charcoal canister assembly.

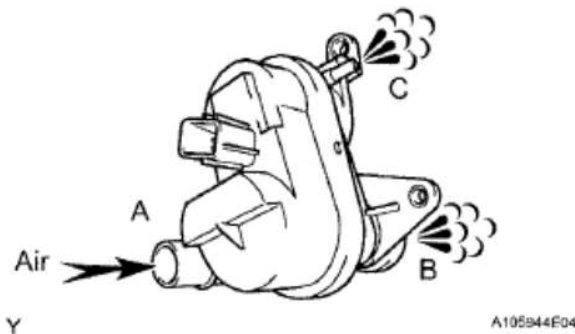


Fig. 20: Checking Air Flows From Port A To Port B And C

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

3. Connect the positive (+) lead of the battery to terminal 7 and the negative (-) lead to terminal 6.
4. Check that the valve is closed.

If the result is not as specified, replace the charcoal canister assembly.

5. Install the canister pump module.

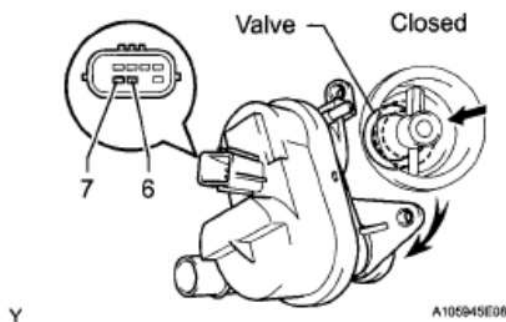


Fig. 21: Checking Valve Is Closed

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

INSTALLATION

1. INSTALL CHARCOAL CANISTER ASSEMBLY

- a. Connect the charcoal canister assembly with the 3 nuts.

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Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

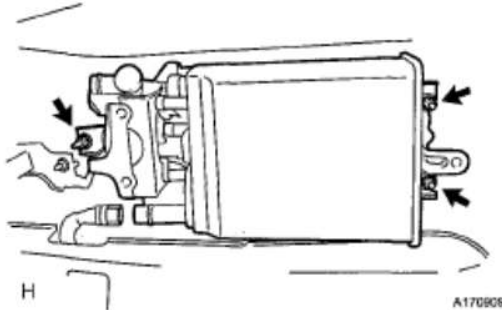


Fig. 22: Locating Charcoal Canister Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the quick connector with the pipe, then push in the quick connector until the retainer makes a "click" sound to connect the charcoal canister fuel hose to the charcoal canister assembly.

NOTE:

- Check that there are no scratches or foreign objects around the connected part of the quick connector and pipe before this work.
- After connecting the charcoal canister fuel hose, confirm that it is securely connected by pulling the quick connector.

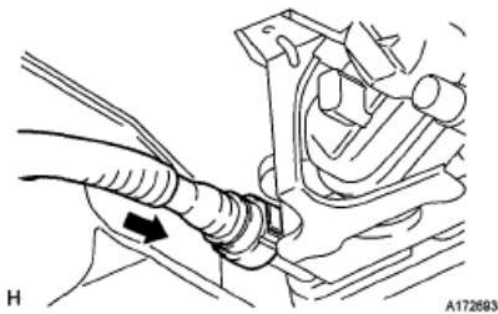


Fig. 23: Aligning Quick Connector With Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the hose.

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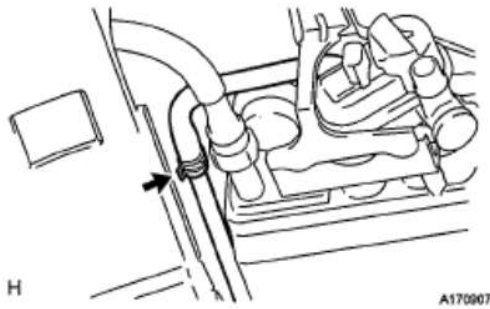


Fig. 24: Locating Charcoal Canister Fuel Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Connect the hose and connector.



Fig. 25: Locating Hose And Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL NO. 3 FRONT FLOOR HEAT INSULATOR

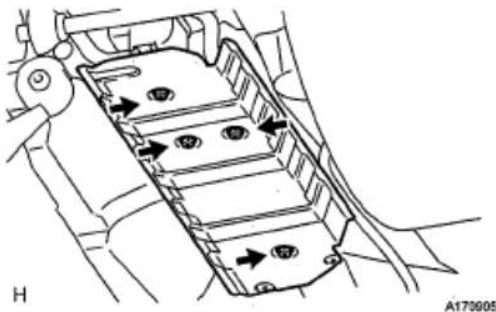
- a. Install the No. 3 front floor heat insulator with the 4 bolts.

Torque: 4.9 N*m (50 kgf*cm, 43 in.*lbf)

3. INSTALL CENTER EXHAUST PIPE ASSEMBLY (See INSTALLATION)

4. INSTALL TAIL EXHAUST PIPE ASSEMBLY (See INSTALLATION)

5. INSPECT FOR EXHAUST GAS LEAK



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Fig. 26: Locating No. 3 Front Floor Heat Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PURGE VALVE

COMPONENTS

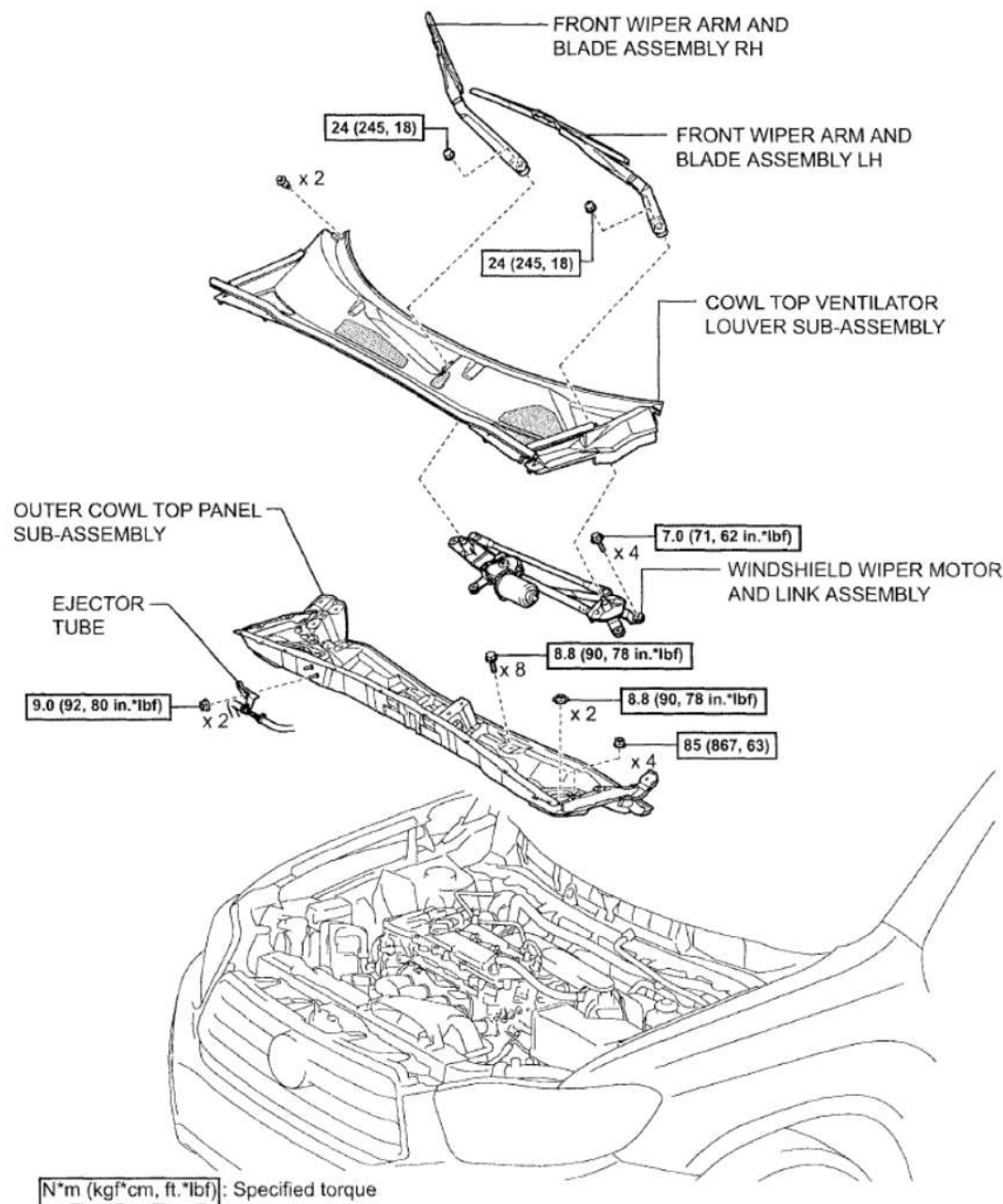


Fig. 27: Identifying Purge Valve Components With Torque Specifications (1 Of 2)

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

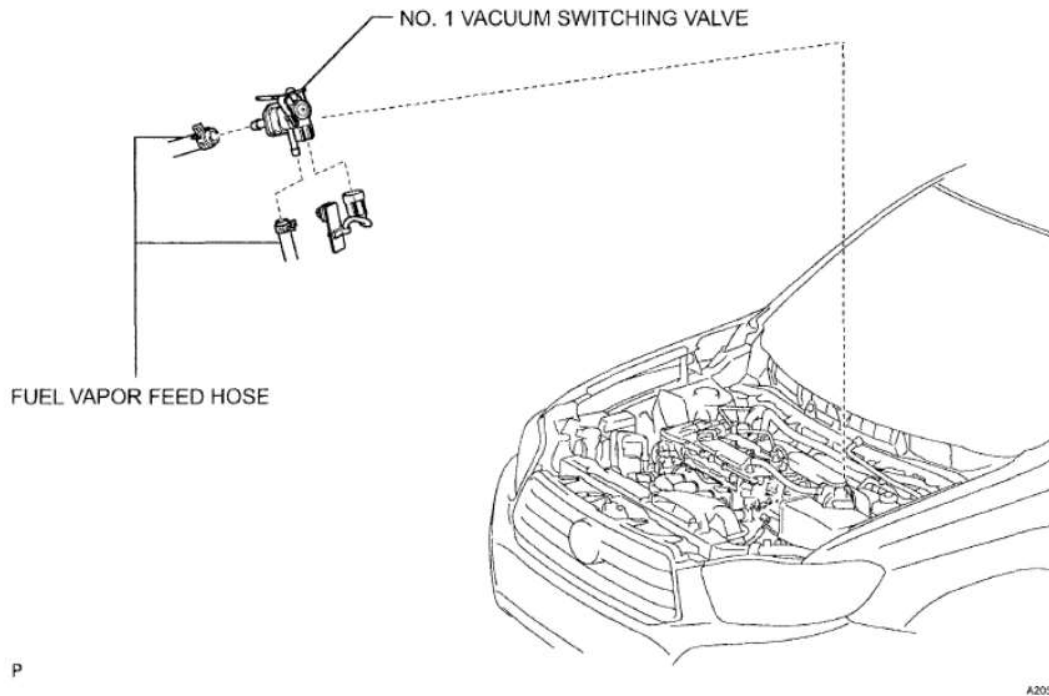


Fig. 28: Identifying Purge Valve Components With Torque Specifications (2 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **SEPARATE EJECTOR TUBE** (See **REMOVAL**)
2. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See **REMOVAL**)
3. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See **REMOVAL**)
4. **REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See **REMOVAL**)
5. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See **REMOVAL**)
6. **REMOVE OUTER COWL TOP PANEL SUB-ASSEMBLY** (See **REMOVAL**)
7. **REMOVE NO. 1 VACUUM SWITCHING VALVE**
 - a. Disconnect the No. 1 vacuum switching valve connector.
 - b. Disconnect the wire harness clamp.
 - c. Disconnect the 2 fuel vapor feed hoses from the No. 1 vacuum switching valve.
 - d. Remove the No. 1 vacuum switching valve from the air cleaner hose.

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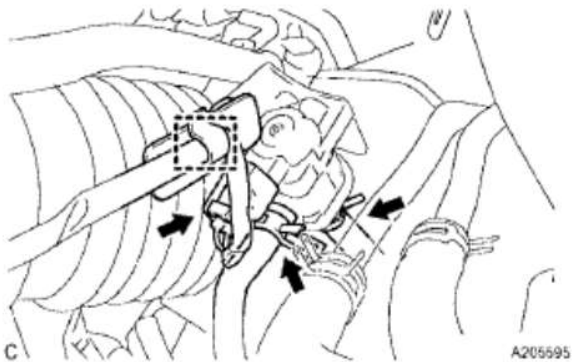


Fig. 29: Locating No. 1 Vacuum Switching Valve Connector And Fuel Vapor Feed Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT NO. 1 VACUUM SWITCHING VALVE

- a. Measure the resistance according to the value(s) in the table below.

Standard Resistance

STANDARD RESISTANCE CHART

Tester Connection	Condition	Specified Condition
1-2	20°C (68°F)	23 to 26 ohms

If the result is not as specified, replace the No. 1 vacuum switching valve.

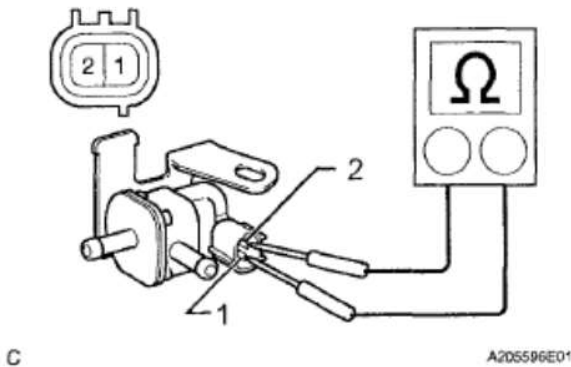


Fig. 30: Measuring Resistance Of Vacuum Switching Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check the operation of the No. 1 vacuum switching valve.
 - 1. Check that air does not flow from port F when air is applied to port E.

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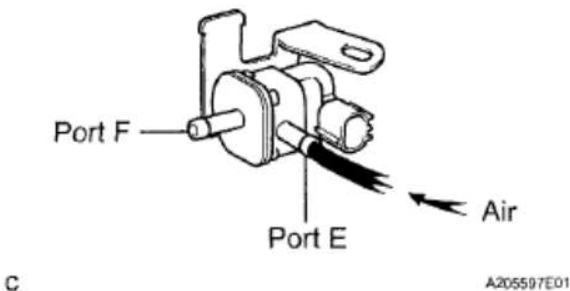


Fig. 31: Checking Air Does Not Flow From Port F When Air Is Applied To Port E
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Apply battery voltage to the connector, and check the VSV operation.

OK

MEASUREMENT CONDITION AND SPECIFIED CONDITION

Measurement Condition	Specified Condition
Battery positive (+) --> Terminal 1 Battery negative (-) --> Terminal 2	Air flows from port E to port F

If the result is not as specified, replace the No. 1 vacuum switching valve.

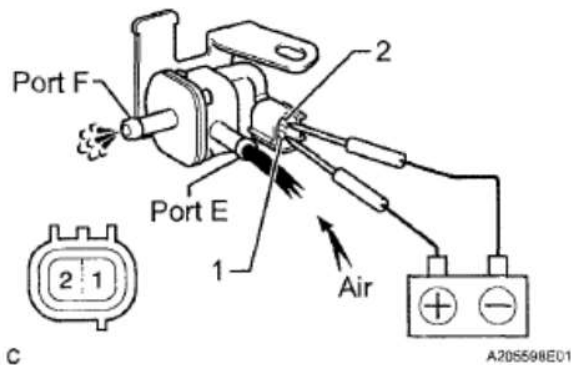


Fig. 32: Applying Battery Voltage To Connector, And Check VSV Operation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL NO. 1 VACUUM SWITCHING VALVE

- a. Install the No. 1 vacuum switching valve to the air cleaner hose.
- b. Connect the 2 fuel vapor feed hoses to the No. 1 vacuum switching valve.

HINT:

The direction of the hose clamp is indicated in the illustration.

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- c. Connect the wire harness clamp.
- d. Connect the No. 1 vacuum switching valve connector.

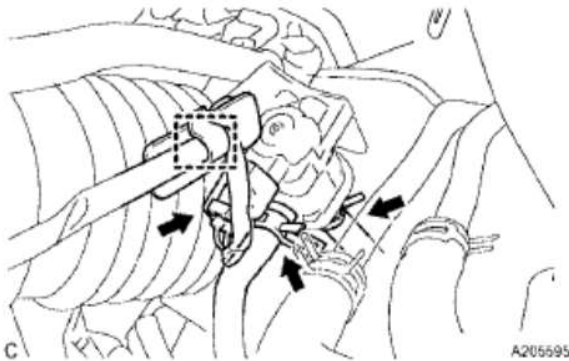


Fig. 33: Locating Fuel Vapor Feed Hoses And No. 1 Vacuum Switching Valve Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL OUTER COWL TOP PANEL SUB-ASSEMBLY** (See INSTALLATION)
3. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See INSTALLATION)
4. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See INSTALLATION)
5. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See INSTALLATION)
6. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See INSTALLATION)
7. **INSTALL EJECTOR TUBE** (See INSTALLATION)

FUEL TANK CAP

INSPECTION

1. **INSPECT FUEL TANK CAP ASSEMBLY**
 - a. Visually check that the cap and gasket are not deformed or damaged.

If the result is not as specified, replace the fuel tank cap assembly.

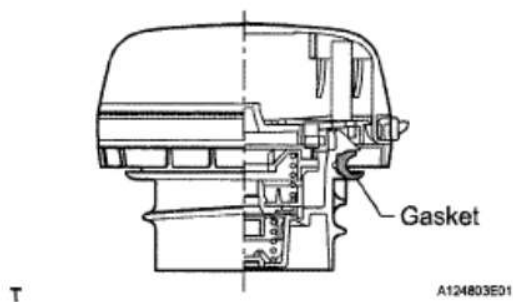


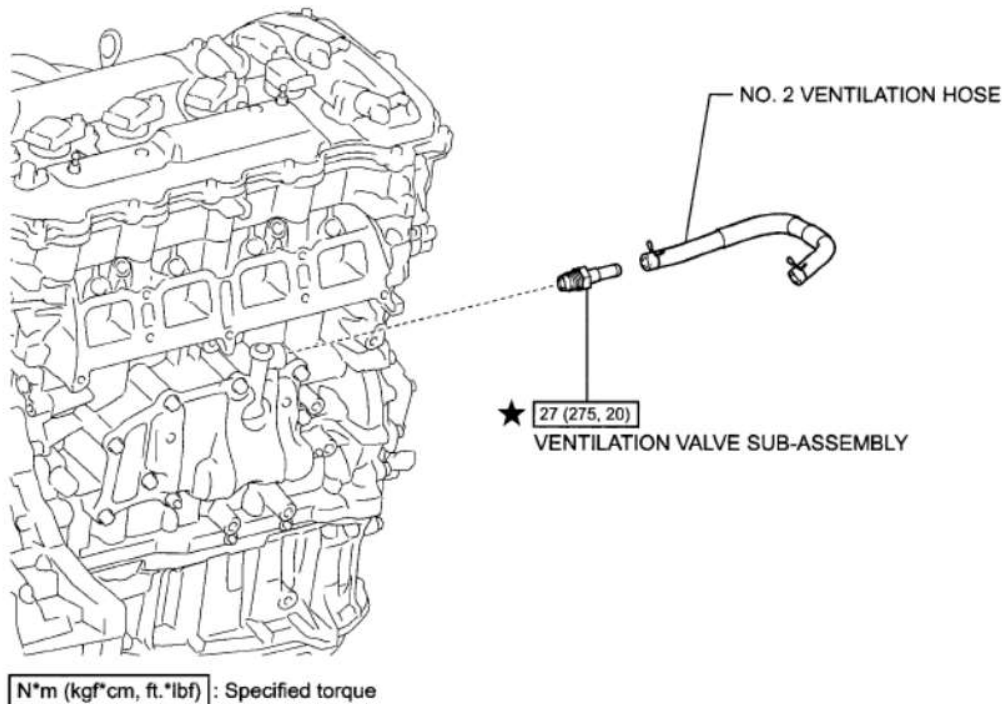
Fig. 34: Inspecting Fuel Tank Cap Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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PCV VALVE

COMPONENTS



★ Precoated part

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Fig. 35: Identifying PCV Valve Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE INTAKE MANIFOLD**
 - a. Remove the intake manifold (See **REMOVAL**).
2. **REMOVE VENTILATION VALVE SUB-ASSEMBLY**
 - a. Disconnect the No. 2 ventilation hose from the ventilation valve sub-assembly.

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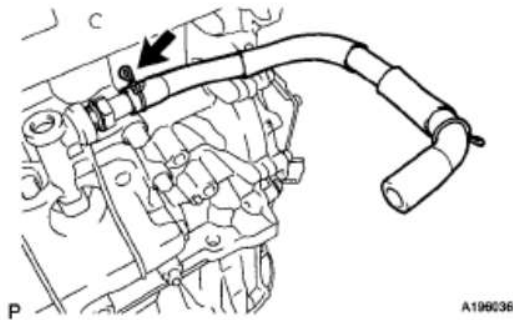


Fig. 36: Locating No. 2 Ventilation Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 19 mm deep socket wrench, remove the ventilation valve sub-assembly.

INSPECTION**1. INSPECT VENTILATION VALVE SUB-ASSEMBLY**

- a. Install a clean hose to the ventilation valve sub-assembly.

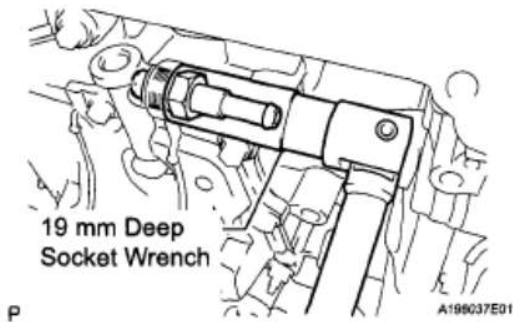


Fig. 37: Removing Ventilation Valve Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check the ventilation valve operation.
 1. Blow air into the cylinder block side and check that air passes through easily. If the result is not as specified, replace the ventilation valve sub-assembly.

CAUTION: Do not suck air through the valve. Petroleum substances inside the valve are hazardous to your health.

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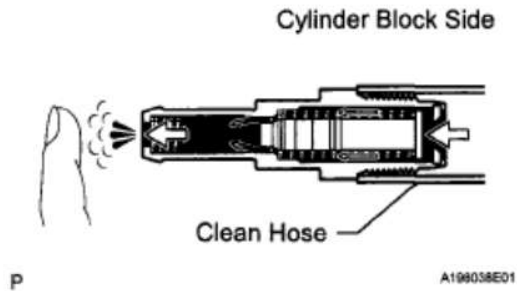


Fig. 38: Checking Ventilation Valve Operation - Blow Air Into Cylinder Block Side
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Blow air into the intake manifold side and check that air passes through with difficulty. If the result is not as specified, replace the ventilation valve sub-assembly.
- c. Remove the clean hose from the ventilation valve sub-assembly.

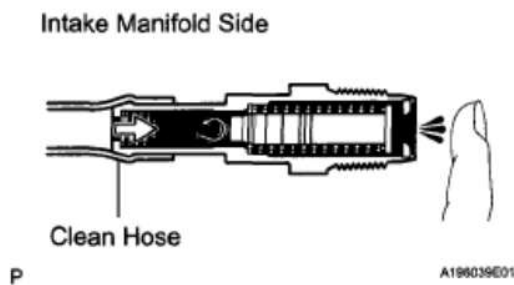


Fig. 39: Checking Ventilation Valve Operation - Blow Air Into Intake Manifold Side
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

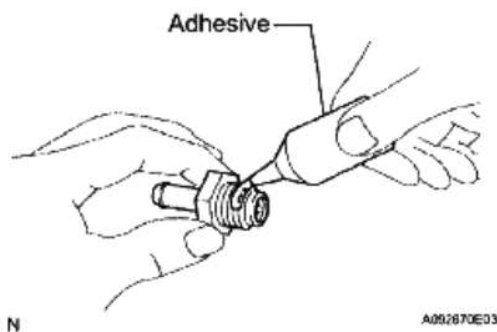
INSTALLATION

1. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Apply adhesive to 2 or 3 threads of the ventilation valve sub-assembly.

Adhesive:

Toyota genuine adhesive 1324, three bond 1324 or equivalent



2009 Toyota Highlander Limited

2009 ENGINE Emission Control (1AR-FE) - Highlander

Fig. 40: Applying Adhesive To Threads Of Ventilation Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 19 mm deep socket wrench, install the ventilation valve sub-assembly.

Torque: 27 N*m (275 kgf*cm, 20 ft.*lbf)

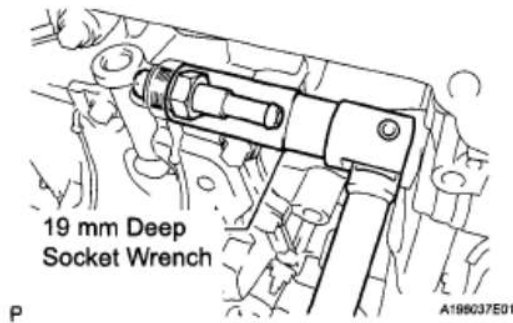


Fig. 41: Installing Ventilation Valve Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the No. 2 ventilation hose to the ventilation valve sub-assembly.

2. INSTALL INTAKE MANIFOLD

- a. Install the intake manifold (See **INSTALLATION**).

3. INSPECT FOR OIL LEAK

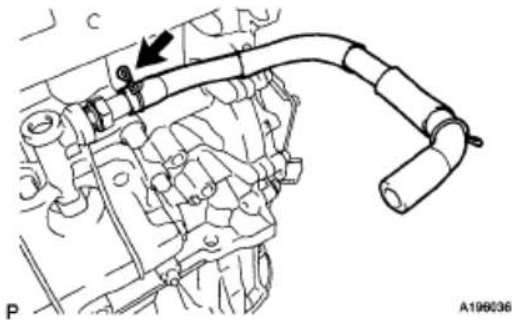


Fig. 42: Locating No. 2 Ventilation Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.