

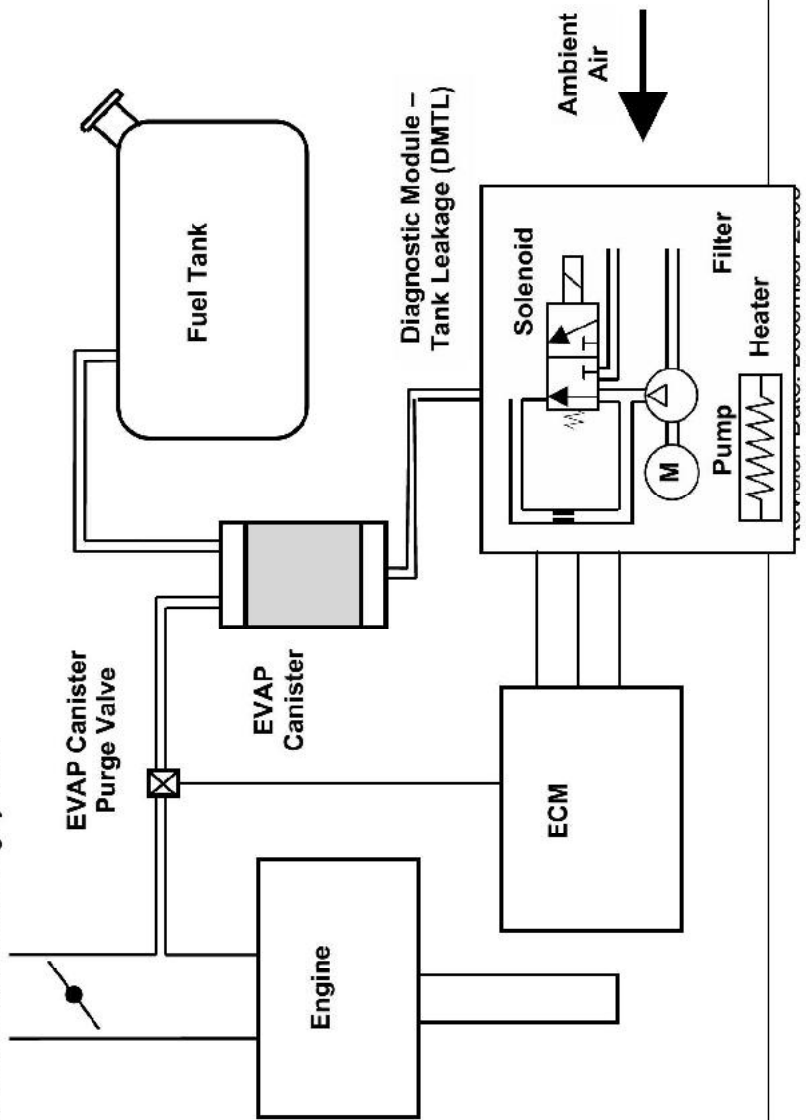
4.5 Evaporative Emission System Monitoring - 0.020" (0.5mm) Diameter

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.

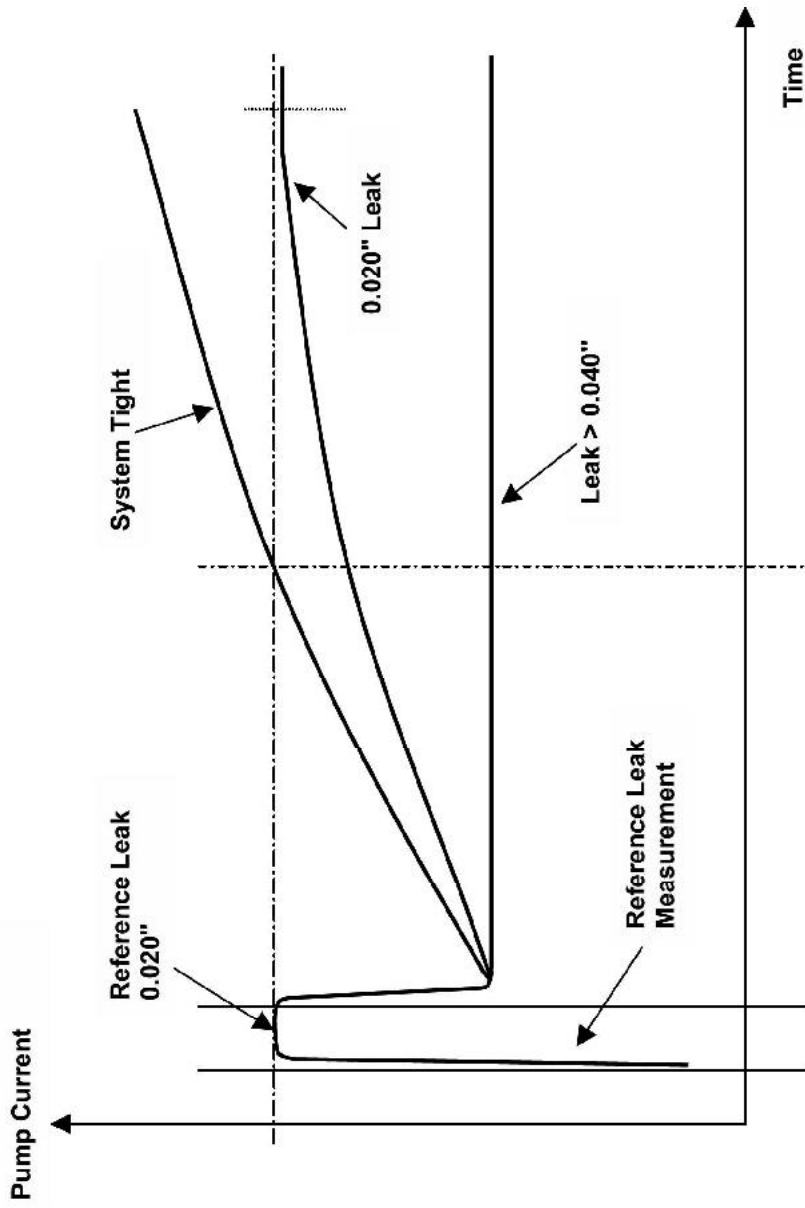
The test proceeds in 2 stages:-

- 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.



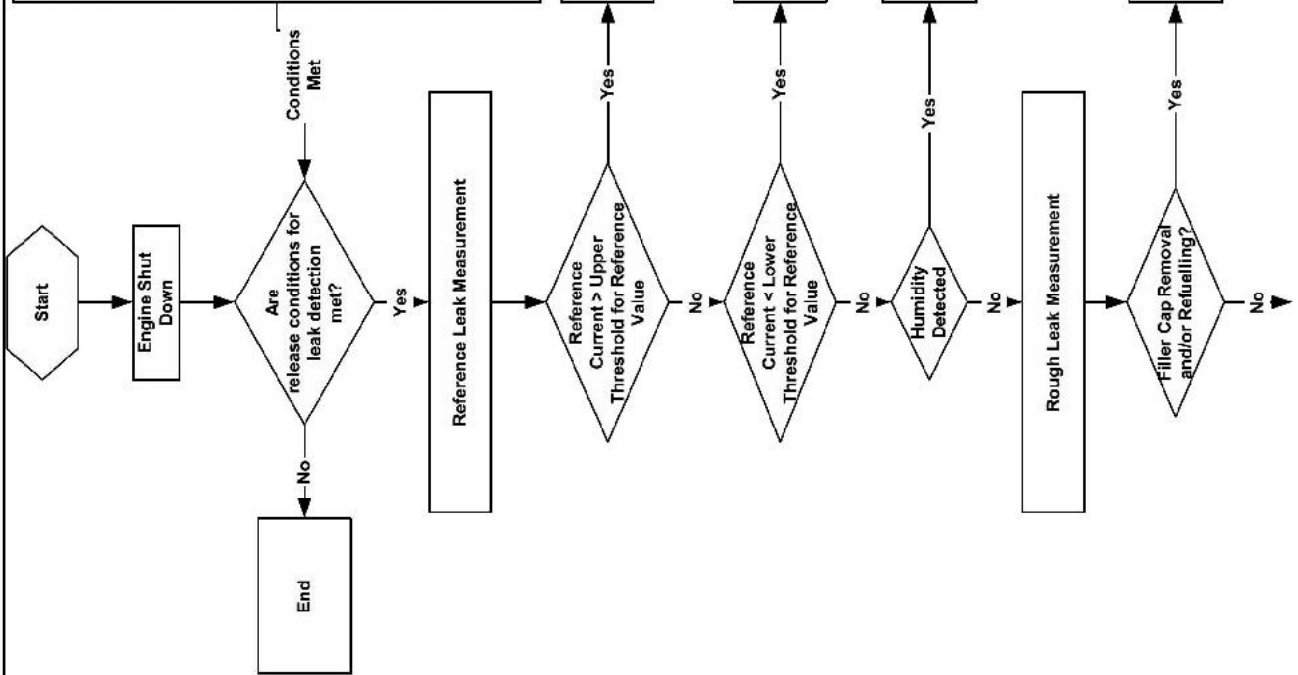


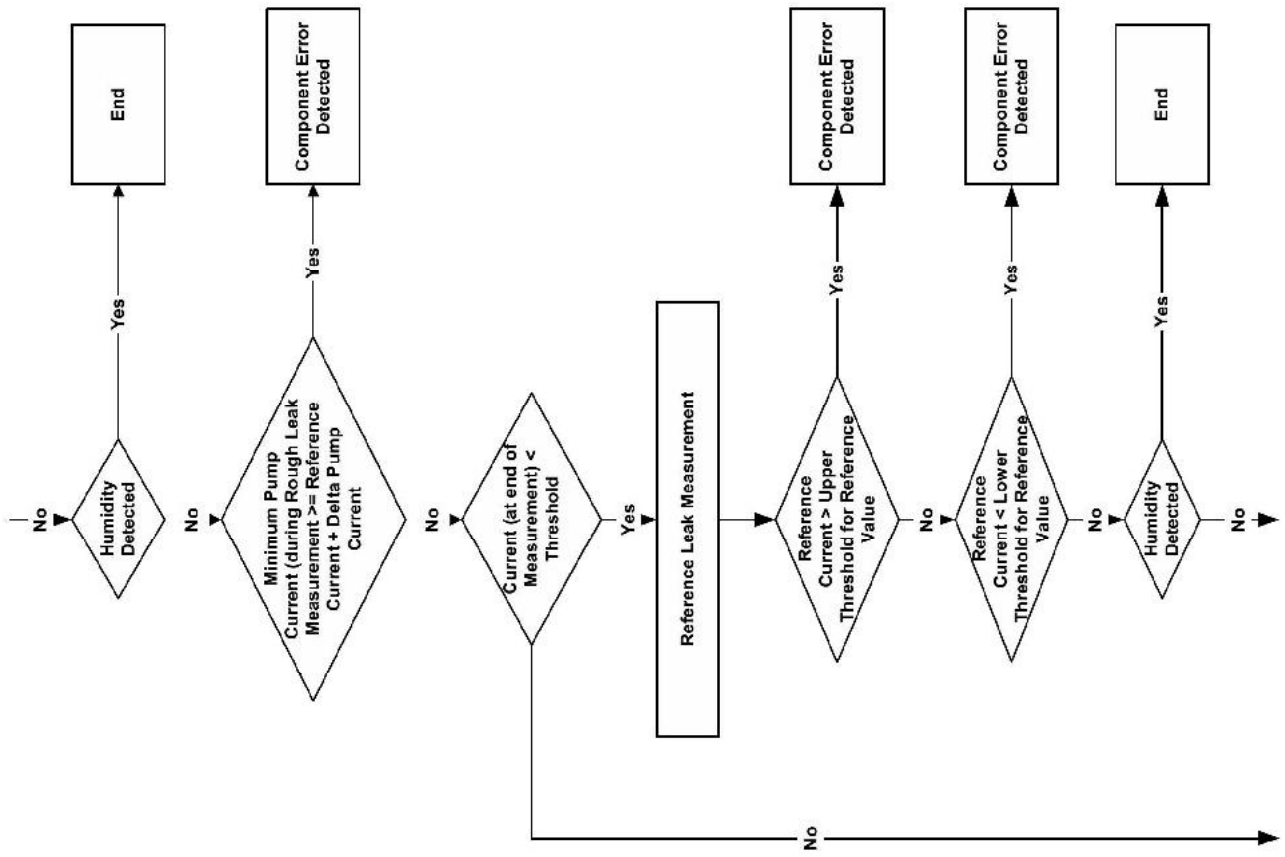
Typical Pump Current

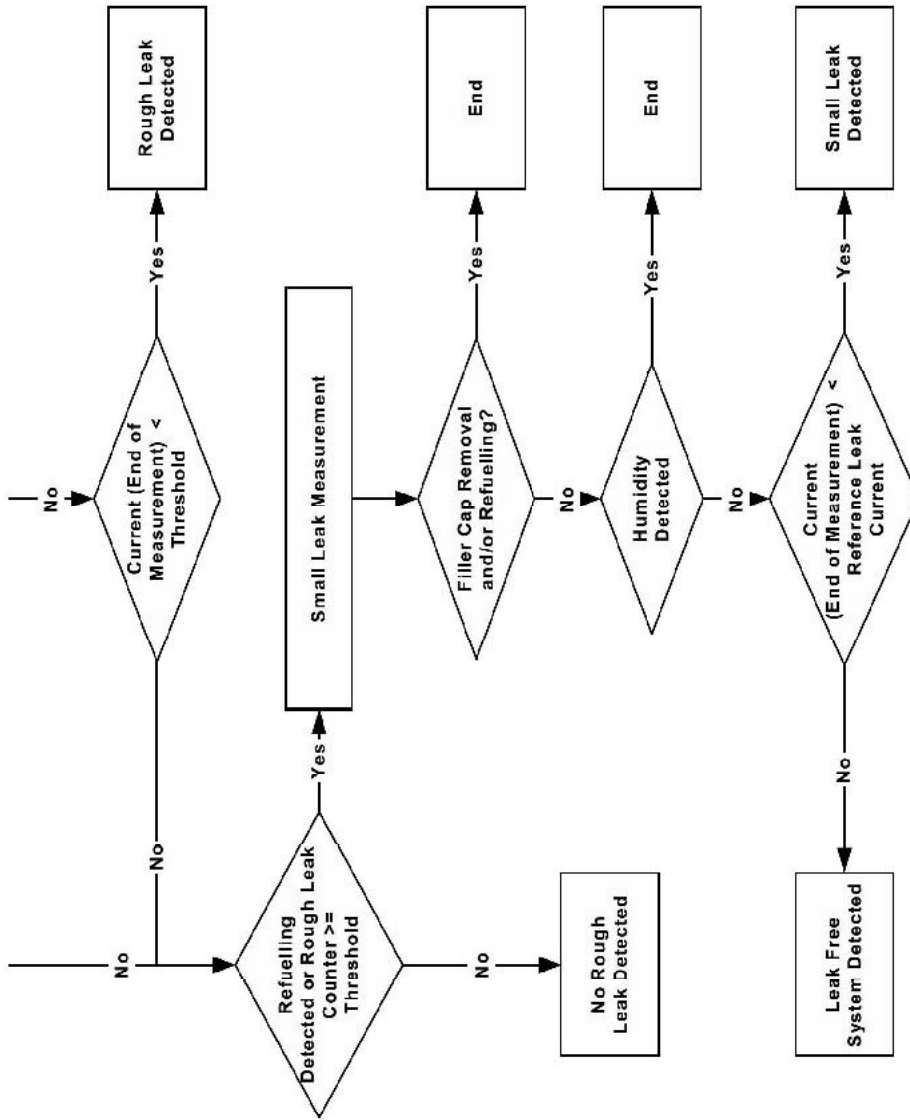




- ** Voltage Supply in Range
- ** ECM in After Run
- ** Engine Speed = 0 RPM
- ** Ambient Temperature in Range
- ** Altitude < Threshold
- ** EVAP Canister Loading < Limit
- ** Fuel Level in Range
- ** EVAP Canister Purge Valve Closed
- ** No Component Errors Detected - (DMTL, EVAP Canister/Purge Valve)
- ** Start of Driving Cycle Detected
- ** Engine coolant temperature at start >= Threshold
- ** Time after start >= Threshold
- ** Vehicle at rest
- ** Soak time > Threshold
- ** Transfer gears in high range









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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	> 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	battery voltage			
	P0444	circuit continuity - open circuit	voltage - drive off	1/3 * Battery positive < voltage < 2/3 * Battery positive				
Evaporative Emission Canister Purge Valve	P0441	functional check - no purge flow detected. Open EVAP canister purge valve and check for feed- back shift, if shift is within a window, check for stoichiometric purge by monitoring idle speed control. If air flow has not changed due to the purge flow then a fault exists	feedback correction factor AND idle air flow change	• 1.125 > 0.875 • 0.17 g/sec	engine state ECT at start altitude factor engine load engine air flow vehicle speed speed fluctuation (time after start) <u>OR</u> (time after start & mixture adapt. & purge factor & ISC diagnostic)	Idle • 12.0 °C • 0.7266 • 2.80 msec • 42.5 g/sec 0 mph • 80 rpm > 1000 sec > 590 sec complete • 8.0 complete	15 sec/ once per driving cycle	two driving cycles
	P1451	circuit continuity - open circuit	voltage - drive off	1/3 * Battery positive < voltage < 2/3 * Battery positive	engine speed battery voltage	> 80 rpm 7.5V < Battery	0.5 sec/ continuous	two driving cycles



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Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
Pump Power Stage		circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive		positive < 17V		
		circuit continuity - short to battery positive	voltage - drive on	> 3.998V	battery voltage	• 45.47V (max for pump control)	0.07 sec/ continuous	
Leak Detection	P1483	circuit continuity - short to battery positive	voltage - drive on	voltage > 1/2 * Battery positive	engine speed	> 80 rpm	immediately/	No MIL
	P1482	circuit continuity - short to ground	voltage - drive off	voltage < 1/3 * Battery positive	battery voltage	7.5V < Battery positive < 17V	continuous	(leak detection defaults to enabled)
	P1481	circuit continuity - open circuit	voltage - drive off	1/3 * Battery positive < voltage < 2/3 * Battery positive				four driving cycles
EVAP Canister Purge System (Discovery only)		over-pressure system using an ECM driven Pump			ECM state	In After Run for > 3.0 sec At Rest • 0.7266 • 2.25 °C 0.0 °C < Amb Temp < 40.0 °C < 3.0		
	P1452	Pump hardware Fault	pump ref. current	< 15.002 mA	engine state altitude factor ECT at engine start ambient temp. (calculated) EVAP canister			
	P1453	Pump hardware Fault	pump ref. current	> 40.002 mA	purge vapour factor time after start vehicle speed	• 4200 sec 0 mph 10.94V < Battery positive < 14.52V (for 3.0 sec)		
	P1450	Pump hardware Fault	pump current (during rough leak)	• ref current - 2.002 mA	battery voltage			



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Component/ System	Fault Codes	Monitoring Strategy Description	Malfunction Criteria	Threshold value	Secondary Parameter	Enable Conditions	Time Required	MIL Illumination
	P0455	rough leak Measurement	pump current at end of test stage 1 stage 2	< idle current + K1(ref. current - idle current) < ref. current + K2(ref. current - idle current) K1 = 0.26 +/- 0.09 K2 = 0.52 +/- 0.13	fuel level in window transfer gears soak time no gas cap removal (during test) no re-fuelling (during test)	15 % < fuel level < 85 % high range • 9000 sec change of pump current < -0.598 mA change of pump current > 0.598 mA	160 sec/ once per driving cycle	
	P0442	small leak Measurement	pump current	• reference Current <u>OR</u>	re-fuelling (prior to test) rough leak counter no gas cap removal (during test) no re-fuelling (during test)	detected • 44 change of pump current < -0.598 mA change of pump current > 0.598 mA	rough leak + 375 sec/ once per driving cycle	

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.



4.6 Fuel System Monitoring

4.6.1 Description

Primary Mixture Control

The air mass taken in by the engine and the engine speed are measured. These signals are used to calculate an injection signal. This primary mixture control follows fast load and speed changes.

Lambda-control

The ECM compares the oxygen sensor signal upstream of the catalyst with a reference value and calculates a correction factor for the primary control.

