

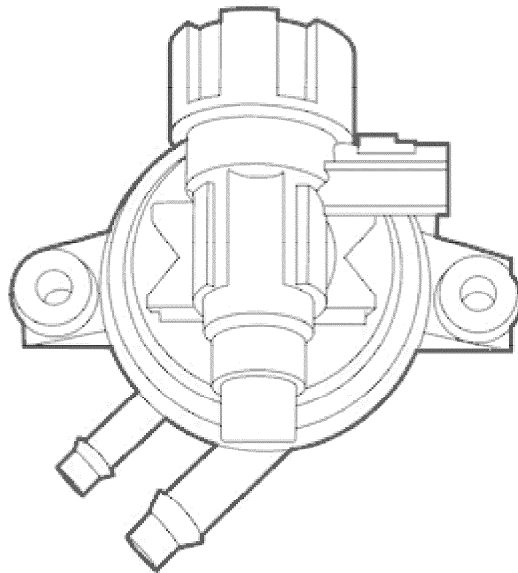
## Evaporative Emissions

To reduce the emission of fuel vapor, the fuel tank is vented to atmosphere through activated evaporative emission canisters which collect the fuel vapor. The evaporative emission canister is periodically purged of fuel vapor when the evaporative emission canister purge valve opens the vapor line between the evaporative emission canister and the air intake induction elbow. This action allows manifold depression to draw air through the evaporative emission canister atmospheric vent, taking up the deposited fuel vapor from the charcoal adsorber inside the evaporative emission canister and burning the resulting fuel vapor in the engine.

There are two variants of the evaporative emissions system. All systems use the charcoal adsorber storage evaporative emission canisters and purge valve and operate as described above. The specific features of each system are described below. The evaporative systems are designated as :

- Vehicles with on-board refueling vapor recovery
- Vehicles without on-board refueling vapor recovery

## Evaporative Emissions Canister Purge Valve



E37603

The evaporative emission canister purge valve controls the flow rate of fuel vapor drawn into the engine during the canister purge operation. The valve is opened by a vacuum feed from the induction elbow : the vacuum feed is controlled by the integral valve solenoid and is applied when the solenoid is energized. The solenoid is pulsed on (energized) and off by a fixed frequency (100Hz) variable pulse width control signal (pulse width modulation). By varying the pulse on to off time, the ECM controls the duty cycle of the valve (time that the valve is open to time closed) and thus the vapor flow rate to the engine.

With no ECM signal applied to the valve solenoid, the valve remains closed.

## Canister Purge Operation

The following pre-conditions are necessary for purging to commence :

- after battery disconnection/reconnection, engine management adaptations must be re-instated.
- engine has run for at least 8 seconds.
- engine coolant temperature is not less than 70 °C.
- engine not running in the fuel cut off condition (eg overrun).

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- the adaptive fuel correction function has not registered a rich or lean failure
- the evaporative emission leak test has not failed
- no faults have been diagnosed in the relevant sensor and valve circuits - air flow meter (AFM), engine coolant temperature sensor, evaporative canister purge valve and evaporative emission canister vent solenoid.

If these conditions have been satisfied, purging is started. If any failures are registered, purging is inhibited.

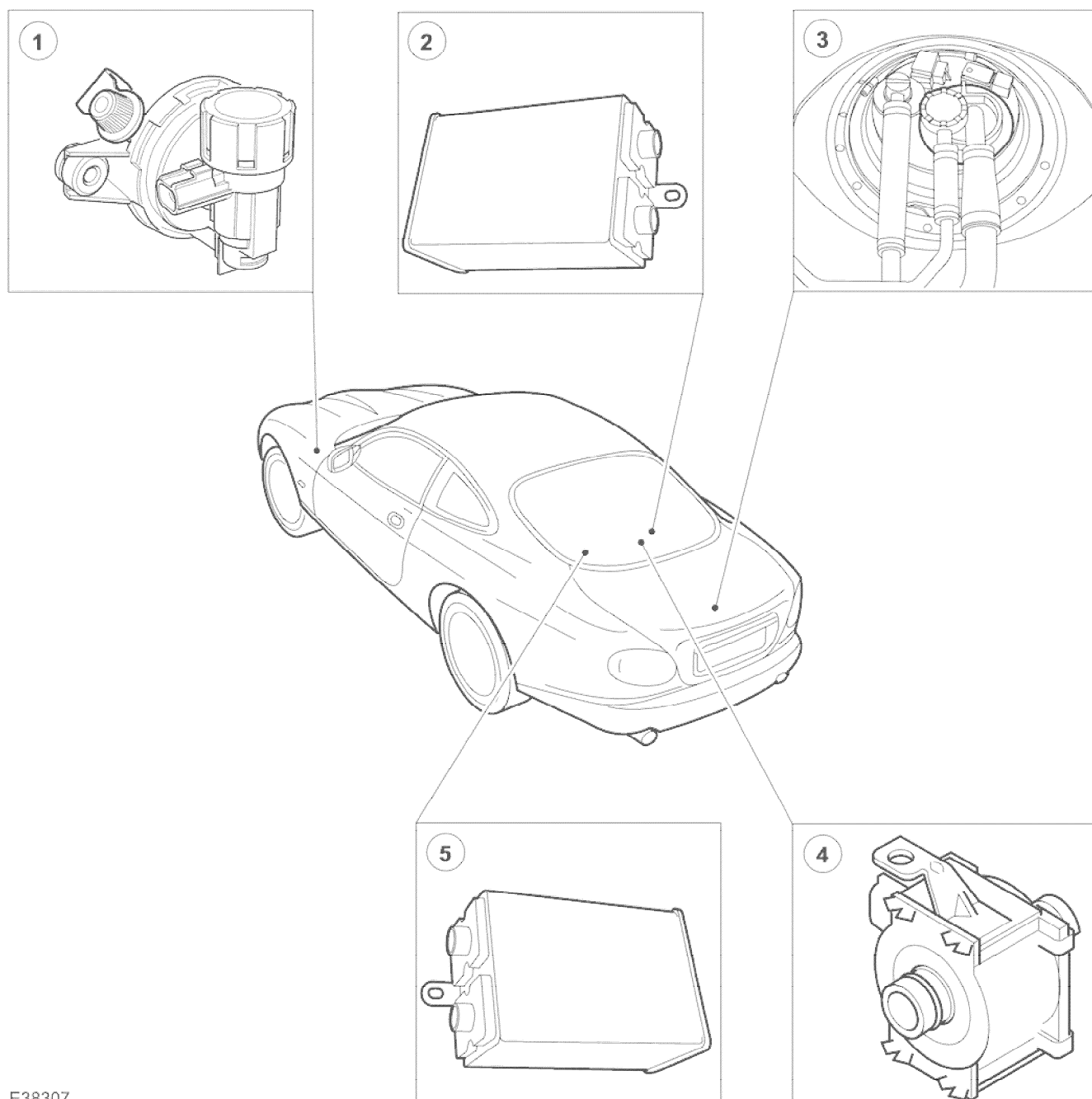
The canister(s) is purged during each drive cycle at various rates in accordance with the prevailing engine conditions. The engine management software stores a map of engine speed (RPM) against engine load (grams of air inducted / rev). For any given engine speed and load, a vapor purge rate is assigned (purge rate increases with engine speed and load).

The preset purge rates are based on the assumption of a vapor concentration of 100%. The actual amount of vapor is measured by the closed loop fueling system : the input of evaporative fuel into the engine causes the outputs from the upstream oxygen sensors to change, the amount of change providing a measure of the vapor concentration. This feedback causes the original purge rate to be adjusted and also reduces the amount of fuel input via the injectors to maintain the correct air to fuel ratio.

Engine speed/load mapping and the corresponding purge rates are different for vehicles fitted on-board refueling vapor recovery and vehicles without on-board refueling vapor recovery.

### **Vehicles With On-board Refueling Vapor Recovery.**

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E38307

Item	Description
1	Evaporative emission canister purge valve
2	Evaporative emission canister
3	Fuel vapor vent valve housing
4	Evaporative emission canister vent solenoid
5	Evaporative emission canister

The system has the following features :

- on-board refueling vapor recovery to reduce the fuel vapor vented directly to atmosphere from the filler nozzle when refueling .
- a fuel tank pressure sensor and an evaporative emission canister vent solenoid are fitted to allow the on-board diagnostic facility to test for leaks in the fuel and evaporative system.

The evaporative emission canister vent solenoid is a solenoid operated device controlled by the ECM. The valve is normally open and is closed only during the leak test sequence.

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The fuel tank pressure sensor is fitted to the fuel vapor vent valve housing and provides a voltage to the ECM which is proportional to tank vapor pressure.

### Operation Of On-board Refueling Vapor Recovery

The on-board refueling vapor recovery system enables fuel vapor generated during refueling to be collected by the charcoal canisters. During normal running of the vehicle, the vapor is collected and purged in the same way as for vehicles without on-board refueling vapor recovery.

The on-board refueling vapor recovery system features are :

- Narrow fuel filler pipe and tank check valve.
- Fuel level vent valve fitted to the fuel vapor vent valve housing and consisting of a two stage shut-off valve with rollover protection and a pressure relief valve.
- Grade vent valve with rollover protection, fitted to the fuel vapor vent valve housing and with an outlet pipe connected to the fuel level vent valve vapor outlet pipe.
- Large bore vapor vent pipes.

The fuel filler pipe has a reduced diameter between the nozzle guide and the tank, providing a liquid seal when refueling and preventing the fuel vapor venting directly to atmosphere. There is no breather tube fitted between the tank and the filler nozzle. To prevent spit back when refueling, a check valve is fitted at the lower end of the filler pipe inside the tank (see Figure).

During refueling, the tank is vented via the fuel level vent valve, large bore vapor pipes and the charcoal canisters. The fuel level vent valve incorporates a float valve which is closed by the rising fuel level, creating a back pressure and causing the fuel delivery to stop. In the closed position, the fuel level vent valve also sets the fuel level.

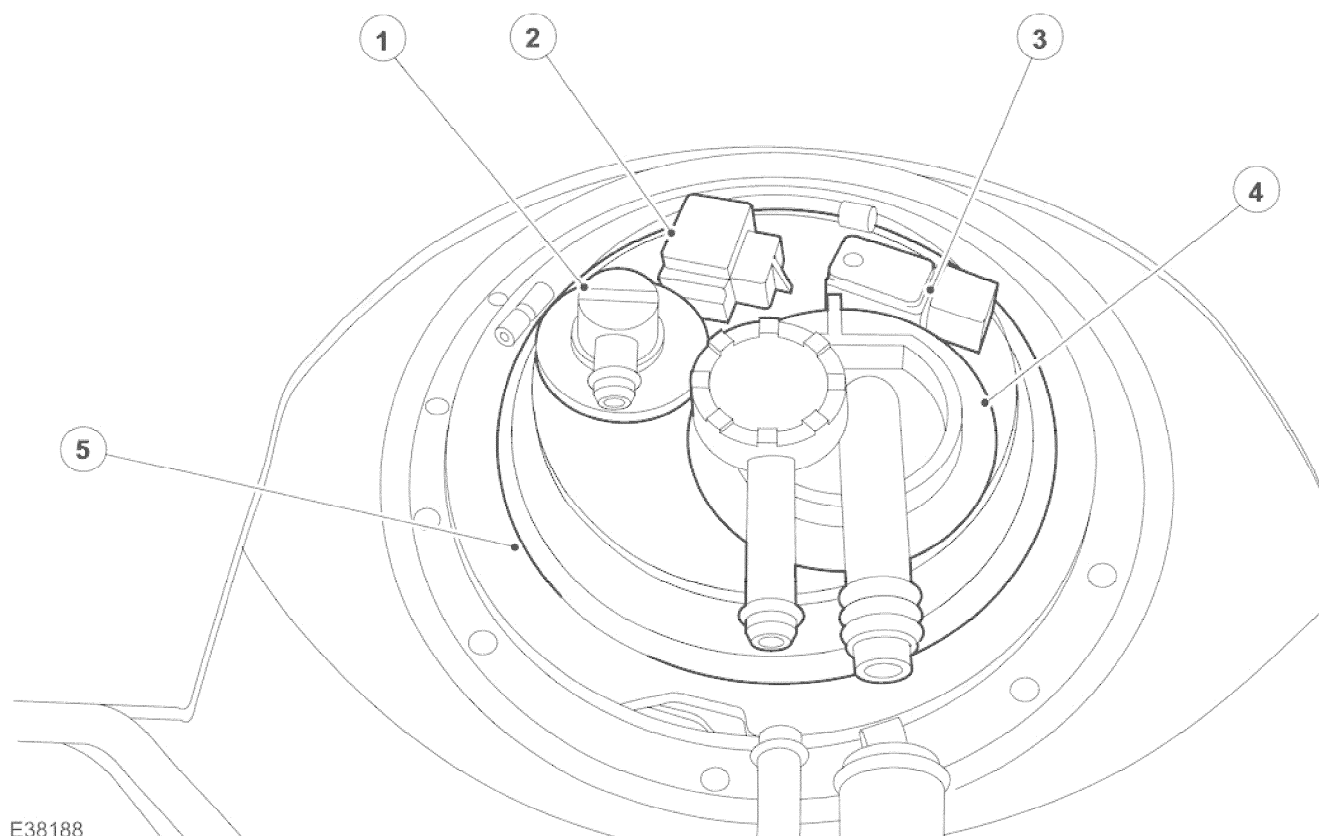
With the fuel level vent valve closed (tank full), any increase in pressure or overfilling is relieved by a separate rollover protected grade vent valve. The outlet from this valve feeds into the main fuel level vent valve vapor outlet pipe, bypassing the closed fuel level vent valve.

When the fuel level is below full, the fuel level vent valve opens to allow unrestricted venting via the canisters.

A pressure relief valve is incorporated into the fuel level vent valve assembly and has an outlet pipe to the filler nozzle. If a blockage or other restriction (eg, evaporative emission canister vent solenoid in the closed position) occurs in the vapor vent system, the pressure relief valve opens to allow venting to atmosphere via the filler nozzle guide and fuel filler cap.

Canister purge operation is as described in Evaporative Emissions.

### Fuel Vapor Vent Valve Housing - Vehicles With On-Board Refueling Vapor Recovery



E38188

Item	Description
1	Grade vent valve
2	Fuel pump module electrical connector
3	Fuel tank pressure sensor
4	Fuel level vent valve
5	Fuel vapor vent valve housing locking ring

The fuel vapor vent valve housing is fitted to the top of the tank via a seal and locking ring arrangement identical to that used for vehicles without on-board refueling vapor recovery. The fuel vapor vent valve housing is removable complete with the fitted components.

The fuel level vent valve is mounted in the fuel vapor vent valve housing assembly via a bayonet fitting : it is turned approximately 90 ° clockwise to release. The grade vent valve and pressure sensor are push in fits via sealing grommets : note that, due to the tight fit, removal of these components may require cutting the grommets. The fuel pump/sender electrical connector is push fitted and crimped into a location tube on the underside of the flange.

### Evaporative Emission Canister, Evaporative Emission Canister Vent Solenoid and Fittings

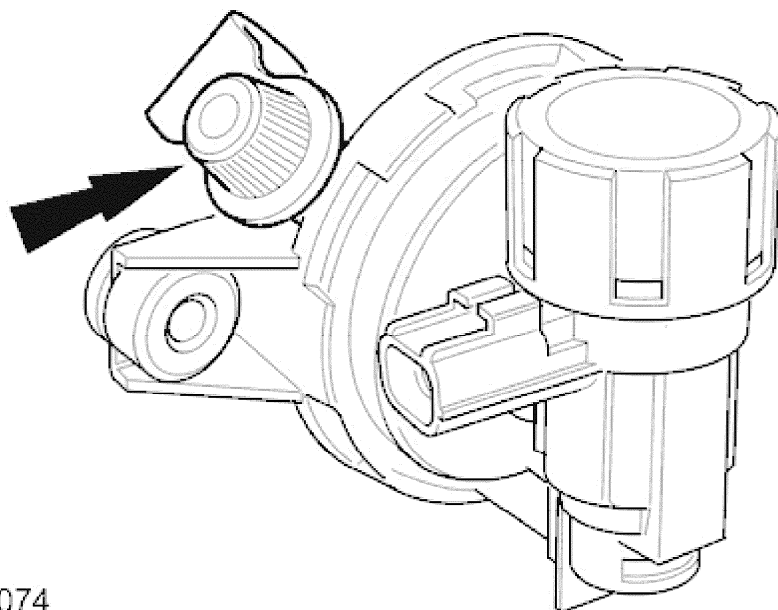
The evaporative emission canisters are fixed to the underside of the vehicle either via semi-enclosed mounting brackets. Two fixing bolts are used at the front of the bracket and a single rear bolt supports the evaporative emission canister and the evaporative emission canister vent solenoid.

The vapor pipes to the canisters, other than the evaporative emission canister vent solenoid, use multi-tang connectors which are push fitted and pulled out without the use of tools.

The evaporative emission canister vent solenoid has a stub pipe with 'O' ring seal which is a simple push fit into the canister. A mounting bracket on the evaporative emission canister vent solenoid enables it to be secured to the underbody via the canister rear mounting bolt.

A hose connects the evaporative emission canister vent solenoid to the bracket mounted adaptor into which the vent system air filter is screwed.

**Standard Federal Testing Procedures (SFTP) Test Port**

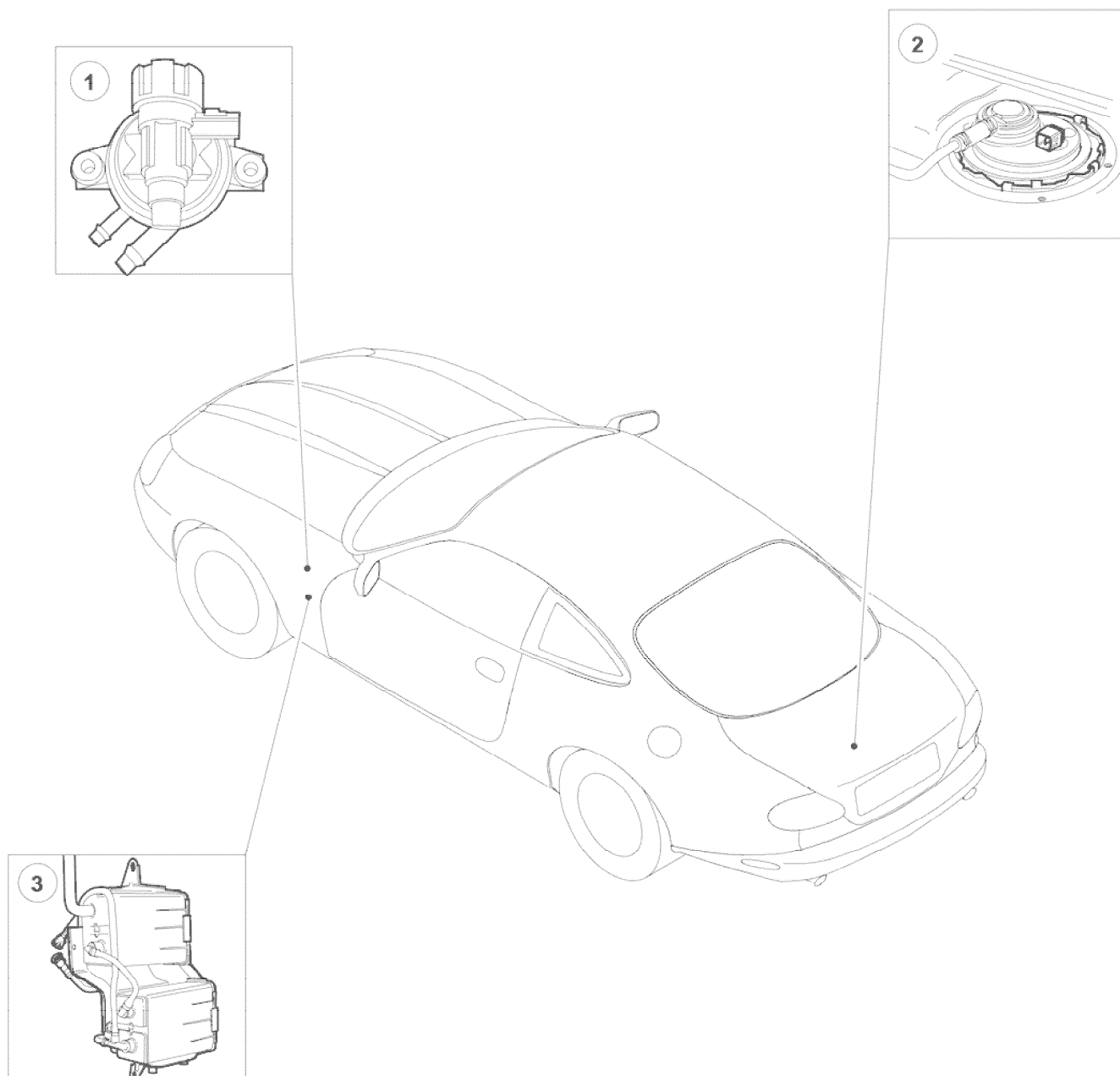


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To comply with Standard Federal Testing Procedures (SFTP) a test port is provided on the evaporative emission (EVAP) canister purge valve to enable leak test diagnosis of the fuel system.

**Vehicles Without On-board Refueling Vapor Recovery.**

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E37605

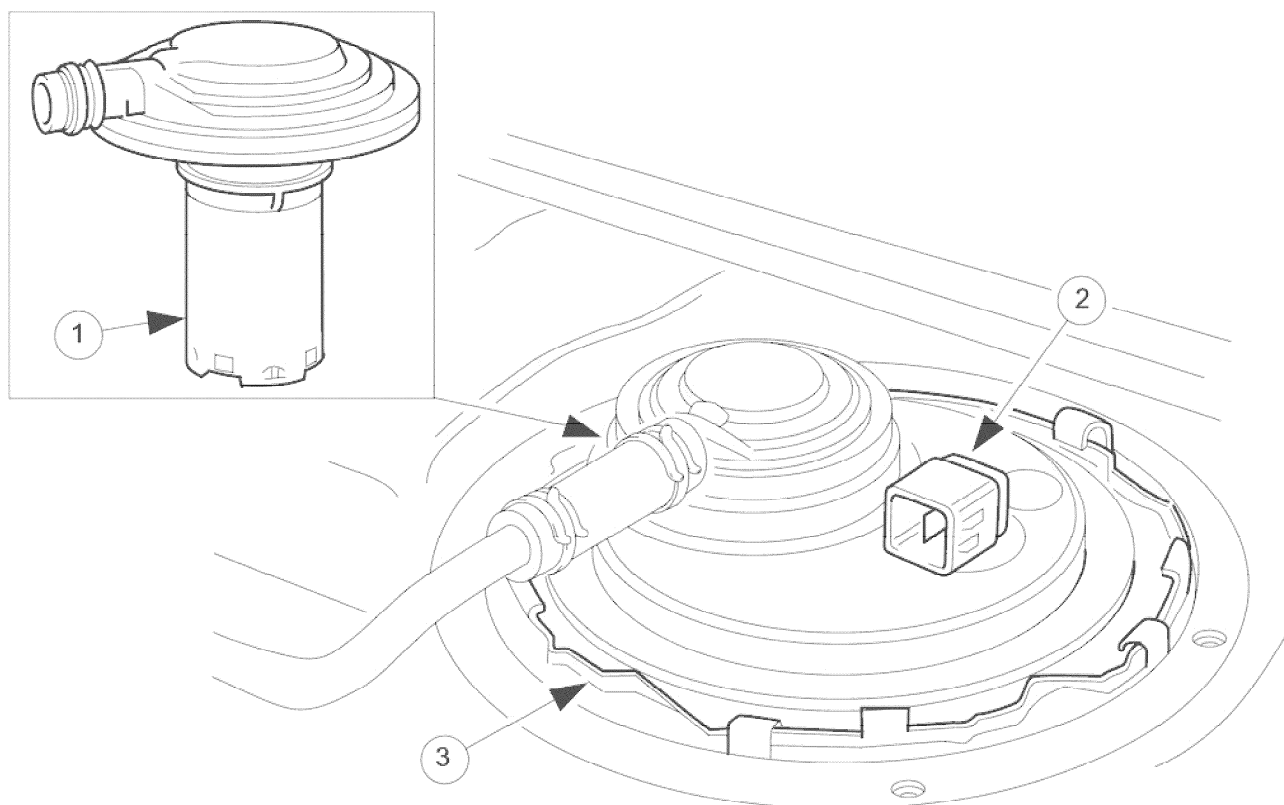
Item	Description
1	Evaporative emission canister purge valve
2	fuel vapor vent valve housing
3	Evaporative emission canisters

This system uses two evaporative emission canisters. The vapor outlet from the fuel tank is taken via a safety rollover valve fitted to the removable flange at the top of the tank.

Canister purge operation is as described in Evaporative Emissions.

## Fuel Vapor Vent Valve Housing - Vehicles Without On-board Refueling Vapor Recovery

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E32545

Item	Description
1	vapor vent / rollover protection valve
2	Fuel pump/sender electrical connector
3	Fuel vapor vent valve housing locking ring

The fuel vapor vent valve housing assembly is fitted to the top of the tank via a seal and locking ring. The assembly is removable complete with the fitted components.

The vapor vent / rollover valve is a push fit via a sealing grommet. The fuel pump/sender electrical connector is push fitted and crimped into a location tube on the underside of the flange.