

Evaporative Emissions

To reduce the emission of fuel vapour, the fuel tank is vented to atmosphere through activated charcoal adsorption canister(s) which collects the fuel droplets. The charcoal is periodically purged of fuel when the EVAP Canister Purge Valve opens the vapour line between the canister(s) and the air intake induction elbow. This action allows manifold depression to draw air through the canister atmospheric vent, taking up the deposited fuel from the charcoal adsorber and burning the resulting fuel vapour in the engine.

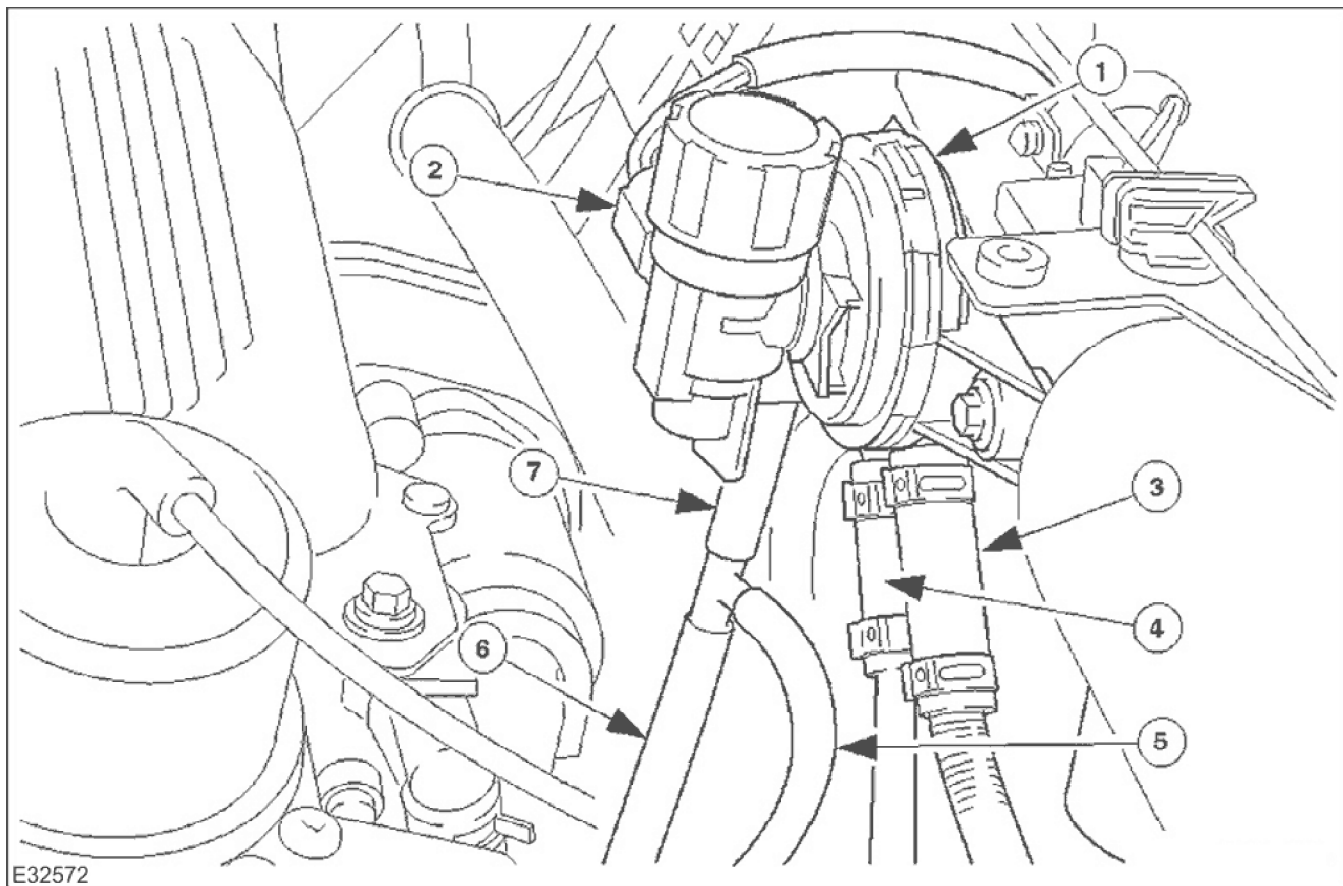
The EVAP Canister Purge Valve is controlled by the engine management system ECM. Purging is carried out in accordance with the engine management fueling strategy (see below).

The fuel tank vapour outlet is via a removeable flange assembly on the top surface of the tank. The vapour storage canister or canisters are fitted on the underside of the vehicle below the rear seats.

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

- single canister system
- running loss system
- running loss with On-board Re-fueling Vapour Recovery (ORVR) system

EVAP Canister Purge Valve



Item	Description
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1	EVAP canister purge valve
2	Valve solenoid connector
3	Vapour outlet to induction elbow
4	Vapour inlet from canister(s)
5	Vacuum control pipe from induction elbow
6	Vacuum control pipe to vapour pressure control valve - applicable to single canister systems only
7	Vacuum control connection to EVAP valve

The EVAP canister purge valve controls the flow rate of fuel vapour 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 energised. The solenoid is pulsed on (energised) 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 vapour 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).
- 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 Canister Close Valve (CCV).

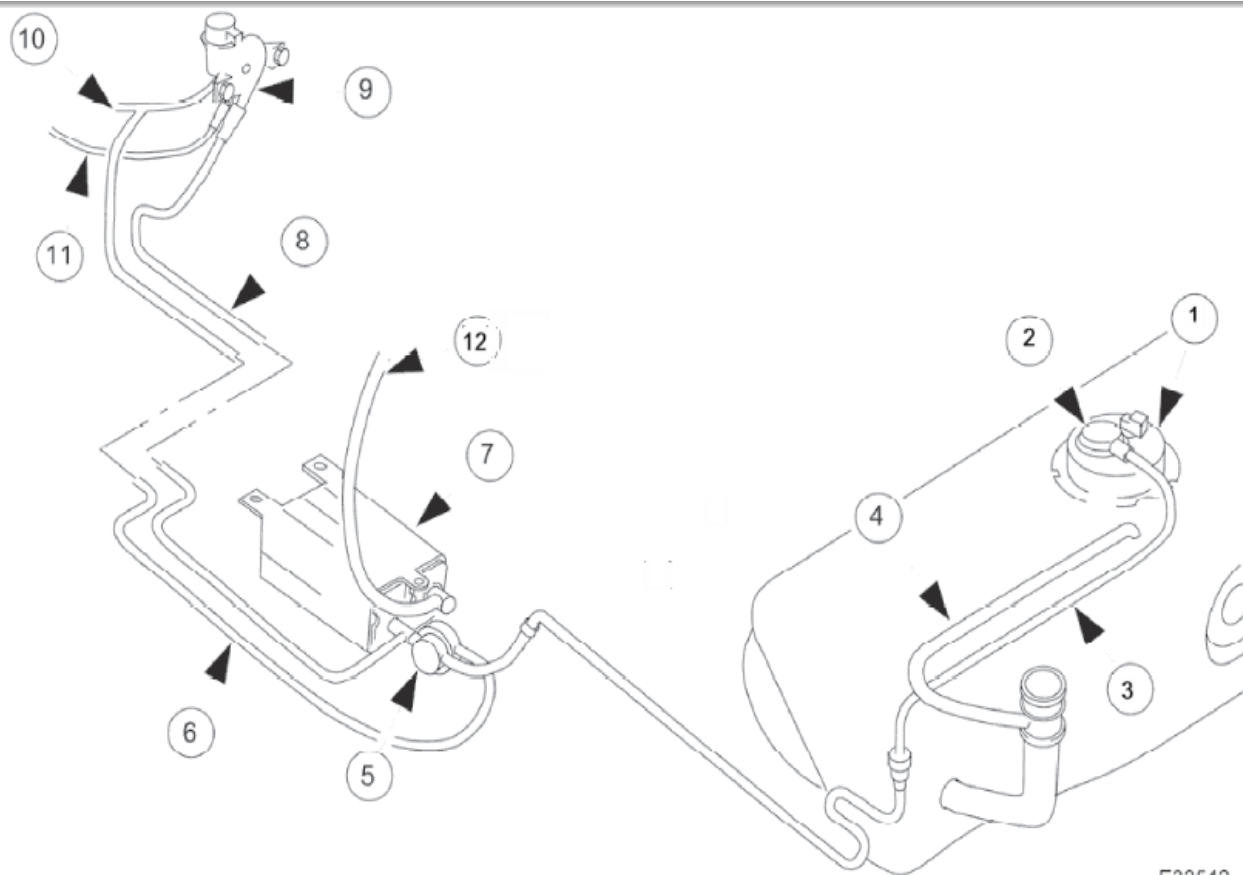
If these conditions have been satisfied, purging is started. If any failures are registered, purging is inhibited.

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 vapour purge rate is assigned (purge rate increases with engine speed and load).

The preset purge rates are based on the assumption of a vapour concentration of 100%. The actual amount of vapour 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 vapour 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 single canister, running loss and ORVR evaporative systems.

Single Canister System



E32542

Item	Description
1	Evaporative flange assembly
2	Vapour outlet rollover valve
3	Tank vapour outlet pipe
4	Breather pipe
5	Pressure control valve
6	Induction vacuum control pipe
7	Charcoal canister
8	Canister vapour outlet pipe
9	EVAP canister purge valve
10	Vacuum control signal from induction
11	EVAP canister purge valve outlet
12	Canister vent to atmosphere

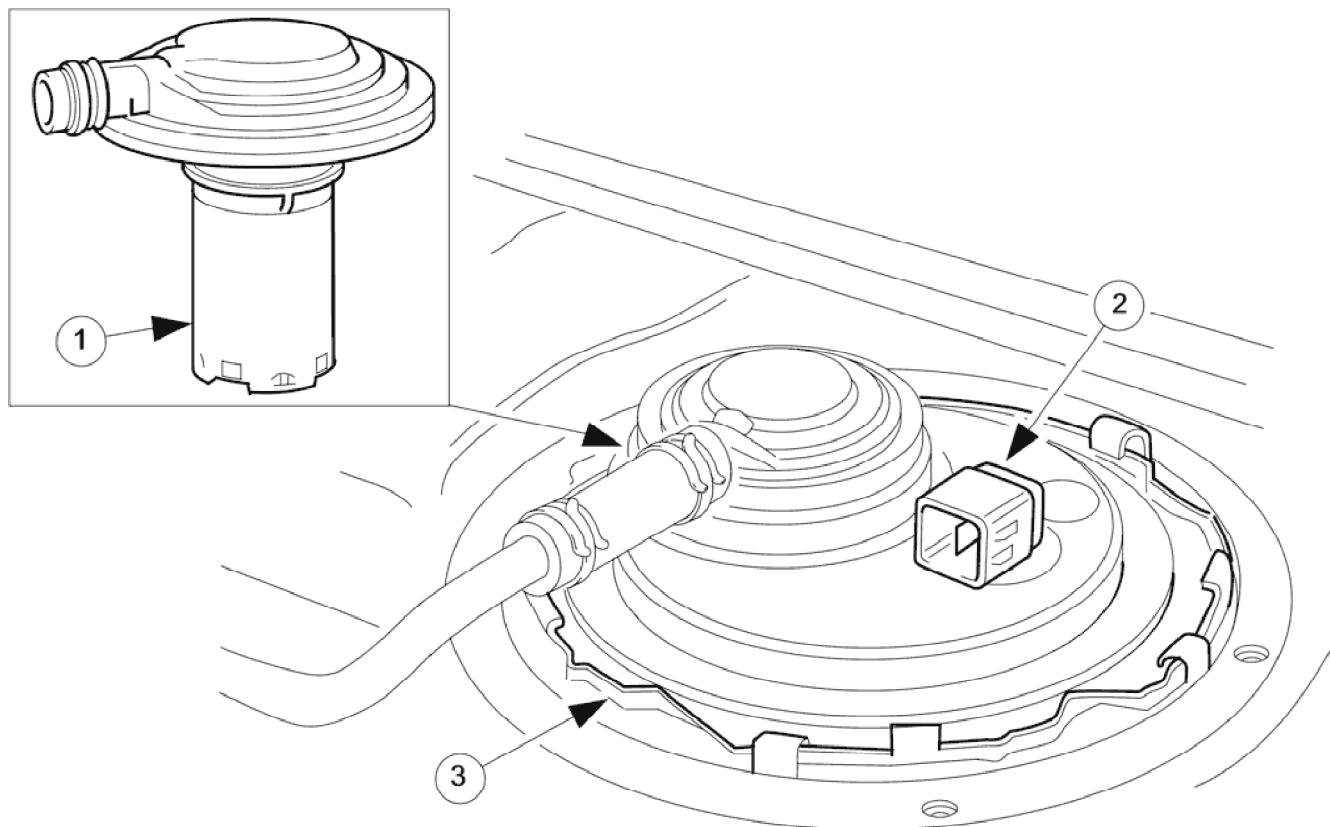
This system uses a single charcoal canister with a pressure control valve between the canister and the fuel tank vapour outlet. A vacuum control pipe is connected from the engine intake induction elbow to the pressure control valve. The vapour outlet from the fuel tank is taken via a safety rollover valve fitted to the removeable flange at the top of the tank.

With the engine stopped, the pressure control valve is closed, maintaining a slight positive pressure in the tank : any further increase in pressure causes the valve to open and release vapour to the canister.

When the engine is running, manifold depression (via the vacuum control pipe) holds the pressure control valve open. Air is drawn into the tank to maintain atmospheric pressure as fuel is used and vapourised fuel is deposited in the charcoal canister.

Canister purge operation is as described in Evaporative Emissions Control.

Evaporative Flange Assembly



E32545

Item	Description
1	Vapour vent / rollover protection valve
2	Fuel pump connector
3	Evaporative loss flange locking ring

The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring. The assembly is removeable complete with the fitted components.

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

Running Loss System



Part#
Fuel Vapor canister - NNB6110AB

#7 on diagram Charcoal canister



Part#

Part#

Fuel Vapor canister - NNB6110AB with FUEL VAPOR CANISTER CLOSE VALVE - LNC1525AC
#7 & #8 on diagram

Part#

FUEL VAPOR CANISTER CLOSE VALVE - LNC1525AC



#8 on diagram Canister Close Valve

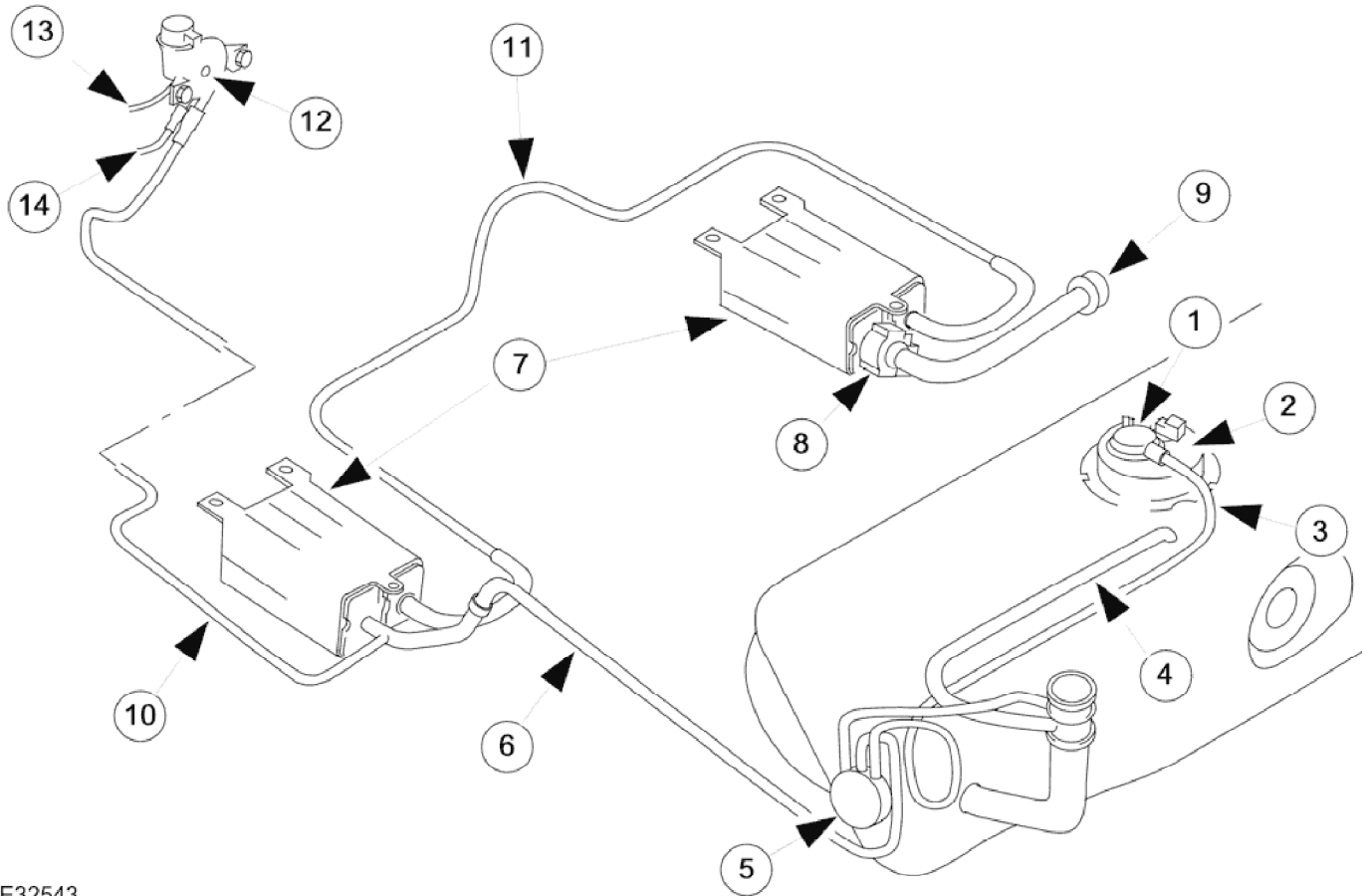
Vapour pipe connecting canisters



Picture of item.



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E32543

Item	Description
1	Vapour outlet rollover valve
2	Evaporative flange assembly
3	Tank vapour outlet pipe
4	Breather pipe
5	Pressure control valve
6	Vapour pipe to canister
7	Vapour pipe connecting canisters
8	Canister close valve
9	Vent pipe air filter
10	Canister purge outlet pipe
11	Vapour pipe connecting canisters
12	EVAP canister purge valve
13	Vacuum control signal from induction elbow
14	EVAP purge valve outlet to induction elbow

The running loss system has the following features :

- a normally open pressure control valve is fitted at the lefthand side of the tank.
- two charcoal canisters are connected in series to reduce the concentration of fuel in vapour vented to atmosphere.
- a tank pressure sensor and canister close valve are fitted to allow the on-board diagnostic facility to test for leaks in the fuel and evaporative system.

The pressure control valve allows continuous venting of vapour to the charcoal canisters during normal running but

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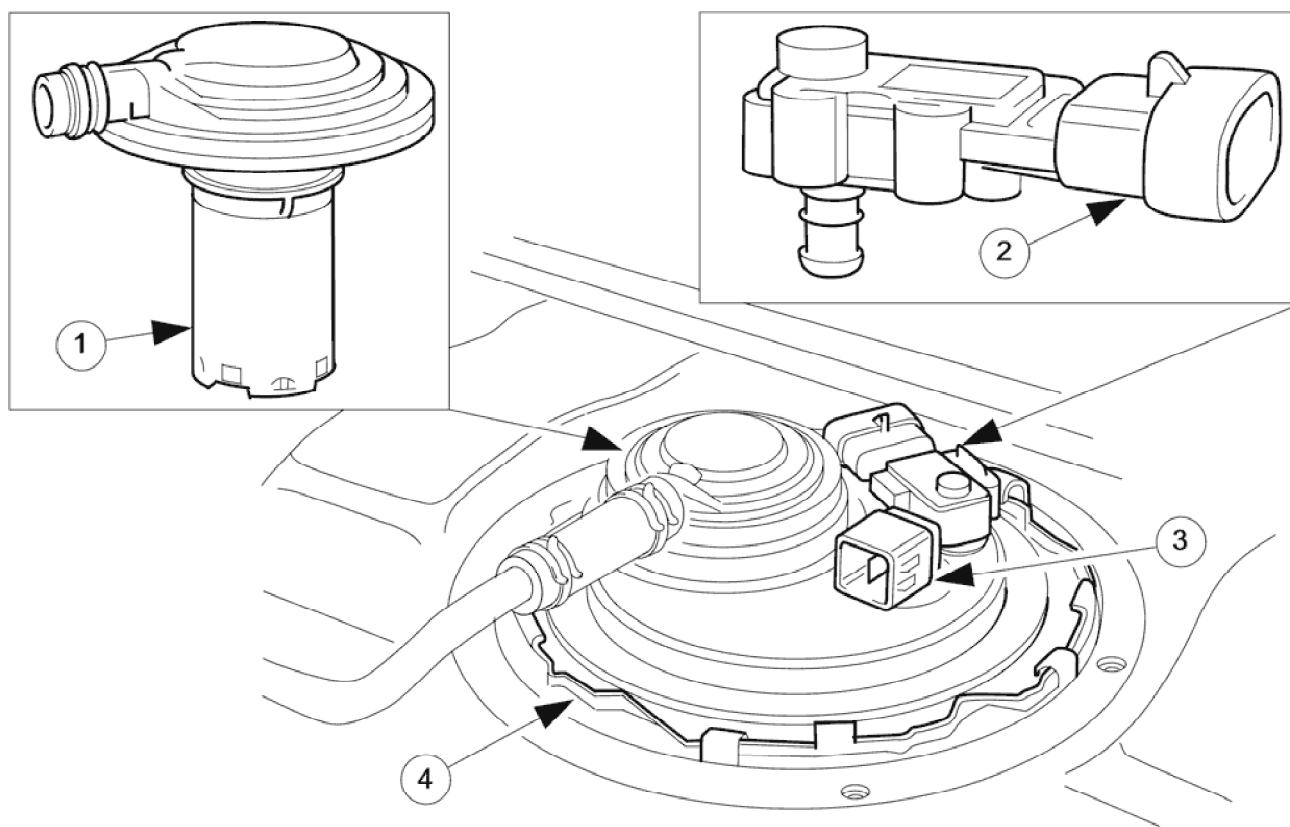
prevents fuel entering the vent line during refueling. Fuel vapour from the tank passes through the valve to the lefthand canister and a third pipe connects the valve to the filler neck. When refueling, the difference in pressure between the tank interior and the open filler neck causes the valve to close, shutting off the vapour vent line. When the fuel cap is replaced, the pressures are equalised and the pressure control valve opens the vent line to the canisters.

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

The fuel pressure sensor is fitted to the evaporative loss flange and provides a voltage to the ECM which is proportional to tank vapour pressure.

Canister purge operation is as described in Evaporative Emissions Control.

Evaporative Flange Assembly



E32546

Item	Description
1	Vapour vent / rollover protection valve
2	Pressure sensor
3	Fuel pump connector
4	Evaporative loss flange locking ring

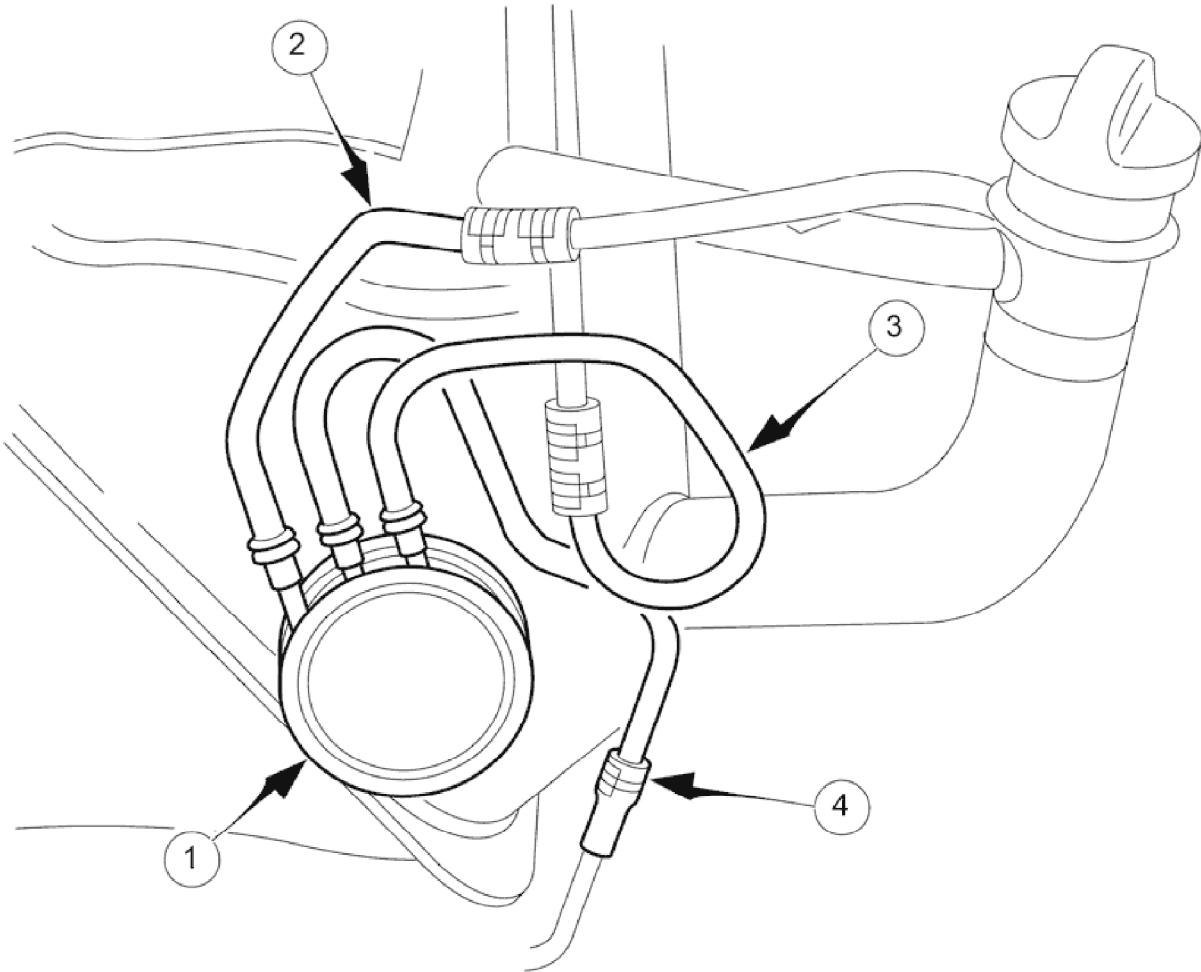
The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring. The assembly is removeable complete with the fitted components.

The vapour vent / rollover valve and pressure sensor are a push fit via sealing grommets. The fuel pump connector is

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push fitted and crimped into a location tube on the underside of the flange.

Pressure Control Valve



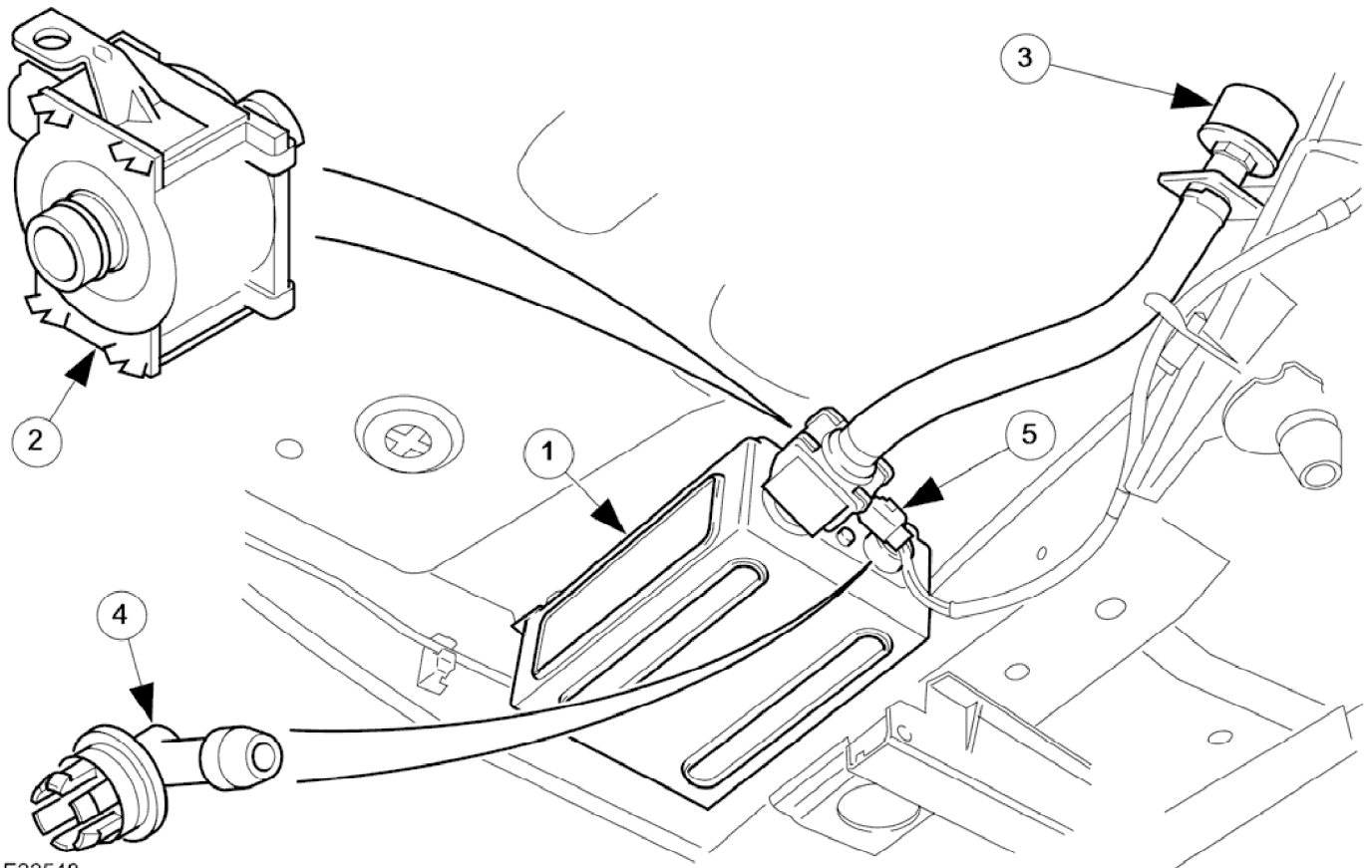
E33195

Item	Description
1	Pressure control valve
2	Filler neck pressure sensing pipe
3	Vapour pipe from tank
4	Vapour outlet pipe to underfloor canister

The pressure control valve is fastened by adhesive to the lefthand side of the tank. It is a non-serviceable component.

Canister, CCV and Fittings

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E32548

Item	Description
1	Charcoal canister (righthand) in mounting bracket
2	Canister close valve (showing canister stub pipe)
3	Air filter
4	Quick-fit vapour inlet connector
5	Canister close valve electrical connector

The canisters are fixed to the underside of the vehicle either directly or via semi-enclosed mounting brackets. Two fixing bolts are used at the front of the canister (or bracket) and a single rear bolt supports the canister and the canister close valve (CCV).

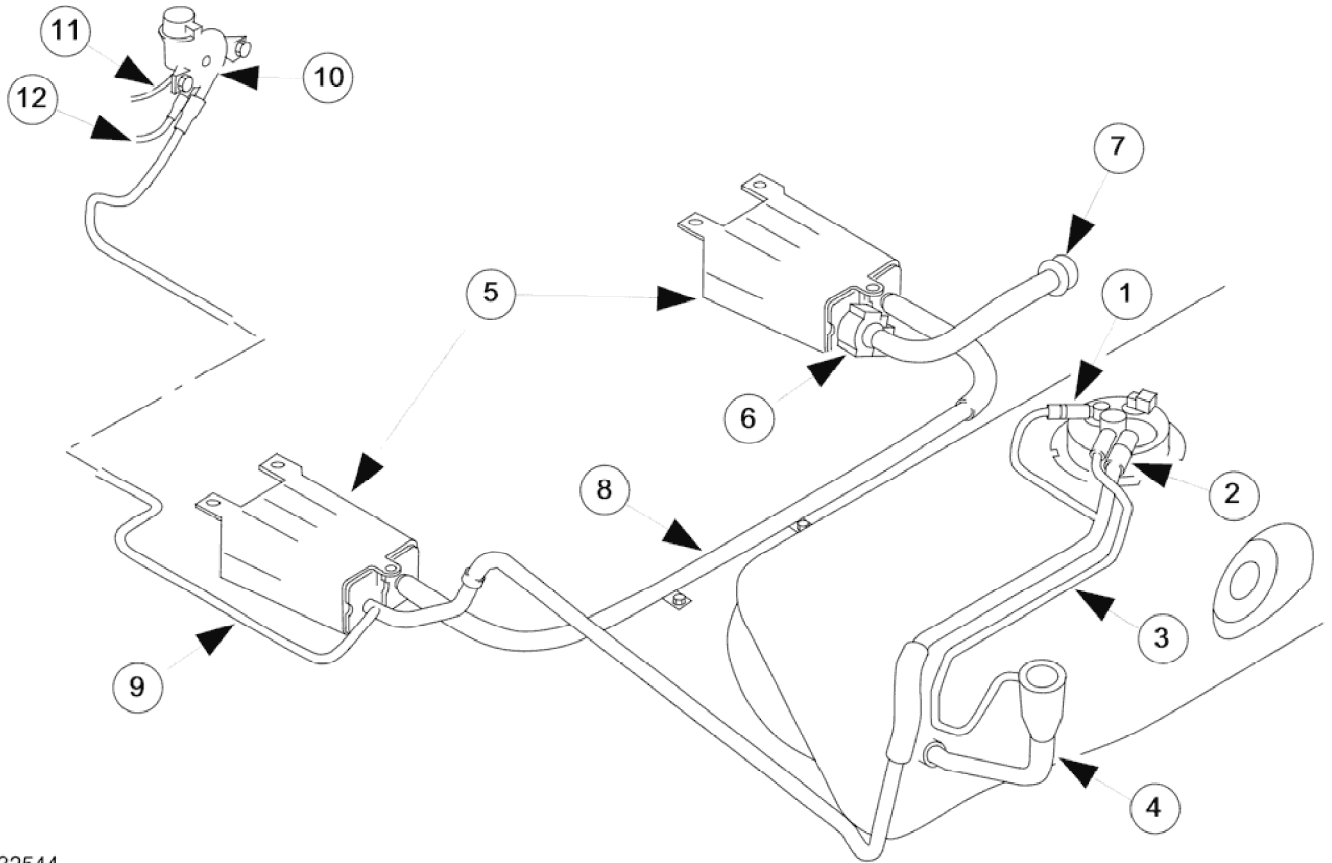
The vapour pipes to the canisters, other than the CCV, use multi-tang connectors which are push fitted and pulled out without the use of tools.

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

A hose connects the CCV to the bracket mounted adaptor into which the vent system air filter is screwed.

Running Loss with On-board Refueling Vapour Recovery (ORVR) System

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E32544

Item	Description
1	Grade vent valve outlet
2	Vapour outlet from fill level vent valve (FLVV)
3	FLVV pressure relief valve outlet pipe
4	Narrow diameter fuel filler tube
5	Charcoal canisters
6	Canister close valve
7	Vent pipe air filter
8	Vapour pipe connecting canisters
9	Canister purge outlet pipe
10	EVAP canister purge valve (engine bay)
11	Vacuum control signal from induction elbow
12	EVAP purge valve outlet to induction elbow

The system has the following features :

- on-board refueling vapour recovery (ORVR) to reduce the fuel vapour vented directly to atmosphere from the filler nozzle when refueling.
- two charcoal canisters are connected in series to reduce the concentration of fuel in vapour vented to atmosphere.
- a tank pressure sensor and canister close valve are fitted to allow the on-board diagnostic facility to test for leaks in the fuel and evaporative system.

The canister close valve 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 pressure sensor is fitted to the evaporative loss flange and provides a voltage to the ECM which is proportional to tank vapour pressure.

Operation of ORVR System

The ORVR system enables fuel vapour generated during re-fueling to be collected by the charcoal canisters. During normal running of the vehicle, the vapour is collected and purged in the same way as for non-ORVR systems.

The ORVR system features are :

- Narrow fuel filler pipe and tank check valve.
- Fuel level vent valve (FLVV) fitted to the evaporative flange 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 evaporative flange and with an outlet pipe connected to the FLVV vapour outlet pipe.
- Large bore vapour vent pipes.

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

During re-fueling, the tank is vented to atmosphere via the fuel level vent valve (FLVV), large bore vapour pipes and the charcoal canisters. The FLVV 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 FLVV also sets the fuel level.

With the FLVV 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 FLVV vapour outlet pipe, bypassing the closed FLVV.

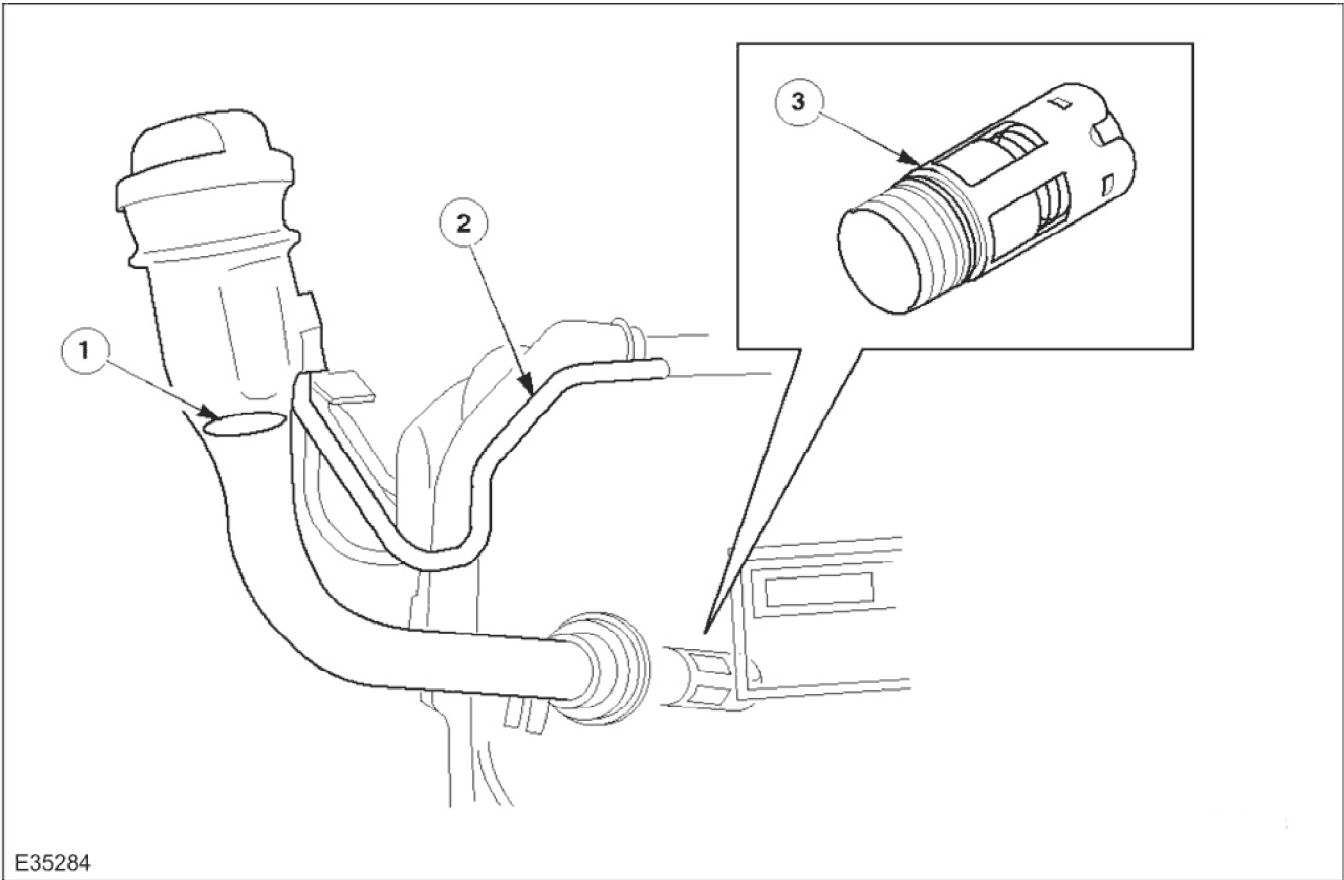
When the fuel level is below full, the FLVV opens to allow unrestricted venting via the canisters.

A pressure relief valve is incorporated into the FLVV assembly and has an outlet pipe to the filler nozzle. If a blockage or other restriction (eg, canister close valve failing in the closed position) occurs in the vapour 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 Control.

Filler Tube and Check Valve

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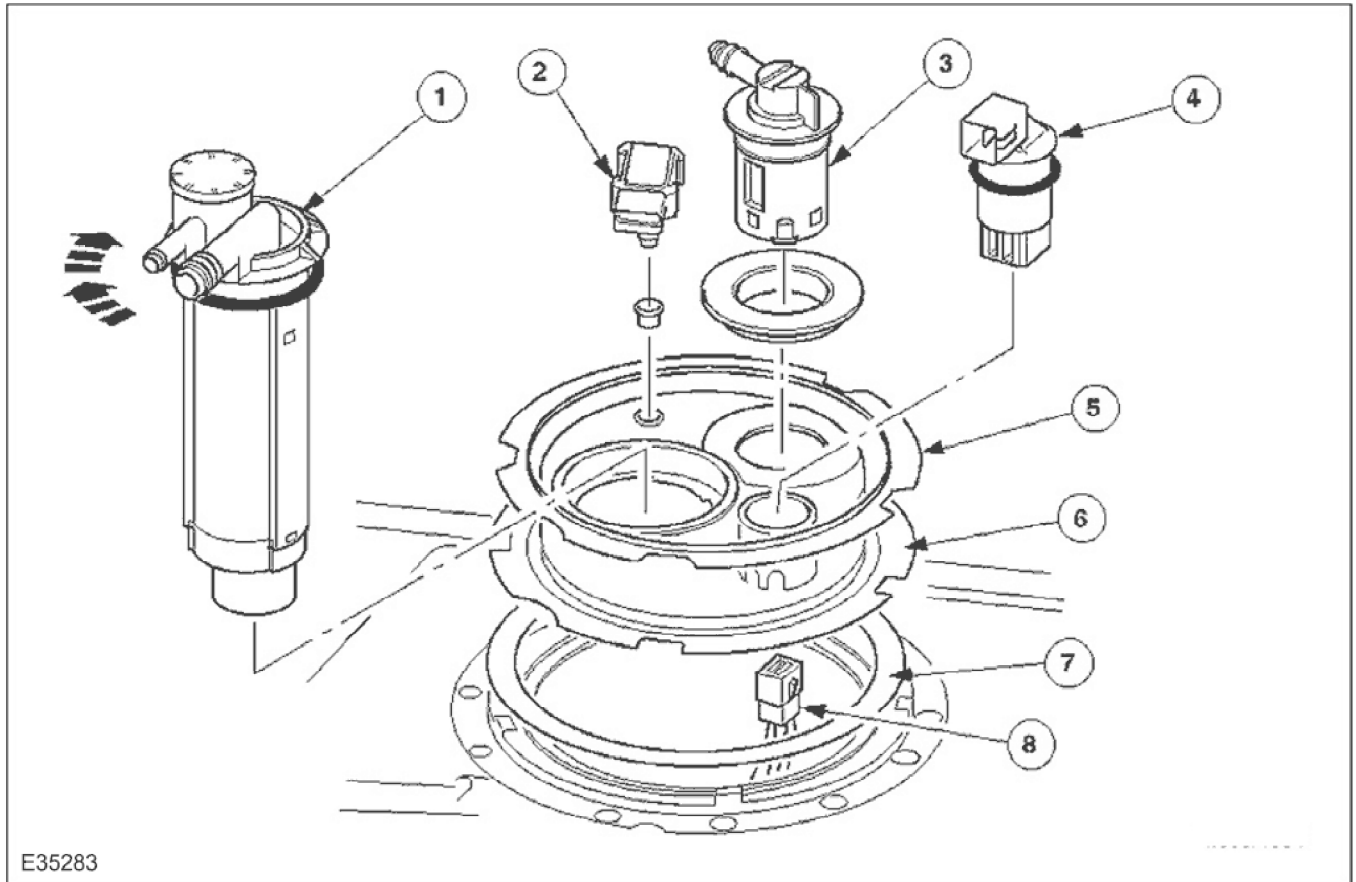
Item	Description
1	Anti-surge valve
2	Pressure relief pipe
3	Check valve

The fuel filler cap is the same as that used on non-ORVR systems.

The check valve assembly is a push fit into the end of the fuel filler tube and is accessible with the evaporative flange removed. The valve has a light spring loading and opens under the inflow of fuel.

ORVR Evaporative Loss Flange Assembly

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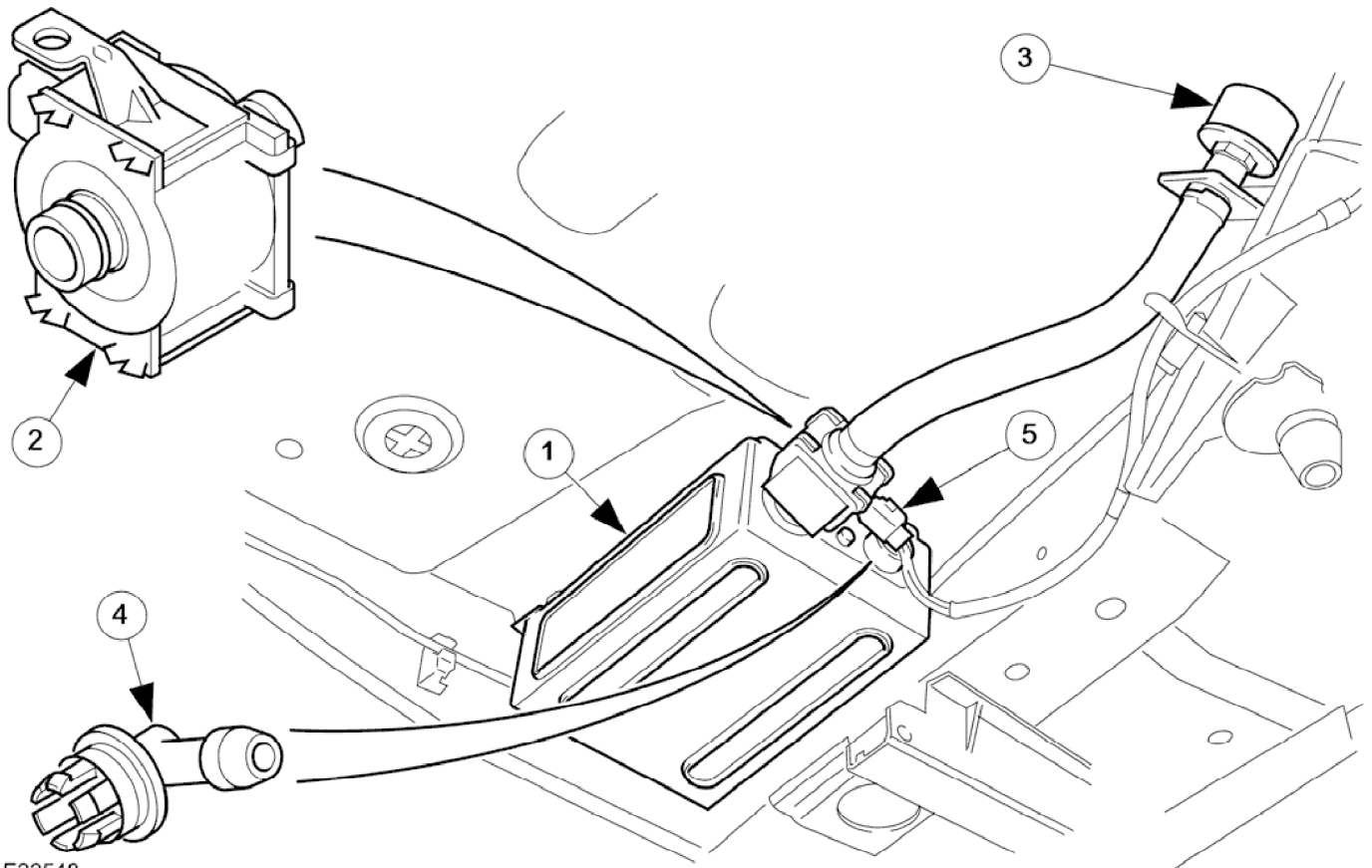
Item	Description
1	Fill level vent valve (FLVV) / pressure relief valve assembly
2	Pressure sensor
3	Grade vent valve
4	Fuel pump connector
5	Locking ring
6	Evaporative loss flange (ELF)
7	Seal
8	Fuel pump link lead

The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring arrangement identical to that used for non-ORVR systems. The assembly is removeable complete with the fitted components.

The fuel level vent valve (FLVV) is mounted in the ELF 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 connector is push fitted and crimped into a location tube on the underside of the flange.

Canister, CCV and Fittings

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E32548

Item	Description
1	Charcoal canister (righthand) in mounting bracket
2	Canister close valve (showing canister stub pipe)
3	Air filter
4	Quick-fit vapour inlet connector
5	Canister close valve electrical connector

The canisters are fixed to the underside of the vehicle either directly or via semi-enclosed mounting brackets. Two fixing bolts are used at the front of the canister (or bracket) and a single rear bolt supports the canister and the canister close valve (CCV).

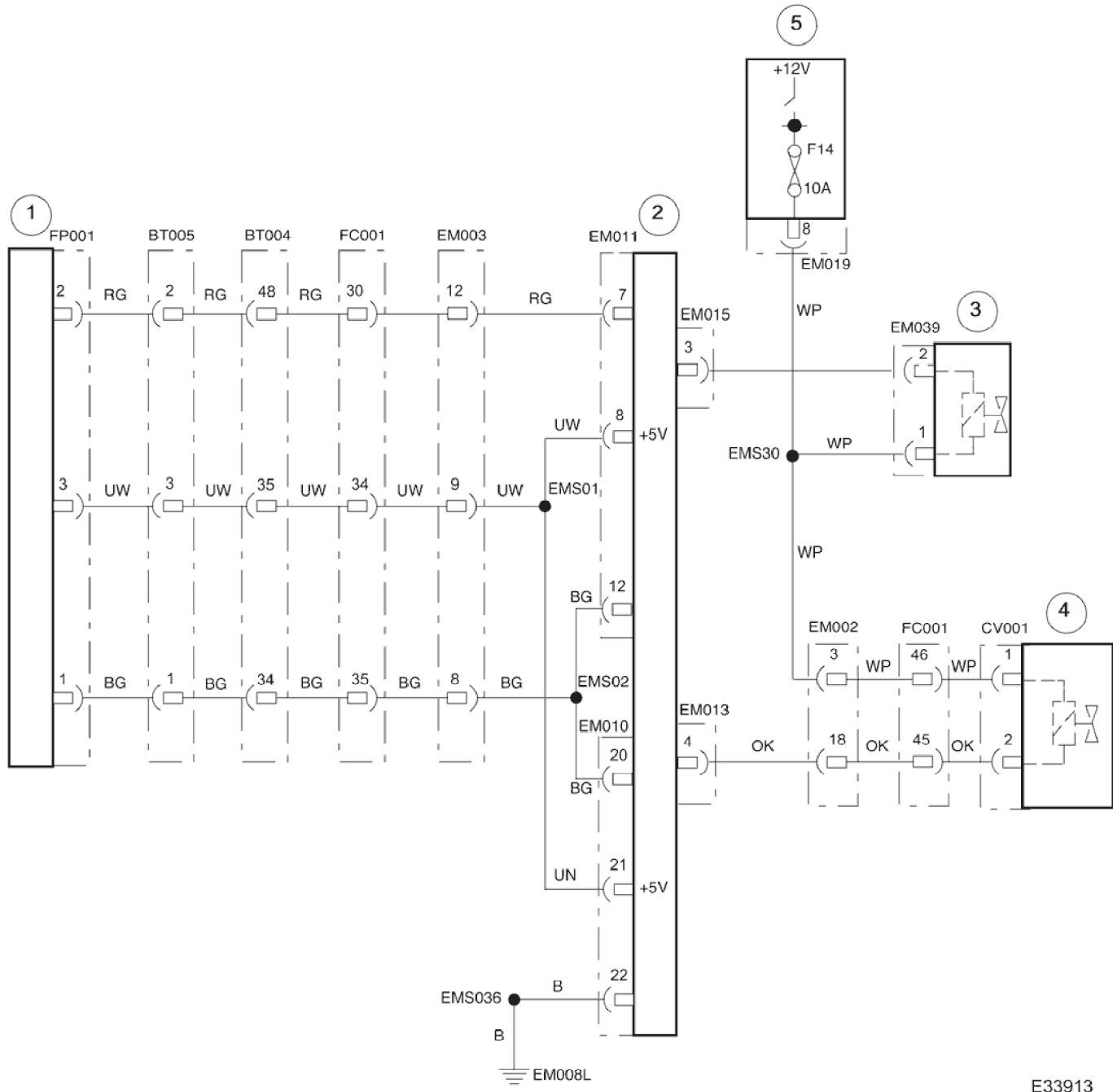
The vapour pipes to the canisters, other than the CCV, use multi-tang connectors which are push fitted and pulled out without the use of tools.

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

A hose connects the CCV to the bracket mounted adaptor into which the vent system air filter is screwed.

Circuit diagram, evaporative emissions systems

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E33913

Item	Description
1	Fuel tank pressure sensor (if applicable)
2	Engine management ECU
3	EVAP canister purge valve
4	EVAP canister close valve (if applicable)
5	Engine management fusebox - IGN supply