4.4 Evaporative Emission System Monitoring – 0.040" (1.0mm) Diameter

4.4.1 Description

The evaporative emission system monitoring permits the detection of leaks in the fuel evaporative emission control system with a diameter of 0.040" or larger.

For this purpose, a system pressure check is performed at idle with the vehicle stationary. Since vapour generation in the fuel tank could cause the false detection of a system leak, the first step is to close the EVAP canister purge valve and EVAP canister vent solenoid valve. Any pressure build-up is then measured, so that later results can be compensated for this fuel evaporation effect.

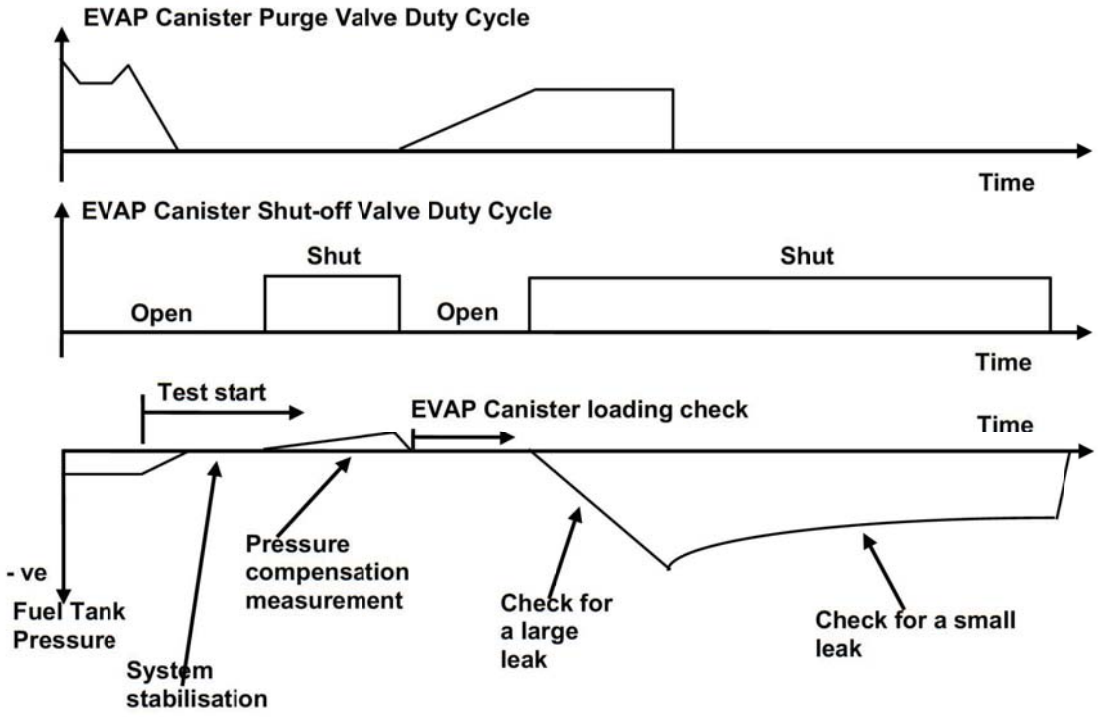
The EVAP canister purge valve is opened and the EVAP canister vent solenoid valve is closed. With this procedure a vacuum in the tank is created, which is measured by the fuel tank pressure sensor.

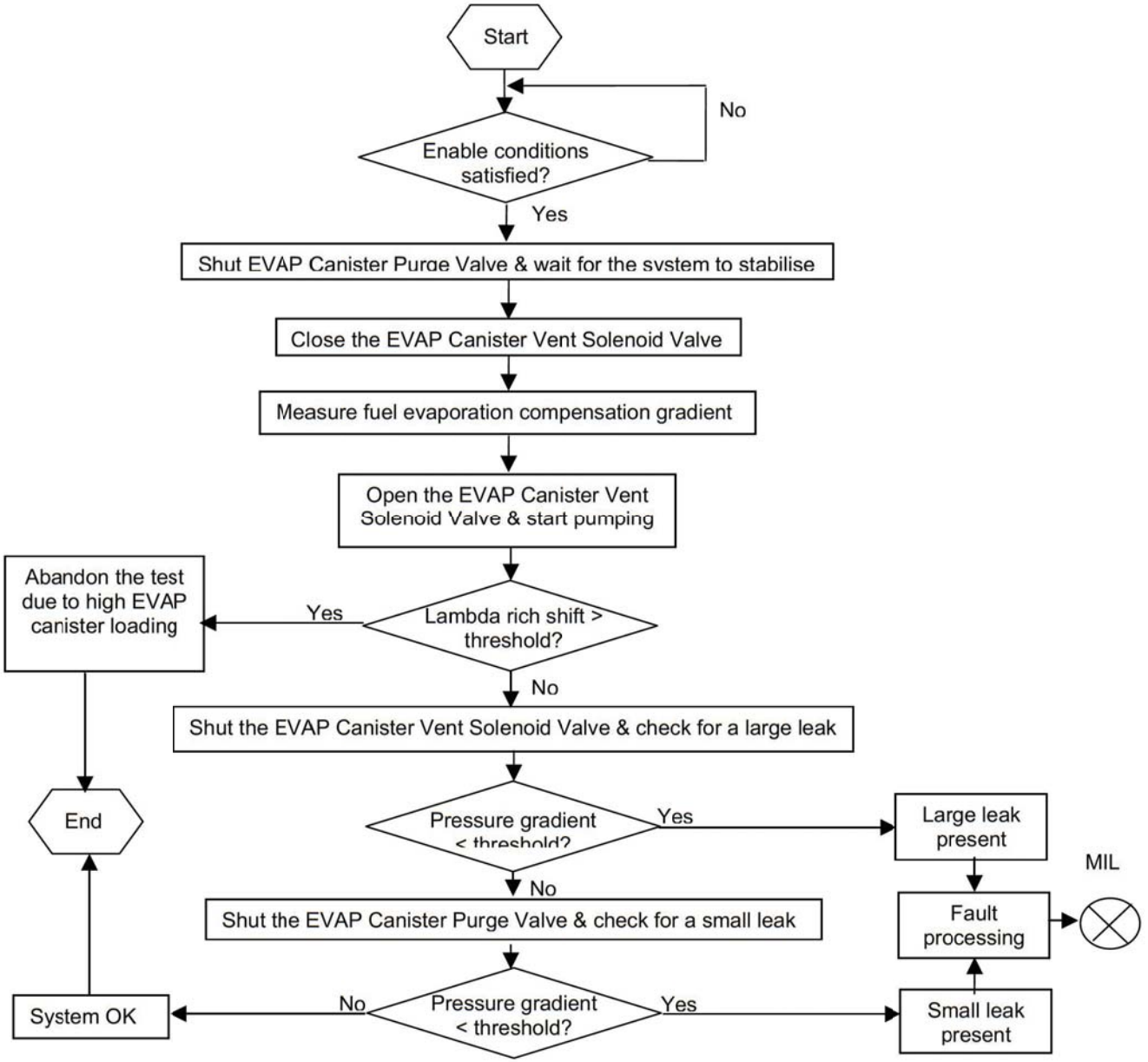
If no vacuum is detected, a large leak is assumed and the diagnosis is halted. If a large lean correction of the oxygen sensor controller is detected during the vacuum build-up, then the check is also halted, since fuel vapour is present in the system due to a high EVAP canister loading and idle instability will occur if the test is continued.

At a pre-determined vacuum the EVAP canister purge valve is closed, and the system is now considered "closed". From the gradient of the vacuum decay and the previously measured fuel vapour generation pressure rise, the presence of a leak can be inferred. The decay of the vacuum gradient also depends on the fuel level in the tank. The fuel level is roughly derived from the gradients of the vacuum build-up and vacuum decay and this information is also used when determining if a leak is present.

4.4.2 Monitoring Structure

Typical fuel tank pressure characteristic during the diagnostic test





Evaporative Emission System Monitoring – 0.040" (1.0mm) Diameter								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Evaporative Emission Canister Purge Valve	P0443	Circuit continuity - short to battery positive	voltage - drive on	voltage > 1/ 2 * Battery positive	engine speed battery voltage	> 80 rpm 7.5V < Battery positive < 17V	immediately/ continuous	two driving cycles
	P0445	Circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive				
	P0444	circuit continuity - open circuit	voltage - drive off	1/3 * B+ < voltage < 2/3 * Battery positive				
	P0440	Functional check – valve open or Leaking	fuel tank pressure during pressure compensation measurement for the EVAP Purge system check	< - 1.464 hPa	see evaporative emission system purge check		up to 24.5 sec/once per driving cycle	two driving cycles
			fuel tank pressure at the end of the large system leak test	< - 15.62 hPa			up to 36.5 sec/once per driving cycle	
Evaporative Emission Purge System	P0455	vacuum check uses the EVAP canister vent solenoid valve & the fuel tank pressure sensor	large system leak (e.g. missing filler cap)	vacuum build up gradient < 0.305 hPa/sec	EVAP canister purge vapour factor fuel tank pressure lambda control engine state battery voltage vehicle speed altitude factor intake air temperature engine load fuel tank level	< 5.0 • •15.13 hPa active idle • •11.0V Zero • 0.73 • •12.0 °C • 2.80 msec not empty	up to 36.5 sec/once per driving cycle	two driving cycles
	P0442		small system leak (• •mm)	vacuum decay grad. - (pressure comp. grad. * comp. factor) > Threshold			up to 41.5 sec/once per driving cycle	

Evaporative Emission System Monitoring – 0.040" (1.0mm) Diameter								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
					engine air flow rate ECT at engine start time after engine start transfer gears	• 40.0 kg/hr -12.0 °C < start temp. < 65.25 °C > 960 sec high range		
Evaporative Emission Canister Vent Solenoid Valve	P0449	circuit continuity - short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive	engine speed battery voltage	> 80 rpm 7.5V < Battery positive < 17V	immediately/ continuous	two driving cycles
	P0448	circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive				
	P0447	circuit continuity - open circuit	voltage - drive off	1/3* Battery positive < voltage < 2/3* Battery positive				
	P0446	functional check for a blocked EVAP canister vent solenoid valve	fuel tank pressure too low during large system leak test	tank pressure < - 1.464 hPa	see evaporative emission purge system check		up to 36.5 sec/once per driving cycle	
			fuel tank pressure too low during stabilisation phase of EVAP system check	tank pressure < - 14.64 hPa			20 sec/ once per driving cycle	
Fuel Tank Pressure Sensor	P0452 P0453	fuel tank pressure signal high/low	fuel tank pressure (min) fuel tank pressure (max)	< -28.30 hPa > 29.52 hPa	transfer gears	high range	5.0 sec/ continuous	two driving cycles
	P0451	sensor functional check	filtered pressure reading	• •15.13 hPa	transfer gears engine state ECT at engine start	high range idle • •35.25 °C	5.0 sec/ once per driving cycle	two driving cycles

Evaporative Emission System Monitoring – 0.040" (1.0mm) Diameter								
Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
					time after start time for stabilisation	• •20.0 sec • •10.0 sec		

If the above table does not include details of the following enabling conditions: - IAT, ECT, vehicle speed range, and time after engine start-up then the state of these parameters has no influence upon the execution of the monitor.

4.5 Evaporative Emission System Monitoring - 0.020” (0.5mm) Diameter

4.5.1 Description

The evaporative emission monitoring system used for the Discovery 2001MY onwards permits the detection of leaks with a diameter of 0.020" or greater. This is achieved by means of a pressure test of the system. This is performed by the DMTL, which is an electrically operated pump fitted to the atmospheric air intake of the EVAP Canister. From the 2002MY this unit contains an electric heater to prevent condensate formation.

The test proceeds in 2 stages:-

- Reference Leak Measurement - The pump operates against the reference restriction within the DMTL. The ECM measures the current consumption of the pump motor during this phase.
- Leak Measurement (see diagram below) - The solenoid in the DMTL is operated in order to shut off normal purge airflow into the EVAP Canister. The pump can now pressurise the fuel tank and vapour handling system. The ECM again measures the current consumed by the pump motor and by comparing this with the reference current, determines if a leak is present or not. A high current indicates tight system and a low current indicates a leaking system.