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Technicians Reference Booklet

Evaporative System Diagnosis

AUTOMOTIVE Youth Educational Systems YES®

September 2003

MSA5P0922C

Technical Training

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Introduction

Testing the on board refueling vapor recovery system involves checking all solenoids, valves and plumbing for air tightness, air flow and proper operation. A failure in any of these items will create a failure in the system.

The evaporative system pressure tester must be used with the Select monitor to achieve the correct results. Begin by first reading the warnings included with the special tool. Section by Section testing will ensure all fittings, hoses, pipes, valves and components are tested.

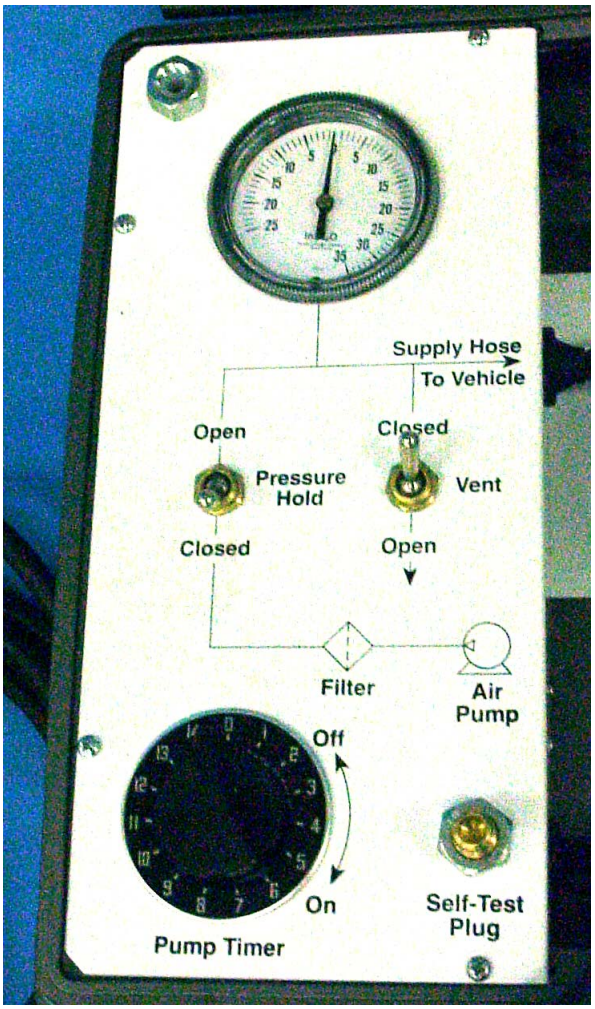
Legend

PT ..... Pressure Tester
CPC ..... Canister Purge Control
M ..... Manifold
D ..... Drain
SOV ..... Shut Off Valve
F ..... Fuel
FH ..... Fuel Hose
PCV ..... Pressure Control Valve
V ..... Vent
PS ..... Pressure Sensor

Pressurize

This is how you pressurize the tester when instructed to do so.

1. Place Pressure hold in open position.
2. Place Vent in closed position.
3. Turn the pump timer on.
4. Observe gauge.
5. When highest pressure is reached place the Pressure hold in closed position.
6. Turn pump timer off.



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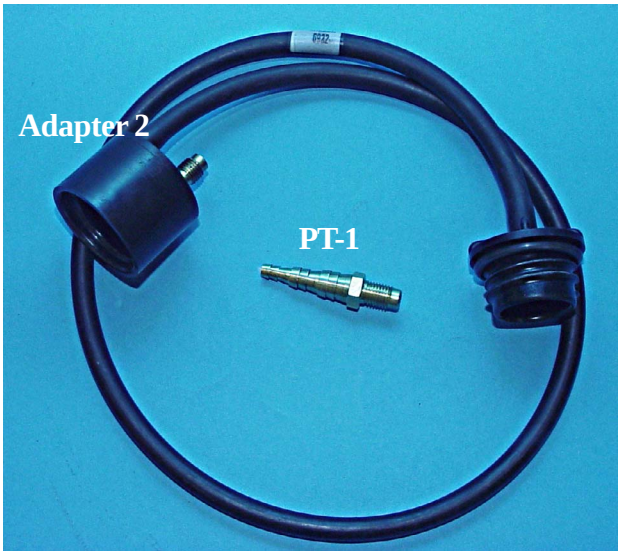
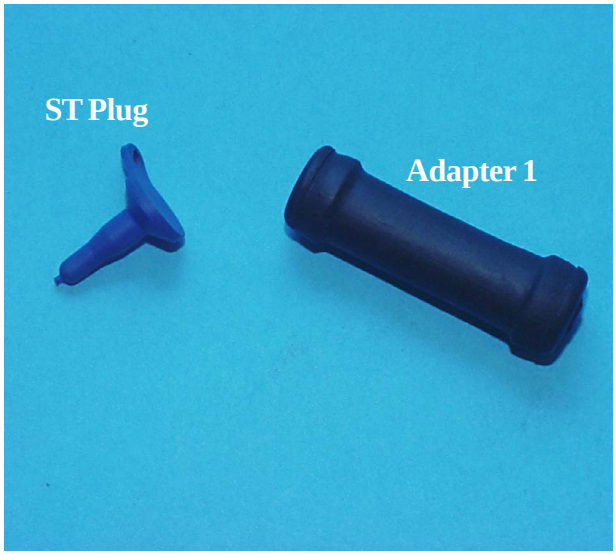
Abbreviation	Component	Location
CPC	Canister Purge Control Solenoid	Right underside of intake manifold.
PCV	Pressure control valve	Above rear differential.
D	Drain valve	Above canister right rear of vehicle.
SOV	Shut Off Valve behind the right rear inner fender.	Located on the fuel filler neck

Test Sequence

- **Follow the directions in each of the above tests.**
- **At the end of a given test a stop sign will appear to signify that you need to go to the next test.**
- **Complete all 6 tests to evaluate the entire evaporative system.**
- **Directions are included in each test that guides you through results that indicate a failure.**
- **Always complete the 6 tests even if a failure has been found and repaired early in the test sequence**.





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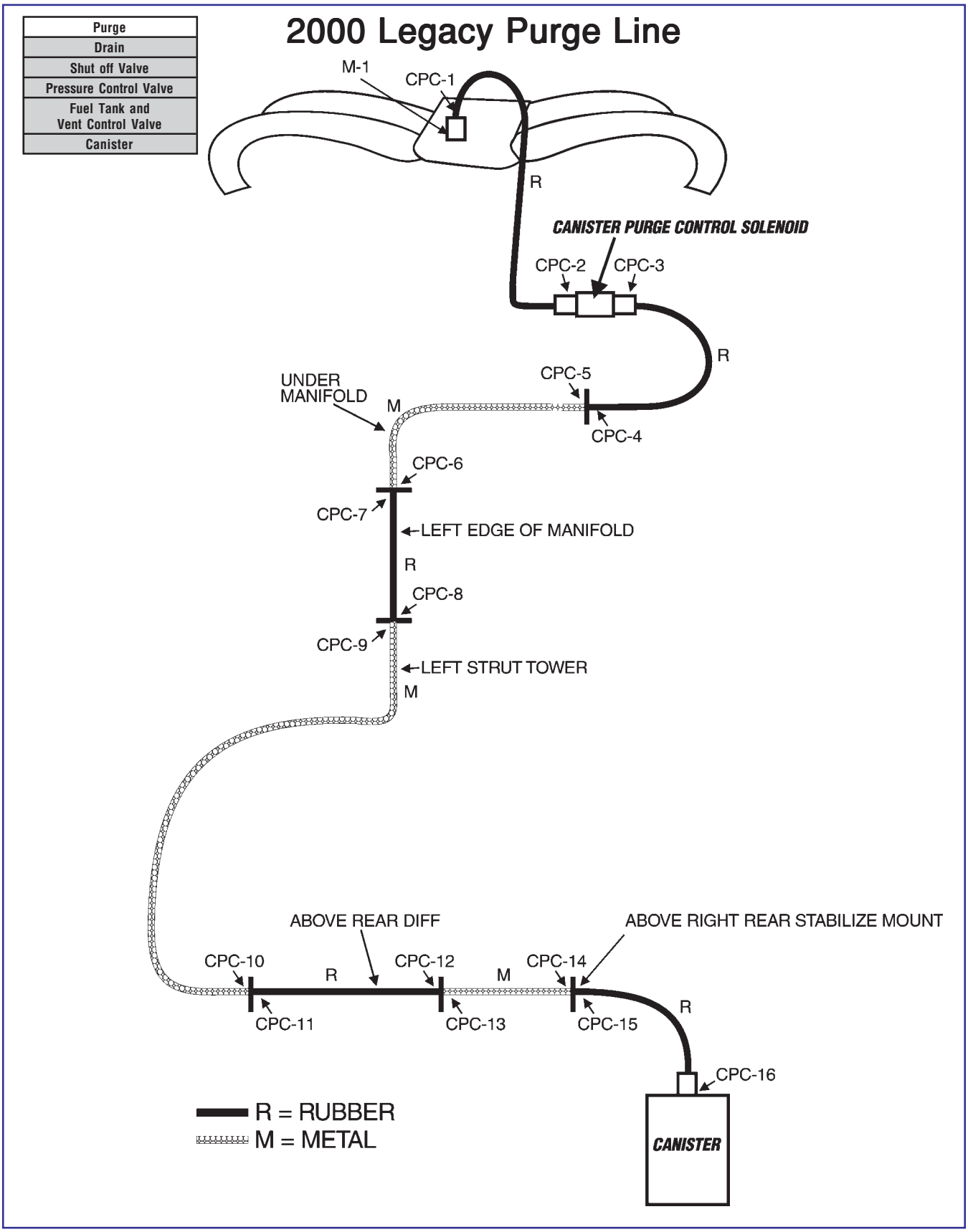


Purge System Test

(1) Disconnect CPC-1 from M-1.

(2) Start engine and check for strong vacuum source at M-1.

(3) Engine off and ignition off

(4) Connect select monitor to data link connector.

(5) Connect inspection mode connectors.

(6) Ignition on and engine off

(7) Turn on select monitor and adjust to system operation check mode.

Activate a component and turn it off to establish full control of all system operation check mode items.

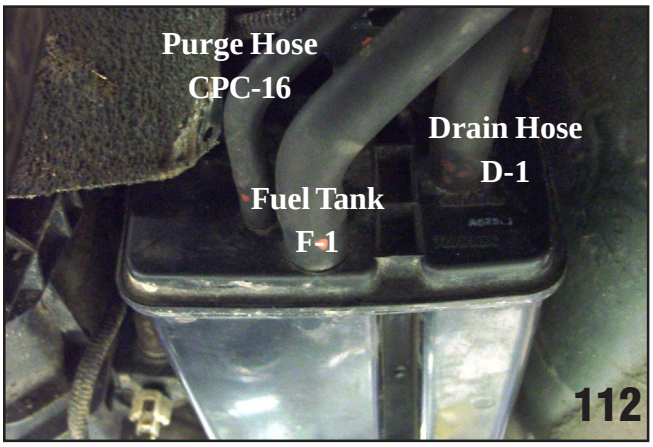
Step 8 and 9 will test the air tightness of the vacuum line from the intake manifold to the canister purge control solenoid. The air tightness of the solenoid is checked at this time also.

(8) Connect PT-1 to CPC-1 and "pressurize".

(9) Did pressure hold?
YES go to step (10).
NO go to step (10F).

Step 10 and 11 will test the electrical and mechanical operation of the canister purge control solenoid and the vacuum line from the out put side of the solenoid to the canister for restrictions or blockages.

(10) Disconnect CPC-16 from canister. Picture 112.



(11) Activate CPC solenoid with select monitor.

(12) Did pressure go to zero immediately?
YES go to step (13).
NO go to step (13F).

Step 13 and 14 will test the vacuum hose from the canister purge control solenoid to the canister for air tightness.

(13) Insert ST plug into CPC-16 to block hose.

(14) Pressurize.

(15) Did pressure hold?
YES go to step (16).
NO go to step (16F).

(16) Turn CPC solenoid off with select monitor.

(17) Remove PT-1 from CPC-1.

(18) Connect CPC-1 to M-1.

(19) Remove ST plug from CPC-16.

(20) Connect CPC-16 to canister.

Notes:

STOP

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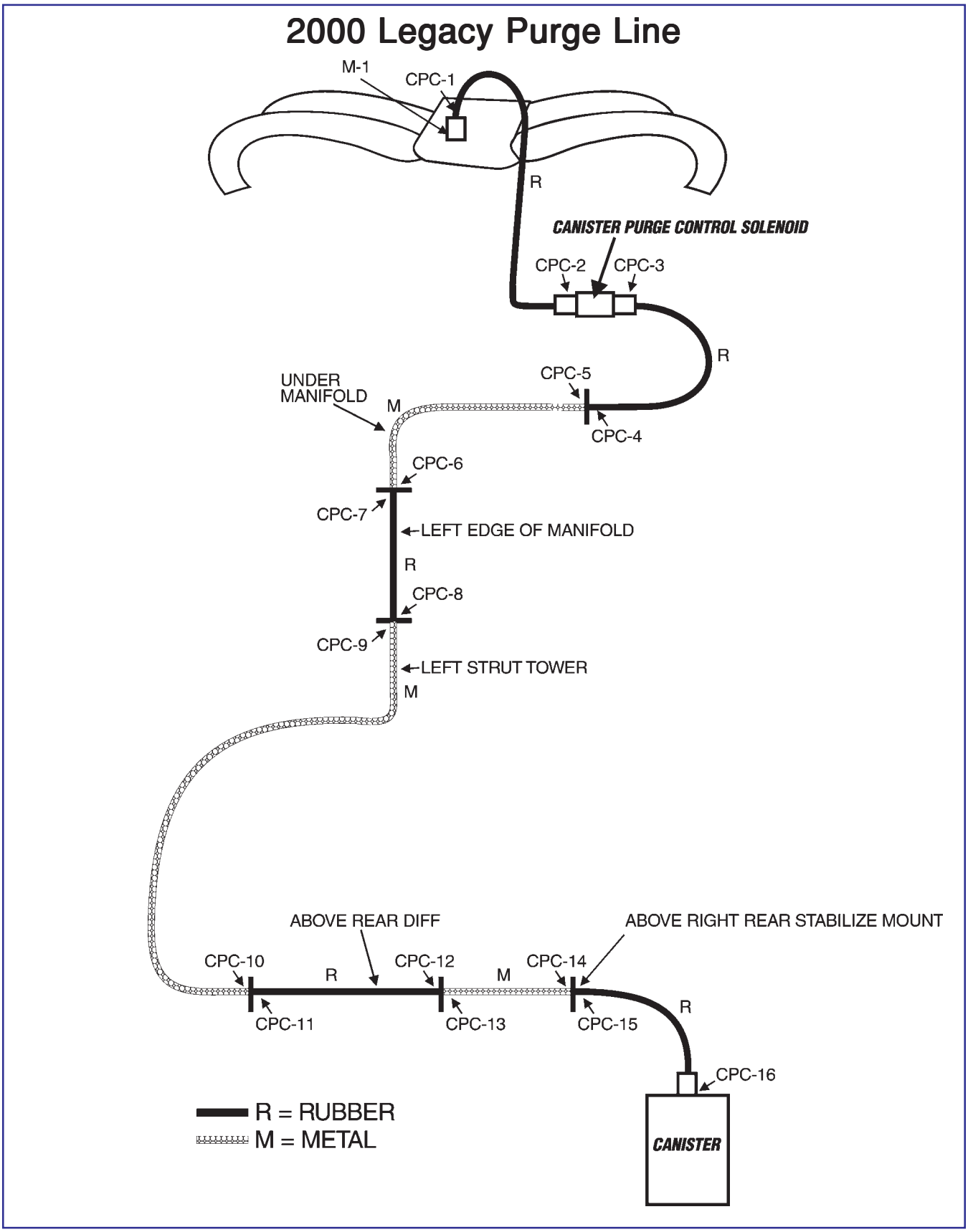

Purge Line 10F

(10F) Disconnect CPC-2 from CPC solenoid.
(10F1) Connect ST plug to CPC-2.
(10F2) Pressurize.
(10F3) Does pressure hold?
YES – Replace CPC solenoid and go to step 8.
NO – Replace hose and go to step 8.

Purge Line 13F

(13F) Turn off CPC solenoid with select monitor.
(13F1) Disconnect CPC-4 from CPC-5.
(13F2) Pressurize and turn on CPC solenoid with select monitor.
(13F3) Does pressure go to zero immediately?
NO go to step (13F4).
YES go to step (13G).
(13F4) Turn off CPC solenoid with select monitor and connect CPC-4 to CPC-5.
(13F5) Disconnect CPC-3 from CPC solenoid.
(13F6) Pressurize.
(13F7) Turn on CPC solenoid with select monitor.
(13F8) Does pressure go to zero immediately?
YES – Replace hose "CPC-3 to CPC-4" and go to step 8.
NO – Replace CPC solenoid and go to step 8.

Purge Line 13G

(13G) Turn off CPC solenoid with select monitor.
(13G1) Connect PT-1 to CPC-5.
(13G2) Pressurize.
(13G3) Disconnect CPC-8 from CPC-9.
(13G4) Does pressure go to zero immediately?
YES go to step (13H).
NO go to step (13G5).
(13G5) Pressurize.
(13G6) Disconnect CPC-7 from CPC-8.
(13G7) Does pressure go to zero immediately?
YES – Replace hose "CPC-7 to CPC-8" and go to step (8).
NO – An obstruction exists in the metal hose from "CPC-5 to CPC-6", clean and remove obstruction or replace hose. Then go to step (8).
(13H) Connect adapter-1 to PT-1.
(13H1) Connect adapter-1 to CPC-8.
(13H2) Pressurize.
(13H3) Disconnect CPC-12 form CPC-13.
(13H4) Does pressure drop to zero immediately?
YES go to step (13I).
NO go to step (13H5).
(13H5) Pressurize.
(13H6) Disconnect CPC-10 from CPC-11.
(13H7) Does pressure drop to zero immediately?
YES – Replace hose "CPC-11 to CPC-12" and go to step (8).
NO – An obstruction exists in the metal hose between "CPC-10 and CPC-9" clean and remove obstruction or replace hose. Then go to step (8).

Purge Line 13I

(13I) Connect adapter-1 to CPC-13.
(13I1) Pressurize.
(13I2) Disconnect CPC-14 to CPC-15.
(13I3) Did pressure drop to zero immediately?
YES – Replace hose "CPC-15 to CPC-16" and go to step (8).
NO – An obstruction exists in the metal hose between "CPC-13 and CPC-14", clean and remove obstruction or replace hose. Then go to step (8).

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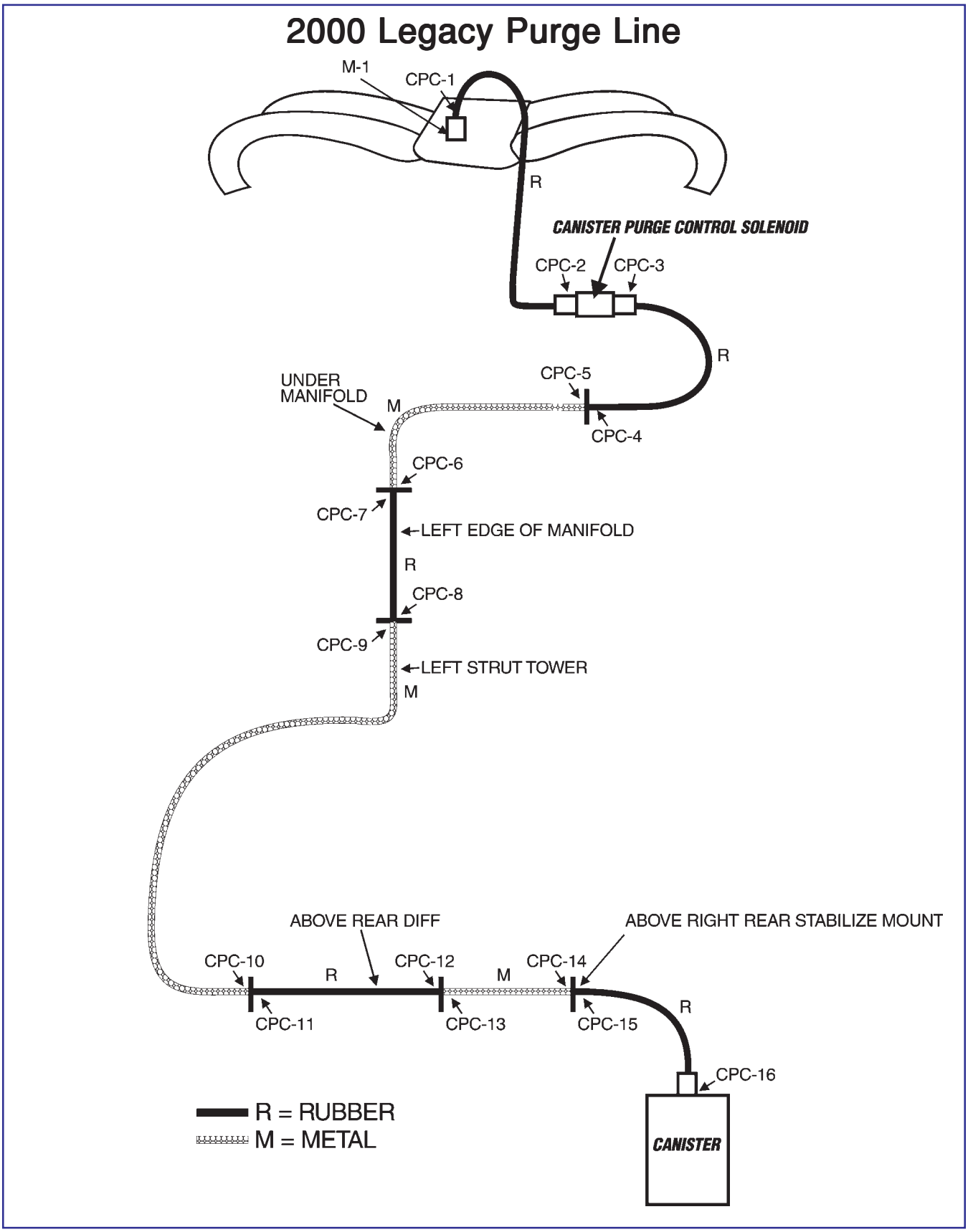


Purge Line 16F

(16F) Turn CPC solenoid off with select monitor.

(16F1) Disconnect CPC-14 from CPC-15.

(16F2) Connect adapter-1 with ST plug to CPC-14.

(16F3) Pressurize.

(16F4) Turn CPC solenoid on with select monitor.

(16F5) Does pressure hold?
NO go to step (16F6).
YES – Replace hose "CPC-15 to CPC-16".

(16F6) Turn CPC solenoid off with select monitor.

(16F7) Disconnect "CPC-12 to CPC-13".

(16F8) Connect ST Plug to CPC-12.

(16F9) Pressurize.

(16F10) Turn CPC solenoid on with select monitor.

(16F11) Does pressure hold?
YES – Replace metal hose "CPC-13 to CPC-14" and go to step 8.
Ensure hoses disconnected in prior step, have been reconnected.
NO – Go to (16F12)

(16F12) Turn CPC solenoid off with select monitor.

(16F13) Disconnect CPC-10 from CPC-11.

(16F14) Connect adapter-1 with ST plug to CPC-10.

(16F15) Pressurize.

(16F16) Turn CPC solenoid on with select monitor.

(16F17) Does pressure hold?
YES – Replace hose "CPC-11 to CPC-12" and go to step 8.
NO – Go to (16F18).

Purge Line 16F18

(16F18) Turn off CPC solenoid with select monitor.

(16F19) Disconnect CPC-8 from CPC-9.

(16F20) Connect ST Plug to CPC-8.

(16F21) Pressurize.

(16F22) Turn CPC solenoid on with select monitor.

(16F23) Does pressure hold?
YES – Replace metal hose "CPC-9 to CPC-10" and go to step (8).
Ensure hoses disconnected in prior step, have been reconnected.
NO go to step (16F24).

(16F24) Turn off CPC solenoid with select monitor.

(16F25) Disconnect CPC-6 from CPC-7.

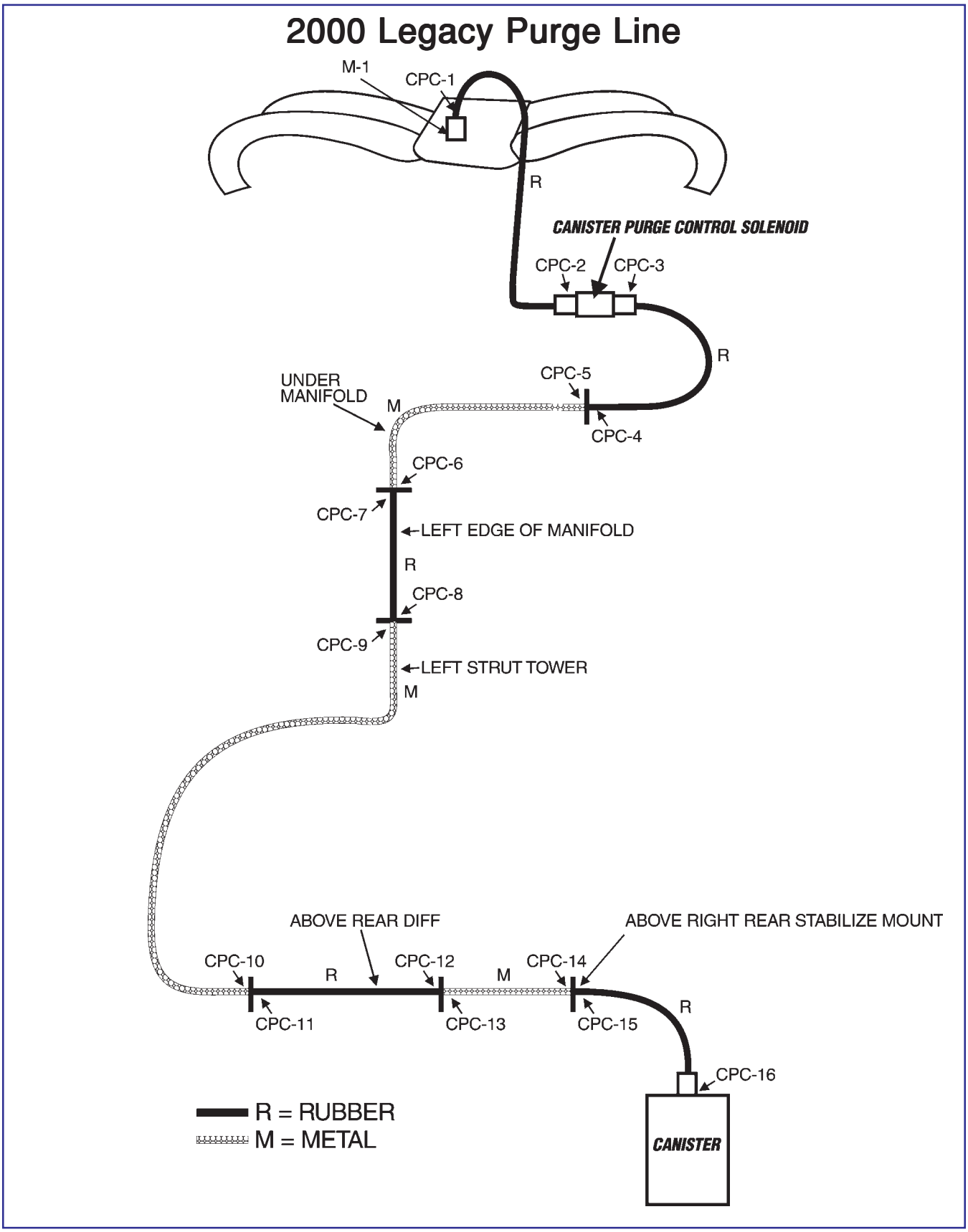
(16F26) Connect adapter-1 with ST plug to CPC-6.

(16F27) Pressurize.

(16F28) Turn CPC solenoid on with select monitor.

(16F29) Does pressure hold?

Notes:


2000 Legacy Purge Line
M-1
CPC-1
R
CANISTER PURGE CONTROL SOLENOID
CPC-2
CPC-3
R
CPC-5
UNDER MANIFOLD
M
CPC-4
CPC-6
CPC-7
LEFT EDGE OF MANIFOLD
R
CPC-8
CPC-9
LEFT STRUT TOWER
M
ABOVE REAR DIFF
ABOVE RIGHT REAR STABILIZE MOUNT
CPC-10
R
CPC-12
M
CPC-14
CPC-11
CPC-13
CPC-15
R
CPC-16
CANISTER
R = RUBBER
M = METAL

Purge Line 16F34

(16F34) Does pressure hold?

YES – Replace metal hose "CPC-5 to CPC-6" and go to step (8).

NO – Go to step (16F35).

(16F35) Disconnect CPC-3 from CPC solenoid.

(16F36) Connect adapter-1 with ST plug to CPC solenoid.

(16F37) Pressurize.

(16F38) Turn CPC solenoid on with select monitor.

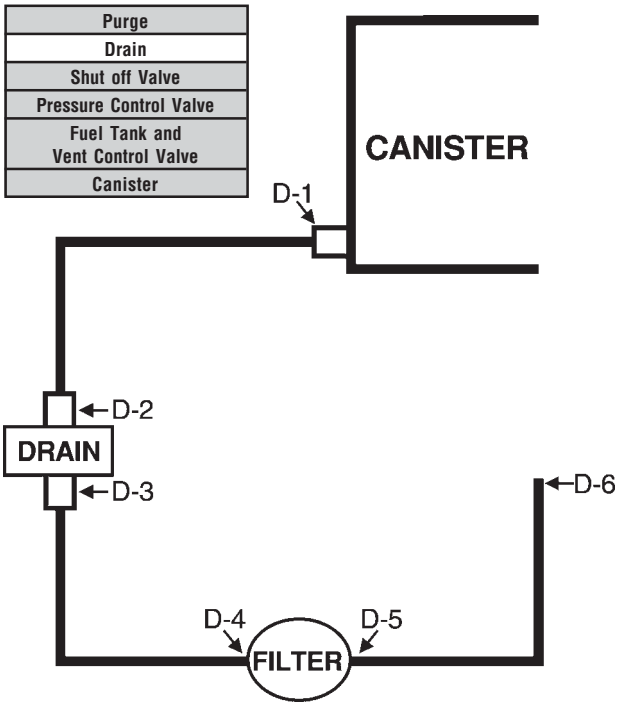
(16F39) Does pressure hold?

YES – Replace hose "CPC-3 to CPC-4" and go to step (8).

NO – Replace CPC solenoid and go to step (8).

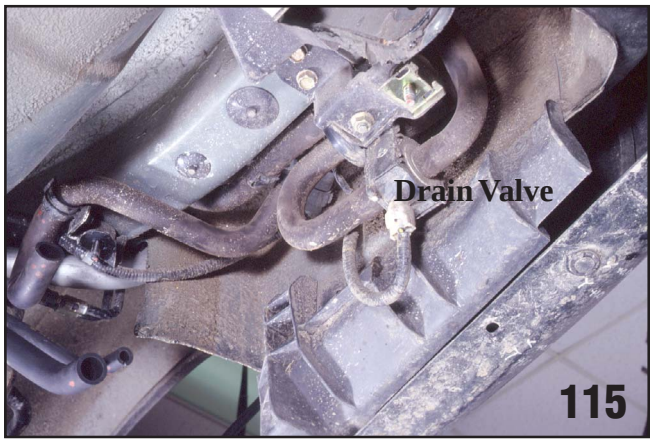
Notes:

2000 Legacy Drain Line



Drain System Test

Steps 1 through 4 are testing the air tightness of the adapter.



(1) Disconnect D-1 from canister. Picture 115.

(2) Connect PT-1 with ST adapter-1.

(3) Block ST adapter-1 with ST Plug and pressurize.

(4) Does pressure hold?
YES go to step (5).
NO, replace Adapter-1 and go to step (1).

(5) Remove ST-plug from ST-adapter-1.
Step 6 and 7 will test the drain hoses, canister, drain valve and filter for restrictions and blockages.

(6) Connect ST-adapter-1 with D-1 hose.

(7) Pressurize.

(8) Did pressure buildup?
NO go to step (9).
YES go to step (9F).

Step 9 and 10 will test the air tightness of the vent hoses from the canister to the drain valve and the mechanical and electrical operation of the drain valve.

(9) Activate vent valve solenoid with select monitor.

(10) Pressurize.

(11) Does pressure hold for the time the solenoid is on and then drop to zero?
YES go to step (12).
NO go to step (12F).

(12) Turn off vent valve solenoid with select monitor.

(13) Remove ST adapter-1 from D-1.

(14) Connect D-1 to canister.

Notes:

STOP

Drain System Test 9F

(9F) Disconnect D-5 from filter.

(9F1) Pressurize
Did pressure hold?
YES go to step (9F2).
NO , replace hose from D-5 to D-6 or remove obstruction from hose.

(9F2) Disconnect D-4 from filter.

(9F3) Pressurize
Did pressure hold?
YES go to step (9F4).
NO , replace filter

(9F4) Disconnect D-3 from Drain Valve.

(9F5) Pressurize
Did pressure hold?
YES go to step (9F6).
NO , replace hose from D-3 to D-4 or remove obstruction from hose.

(9F6) Disconnect D-2 from Drain Valve.

(9F7) Pressurize
Did pressure hold?
YES , replace hose from D-1 to D-2 or remove obstruction from hose.
NO , replace Drain Valve

Reconnect all hose.

Drain Line System 12F

(12F) Disconnect D-2 from Drain Valve

(12F1) Insert adapter –1 with ST plug into D-2 hose.

(12F2) Pressurize
Did pressure hold?
YES, replace Drain Valve and go to step 9.
NO, replace hose from D-1 to D-2 an go to step 9.

Notes:

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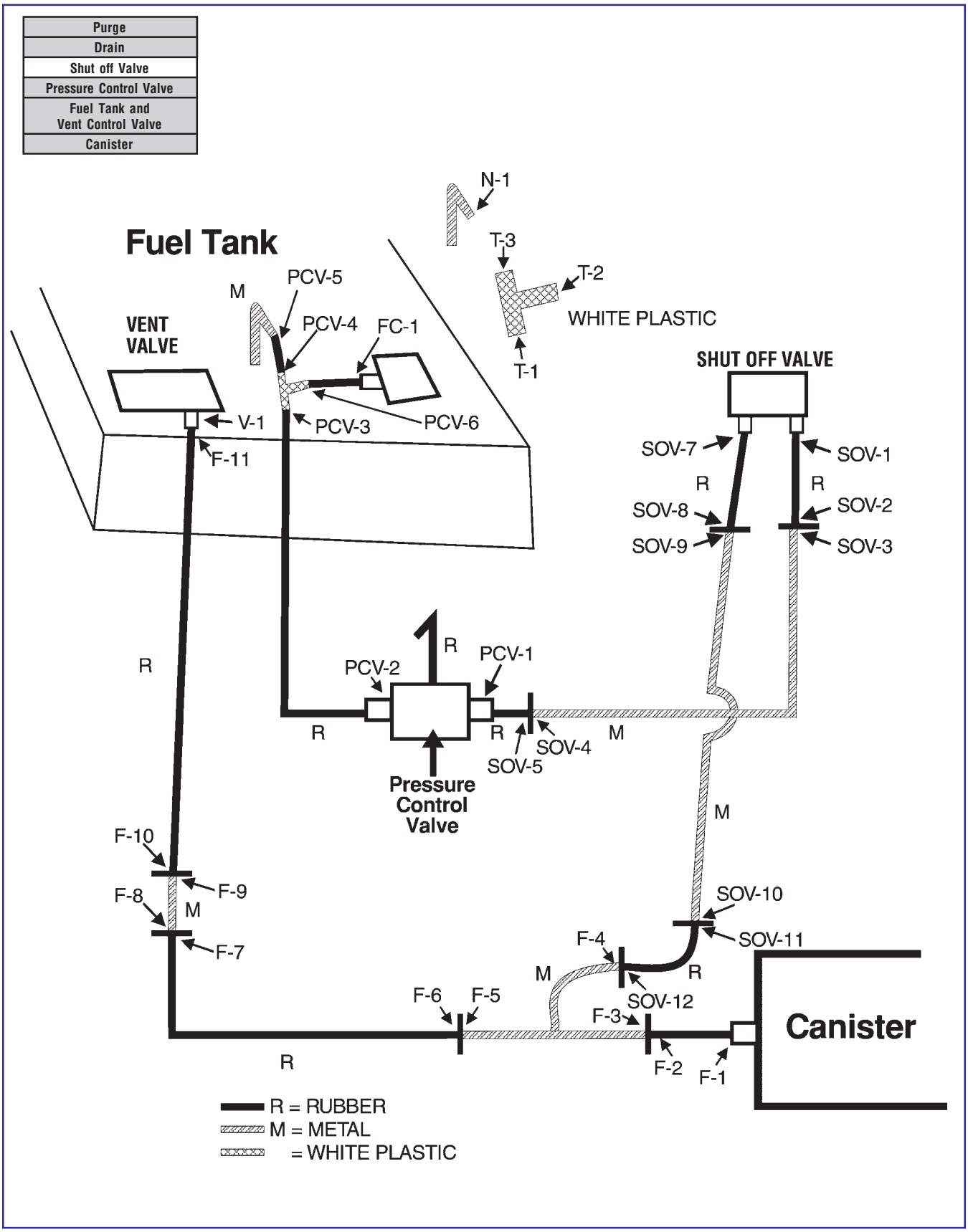


Shut Off Valve Test

Step 1 through 4 tests the vacuum hose from SOV-12 to the shut off valve, the shut off valve itself, and the vacuum hose from the shut off valve to the pressure control valve for restrictions and blockages.

(1) Disconnect SOV-12 from F-4.

(2) Disconnect PCV-1 from PCV.

(3) Connect PT-1 to SOV-12.

(4) Pressurize.

(5) Does pressure build up?
NO go to step (6).
YES go to step (6F).

Step 6 and 7 will test the air tightness of the vacuum hose from SOV-12 to the shut off valve, the shut off valve itself, and the vacuum hose from the shut off valve to the pressure control valve.

(6) Connect ST Plug to PCV-1.

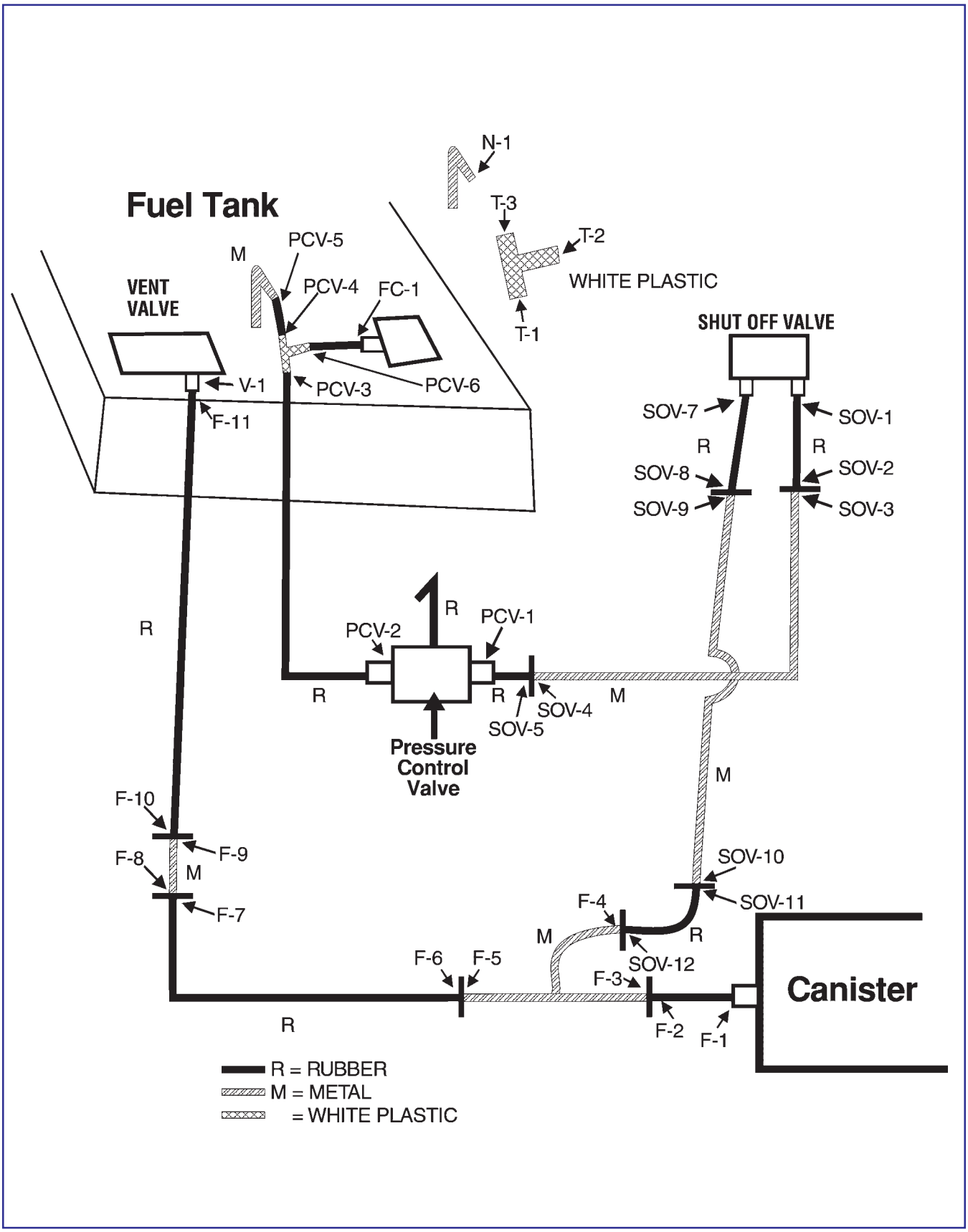
(7) Pressurize.

(8) Did pressure hold?
YES go to step (9).
NO go to step (9F).

(9) Remove Pt-1 from Sov-12 and connect Sov-12 to F-4.

Notes:

2000 Model Year Evaporative System Diagnosis



Shut Off Valve Test 6F

(6F) Pressurize.

(6F1) Disconnect SOV-11 from SOV-10.

(6F2) Does pressure build up?
YES – Replace hose "SOV-12 to SOV-11" and go to step (3).
NO – Connect SOV-11 to SOV-10 and go to step (6F3).

(6F3) Pressurize.

(6F4) Disconnect SOV-8 from SOV-9.

(6F5) Does pressure build up?
YES – Clean or replace metal hose "SOV-1 to SOV-9" and go to step (3).
NO-Connect SOV-8 to SOV-9 and go to step (6F6).

(6F6) Pressurize.

(6F7) Disconnect SOV-7 from Fuel Shut Valve.

(6F8) Does pressure build up?
YES – Replace hose "SOV-8 to SOV-7" and go to step (3).
NO – Connect SOV-7 to Fuel Shut Valve.

(6F9) Pressurize.

(6F10) Disconnect SOV-1 from Fuel Shut Valve.

(6F11) Does pressure build up?
YES – Replace Fuel Shut Valve and go to step (3).
NO – Connect SOV-1 to Fuel Shut Valve and go to step (6F12).

Shut Off Valve Test 6F12

(6F12) Pressurize.

(6F13) Disconnect SOV-2 from SOV-3.

(6F14) Does pressure build up?
YES – Replace hose "SOV-1 to SOV-2" and go to step (3).
NO – Clean or replace metal hose "SOV-3 to SOV-4" and go to step (3).

Notes:

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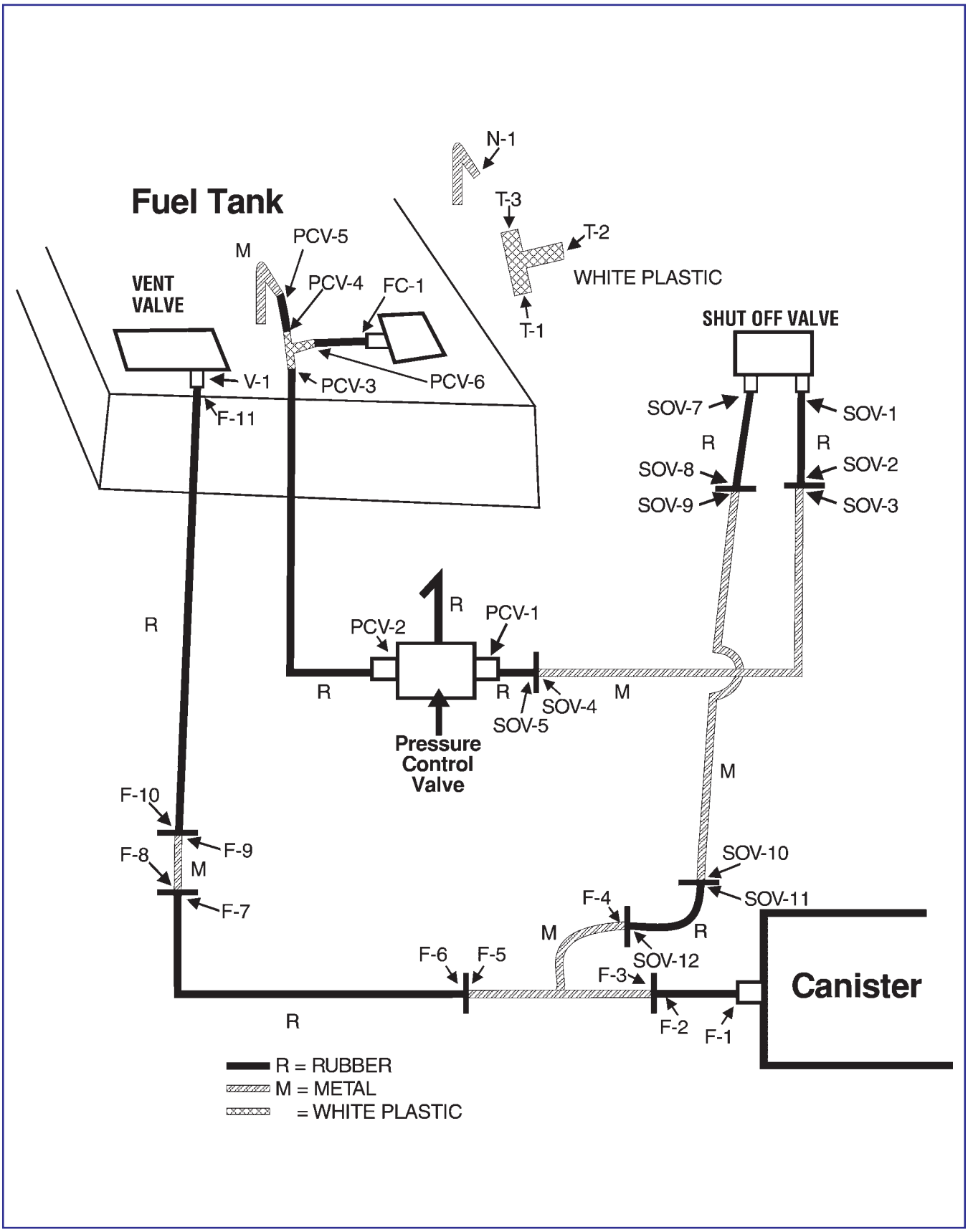

Shut Off Valve Test 9F

(9F) Go to step (9G)

Shut Off Valve Test 9G

(9G) Disconnect SOV-4 from Sov –5.

(9G1) Connect Adapter –1 with ST plug to SOV-4.

(9G2) Did pressure hold?

YES, replace rubber hose PCV-1 to SOV-5 and go to step 6.

NO, go to step (9G3)

(9G3) Disconnect SOV-2 from Sov –3.

(9G4) Connect ST plug to SOV-2.

(9G5) Pressurize

Did pressure hold?

YES , replace metal hose SOV-3 to SOV-4 and go to step 6.

NO, go to step (9G6)

(9G6) Disconnect SOV-1 from shut off valve.

(9G7) Connect Adapter-1 with ST plug to shut off valve.

(9G8) Pressurize

Did pressure hold?

YES , replace rubber hose SOV-1 to SOV-2 and go to step 6.

NO, go to step (9G9)

(9G9) Disconnect SOV-7 from shut off valve and connect ST plug to SOV-7.

Pressurize

Does pressure hold?

YES, replace shut off valve and go to step 6.

NO, go to step (9G10)

(9G10) Disconnect SOV-8 from SOV-9.

(9G11) Connect Adapter-1 with ST plug to SOV-9.

(9G12) Pressurize

Does pressure hold?

YES, replace rubber hose SOV-7 to SOV-8 and go to step 6.

NO, go to step (9G13)

(9G13) Disconnect SOV-10 from SOV-11.

(9G14) Connect ST plug to SOV-11

(9G15) Pressurize

Does pressure hold?

YES, replace metal hose SOV-10 to SOV-9 and go to step 6.

NO, replace rubber hose SOV-11 to SOV-12 and go to step 6.

Notes:

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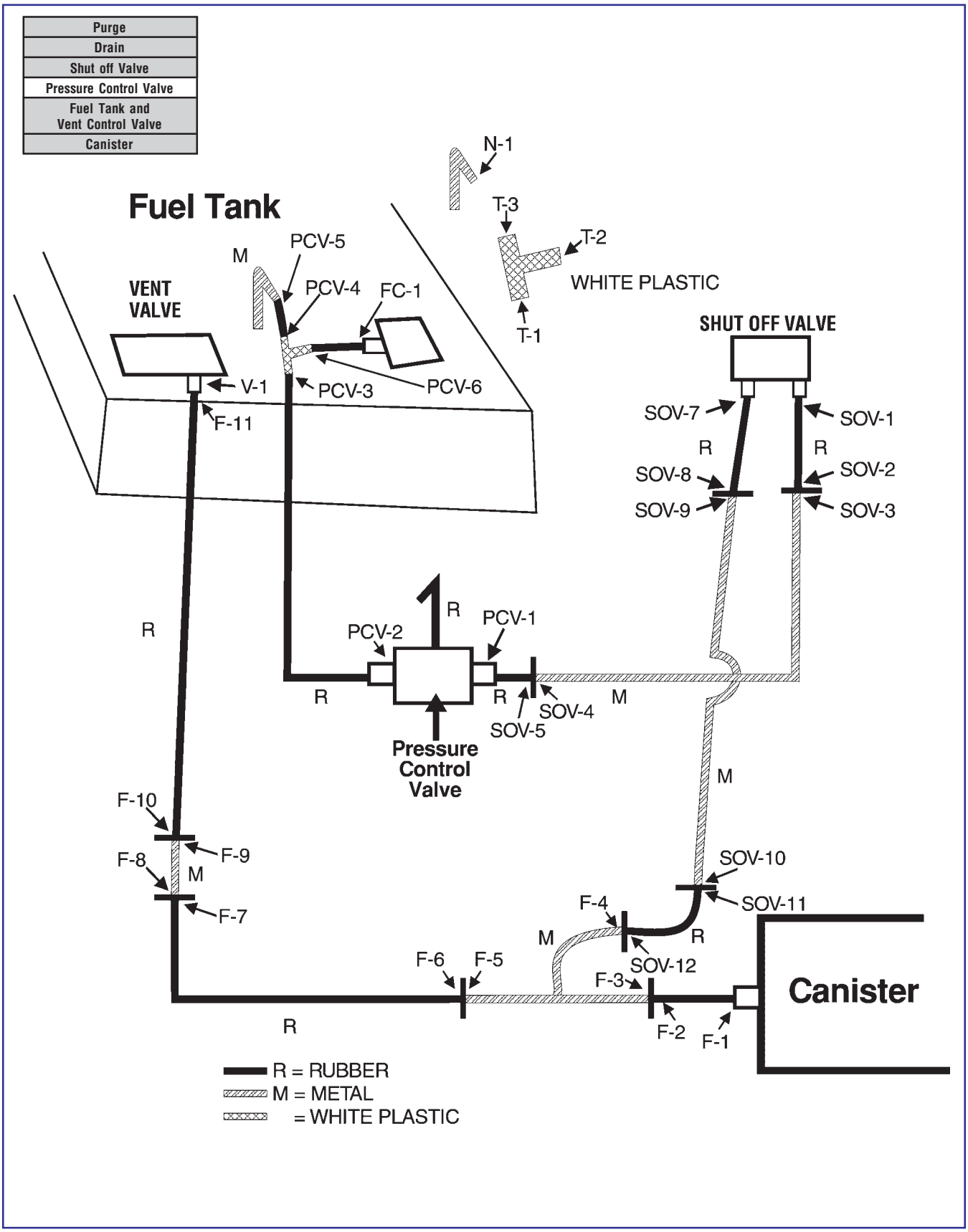


Pressure Control Valve Test

Step 1 through 8 will test the Pressure control valve for electrical and mechanical operation.

(1) Remove ST plug from PCV-1.

(2) Connect PT-1 with ST adapter-1.

(3) Disconnect PCV-2 from PCV.

(4) Connect adapter-1 to PCV, applying pressure where PCV-2 connects to PCV.

(5) Activate PCV solenoid with select monitor.

(6) Turn pump timer on with HOLD SWITCH to OPEN position.

(7) Does pressure build to approximately 21 and then fluctuates by 1 as solenoid turns on and off?
YES go to step (8).
NO , replace PCV and go to step (1)
Turn pump timer off.
Turn the Pressure control valve off with the select monitor.

Step 8 test the PCV for air tightness.

(8) Block PCV at PCV-1 and pressurize.
Did pressure hold?
YES go to step (9).
NO, replace PCV and go to step (1).

(9) Turn pump timer off.

(10) Turn off PCV with select monitor.

(11) Remove ST plug from PCV.

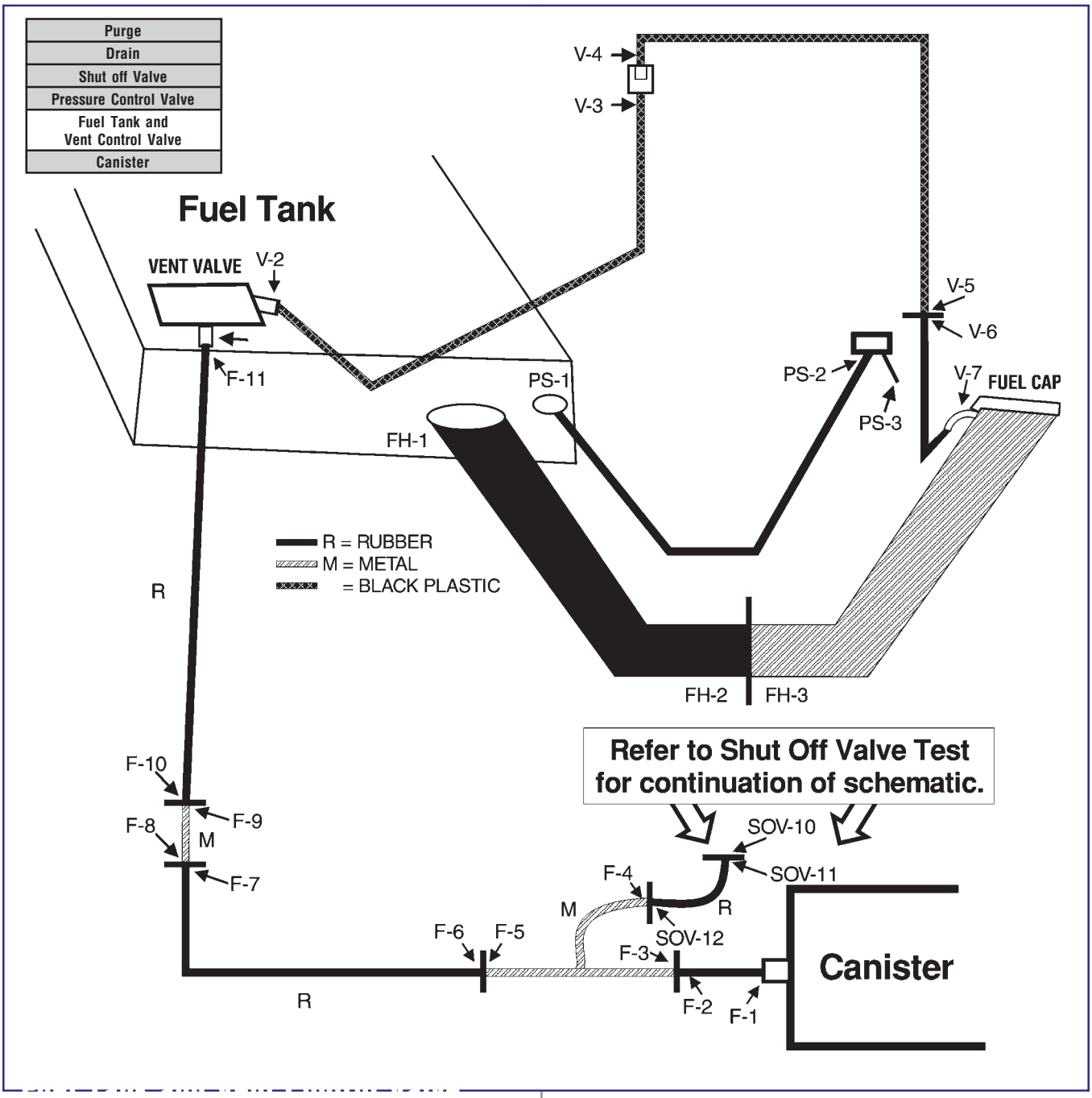
(12) Remove PT-1 wiht ST-adapter-1 from PCV.

(13) Connect PCV-1 to PCV.

(14) Connect PCV-2 to PCV.

Notes:

STOP



Fuel Tank and Vent Control Valve Test

WARNING: Next step introduces fuel vapors into the atmosphere. Test in well ventilated space. NO SMOKING!

Steps 1 through 9 tests the air tightness of the fuel tank, lines, and items shown in the illustration above.

WARNING: The pressure introduced into the fuel tank by the tester can push fuel from an open fuel line into the atmosphere.

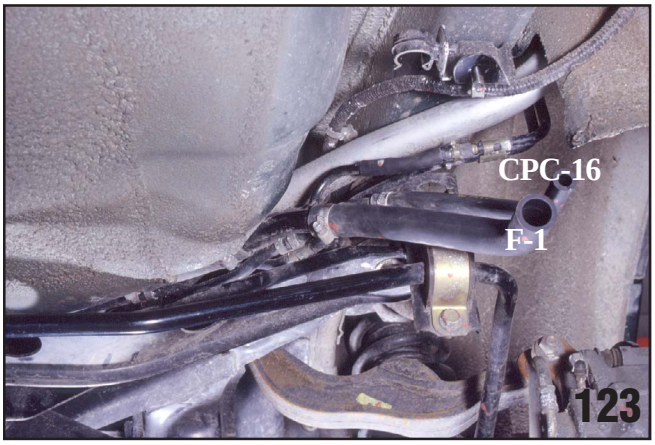
- ***Adjust the Select Monitor to read the fuel tank pressure.***
- ***Check and record the fuel tank pressure. (With the cap off the pressure should be near zero.)***
- ***Pressure higher or lower than zero could indicate a blockage in the PS-3 hose,- PS-2 hose, the fuel tank passage or a failure of the pressure sensor.***

(1) Remove Fuel Cap and connect cap to adapter-2. Picture 121

(2) Connect opposite end of adapter-2 to filler neck.

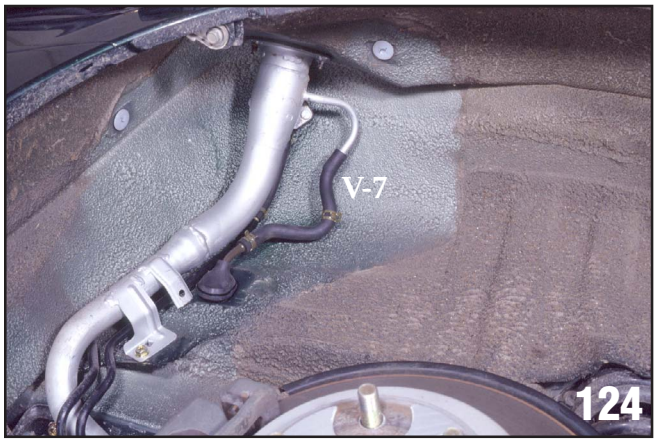
(3) Remove PT-1 from hose and connect to threaded portion of adapter-2.

(4) Disconnect F-1 from canister. Picture 123.



(5) Connect adapter-1 with ST plug to F-1.

(6) Loosen connection V-7. Do not remove at this time. Picture 124.



(7) Pressurize.

Check and record the fuel tank pressure.
(At 24in HG on the tester pressure gauge, the pressure reading on the select monitor should be +0.91in HG or +23.3mm HG.)
If the pressure is not within specifications check the PS-3 hose for restrictions or blockage, and the PS-2 hose for restrictions, blockage and leaks. Confirm that the fuel tank passage located at PS-1 is allowing fuel tank pressure to exit the tank.

(8) **WARNING: Next step introduces fuel vapors into the atmosphere.**

(9) After 2 minutes, does pressure hold?
YES – go to step (10).
NO – go to step (10F).

Step 10 and 11 will test the mechanical operation of the Vent control valve.

(10) Listen to the sound of air leaving the tank as adapter-1 with ST plug is removed from F-1. Picture 123.

(11) Listen to the sound of air leaving the tank as V-7 is disconnected. Picture 124.

(12) Did the speed of air escaping the tank increase from steps (10) to (11)?
YES – go to step (13).
NO – go to step (13F).

(13) Connect V-7 to filler neck.

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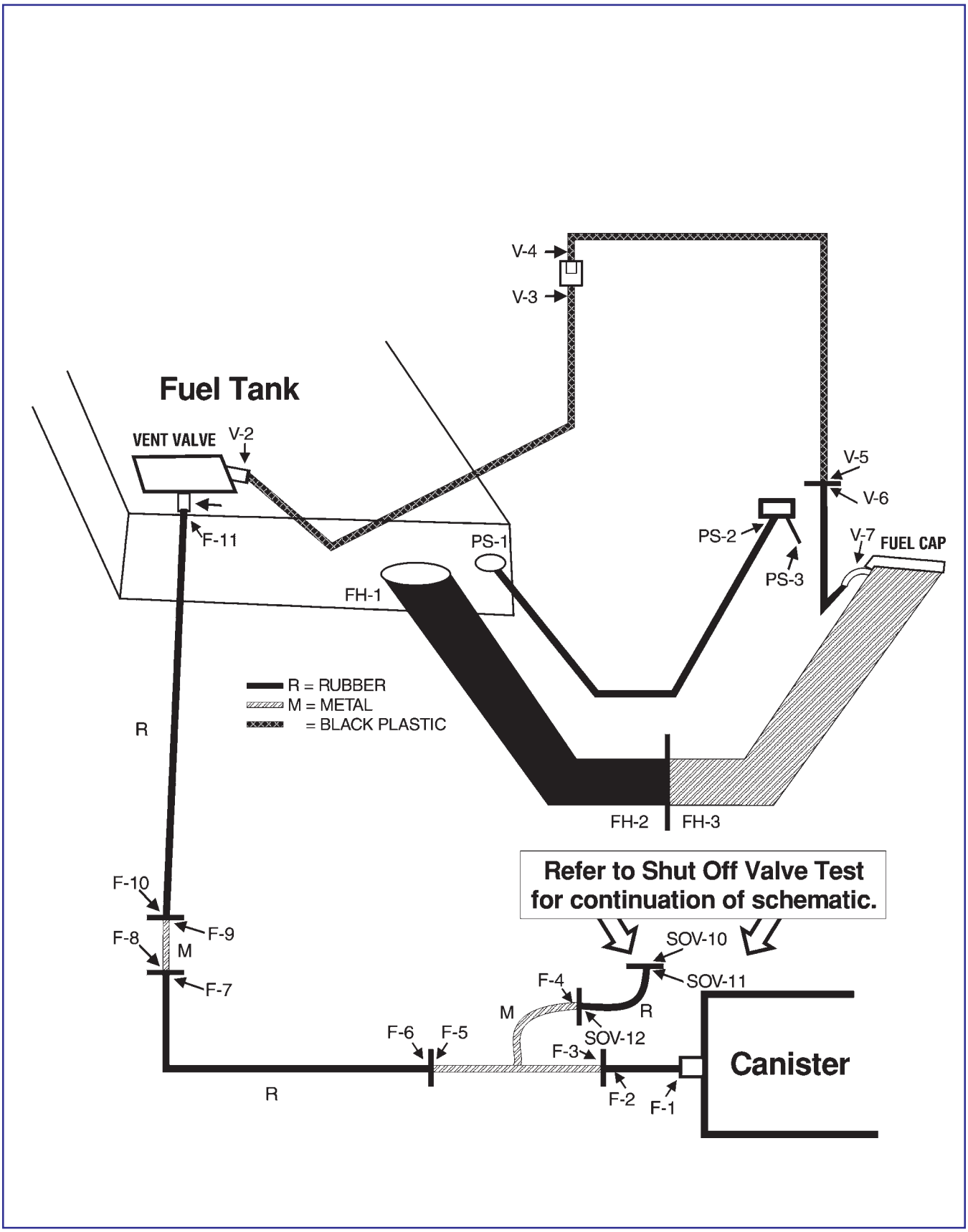


Fuel Tank and Vent Control Valve Test 10F

(10F) Check all fuel lines, fuel cap and Evaporative lines for proper connection.

(10F1) Remove all fuel and tank pressure.

(10F2) Follow instructions in the appropriate Subaru service manual for removing the fuel tank

(10F3) Plug all inlets and outlets from the fuel tank and external valves.

(10F4) Ensure fuel tank is at least half full and pressurize.

(10F5) After leak has been found and repaired go to (10F6)

(10F6) Pressurize.

WARNING: Next step introduces fuel vapors into the atmosphere.

(10F7) After 2 minutes, does pressure hold?
YES – go to step (10F8).
NO – Recheck for leaks and go to (10F5)

(10F8) The following steps will check the operation of the vent control valve.

This should be performed before installing the tank because the tank must be removed to replace a faulty valve.

Steps (10F9) through (10F11) will test the mechanical operation of the Vent control valve.

(10F9) Listen to the sound of air leaving the tank as plug for F-11 is removed.

(10F10) Listen to the sound of air leaving the tank as plug for V-2 is disconnected.

(10F11) Did the speed of air escaping the tank increase from steps (10F9) to (10F10)?
YES, Remove all fuel and tank pressure and install tank-using instructions from the appropriate Subaru service manual.
NO, Remove all fuel and tank pressure and replace Vent control valve using instructions from the appropriate Subaru service manual.

If tank has been removed, perform step 1 through 13 to confirm air tightness of fuel tank and vent control valve after installation.

Fuel Tank and Vent Control Valve Test 13F

(13F) Remove all tank pressure.

(13F1) Remove V-7 from fuel neck and connect PT-1.

(13F3) Remove V-2 from vent control valve.

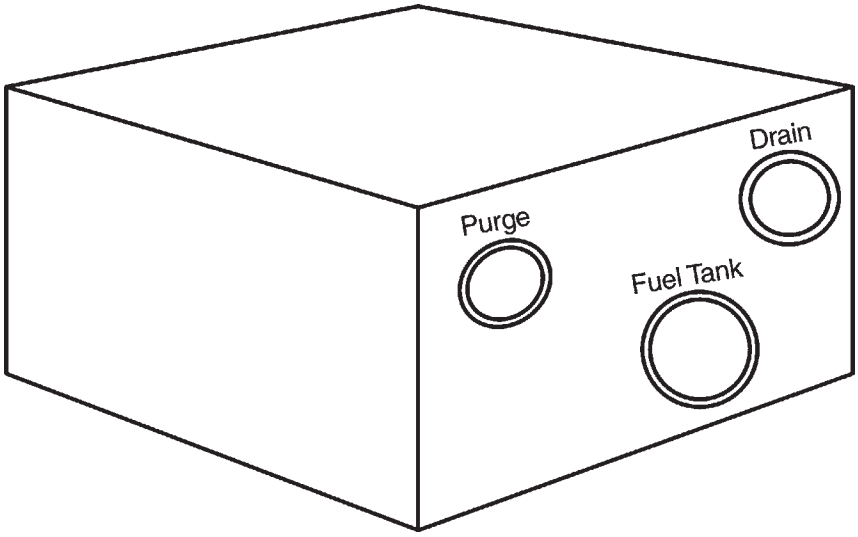
(13F4) Pressurize
Did pressure hold?
YES , replace or remove obstruction from rubber hose V-7 through V-2 and go to step 7.
NO , go to (13F5)

(13F5) Insert ST Plug into V-2 hose.

(13F6) Pressurize
Did pressure hold?
YES , Remove all fuel and tank pressure and replace Vent control valve using instructions from the appropriate Subaru service manual.
NO , replace rubber hose V-7 through V-2 and go to step 7.

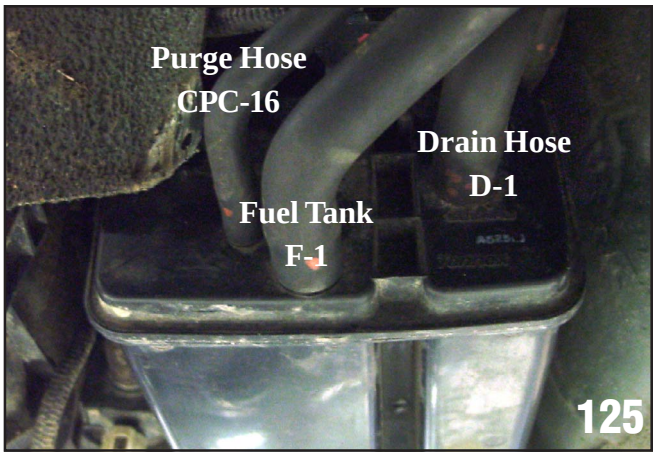
If tank has been removed perform step 1 through 13 to confirm air tightness of fuel tank and vent control valve after installation.

Purge
Drain
Shut off Valve
Pressure Control Valve
Fuel Tank and Vent Control Valve
Canister



Canister Test

Steps 1 through 8 tests the air tightness of the canister.

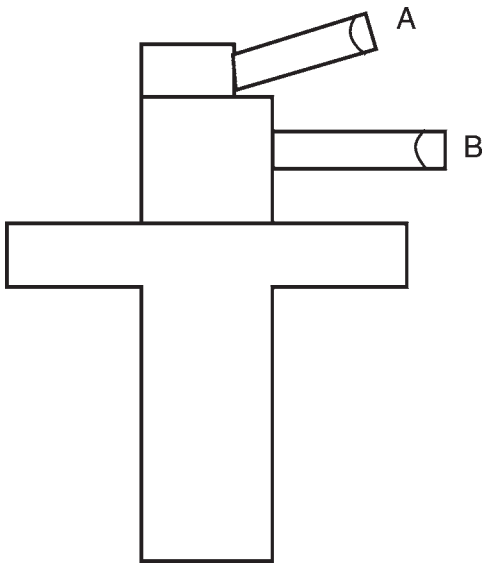


(1) Disconnect 3 hoses from canister. Picture 125.
(2) Reinstall PT-1 to pressure tester hose.
(3) Connect adapter-1 to PT-1.
(4) Connect adapter-1 to purge hose connection of canister. Picture 125.
(5) Connect adapter-3 to fuel tank hose connection of canister.
(6) Connect adapter-4 to Drain hose connection of canister.
(7) Pressurize.
(8) After 2 minutes, does pressure hold?
YES – go to step (9).
NO – go to step (9F).
(9) Disconnect 3 adapters from canister.
(10) Connect all hoses back to canister and secure.

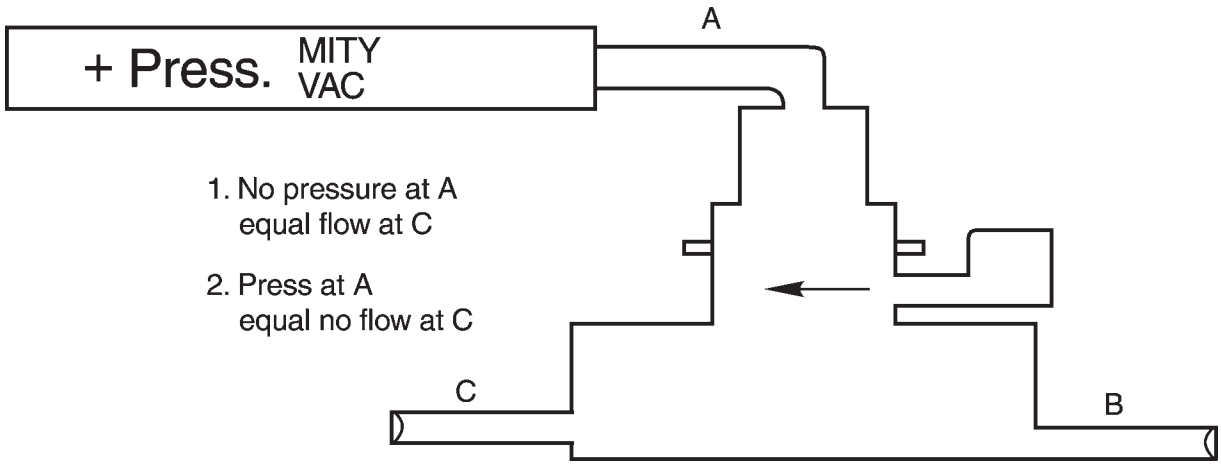
STOP

Vent Valve Test

Pressurize tank through Port B or fuel hose.
Allow tank pressure to escape through Port B.
Apply pressure to Port A. Tank pressure should then stay in tank.

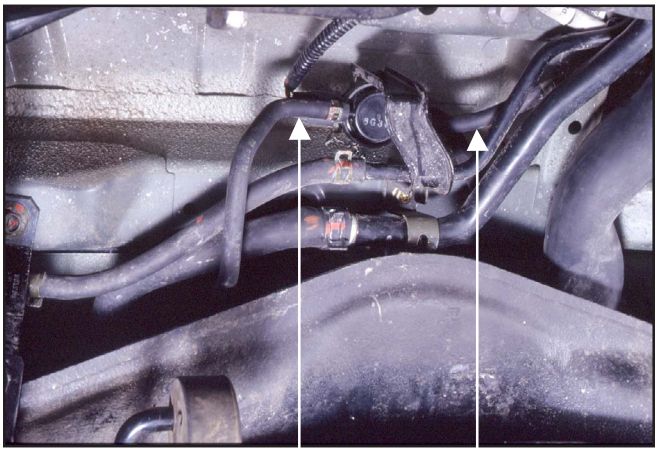


PCV Test

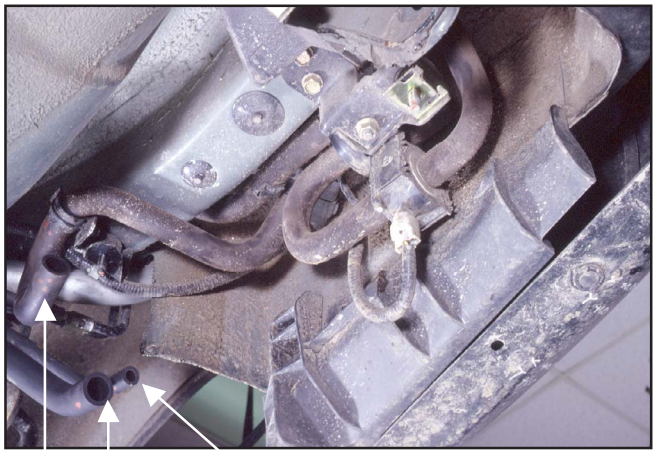


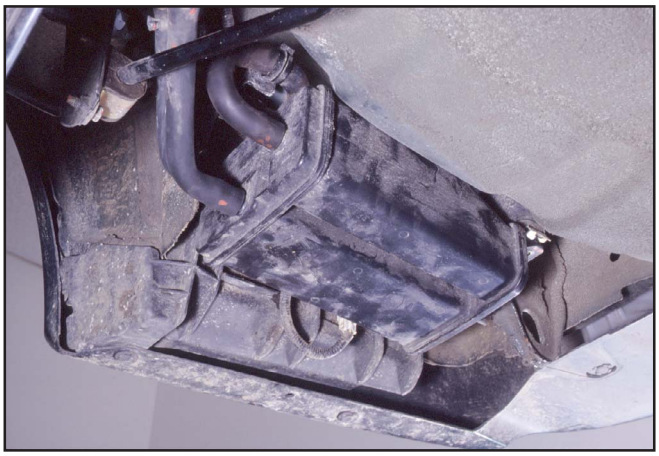
2000 Model Year Evaporative System Diagnosis

Pressure Control Valve

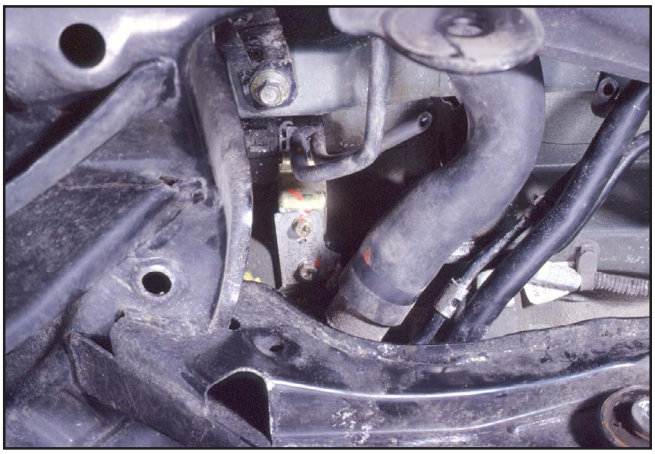


Drain Valve

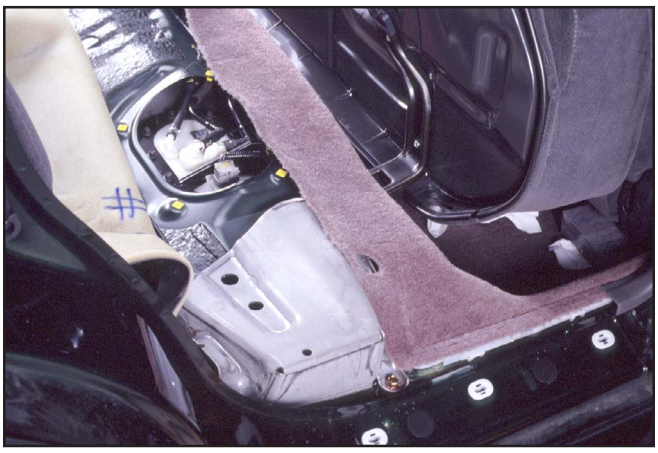




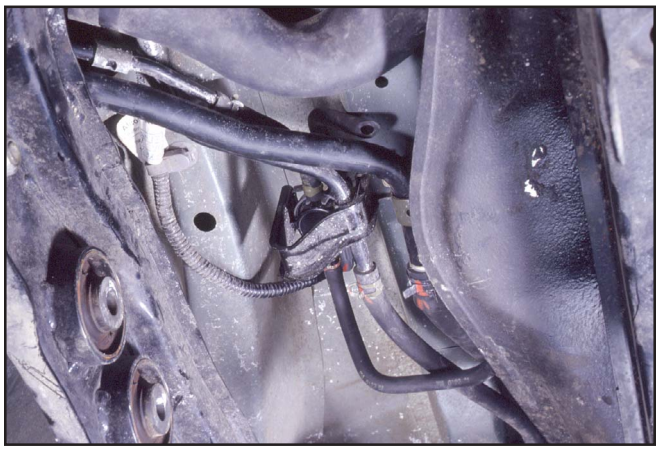
Canister



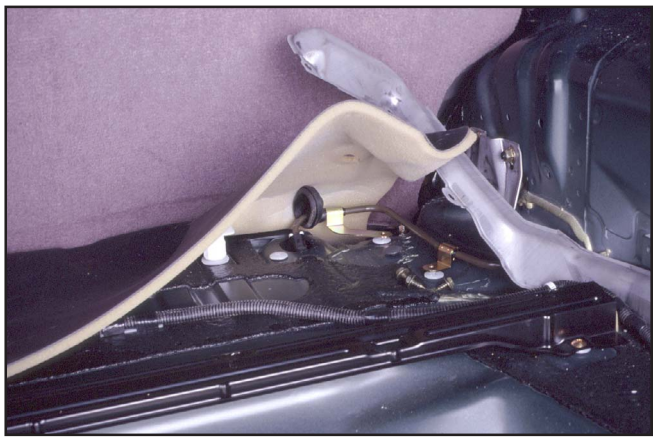
Pressure Sensor



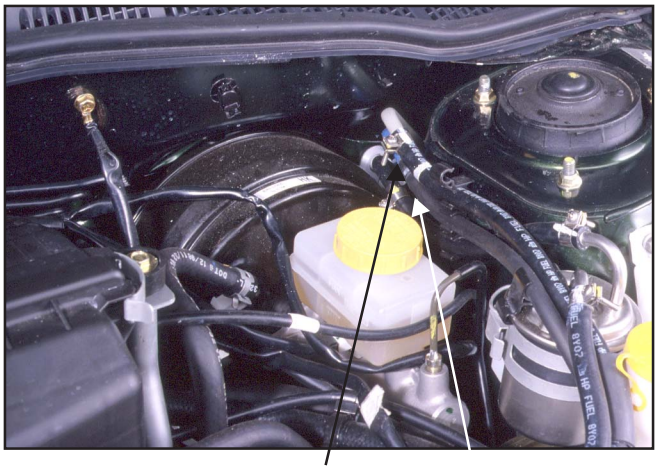
Fuel Pump under rear seat



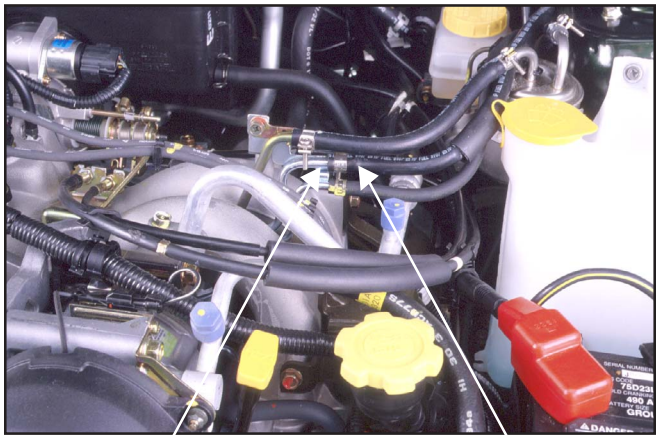
Pressure Control Valve



Quick Connector on Vent Hose
(Located in cargo area of station wagon, trunk of sedan.)

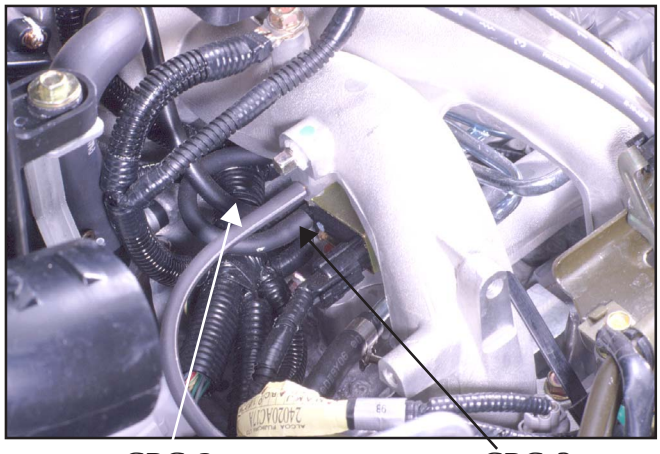


CPC-9 CPC-8

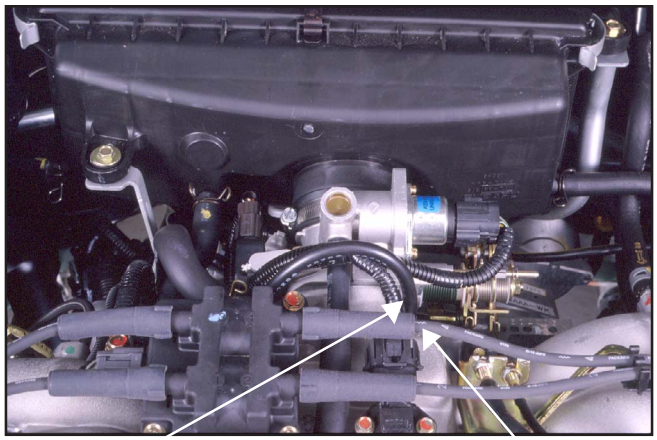


CPC-6 CPC-7

Canister Purge Control solenoid



CPC-2 CPC-3



CPC-1 M-1

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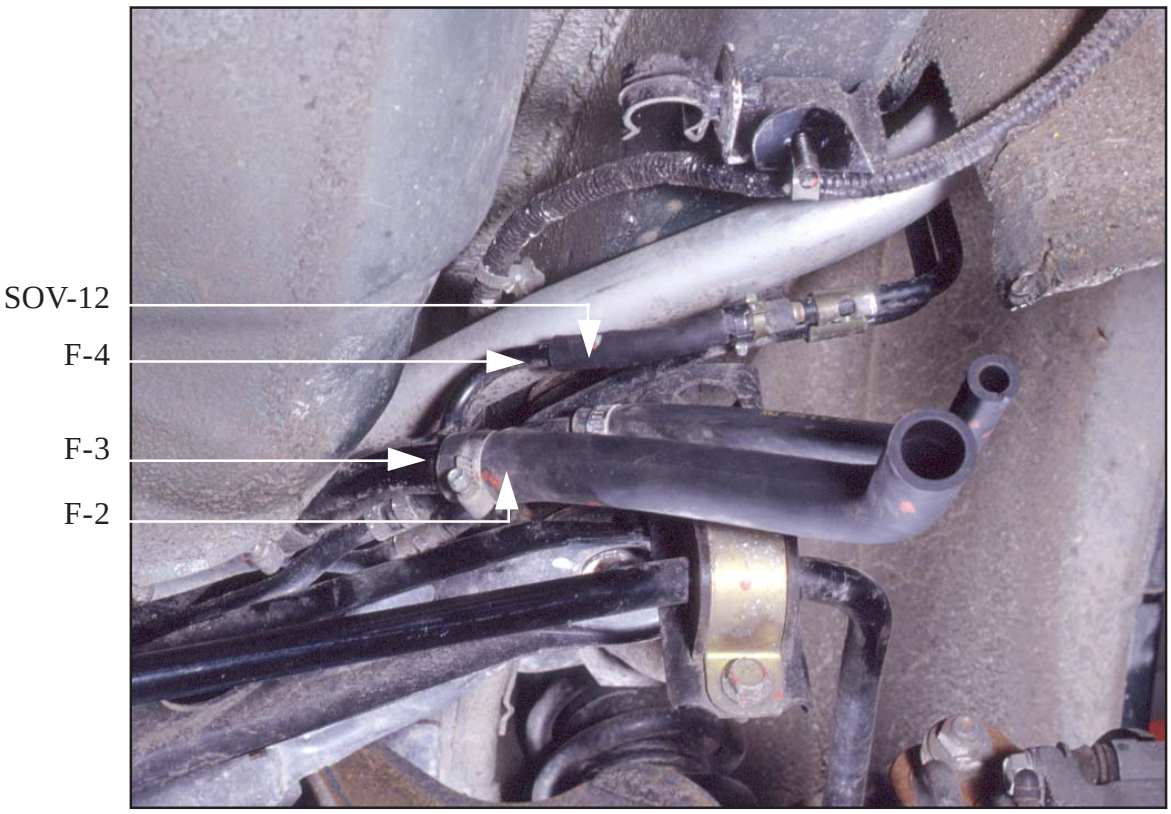

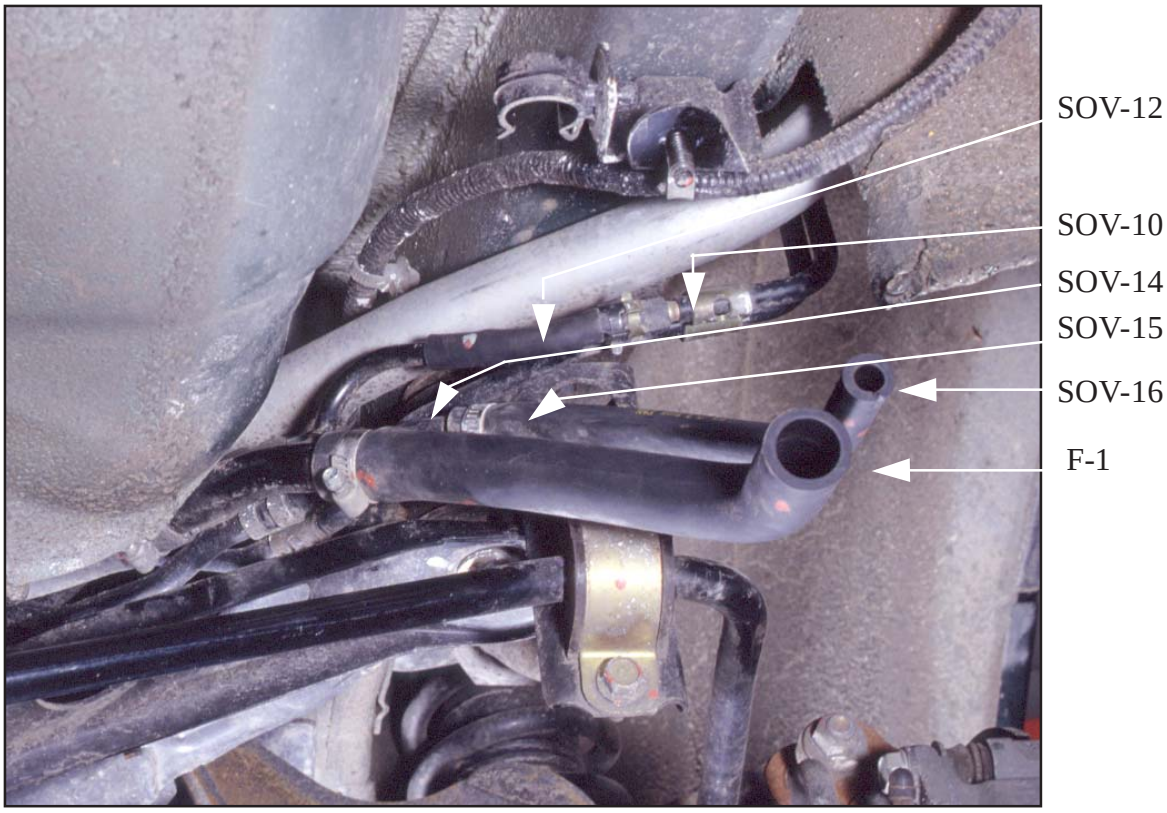

Notes:

Notes:


CERTIFIED
SUBARU
TECHNICIAN


AUTOMOTIVE
Youth
Educational
Systems
YES
PROUD PARTNER