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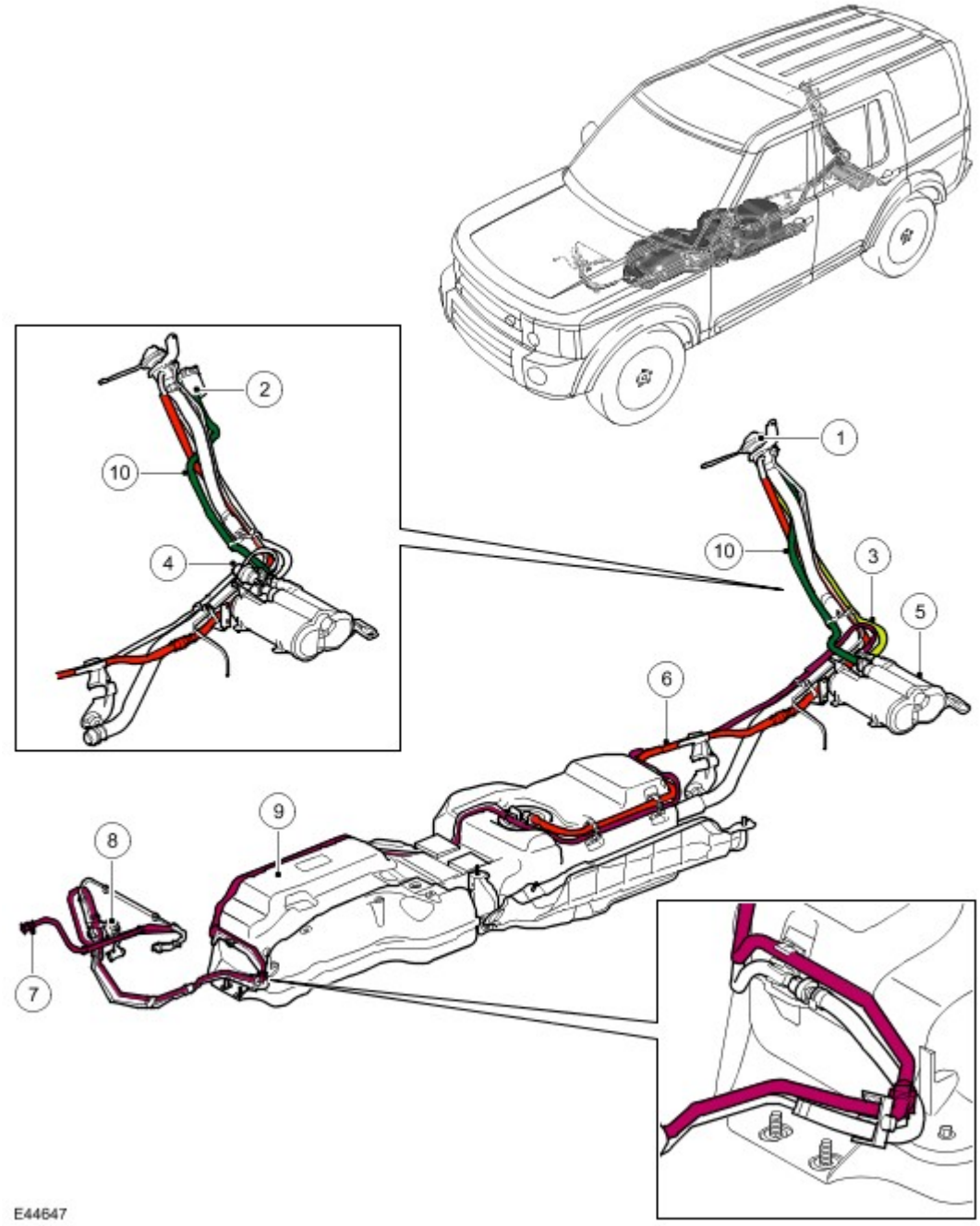
Evaporative Emissions

4.4L V8 Evaporative Emissions Component Layout



Item	Part Number	Description
1	-	Fuel filler head
2	-	DMTL pump filter (NAS only)
3	-	Fuel tank vent hose to canister
4	-	DMTL pump (NAS only)

5	-	Charcoal canister
6	-	Fuel tank breather hose from tank
7	-	Purge hose
8	-	Purge valve
9	-	Fuel tank
10	-	Charcoal canister vent hose (All except NAS) or DMTL pump vent hose (NAS)

GENERAL

The 4.4L V8 Evaporative emission (EVAP) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses. The vent pipes are connected to the system components using quick release connectors.

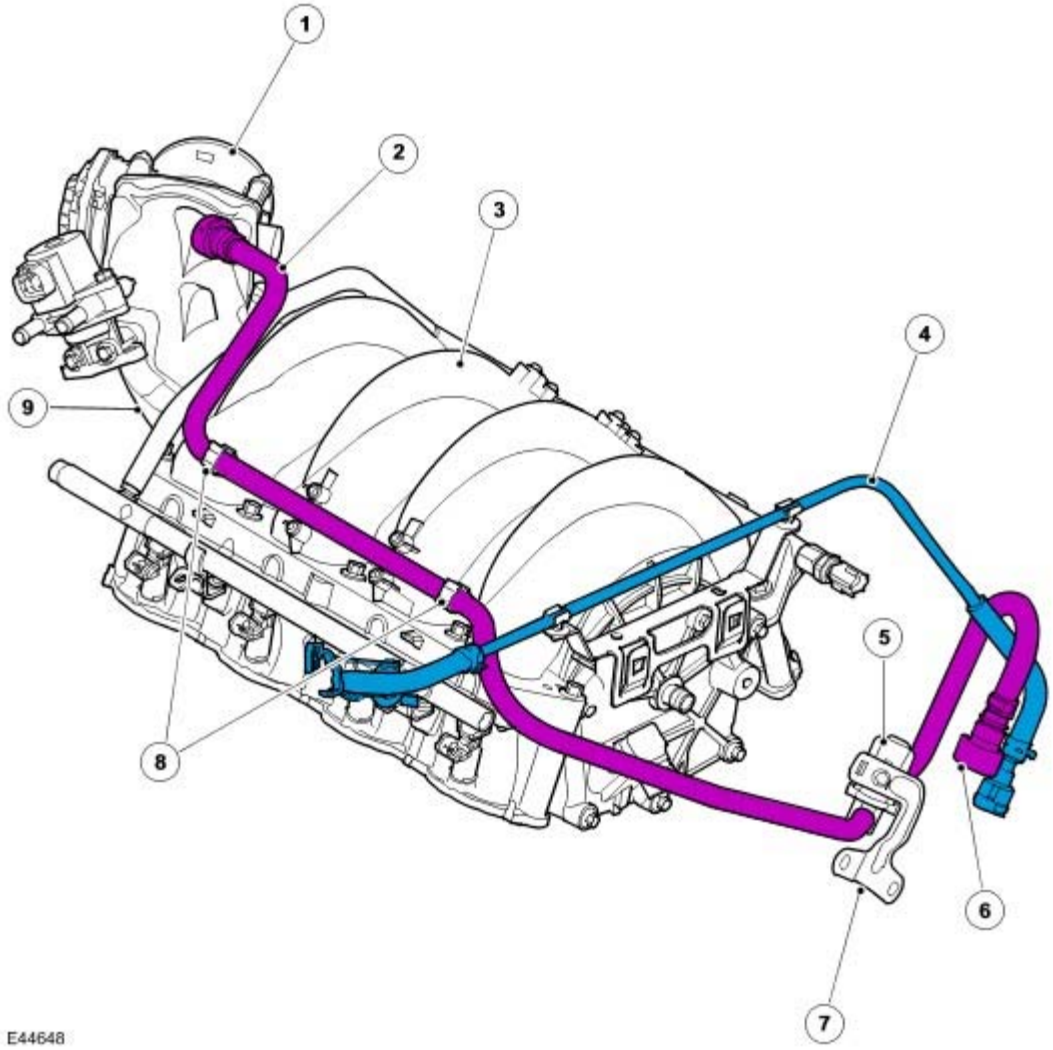
Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister via a 'Y' piece mounted on the filler head.

On NAS vehicles the vapor generated during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

PURGE VALVE AND HOSES



Item	Part Number	Description
1	-	Electric throttle
2	-	Purge hose
3	-	Intake manifold
4	-	Fuel feed jump hose (Ref. only)
5	-	Purge valve
6	-	Purge hose connector
7	-	Bracket
8	-	Hose clamps
9	-	Elbow assembly

The purge valve is located at the rear of the engine, on a bracket which is attached to the transmission bell housing. The purge hose is routed from the purge valve, along the left hand side of the air intake manifold, to the elbow assembly which locates the electric throttle.

The purge hose is connected, at the right hand rear of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line along the top of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is located on a bracket on the bell housing and is secured with a single bolt. The purge valve is a

solenoid operated valve which is closed when de-energised. The valve is controlled by the Engine Control Module (ECM) and is operated when engine operating conditions are correct to allow purging of the charcoal canister.

The purge valve is Pulse Width Modulated (PWM) at 10Hz by the ECM. At this high frequency the pulses of purge gas flowing into the inlet manifold are almost a continuous flow. The valve operates between 5% and 100% duty or mark space ratio (% open time).

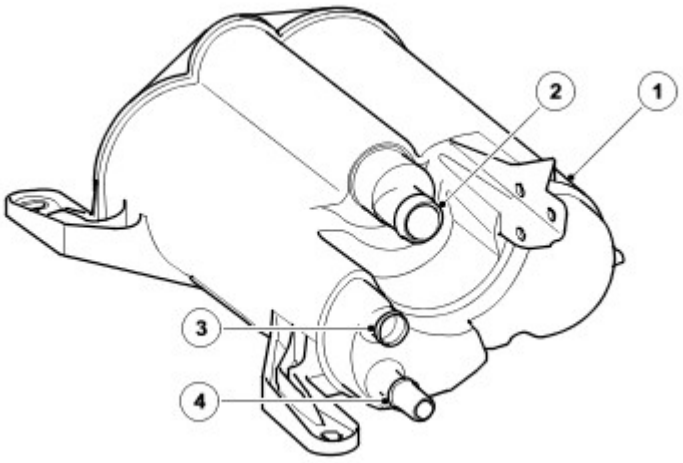
The ECM waits until the engine is running above 40°C (104°F) coolant with closed loop fuel operational. Under these conditions the engine should be running smoothly with no warm up enrichment. The purge valve duty (and flow) is initially ramped slowly because the vapor concentration is unknown (a sudden increase in purge could cause the engine to flood). The concentration is then determined from the amount of adjustment that the closed loop fuelling is required to make to achieve the target Air Fuel Ratio (AFR). Once the concentration has been determined, the purge flow can be increased rapidly and the injected fuel can be proactively adjusted to compensate for the know purge vapor and the target AFR control is maintained.

When the purging process is active, fresh air is drawn into the charcoal canister via the DMTL pump atmospheric vent connection and its filter on NAS vehicles and via the atmospheric vent hose connection and the spider trap on non NAS vehicles.

On NAS vehicles the system does not include a pressure test point. Pressure testing of the purge valve hose is achieved by disconnecting the purge valve joint on the underside of the vehicle, forward of the fuel tank and connecting a special tool to allow the system to be pressure tested. The test performs a pressure test on the purge hose connection forward of the fuel tank back to the charcoal canister. The special tool is then connected to the purge hose connection forward of the fuel tank to perform a pressure test on the purge hose to the purge valve.

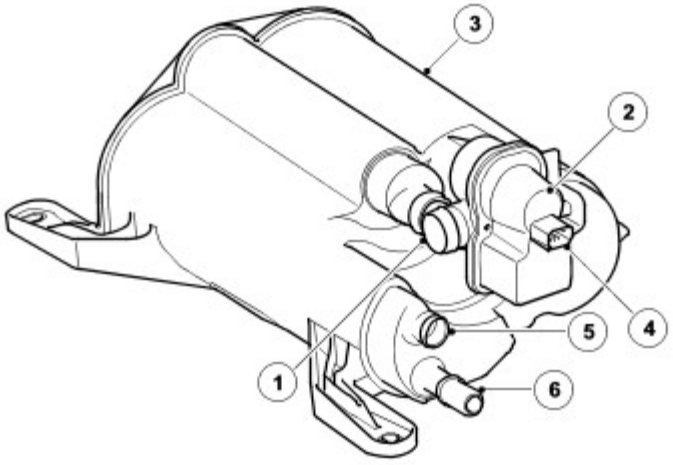
CHARCOAL CANISTER

Charcoal Canister - All except NAS



Item	Part Number	Description
1	-	Charcoal canister
2	-	Charcoal canister atmospheric vent connection
3	-	Purge hose connection
4	-	Charcoal canister tank vent connection

Charcoal Canister - NAS



Item	Part Number	Description
1	-	Charcoal canister atmospheric vent connection (via DMTL pump)
2	-	DMTL pump
3	-	Charcoal canister
4	-	Electrical connector
5	-	Purge hose connection
6	-	Charcoal canister tank vent hose connection

The charcoal canister is located in a central position, forward of the spare wheel. It is attached at the rear with two bolts which screw into the spare wheel carrier. At the front, the canister has two lugs which locate in the parking brake module support bracket.

The canister on ROW vehicles has a capacity of 1400 cc (85.4 in^3).

The canister on NAS vehicles has a capacity of 3000 cc (183 in^3).

The canister has three ports which allow for the attachment of the atmospheric vent hose, the purge hose and the tank vent hose. On NAS vehicles the atmospheric vent hose connection allows for the attachment of the DMTL pump.

The canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of LEV2 emission regulations.

DIAGNOSTIC MONITORING OF TANK LEAKAGE (DMTL) - NAS ONLY

The DMTL system is a legislative requirement for NAS vehicles. The DMTL system periodically checks the EVAP system and the fuel tank for leaks when the ignition is switched off.

The DMTL system comprises the previously described components of the EVAP system with the following additional components; a DMTL pump and a DMTL filter.

The DMTL pump is connected to the atmospheric vent of the charcoal canister and incorporates a Positive Temperature Co-efficient (PTC) heating element, a normally open valve and a reference orifice. The DMTL pump is only operated when the ignition is switched off and is controlled by the ECM. The ECM also monitors the electric air pump operation and the normally open valve for faults.

The DMTL filter protects the pump from dust being drawn into the system when the pump is being operated. The filter is located on the fuel filler head and is connected to the DMTL pump by a hose.

DMTL Operation

To check the fuel tank and the EVAP system for leaks, the ECM operates the DMTL pump and monitors the current draw. Initially, the ECM establishes a reference current by pumping air through the reference orifice and back to atmosphere. Once the reference current is determined, the ECM closes the normally open valve which seals the EVAP system. The purge valve remains de-energised and is therefore closed. The output from the air pump is diverted from the reference orifice and into the EVAP system.

When the normally open valve is closed, the load on the air pump falls to zero. Providing there are no leaks, the air pump will begin to pressurise the EVAP system and the load and current draw in the pump increases. By monitoring the rate and level of the current increase, the ECM can determine if there is a leak in the EVAP system.

During normal vehicle operation, the ECM energises the heating element in the pump to prevent condensation formation and possible incorrect current readings.

Leaks are classified as:

- Minor - equivalent to a hole diameter of 0.5 to 1.0 mm (0.02 to 0.04 in)
- Major - equivalent to hole diameter of 1.0 mm (0.04 in) or greater.

The ECM performs a check for major leaks each time the ignition is switched off, providing the following conditions are met:

- The vehicle speed is zero
- The engine speed is zero
- The pressure altitude (70 kPa (10.15 lbf/in^2) derived from engine load calculations) is below 3047 m (10,000 feet)
- The ambient temperature is between 0 and 40°C (32 and 104°F)
- The charcoal canister load factor is 2 or less (where the load factor is a measure, between -1 and +30, of the fuel vapor stored in the charcoal canister. Where -1 is 0% fuel vapor, 0 is stoichiometric fuel vapor level and +30 is 100% saturated with fuel vapor.
- The fuel tank level is valid and between 15 and 85% of nominal capacity
- The engine running time during the previous cycle was more than 10 minutes
- The battery voltage is between 10 and 15 volts
- The last engine off time was more than 180 minutes
- No errors are detected with the EVAP components, the engine coolant temperature, the ambient air temperature and the fuel level
- High range must be selected on the transfer box.

NOTE :

A leak test can be performed using T4. This overrides the above conditions and is useful for checking correct system and component operation.

The ECM performs a check for minor leaks after every 14th major leak check or after refuelling is detected.

When the leak check is complete, the ECM stops the DMTL pump and opens (de-energises) the normally open valve.

If the fuel filler cap is opened or refuelling is detected during the leak check, by a sudden drop in the current draw or a rise in the fuel level, the ECM aborts the leak check.

If a leak is detected during the check, the ECM stores an appropriate fault code in its memory. If a leak is detected on two consecutive checks, the ECM illuminates the Malfunction Indicator Lamp (MIL) in the instrument cluster on the next drive cycle.

The duration of a leak check can be between 40 and 270 seconds depending on the results and fuel tank level.