EVAP systems, operation and diagnosis

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INTRODUCTION

This course will introduce you to the Evaporative Emissions (EVAP) and On-board Re-fueling and Vapor Recovery (ORVR) systems.

Objectives:

- Explain the importance of Evaporative Emissions (EVAP) and On-board Re-fueling and Vapor Recovery (ORVR) systems.
- Explain the operation of the EVAP system.
- Explain the operation of the Leak Detection Pump (LDP).
- Explain EVAP system testing guidelines.
- Explain the operation of the ORVR system.

Evaporative Emissions (EVAP):

Evaporative Emissions systems are nothing new. As airborne pollution levels began to rise in the 60's and 70's, automobile manufacturers and governments realized a need to control the amount of emissions escaping into the atmosphere.

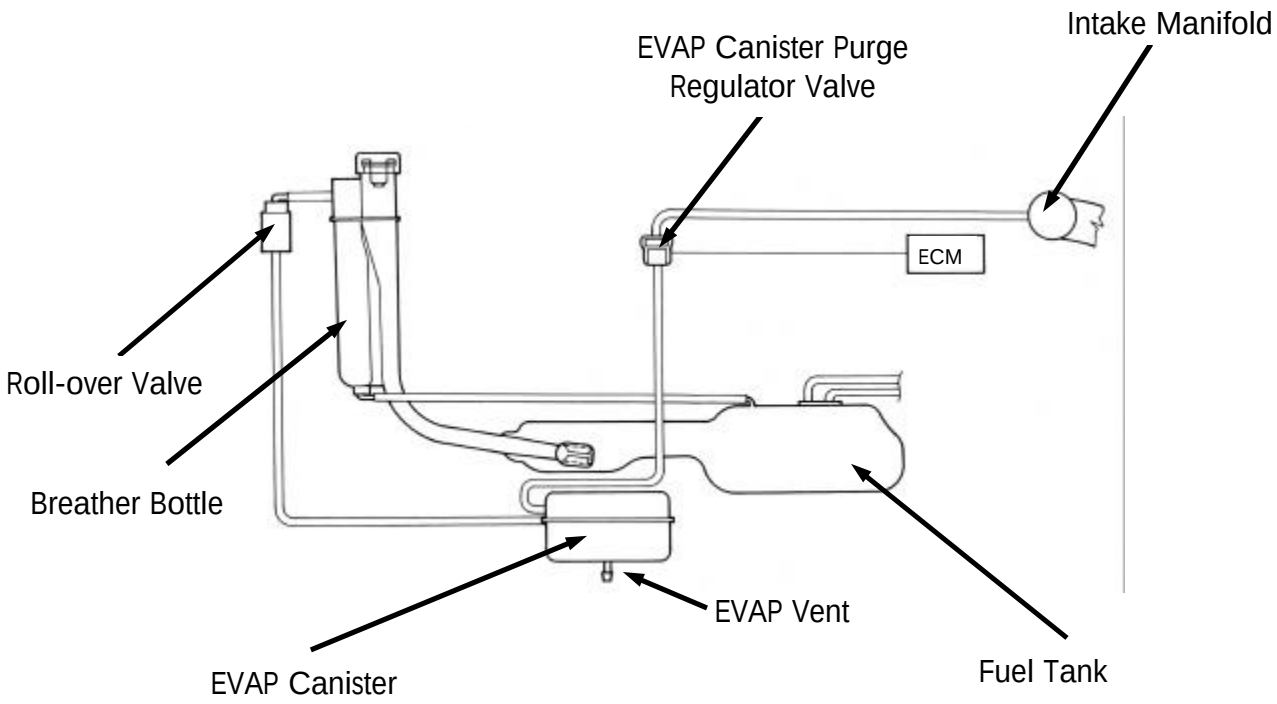
When unburned hydrocarbon particles are exposed to sunlight, a chemical reaction occurs creating low-level ozone. Low-level ozone is the primary reason for smog and is linked to respiratory disorders.

Evaporative Emissions (EVAP) systems were created to trap this fuel vapor from escaping into the atmosphere.

EVAP System:

The primary function of the EVAP system is to trap fuel vapor created by the fuel in the fuel tank.

The components below create a sealed system that routes fuel vapor from the Fuel Tank to the Intake Manifold to be burned during normal combustion.



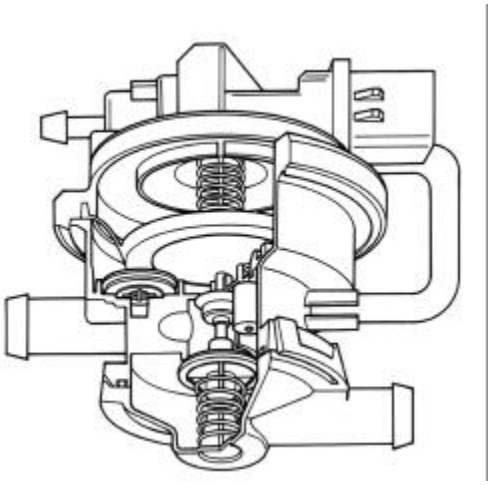
Basic EVAP System

Leak Detection Pump (LDP):

In 1998, the Leak Detection Pump (LDP) was added to ensure the integrity of the EVAP system to meet the stringent requirements of OBD II.

These OBD II regulations require an automatic leak-check every drive cycle.

When a leak is detected, the Malfunction Indicator Lamp (MIL) will illuminate, warning the driver that something is wrong with the vehicle.



Leak Detection Pump (LDP)

On-board Re-fueling and Vapor Recovery (ORVR) System:

Another recent addition to the EVAP system is On-board Re-fueling and Vapor Recovery (ORVR).

Even though the EVAP system was performing its function well, it had no capability to control the hydrocarbons escaping during re-fueling.

The vapor return systems installed on gas pump nozzles have relatively little effect on the amount of vapor escaping. As a result, the ORVR system was created to trap the hydrocarbons released during re-fueling.

As fuel is being channeled into the Fuel Tank, the ORVR system directs the fuel vapor to be stored in the EVAP Canister. This vapor is later routed to the engine to be burned during normal combustion.

The EVAP and ORVR systems have been very successful in the containment of hydrocarbon emissions.

EVAP system:

The EVAP system has been designed to stop hydrocarbons from escaping from the fuel tank into the atmosphere.

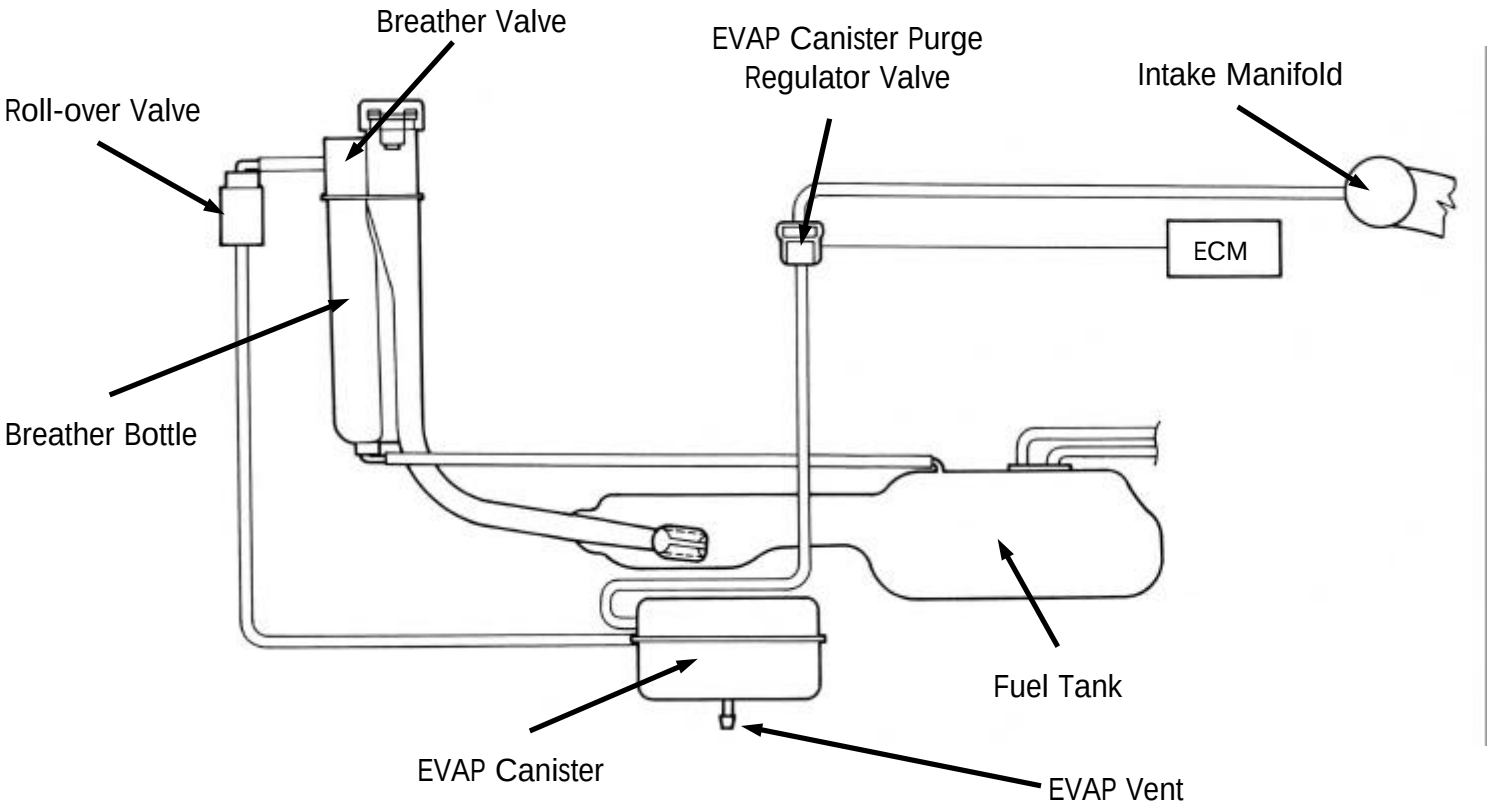
To see how this is accomplished, let's first take a look at the components in the system:

- Fuel Cap
- Fuel Tank
- Breather Valve
- Breather Bottle
- Roll-over Valve
- EVAP Canister
- EVAP Canister Vent
- EVAP Canister Purge Regulator Valve
- Engine Control Module (ECM)

These components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

Either through heat or agitation, fuel vapor builds up inside of the Fuel Tank.

This vapor cannot escape through the Fuel Cap, except under extreme pressure circumstances, so it is collected in the Breather Bottle and routed through the Breather Valve.

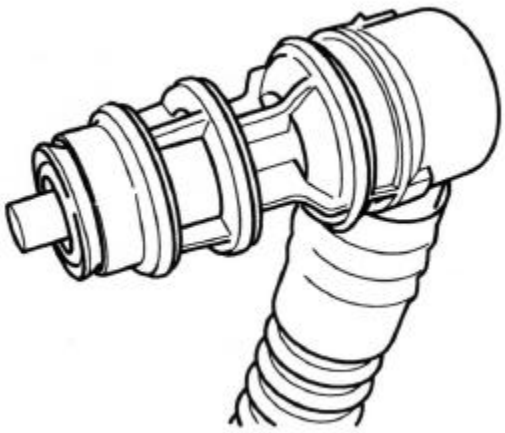


Basic EVAP System

Breather Valve

The function of the Breather Valve is to close the top of the Breather Bottle during re-fueling. This traps air in the Breather Bottle so that there is a space for the fuel vapor to expand.

The Breather Valve is opened when the Fuel Cap is re-installed on the Filler Neck.



Breather Valve

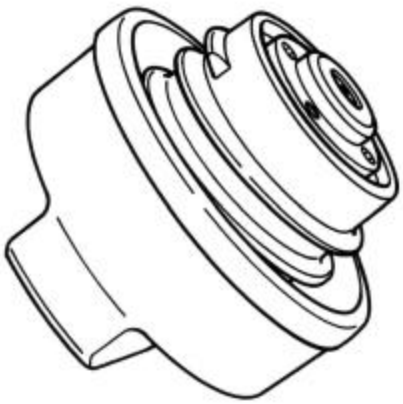
Fuel Cap

The fuel cap seals the top of the system and will only vent to the outside air if excess pressure exists in the system.

It is important that the correct Fuel Cap is used. Some after-market caps will not extend far enough into the Filler Neck to open the Breather Valve.

In this case, the Vent Line will not be opened, and as fuel is drawn from the tank, a vacuum is created. This can cause the tank to collapse.

After the vapor has been routed through the Breather Valve, it is passed on to the Roll-over Valve.



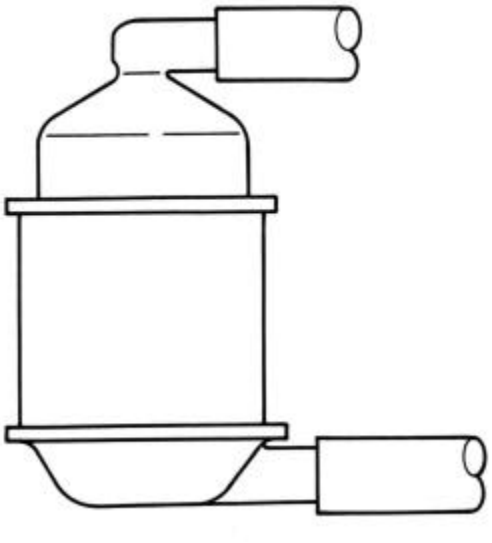
Fuel Cap

Roll-over Valve

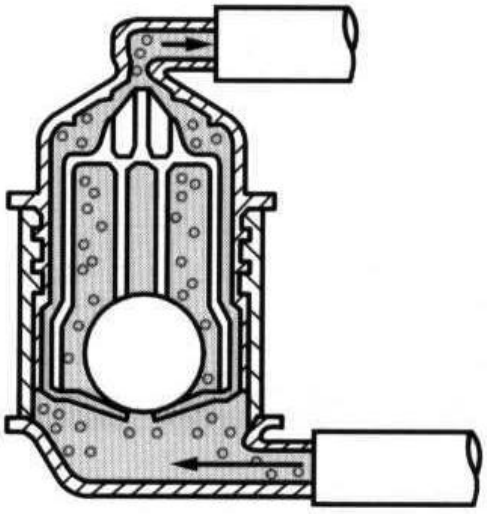
The Roll-over Valve functions as a safety valve in case the vehicle should roll over.

If the vehicle rolled over, liquid fuel would be able to pass through the Vent Lines and through to the EVAP Canister Vent. The Roll-over Valve is placed in the Vent Line to keep this from happening.

Fuel vapor is passed through the Roll-over Valve to the Vent Lines and to the EVAP Canister.



Roll-over Valve Exterior



Roll-over Valve Interior

EVAP Canister

Fuel tank pressure is allowed to escape to the outside atmosphere after the fuel vapor/air mixture is passed through the EVAP Canister, which is filled with activated carbon.

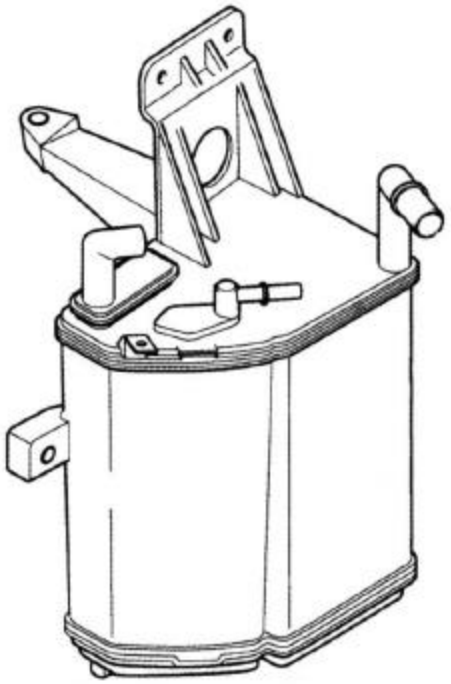
As this mixture is passed through the layer of activated carbon, the fuel vapor is absorbed.

The air portion of the mixture is allowed to escape to the atmosphere through the vent.

That is how the EVAP canister absorbs fuel vapor. It is simply passed through activated carbon.

However, the EVAP canister does not have unlimited storage. Let's take a look at how fuel vapor is purged from the EVAP canister.

The EVAP canister has a Vent Line that runs to the EVAP Canister Purge Regulator Valve. From here, the fuel vapor is routed to the Intake Manifold and into the engine to be burned during normal combustion.



EVAP Canister

EVAP Canister Purge Regulator Valve

The EVAP Canister Purge Regulator Valve is an electromagnetic solenoid valve that can be pulsed to allow a variable percentage of fuel vapor to enter the intake manifold.

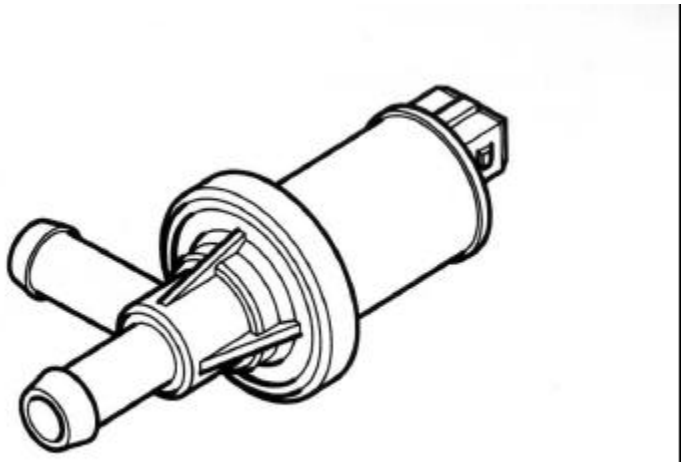
The EVAP Canister Purge Regulator Valve is controlled by the ECM.

Based on information from the Oxygen Sensors about the fuel to air ratio in the exhaust, the ECM opens the EVAP Canister Purge Regulator Valve and allows vapor from the EVAP Canister to be drawn into the Intake Manifold.

As air is now drawn in through the EVAP Vent, it is passed back through the activated carbon that holds the fuel vapor. The fuel vapor separates from the activated carbon and combines with the air.

This fuel vapor/air mixture is drawn through the vent line, through the EVAP Canister Purge Regulator Valve and into the Intake Manifold.

The EVAP Canister Purge Regulator Valve is modulated so that the right amount of fuel vapor is allowed to enter the Intake Manifold.



EVAP Canister Purge Regulator Valve

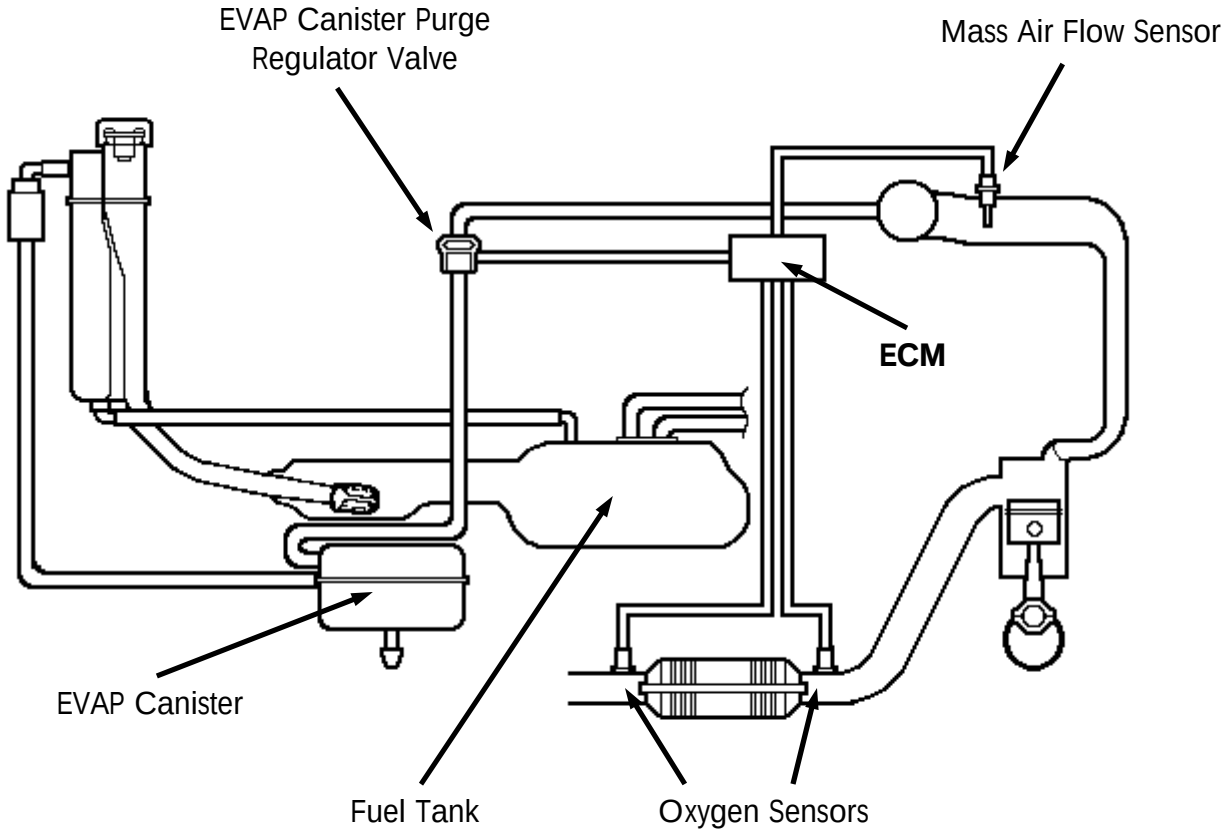
EVAP Canister Purging

The volume of air and fuel vapor entering the Intake Manifold from the EVAP Canister can change how the engine runs. The ECM has to constantly monitor the Mass Air Flow sensor and the Oxygen Sensors to determine the air to fuel ratio.

A 1% concentration of fuel vapor from the EVAP Canister can vary the air/fuel mixture by as much as 20%. This can have a drastic effect on engine driveability and vehicle emissions.

Also, the EVAP Canister can be fully purged, sending only air through to the Intake Manifold. This can cause a lean condition.

As the ECM monitors the inputs from its sensors, it will either increase or decrease the signal to the EVAP Canister Purge Regulator Valve. This controls the purge rate for best efficiency under all operating conditions.



ECM Monitoring of the EVAP System

Summary

That's all there is to the EVAP system. It is a sealed system that traps fuel vapor created in the fuel tank. This vapor is routed through the Breather Bottle and Roll-over Valve to the EVAP Canister. The EVAP canister then sends the fuel vapor through the Vent Lines to the EVAP Canister Purge Regulator Valve. The ECM controls this valve and allows the fuel vapor to be burned in the engine.

Leak Detection Pump (LDP):

For 1998 and newer vehicles, On-board Diagnostics II (OBD II) regulations require a system that checks the integrity of the EVAP system during every drive cycle.

As a result, the Leak Detection Pump (LDP) was added to all Audi vehicles.

Some 1996 and 1997 vehicles were equipped with an LDP. It is a non-functional unit for 1996 models. Some 1997 models have a fully functional LDP, but very few vehicles were equipped with it.

The LDP is integrated into the EVAP system and can have two functions. The LDP can:

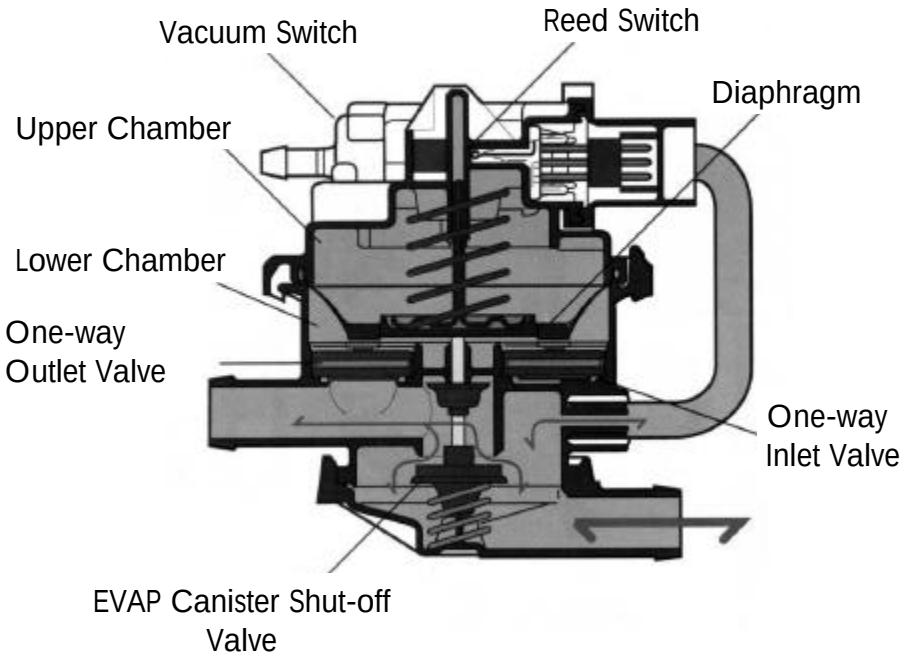
- pressurize the EVAP system and detect a drop in pressure that would indicate a leak
- function as the EVAP Canister Vent on vehicles that do not have a separate EVAP Canister Vent.

The LDP is made up of the following components:

- Vacuum Switch
- Reed Switch
- Diaphragm
- Inlet Valve
- Outlet Valve
- Upper Pump Chamber
- Lower Pump Chamber
- EVAP Shut-off Valve
- Diaphragm Spring.

The LDP is a vacuum-driven, ECM controlled, diaphragm pump. In order to operate, the engine must be running and vacuum applied to the Vacuum Switch.

Note: The LDP only acts as the EVAP canister vent when the leak diagnosis test is not running.



LDP operation:

During every drive cycle, the ECM looks for certain conditions to be met before the leak detection process can be run.

These conditions include, but are not limited to:

- Engine coolant temperature
- Intake air temperature.

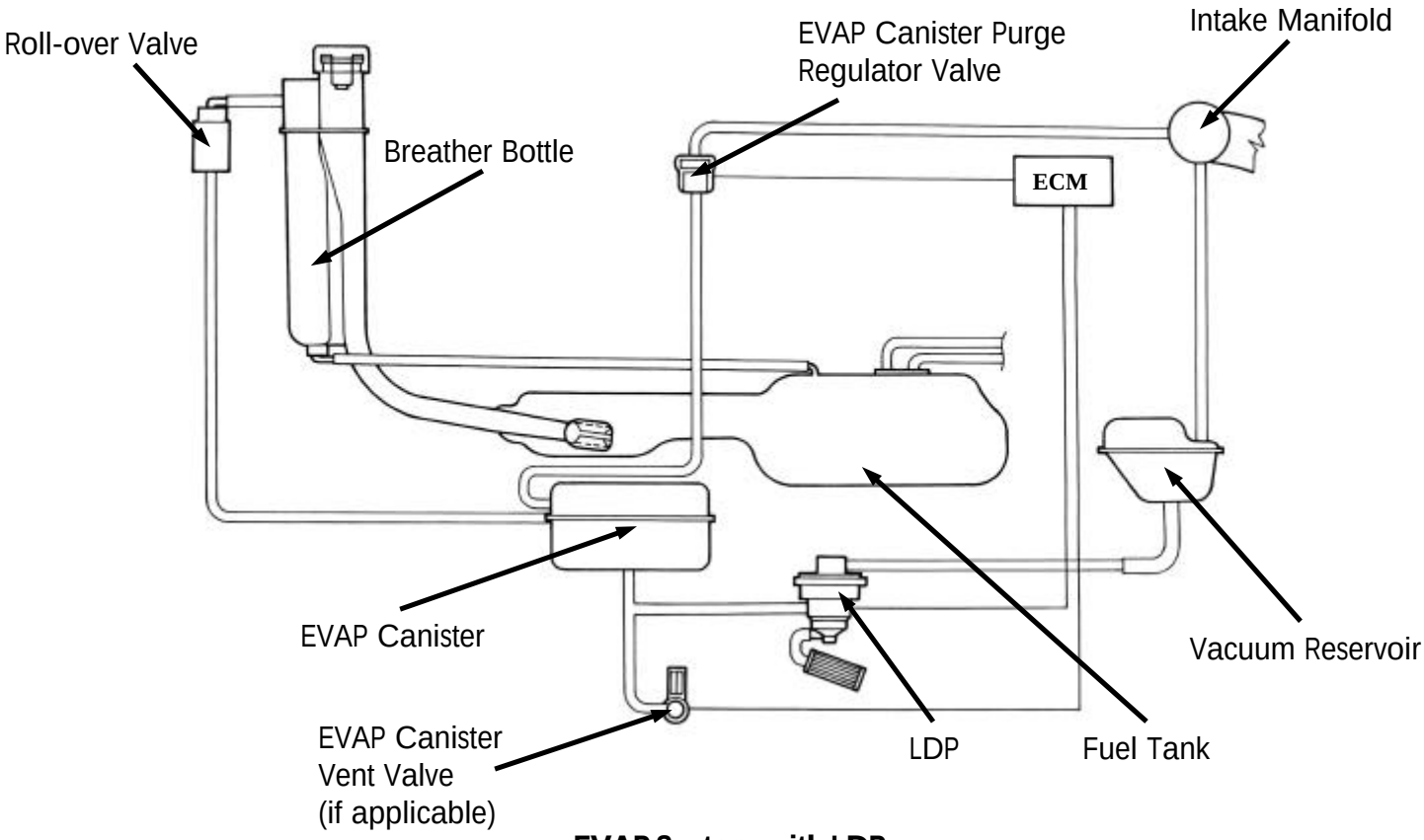
In order to pressurize the EVAP system, the vent for the EVAP Canister must be sealed.

Many vehicles use the EVAP Shut-off Valve at the bottom of the LDP as the EVAP Vent. This valve closes whenever the LDP is operating.

On vehicles where the LDP is located a distance away from the EVAP Canister, a separate EVAP Vent Valve is used to seal the system. This is sometimes referred to as the Condensate Drain Valve, which can be a misleading term.

The EVAP Shut-off Valve is also used to seal the system.

At the same time the ECM commands the LDP to operate, it also closes the EVAP Canister Purge Regulator Valve and the EVAP Vent Valve (if applicable).



EVAP System with LDP

Internal LDP Operation

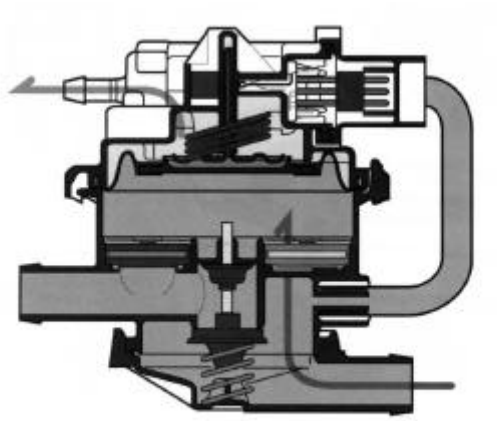
Whenever the engine is running, vacuum is applied to the Vacuum Switch. This switch applies vacuum to the Upper Chamber of the pump when it receives a ground signal from the ECM. This signal is a duty cycle pulse of approximately 40%.

When vacuum is applied to the Upper Chamber, fresh air flows in through the One-way Inlet Valve, compressing the spring above the diaphragm.

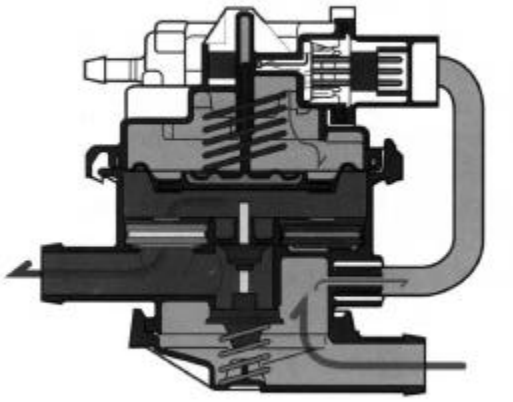
When the Diaphragm begins to rise, the Reed Switch, attached to the Diaphragm Rod, opens.

When the Vacuum Switch closes, the vacuum in the Upper Chamber is released.

As a result, the spring pushes the Diaphragm down. As the Diaphragm is pushed down, the air in the Lower Chamber is pushed out of the One-way Outlet Valve into the EVAP system.



Diaphragm Lifting



Diaphragm Falling

Internal LDP Operation cont.

This process continues until the pressure in the EVAP system no longer allows the spring to push the Diaphragm down. With tension on the Diaphragm, the ECM waits for a certain period of time to watches for the Diaphragm to fall.

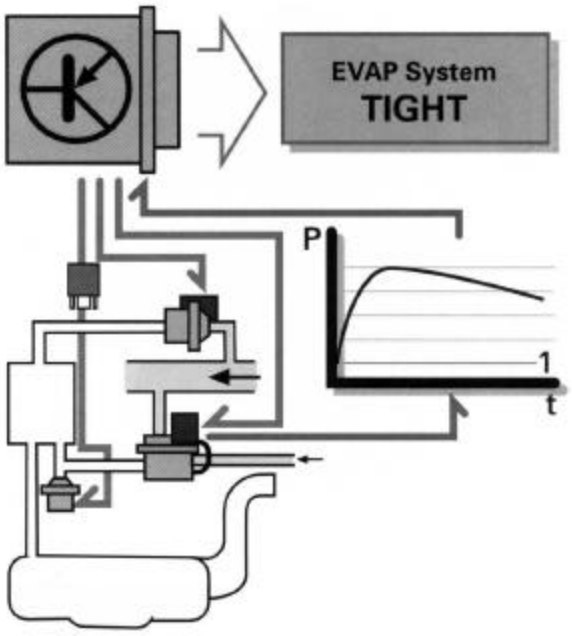
The Reed Switch closing signals that the Diaphragm has fallen to its lowest point.

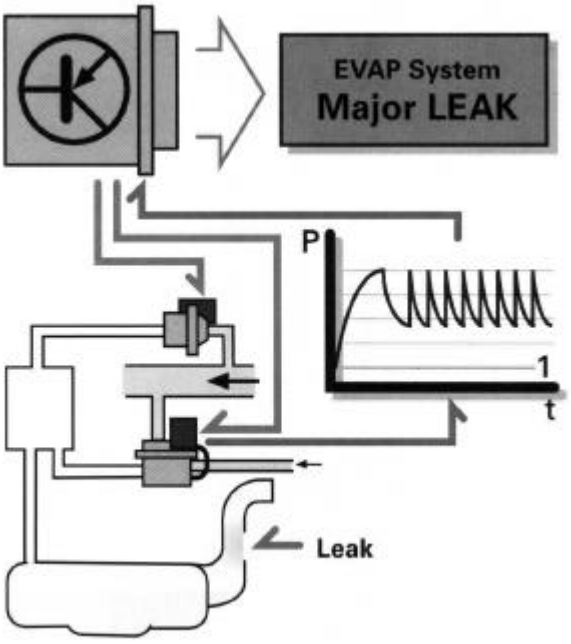
When the Reed Switch closes, the ECM may cycle the LDP to build up system pressure again.

The ECM measures the time it takes for the Reed Switch to close once the LDP has stopped running to determine if there is a leak in the system.

The slower the Diaphragm falls after the pump stops running, the less air is leaking out of the EVAP system.

Unfortunately, the ECM cannot determine where a leak in the system is. We will discuss finding the leak in the next module.





Summary

In summary, the LDP is simply a pump used to pressurize the EVAP system to check for leaks.

In addition, it can also function as the EVAP Canister Vent on most vehicles. When the ECM starts the LDP, the EVAP Canister Purge Regulator Valve and the EVAP Vent Valve, if applicable, are closed.

The Vacuum Switch then applies vacuum to the Upper Chamber of the pump to pull the Diaphragm up.

When the Vacuum Switch closes the vacuum circuit, the Diaphragm is pushed down by the spring. This sends air into the system for pressurization.

The LDP cycles many times and then waits for the pressure to drop. Depending on the rate of pressure drop, the ECM determines if a leak is present.

EVAP System Diagnosis

Now that you know all about the EVAP system that incorporates the LDP, let's take a look at how to fix the system.

Due to different EVAP system designs and part locations, it is not possible to describe a single, comprehensive test for all vehicles. The test procedures for individual vehicles can be found in the Service Information System.

In order to illustrate these procedures, we will use a 1999 A4 as an example in this module. Other Audi vehicles will be similar.

The procedures discussed in this section only apply to vehicles with an active leak detection system.

Most customer complaints involving the EVAP system will be that the MIL light is on. Use the VAG 1551,1552 or the VAS 5051 to read the Diagnostic Trouble Code stored in memory.

This DTC will tell you if there is a specific electrical failure in the system, or if there is a malfunction such as a leak or EVAP system flow concern. A specific electrical failure is easy to diagnose and repair. In this module we will look at a couple of common DTCs that can be difficult to diagnose.

The testing procedures on all vehicles can be affected by the following:

- Incorrect engine temperature
- Incorrect air intake temperature
- Accessory drains
- Many other factors.

Be sure to check the Service Information system for other factors that may affect the vehicle you are working on.

Be sure to turn off all of the accessories, including air conditioning, before running any tests on the vehicle. This will assure a correct diagnosis.

Caution! Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

EVAP Canister Purge Regulator Valve Testing

When testing for an EVAP Canister Purge Regulator Valve malfunction, it is important to remember how the ECM monitors the function of this valve.

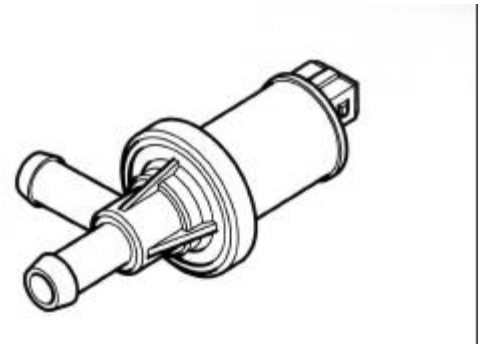
The ECM uses the inputs from the Mass Air Flow Sensor and the Oxygen Sensors to determine if the flow from the EVAP Canister Purge Regulator Valve is correct.

In order to test the system, use the EVAP Canister Purge Regulator Valve test from the readiness code setting procedure, in this case, basic settings group 070.

The ECM opens the EVAP Canister Purge Regulator Valve and monitors the changes in the Mass Air Flow signal and the Oxygen Sensor signals.

As long as the ECM identifies a change in the oxygen sensor signal, the EVAP Canister Purge Regulator Valve passes the test.

However, if the air and fuel mixture coming from the EVAP Canister Purge Regulator Valve is 14.7 to 1, the correct range, there is no effect on the Oxygen Sensor.



EVAP Canister Purge Regulator Valve

In this case, the ECM also looks for a change in the signal from the Mass Air Flow Sensor.

The opening of the EVAP Canister Purge Regulator Valve will cause a change in the MAF signal regardless of air to fuel ratio.

If there is no change in either the Oxygen Sensor signal or the Mass Air Flow signal, the ECM records a DTC for a malfunction or incorrect flow.

You can find the specifications for these signals in the Service Information System under the Readiness Code setting procedures.

When diagnosing EVAP system faults, remember that the ECM is checking for flow.

It is possible that the EVAP Canister Purge Regulator Valve could be blocked or defective, yet not show a DTC for an electrical failure.

The vent lines might be plugged or pinched. Check them thoroughly for damage or blockage.

Also, check to be sure the EVAP Canister, EVAP Canister Vent and the EVAP Canister Vent Valve are not plugged.

Finally, run the system test several times, especially if the DTC is sporadic. A single test may not be good enough to determine if the system is functioning correctly.

EVAP System Leak Diagnosis

To diagnose a leak, you must look in the Service Information System for the diagnostic procedures to test the EVAP system.

The Service Information System will show you how to test the EVAP system for a leak using the LDP.

If a vehicle came in with the MIL on and the VAG 1551 identified a DTC for a large leak, the Service Information system directs you to a specific measuring value block. In this example, Display Group 071, Display Zone 1.

If the display zone in the measuring block reads, "open," it means pressure still exists in the EVAP system and is not allowing the LDP diaphragm to seat.

The LDP cannot perform an accurate test when the diaphragm is not seated and the reed switch is not closed.

To continue testing, this pressure must be released. Loosen the Fuel Cap to release the pressure in the EVAP system, and check that the display zone 1 switches to, "closed." Tighten the Fuel Cap.

Continue with the testing procedure by switching to Basic Settings. The ECM will run the LDP and check for leaks.



Service Information System

Fuel Cap Test

If the system fails the test, the first thing to check is the tightness of the Fuel Cap.

If the Fuel Cap is loose, the LDP will be unable to pressurize the system and will set a DTC for a leak. If the Fuel Cap is loose, tighten it and re-test the system.

Also, check the seal on the Fuel Cap to make sure it is not defective. That can also cause pressure leaks.

To ensure that the Fuel Cap is not defective, exchange it with another from a vehicle that does not have an EVAP system leak concern.

Re-testing the system will let you know if a different Fuel Cap has corrected the concern.

LDP Operation Test

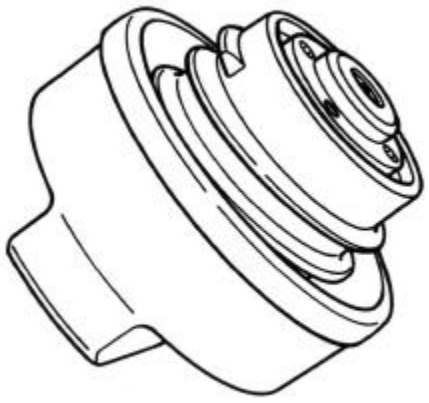
If the tester still indicates a leak, the next step is to check the operation of the LDP.

Locate the LDP on the vehicle, then re-run the test. You will feel the LDP clicking if it is operating.

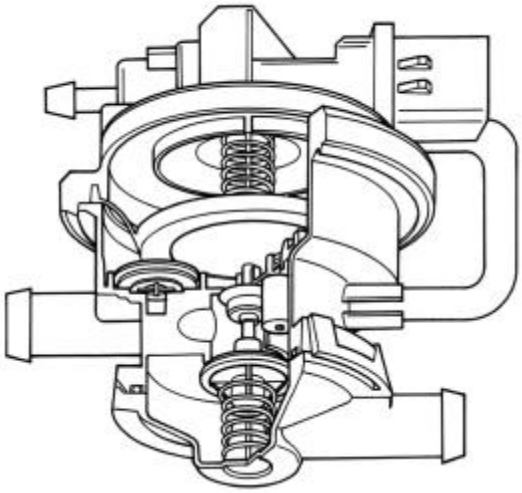
If the LDP does not run, check the vacuum supply to the pump. Remember that the LDP runs off of engine vacuum.

Most vehicles will set a DTC if there is a problem with the vacuum supply, but this DTC can also be set if there is an internal problem in the pump.

Most electrical problems with the LDP will set a separate DTC.



Fuel Cap



LDP

If the LDP runs, the next step is to pinch off the line from the LDP to the EVAP Canister and run the test a couple of times. Leaking valves can cause intermittent faults that a single test may not catch.

If the system fails the test at this point, the LDP is leaking internally and needs to be replaced.

If the system passes the test, then the LDP is working properly and the leak is elsewhere in the system.

On most systems, there is a display group that shows the leak-down time of the EVAP system when pressurized by the LDP. In this example, Display Group 137, Display Zone 1. The acceptable leak-down time for the EVAP system is two seconds.

If the EVAP system leak-down time is close to two seconds, run the test several times to make sure an intermittent fault is not present.

EVAP Canister Purge Regulator Valve Test

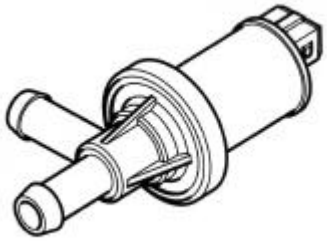
Pinch off the line leading from the EVAP Canister Purge Regulator Valve to the intake manifold and run the test to check for a leaking valve.

If the system passes the test, first check the EVAP Canister Purge Regulator Valve and make sure it is installed correctly.

If it has been installed backwards, the LDP will be unable to pressurize the EVAP system and will set a DTC.

If the valve was installed correctly and the system passes the test with the Vent Line pinched, then the valve is probably defective. Replace the valve and re-test.

If the system fails the test, continue checking for the leak.



EVAP Canister Purge Regulator Valve

The Service Information System leads you through a series of tests to isolate the leak in the EVAP system.

This series basically consists of pinching or plugging a certain area of the EVAP system and running the LDP test again.

As you test different sections of the system, you will be able to isolate the area the leak is coming from.

Be sure to check the seal at the Fuel Level Sensor for a leak or damage. Also, check the EVAP Canister and Vent Lines for damage.

Remember, if a component such as the EVAP Canister Purge Regulator Valve or an EVAP Canister Vent Valve has been isolated as the fault, be sure that component is receiving the correct electrical signal. Use the Service Information System to perform the correct electrical tests.

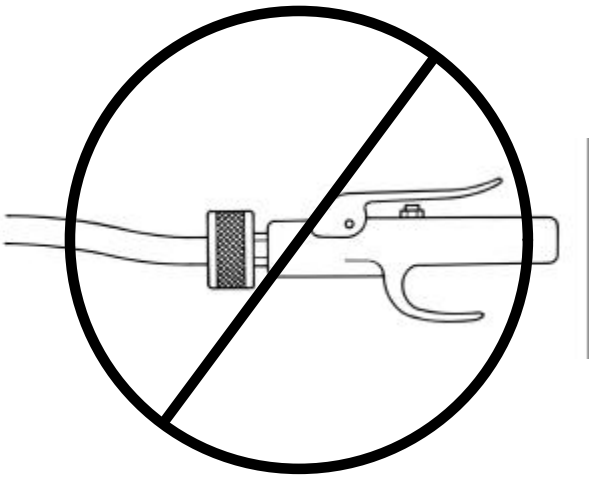
Remember not to pinch hard lines. They will crack and create more work for you.

There are other systems that can be used, besides the LDP, to pressure test the EVAP system.

These testers pressurize the system with an inert gas to keep explosive fuel vapor from flowing into your shop area. Be sure not to use any system that would cause fuel vapor hazards, and follow the directions given with that specific testing tool.

Do not, under any circumstance, pressurize the system with an air hose.

This can cause damage to many components in the EVAP system and also cause a vapor hazard to yourself and your fellow technicians.



Summary

That covers a few of the guidelines you can use to accurately test the EVAP system. Knowing how to test the system accurately will create less work for you and will maintain customer satisfaction.

As you can see, fixing the EVAP system is easy, once you understand how the system operates.

You can use the VAG 1551, 1552 or the VAS 5051 in conjunction with the Service Information System to diagnose a failure in the EVAP system.

After that, all you have to do is repair or replace the faulty area and the vehicle is on its way.

Caution! Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and be sure the area you are working in is well ventilated.

Remember, after you have repaired a fault in the EVAP system and everything checks out okay, RESET THE READINESS CODE.

On-board Re-fueling and Vapor Recovery (ORVR)

Starting in 1998, another system was developed to stop another type of vapor emissions, re-fueling vapor emissions.

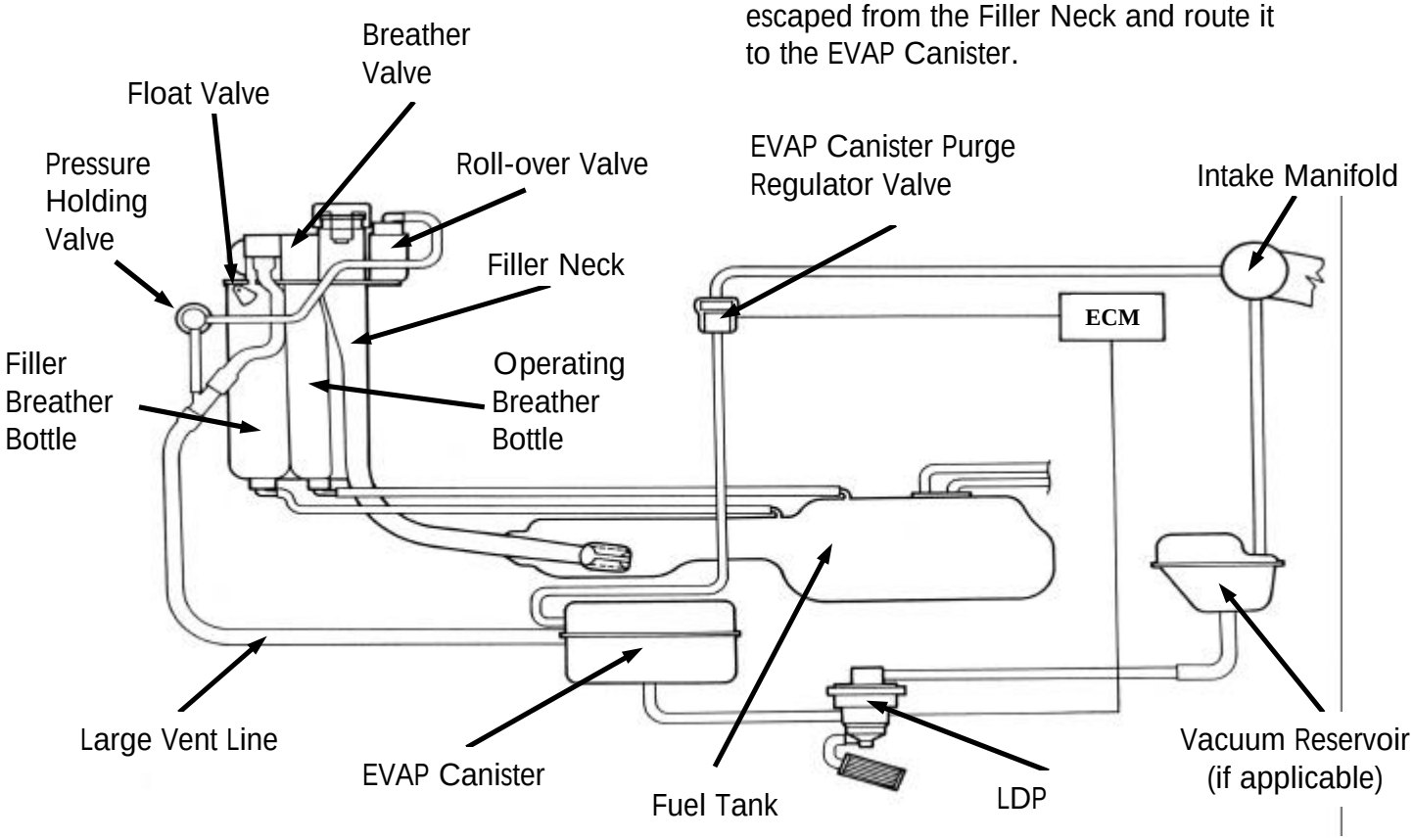
This type of fuel vapor recovery is called the On-board Re-fueling Vapor Recovery (ORVR) system.

The ECM has no control over the components during the ORVR process. All activity through the system is mechanical.

To see how the ORVR system works, let's first take a look at the components in the system:

- Pressure Holding Valve
- Breather Valve
- Roll-over Valve
- Filler Neck
- Operating Breather Bottle
- Filler Breather Bottle
- Fuel Tank
- Leak Detection Pump
- Vacuum Canister
- EVAP Canister
- EVAP Canister Vent
- EVAP Canister Purge Regulator Valve.

These components work together to trap the fuel vapor that would previously have escaped from the Filler Neck and route it to the EVAP Canister.



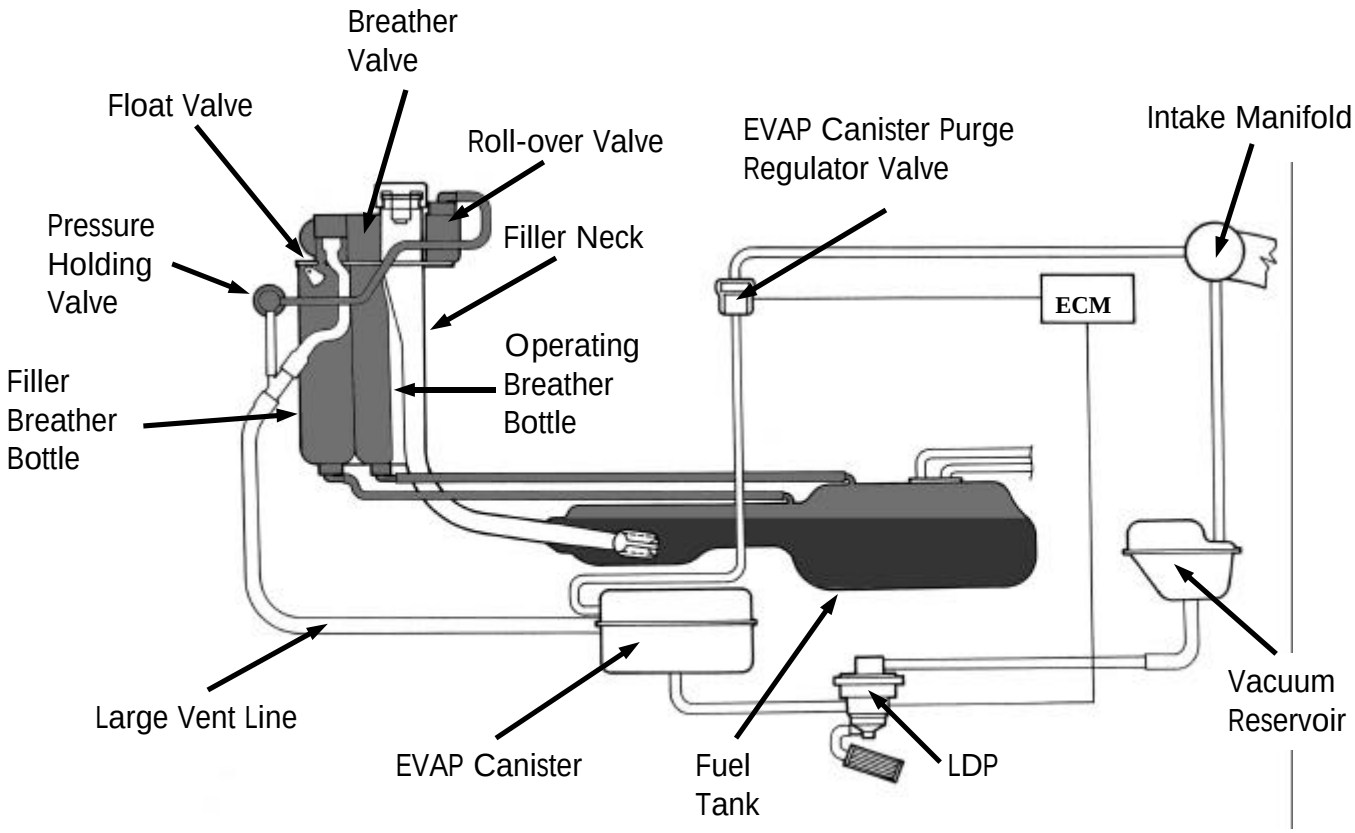
ORVR System During Normal Operation

Normal Operation

During normal operation, the ORVR system works the same as in previous systems.

Fuel vapor is collected in both the Operating and Filler Breather Bottles, then routed through the Breather Valve.

From the Breather Valve, the fuel vapor is passed to the Roll-over Valve and on to the Pressure Holding Valve.



ORVR System During Normal Operation

Pressure Holding Valve

The Pressure Holding Valve is located in the Vent Line between the Fuel Tank and the EVAP Canister.

It controls the amount of fuel tank pressure that can be passed from the Fuel Tank to the EVAP Canister to control the amount of fuel vapor created.

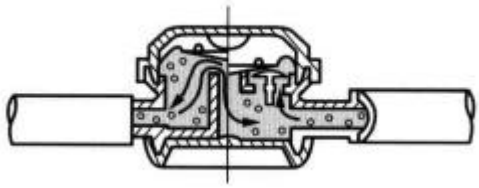
By keeping a small amount of pressure on the fuel in the Fuel Tank, fewer vapors are formed.

When the pressure in the Fuel Tank exceeds this set pressure, the Pressure Holding Valve opens to vent the fuel vapor through to the EVAP Canister.

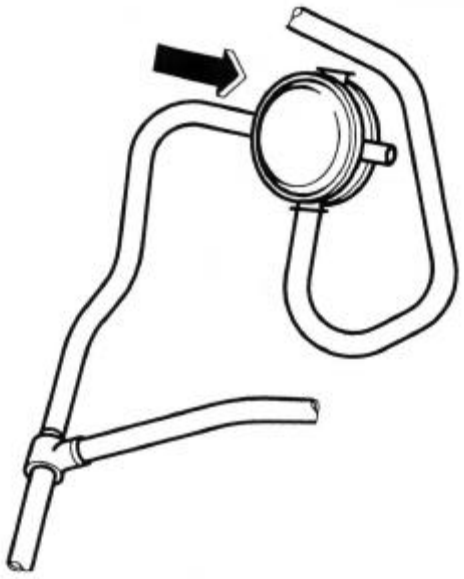
The Pressure Holding Valve also allows air from the EVAP Canister Vent into the Fuel Tank. This relieves the vacuum created when fuel is drawn from the Fuel Tank by the engine.

When the EVAP Canister Purge Regulator Valve is purging the EVAP system of fuel vapor, the Pressure Holding Valve closes. This prevents fuel vapor from being drawn out of the Fuel Tank.

When the EVAP Canister Purge Regulator Valve closes and the pressure in the Vent Lines rises, the Pressure Holding Valve reopens and allows vapor through to the EVAP Canister.



Pressure Holding Valve Interior



Pressure Holding Valve Exterior

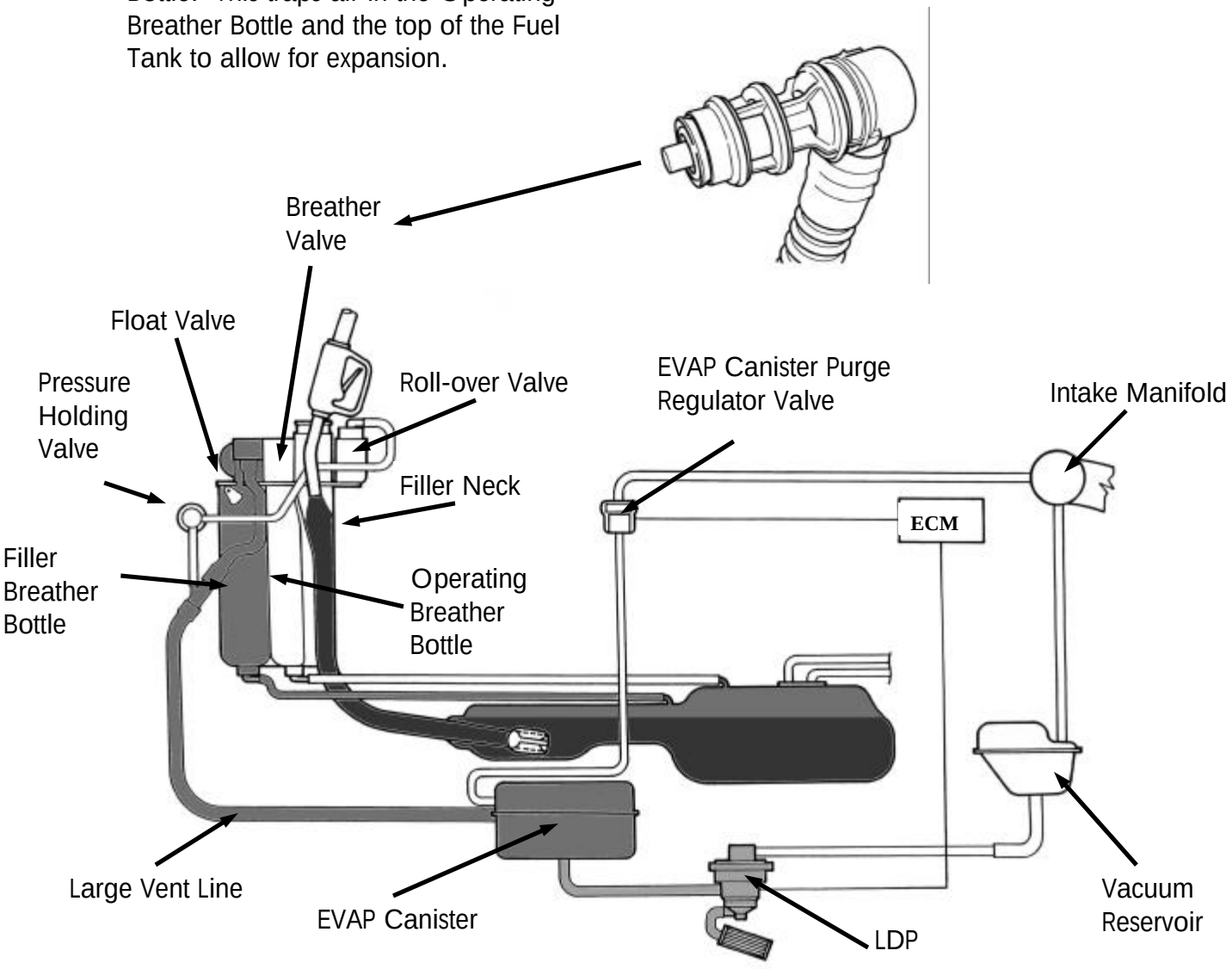
Re-fueling Operation

During re-fueling, the nozzle from the gas pump pushes aside the Fuel Tank Filler Flap, which in turn pushes on the Breather Valve.

The Breather Valve closes the Fuel Tank venting path from the Operating Breather Bottle. This traps air in the Operating Breather Bottle and the top of the Fuel Tank to allow for expansion.

At the same time, the larger Vent Line from the Filler Breather Bottle is opened.

As fuel flows down the Filler Neck and into the tank, either a Liquid or Mechanical Seal will keep fuel vapor from passing out through the top of the Filler Neck.

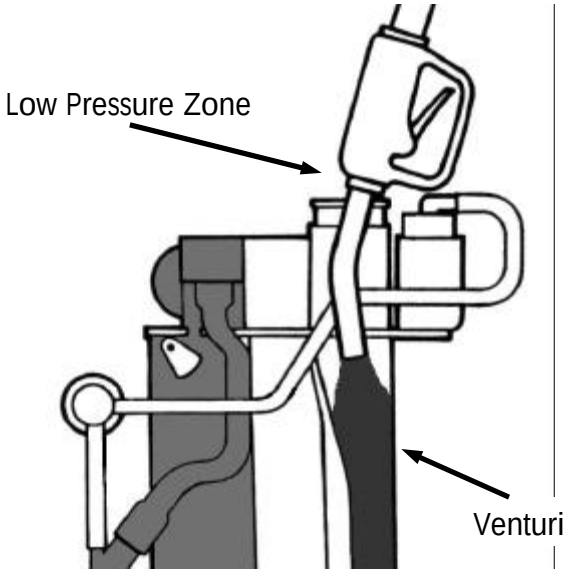


ORVR System During Re-fueling

Liquid Seal

A Liquid Seal uses the design of the Filler Neck to stop fuel vapor from escaping.

As fuel flows through this Filler Neck, a venturi effect is created, drawing the fuel vapor into the Fuel Tank.

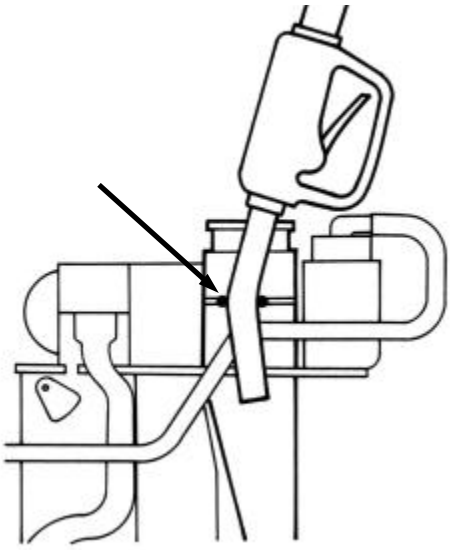


Liquid Seal

Mechanical Seal

A Mechanical Seal uses physical contact to stop fuel vapor from escaping.

This is a diagram of a Mechanical Seal. Notice the rubber seal. This seals around the Filler Nozzle to stop the fuel vapors from escaping.



Mechanical Seal

Vapor Travel Through the System

After the fuel vapor passes though one of these seals, it is forced into the Fuel Tank, through the Vent Line and into the Filler Breather Bottle.

From the Filler Breather Bottle, the fuel vapor passes into the Large Vent Line and finally through to the EVAP Canister.

EVAP Canister

The EVAP Canister functions the same way during ORVR operation as it does during EVAP operation.

As the fuel vapor and air mixture is passed through the EVAP Canister, it passes through a layer of activated carbon.

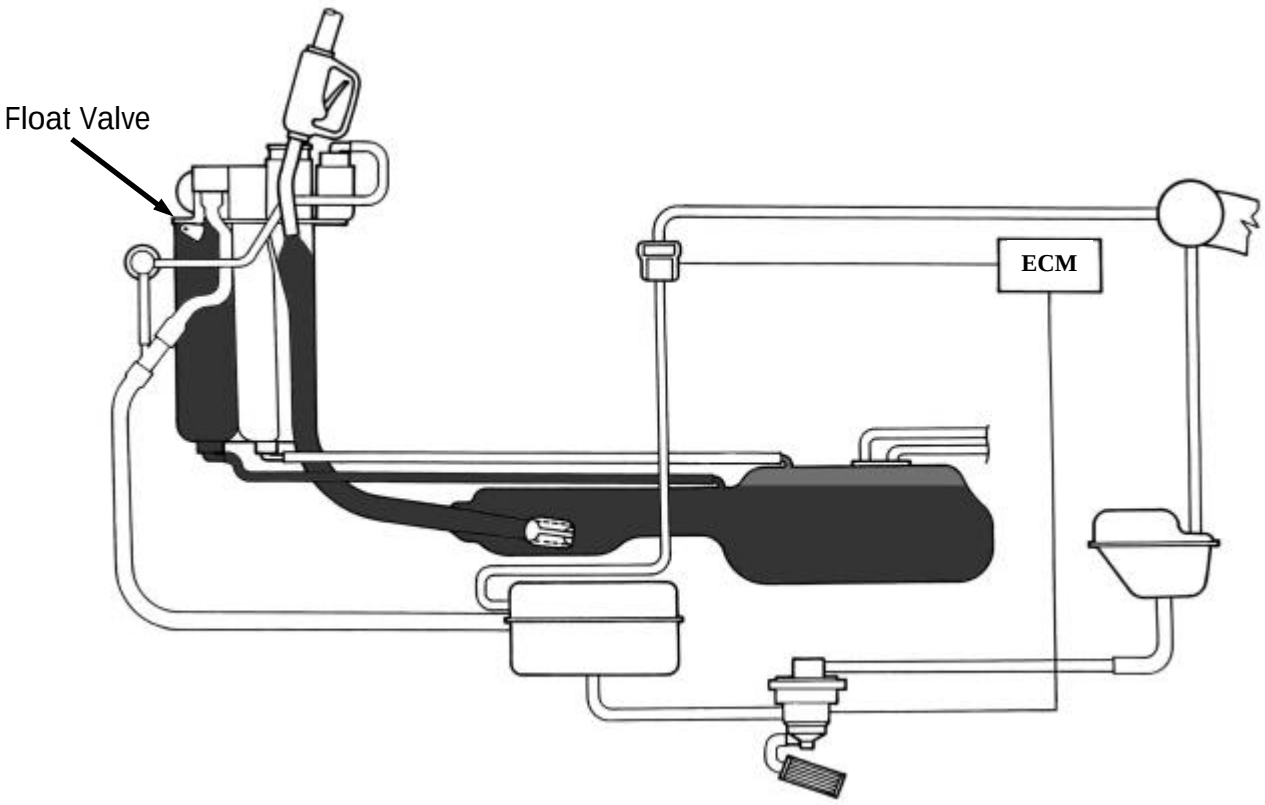
This carbon absorbs the fuel vapor from the air mixture, only letting clean air escape out of the LDP Vent or the EVAP Canister Vent Valve, whichever the system is equipped with.

Filler Breather Bottle

Once the Fuel Tank fills, liquid fuel travels through the lower fuel tank Vent Line to the Filler Breather Bottle.

When the Filler Breather Bottle is full of fuel, a Float Valve at the top closes. This prevents liquid fuel from traveling to the EVAP Canister.

The increased tank pressure caused by the Float Valve closing causes liquid fuel to back up in the Filler Neck, covering the aspirator on the gas pump nozzle. This shuts off the gas pump.



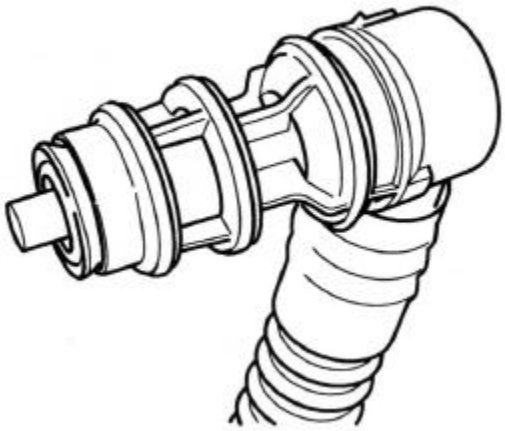
ORVR system Float Valve

Breather Valve

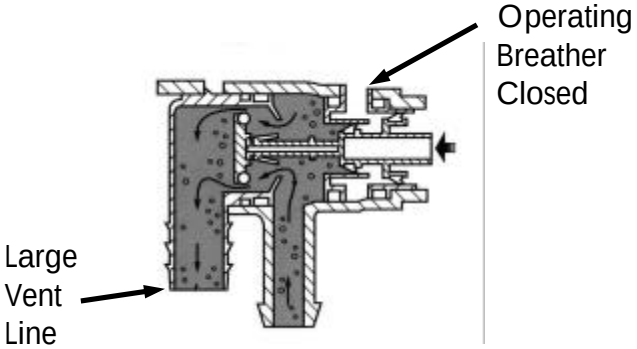
When the gas pump nozzle is removed, the Breather Valve switches back to its normal operating position.

This closes the large Vent Line and opens the vent at the top of the Operating Breather Bottle.

The air in the Operating Breather Bottle is released, and now the fuel in the Filler Breather Bottle flows back into the Fuel Tank. Both Breather Bottles are left empty for expansion.



Breather Valve



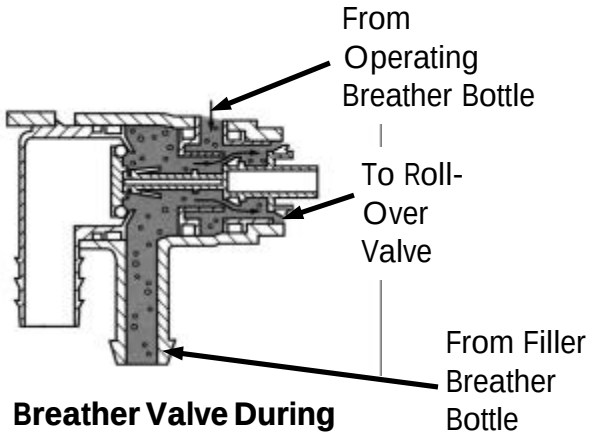
Breather Valve During Filling Operation

ORVR Summary

That covers the ORVR system. As you can see, the ORVR system is a great way to keep the excess fuel vapor from escaping into the environment.

During normal operation, it pretty much acts like the EVAP system, but uses some different components. The fuel vapor is recovered from the Fuel Tank and the EVAP Canister, sent through the EVAP Canister Purge Regulator Valve and burned in the engine.

During the re-fueling process, the vapor is routed through Breather Bottles, the Pressure Holding Valve, the Roll-over Valve and to the EVAP Canister.



Breather Valve During Normal Operation

FINAL SUMMARY

EVAP System

The EVAP system started out to keep the fuel vapor in the fuel tank from escaping.

EVAP System with LDP

This system later added an LDP to pressurize and check for leaks.

The LDP is vacuum operated, ECM controlled, and can detect a leak as small as 1 millimeter in diameter.

EVAP System Diagnosis

Now that the LDP was added, the technician had to be given information on how to repair the system. Understanding the operation of the system gives you the tools to properly diagnose faults in the system.

Using scan tools, the Service Information System, and the LDP as a pump, the technician has the capability to find any fault in the system.

ORVR System

The ORVR system was added to vehicles after the EVAP system, and has the capability to trap the vapor created during the re-fueling process.

This vapor is later routed to the engine, in a similar manner to the EVAP system, to be burned.

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this SSP.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.accessaudi.com

From the accessaudi.com homepage:

- Click on the “ACADEMY” Tab
- Click on the “Academy Site” Link
- Click on the ”CRC Certification” Link

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