



SWANSEA METROPOLITAN UNIVERSITY

PRIFYSGOL FETROPOLITAN ABERTAWE

Emissions Control and Diagnostics

Evaporative Emission Control Systems

The need for EVAP system

- The purpose of the evaporative (EVAP) emission control system is to trap and hold gasoline vapours.
- Before 1970 gasoline fumes were vented to the atmosphere
- To stop this EVAP systems trap Volatile Organic Compounds (VOCs)
- By routing VOCs to a charcoal canister and from there to the intake manifold to be burned in the engine

EVAP components

- Filler caps are of a special design with a pressure vacuum valve built into them to avoid vacuum lock in fuel system
- Also protects tank from overexpansion in hot days or over contraction in cold ones
- Another method is to add an expansion reservoir to the fuel tank to allow fuel on a full tank to expand and vapours to be collected
- Some of this are of a special shape or fitted with an overfill limiting valve.
- In any case when filling a car up you should stop when the pump clicks to avoid over filling and potentially soaking the charcoal canister

EVAP components



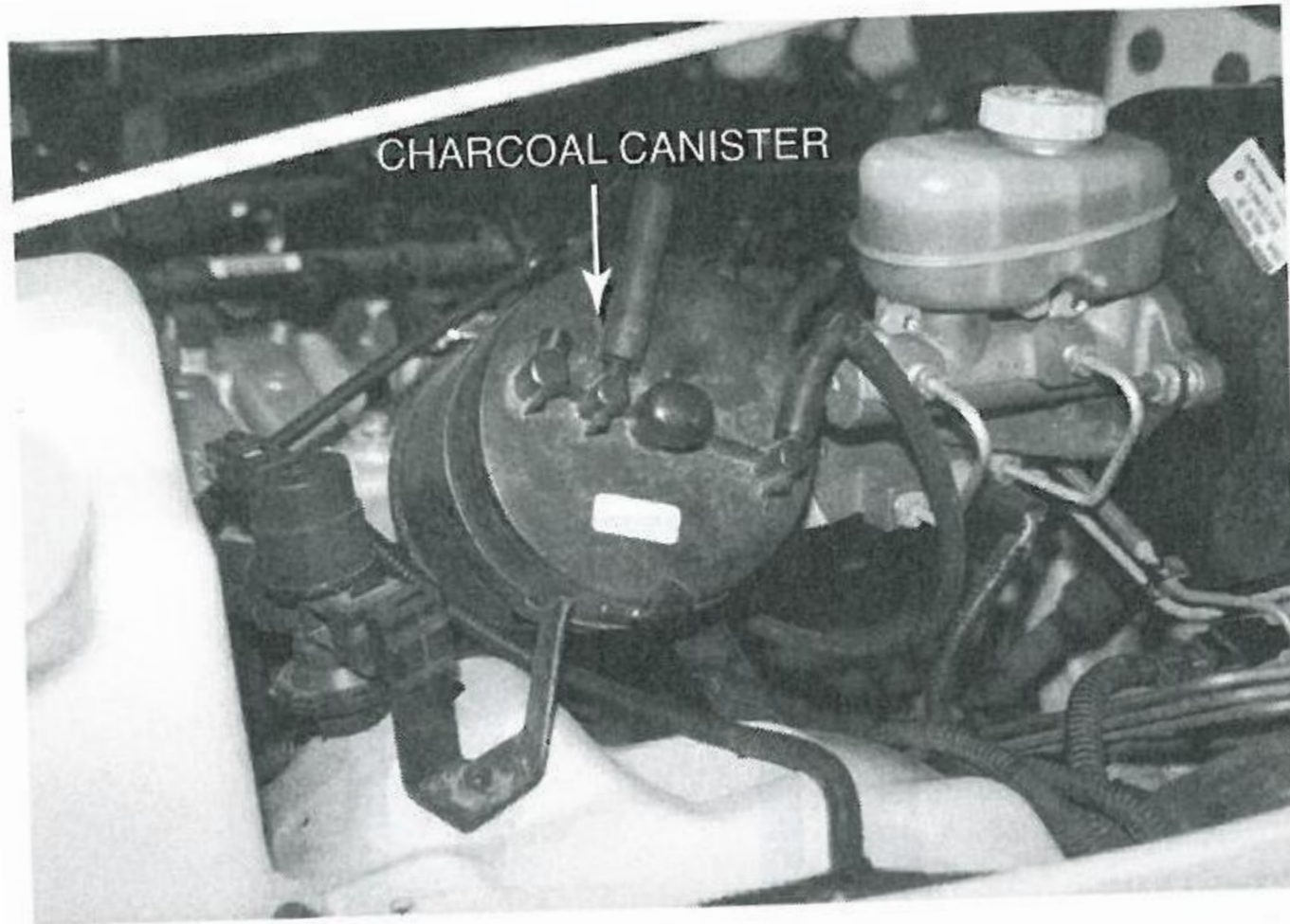
EVAP components

- A vapour canister is located in the engine compartment or under the car and is filled with charcoal granules
- A vent line connects the tank to the canister
- Active charcoal is very effective since each gram has a surface area of 1100 sq metres!
- The fuel gets attached to the carbon molecules but since it is a weak bond, purging it with fresh air released the fuel
- This HC rich purge is then fed to the throttle body mixing it with the air/fuel charge
- This is controlled by the ECU via a vacuum solenoid to avoid upsetting the delicate air- fuel ratio the engine intakes

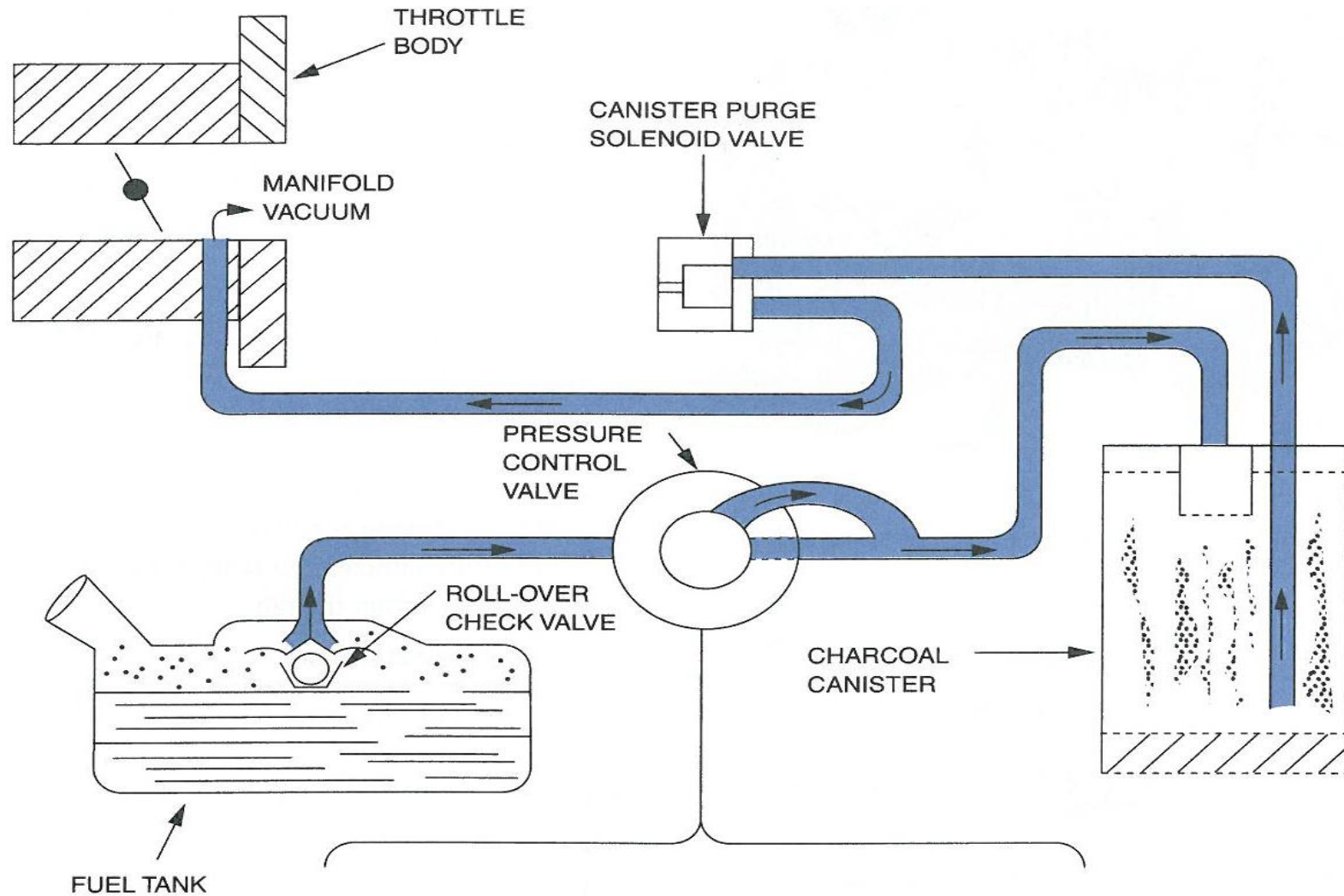
EVAP components



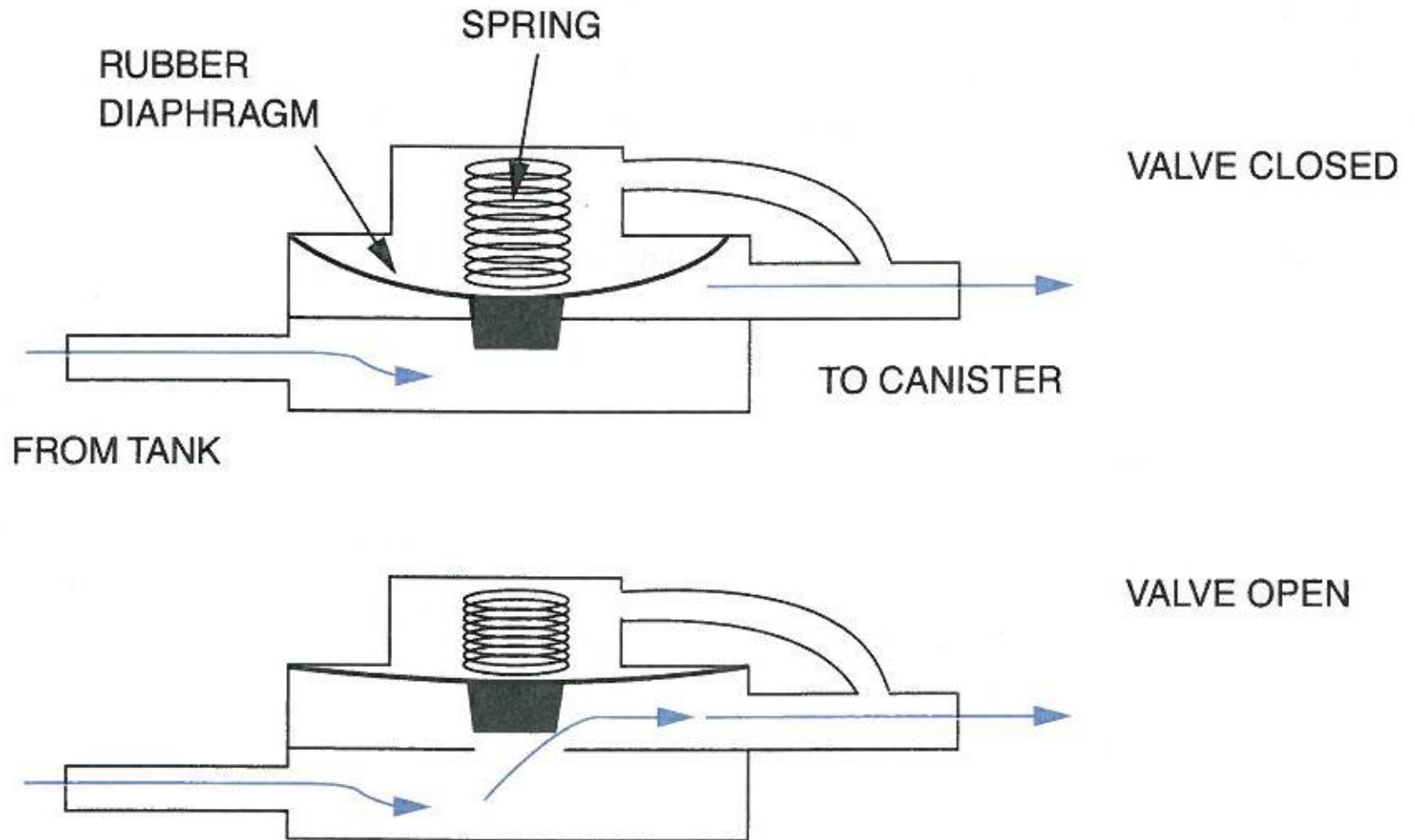
SWANSEA METROPOLITAN UNIVERSITY
PRIFYSGOL FETROPOLITAN ABERTAWE



EVAP components

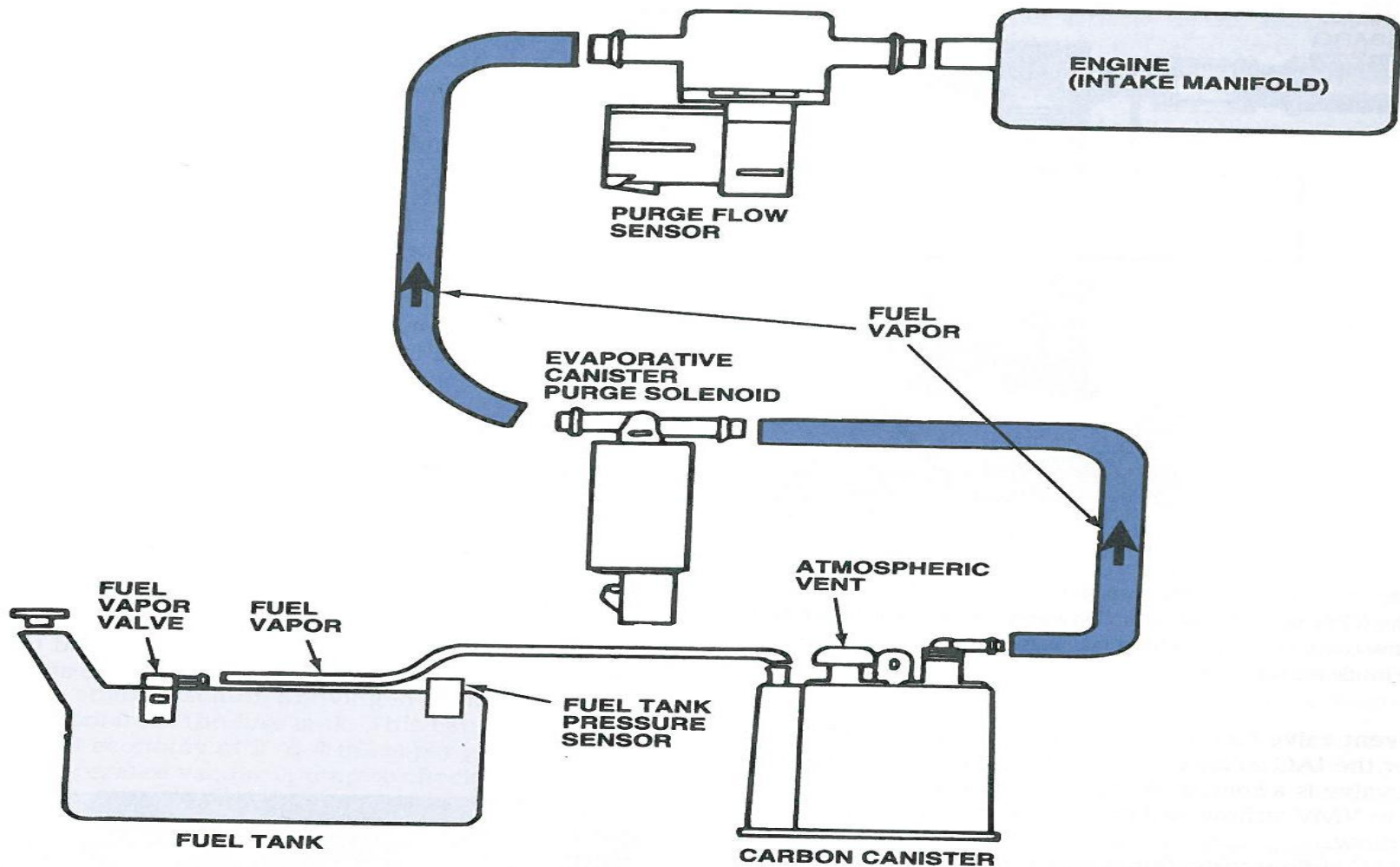


EVAP components

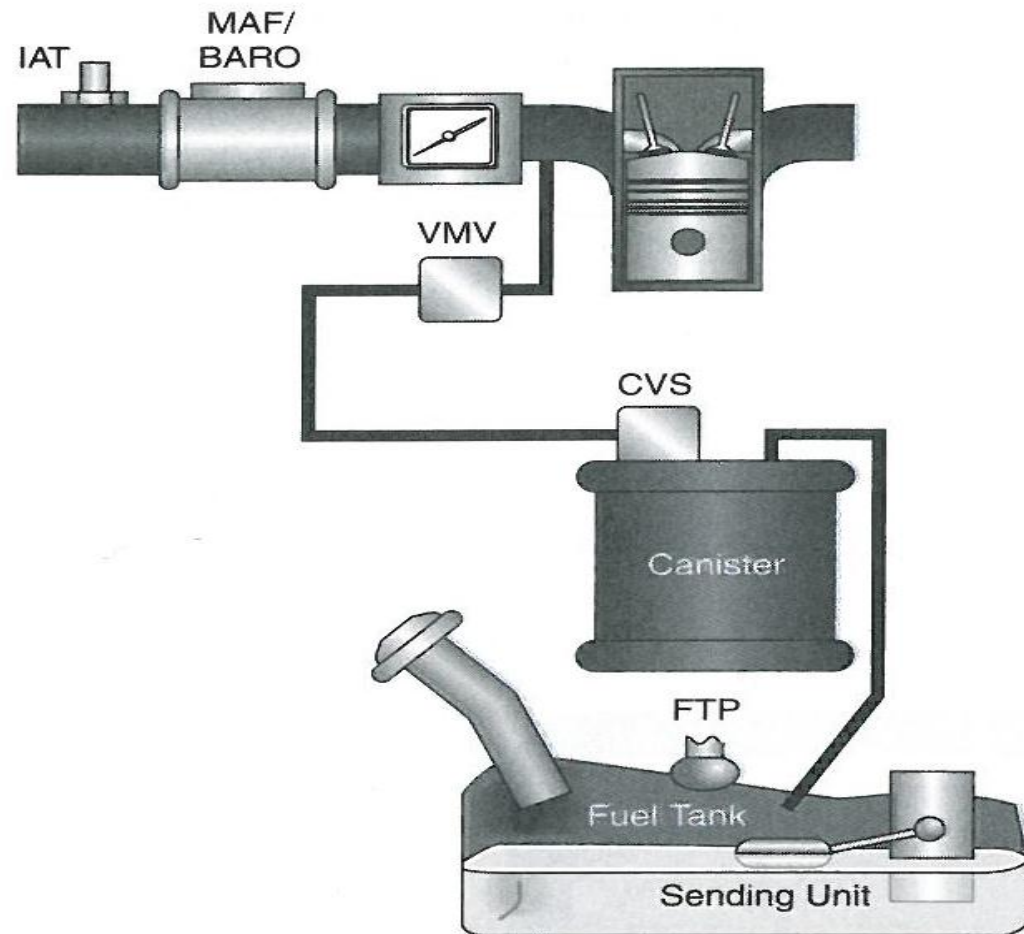


- Pre 1996 EVAP systems were known as evaporation since they had little diagnostic capabilities
- From 1996 and the introduction of OBD-II vehicle had to be equipped with systems to detect purge flow and leakage.
- The system controls the vent valve that is normally open, allowing air to enter the tank.
 - It also allows this air to be used at idle and can therefore check is functionality
- The purge valve on the other hand is normally closed
 - During purging it pulsed allowing engine vacuum to suck the vapours

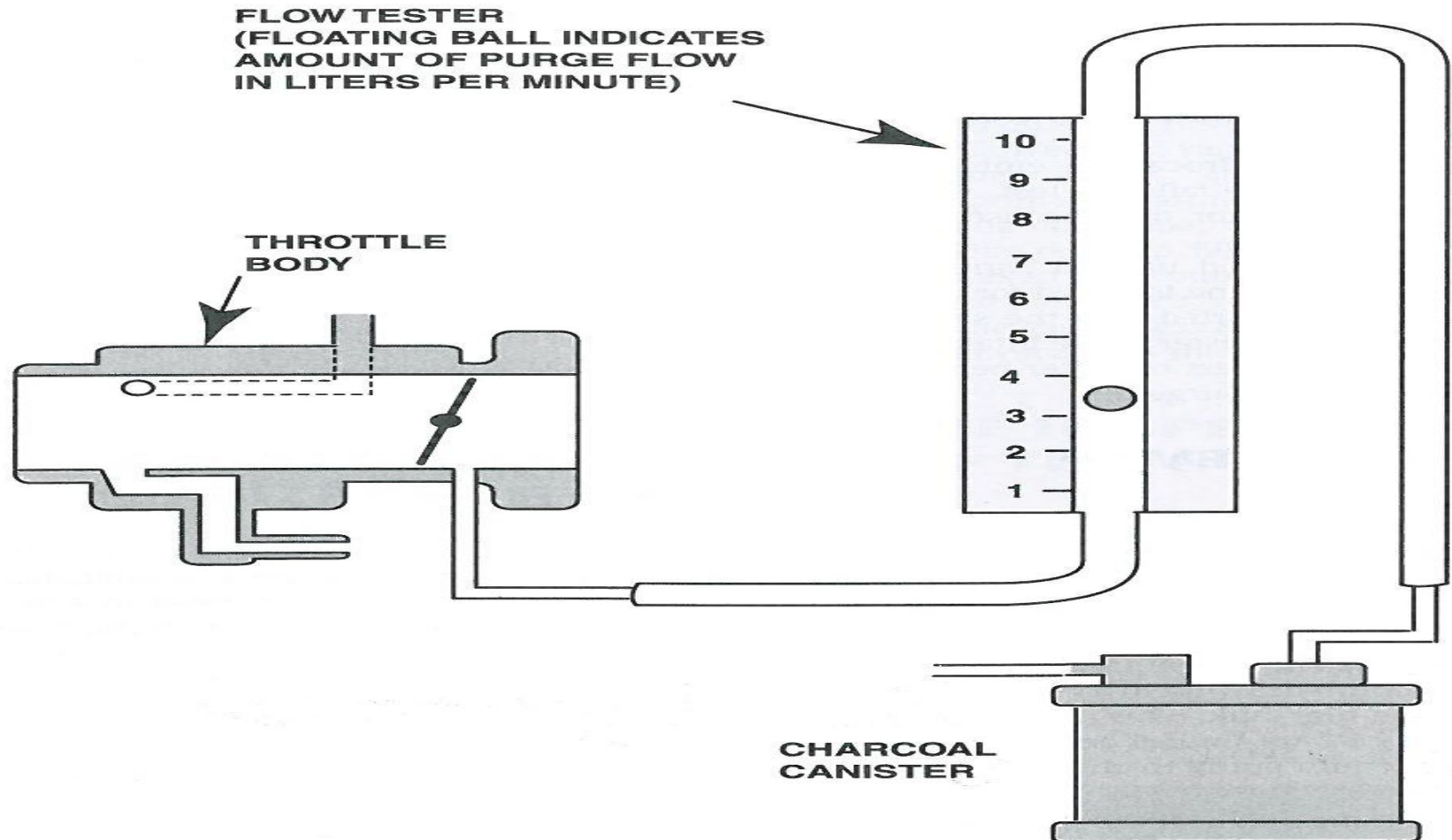
OBD-II EVAP



EVAP Valves



- First the fuel cap is tested to ensure it seals and holds pressure
- Next cap is fitted using an adapter to pressurise the system to 0.5psi
 - a good system should not drop to less than 0.3 after 2 minutes
- If the system leaks an ultrasonic leak detector may be used to find the leak
- Final test is, with a warm engine running at moderate speed, a flow meter is inserted in the purge line to measure flow.
 - In most cases 1 litre per minute is what is expected



EVAP fault symptoms

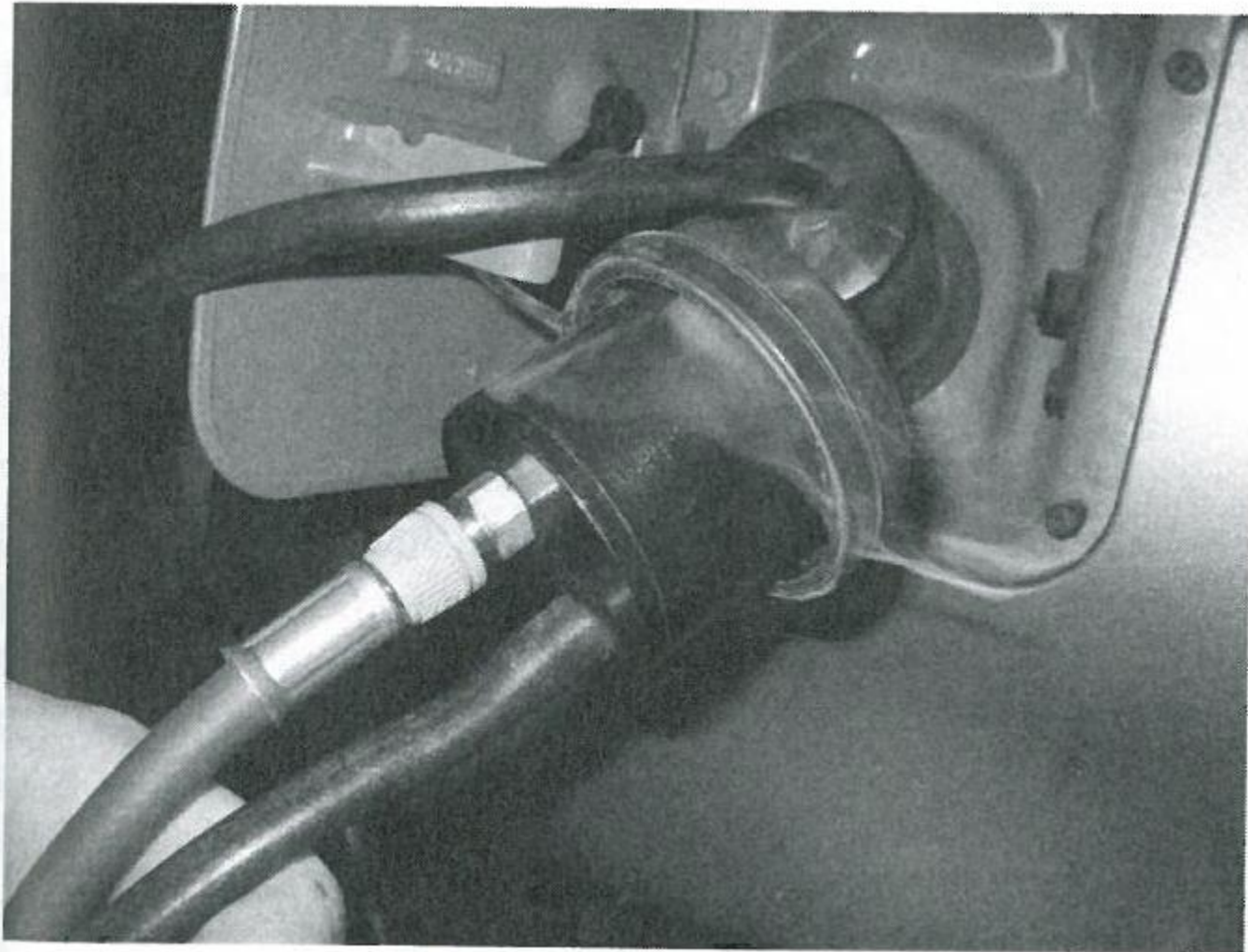
- Poor fuel economy
 - A leak in the vacuum valve diaphragm means the car is constantly suckling gasoline vapours and as a result a drop of mpg of 2-4 will result
 - Using a hand vacuum pump will test the valve. If it does not hold vacuum it need replacing
- Poor performance – engine response
 - A leak in the manifold or vacuum hose will make the engine run rough
 - Rubber hoses will deteriorate over time specially if subjected to heat

- A leak may be detected via the OBD-II system that will generate a fault code or in some cases by a smell of gasoline in the engine compartment
- Locating the leak can be done by two methods
 - Smoke machine testing
 - Most efficient method
 - Low pressure smoke from smoke machine
 - Watch where it comes out
 - Nitrogen gas pressurization
 - Low pressure - <1 psi – in the system
 - Listen for escaping gas using amplified headphones

EVAP leak detection



SWANSEA METROPOLITAN UNIVERSITY
PRIFYSGOL FETROPOLITAN ABERTAWE



(b)

- Modern OBD-II systems not only control EVAP valves also perform periodic tests to the system to monitor its performance
- Usually they will compare the vacuum in the system at certain conditions to what the system should be doing
 - If purge solenoid is closed = no vacuum in line
 - If vacuum is detected then a code will be generated
 - Leaking valve or stuck solenoid
 - If no vacuum detected during a purge another code will be generated
 - Blocked line or clogged solenoid
 - A typical EVAP system closes the system off and opens the purge valve during cruising
 - A fuel pressure sensor can monitor the flow rate of the purge via a leak down test

EVAP developments



SWANSEA METROPOLITAN UNIVERSITY
PRIFYSGOL FETROPOLITAN ABERTAWE



- Some EVAP systems will only work if tank is filled between 15 and 85% so avoid running low
- Ensure the cap is properly tightened to avoid the EVAP system generating fault codes
 - Ensure cap is tightened until it clicks 3 times
- If you smell petrol check for the usual fuel leaks in the main system and if no evidence is there assume EVAP system issue