

FIND SMOKE WITHOUT FIRE

They say that if America sneezes, the rest of the world catches a cold. In the same way, when US technicians started going crazy for smoke testing, it wasn't long before the trend took off here. Technical expert James Dillon finds out more about the unusual uses and hidden dangers of smoke testing

JAMES DILLON

THE REGULAR use of smoke machines in diagnostics has grown rapidly in the last 12 months. Originally, the smoke machine concept was developed in the USA and gained popularity among workshops there. This is due mainly to their legislative On Board Diagnostic (OBDII) system which monitors the evaporative control system (EVAP) for leaks. In order for the OBDII system to be able to detect leaks, some manufacturers implement a leak detection pump (LDP).

The purpose of this device is to generate positive pressure in the EVAP system during the running of the OBDII's EVAP monitor. If a pressure drop is recognised by a decline in the generated pressure, a fault code is set and the malfunction indicator lamp (MIL) will be illuminated.

European style

To date, the European version of OBDII (European On Board Diagnostics or EOBD) doesn't support EVAP leak detection. Typically, EOBD vehicles will flag lean mixture fault codes (such as P0171 bank one mixture lean) when leaks in the EVAP system are present.

Other mixture-related components (such as oxygen sensor issues) may also cause this code to be flagged. However, when Euro 5 emissions are implemented (they are set to be phased in between 2009 and 2011) EOBD is expected to implement the US-style EVAP diagnostic routine.

As and when this happens, technicians will begin to see codes such as P0442 (EVAP small leak detected), which are pretty much bread and butter jobs for our American counterparts.

On the lookout for leaks

When it first arrived, the smoke machine proved to be an invaluable resource in finding 'micro-leaks' (a total system leak between 0.5mm and 1.0 mm) in the EVAP systems which can cause this trouble code.

Without the use of a smoke machine, these leaks are notoriously difficult to find. This is due mainly to the complex routing and difficult-to-access location of the EVAP vacuum pipe-work. The traditional method of leak detection was to use a stethoscope and 'listen' for the leak. In the modern, complex EVAP system, this method proved extremely time consuming and

unreliable so, unsurprisingly, it is becoming less and less widely used.

Smoke testing in action

The smoke machine is a great visual aid and can be used to flush out minute leaks in the EVAP system. It works by using highly refined mineral oils which are heated. This is achieved through the immersion of a heating element in the oil which heats it to the point at which the oil turns into smoke.

A compressed gas is then applied to the smoke chamber which pressurises the smoke and forces it down the smoke machine's outlet pipe. This pipe is then attached to the system under test. One end of the system is blocked and the void fills with smoke under pressure.

For example, when diagnosing an engine for vacuum leaks, the air intake would be blocked (using a special bung or plug), and the smoke machine would be attached neatly to the vacuum pipe.

Smoke under pressure fills the engine and leaks out wherever even the tiniest of holes is present. Sometimes, a UV dye is applied to the oil solution which 'stains' the point of leakage. A UV lamp can be then used to detect the stain at the precise point of the leak, even after the smoke has long gone.

JAMES SHOWS HIS SUPPORT FOR BEN

James, who runs training company Technical Topics, has shown his support for technicians like you, by donating to Aftermarket On Tour - this magazine's unique fundraising trip in support of BEN.

James generously donated £100, which BEN will use to help people cope during times of emotional or financial hardship. For details, go to:

www.justgiving.com/aftermarketontour



FEELING THE BURN: Using smoke to help find and diagnose faults is an effective and increasingly popular method. However, following concerns about flammability, smoke testing is evolving to help find faults in a growing number of systems

EGR control systems

In addition, this relatively low cost diagnostic process can help diagnose a plethora of other problems, such as leaks in EGR control systems, engine vacuum leaks (this can include manifold gaskets, induction pipe-work, throttle body seals and injector seals).

It can also hunt out trouble with exhaust leaks, positive crankcase ventilation (PCV) valves, leaking oil filler caps (which are integral in PCV systems) and fuel tank sender seals. Items like transmission and engine oil seals, gasket leaks, door seals and air conditioning evaporators can also be taken care of with smoke testing.

Testing danger

More recently, there have been developments in the use of propulsion gasses which have been driven largely by safety concerns. Many of the smoke machines on the market use the common workshop compressed air supply to pressurise the smoke chamber. Using this method on engine intake and EVAP systems can lead to health and safety issues. To understand why, just think of the three basic but key elements of combustion:

- Fuel
- Oxygen
- An ignition source

The EVAP system provides the fuel (vapour) and a smoke machine provides the oxygen. All that is missing for this to be a truly explosive problem is a single stray spark - something that could be triggered by just one of dozens of causes around the workshop!

How to stay safe

My tip is that if you have one of these machines and are using it to diagnose engine, fuel system and EVAP related leaks, make sure

that your next test uses nitrogen (or CO₂ or argon) or else it could be your last test!

Want to contact James?

James is a key member of Aftermarket's team of technical writers and runs Technical Topics, a company that supplies bulletins to help technicians get to grips with the latest diagnostic, CAN Bus technology and more. To find out more, call 01278 671 919, email sales@techttopics.co.uk or go to www.techttopics.co.uk. Alternatively, fill in **802** on the free reader enquiry card.

DON'T MAKE NEXT TEST YOUR LAST!

My tip is that if you have a smoke testing machine and are using it to diagnose engine, fuel system and EVAP related leaks, make sure that your next test uses nitrogen (CO₂ or argon are also acceptable alternatives). If you don't, then given the explosive problems explained in the red box (right), your next test could quite easily be your last!

SOLUTIONS TO THE EXPLOSIVE DANGER OF SMOKE TESTING

Regardless of how effective a repair or diagnostic technique is, you should always ask yourself if it is actually safe before you go ahead. Research in Canada shows that even the tiniest of leaks can be a potentially explosive problem

Ignition risk

Dr David Checkel from the University of Alberta in Canada has performed research into oil safety and concludes that a fuel vapour mix containing just 11% of oxygen can be ignited through a pin hole of just 1mm. Keep in mind when thinking about this just how weak 11% is. The air we breathe only contains 21% oxygen!

Dr Checkel also found that the vapour in the EVAP system can enter this highly flammable state after between one and five minutes, when compressed air is used as the smoke propellant.

Nitrogen solution

Thanks to this safety issue, many motor manufacturers are now specifying that nitrogen be used as the propulsion gas when diagnostic smoke testing is undertaken.

TESTING TIMES: Smoke testing can help diagnose faults on a wide range of engine areas, including EGR control systems, manifold gaskets, Positive Crankcase Ventilation valves, oil filler caps and more. James says being aware of the safety implications of smoke testing is also important.