

Emissions and diagnosis

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Emission control diagnosis

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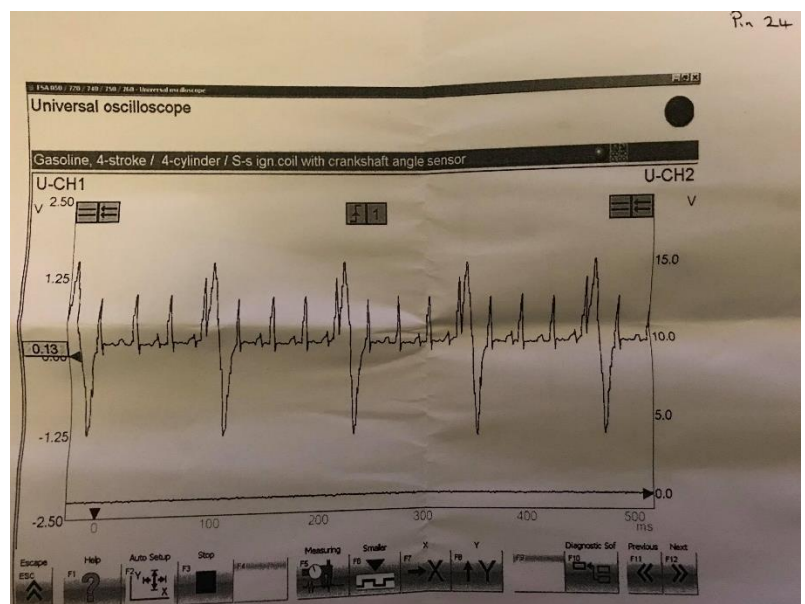
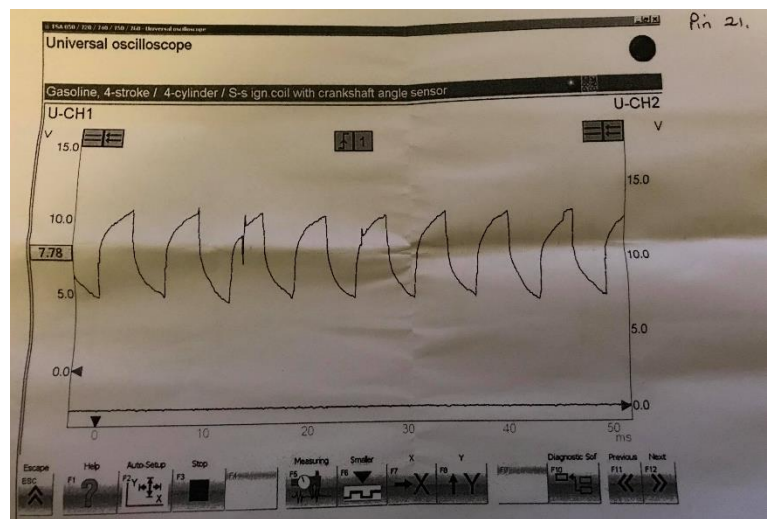
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1 Introduction

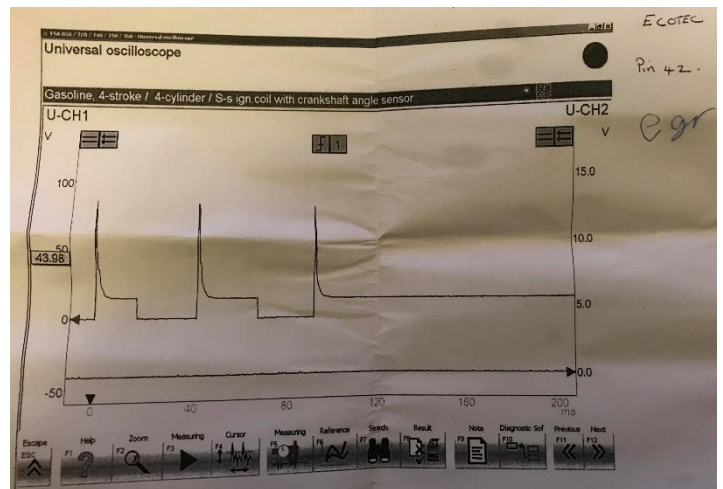
With this assignment will be going over the topics of catalytic converter/ temperature, EVAP, EGR, SAIR, PCV valves and systems and Air/fuel ratio and euro 6 standards. Need to discuss what each one is and how they work and what the effects they have on the emissions of the vehicle and the different type emissions vehicles throw into the atmosphere, for example NOx and others to see what these do to the environment and what can be done to reduce these harmful gases from being produce. Shall also be looking at euro 6 and what changes could be to the catalytic converter for the better.

2 Workshop schematics

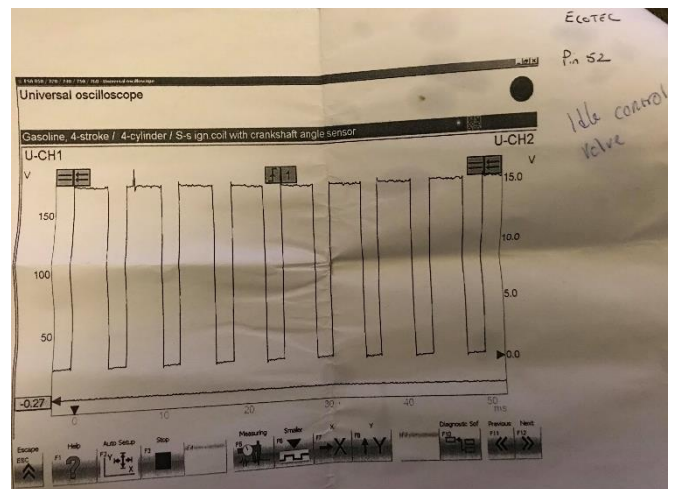
as part of this assignments we went into the workshop to be shown and have a demonstration on how the different sensors worked and how to test each one is working, starting of with testing pin 21, and 24, using a oscilloscope.



With the EGR (exhaust gas recirculation valve) testing, as the engine is turned on, there's a surge in the signal then a flatline and dips down again and then a repeat.



Then for the idle control valve, with every oscillation in the readings when each rev whilst idling, with the high frequency waves showing that the higher the frequency the faster the revs are.



3 Background research primary and secondary

This is where, is shall go over each part/ sensor and catalytic converter in the assignment.

Designed to reduce harmful emissions produced by the combustion engine. Because the combustion of the engine isn't perfect, an engine produces harmful gases such as carbon monoxide and nitrogen oxide for example, when the perfect engine would combine all the carbon and hydrogen and oxygen to produce carbon dioxide and water. A catalytic converter has ceramic in it to heat up so it cause the gases to react with each other, inside a catalytic converter you have a reduction catalyst made up of platinum and rhodium, this is used to separate the nitrogen oxides, now the nitrogen and oxygen are separated they go off and further into the catalytic converter. The oxidation stage for the converter is made up of platinum and palladium which is used to bond the oxygen and carbon monoxide to make carbon dioxide, and also used to combine the hydro carbons and oxygen to make H₂O and CO₂, catalytic converters work fairly efficiently but can always be improved.

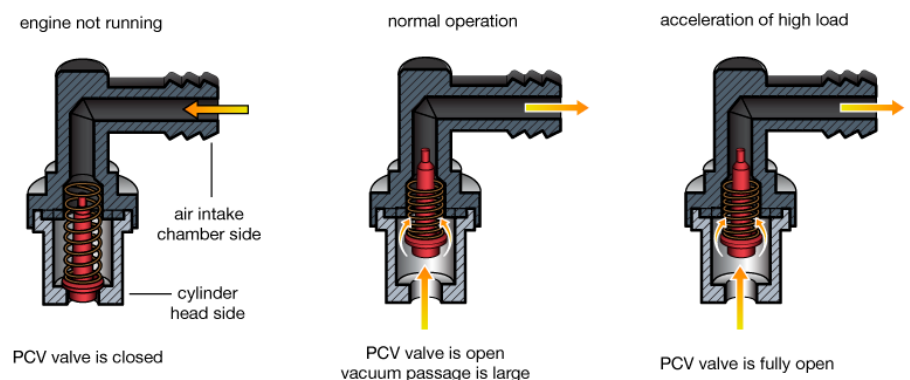
The improvements that can be made to a catalytic converter are, moving the converter closer to the engine so it warms up quicker but the disadvantages of this are that the catalytic converter can get too hot, so around 1500 degrees F would be the limit of how hot you'd want to run your converter. Some vehicles run pre cats, which is essentially another catalytic converter close to the engine and then the main one being further along the exhaust. The optimum operating temp is thought to be around 800 degrees F, the development of the catalytic converters are constantly be improved and made more efficient.

An EGR valve is an exhaust gas recirculation valve, roughly recirculating around 5-15% back into the combustion process. This is to ensure that the fuel gets fully burnt whilst decreasing the production of harmful gases such as NO_x and carbon monoxide. The benefits of an egr that's fully functioning are: less emissions, with the recirculating gases keep the engine cool and stop the production of harmful gases for example, nitrous oxide which can only be produced above a certain temperature. Theirs a reduction of throttle loss on spark ignition engines. Extends the life of the engine by reducing the temperatures it's exposed too so this would reduce ware. There's two types of EGR valves, electric and mechanical (pneumatic). Most common way to know that your EGR valve isn't working correctly is that the valve is more than likely blocked by exhaust particles.

The EVAP system is used to prevent fuel vapour from escaping the fuel tank and being released into the atmosphere, this system doesn't really need maintaining, but faults can turn the check engine light on the dashboard. On older systems, spring loaded valves were used inside the gas cap, and on newer systems, they use an EVAP canister.

The SAIR system is, secondary air injection reaction, this is used to muffle engine noise whilst also reducing the harmful fuel vapours and exhaust pollutants. This is used to inject air into the exhaust stream to allow for fuller combustion of exhaust gases.

PCV also known as crankcase ventilation system, when the engine isn't running the valve is closed. In the normal operation of the engine, the valve is open and vacuum passage on the valve is large. And when the acceleration load is high the valve is fully opened.



Air/fuel ratio is the ratio between air and fuel, when you hear people talking about running 'rich' or 'lean' they are referring to amount of fuel that is present in the air/fuel mixture entering the engine. the ratio for standard air fuel mix is 14.7:1 14.7 parts air to 1-part fuel, this is for the cleanest and emission free combustion of an engine. For rich mix you'd have even more fuel and less air going into the combustion stage, and then for lean mix you'd have even more air and much less fuel. When it comes to trying to achieve max engine power, it is believed that a ratio of 12:1 is about right. (12 parts air and 1-part fuel). Modern cars use various sensors such as throttle position and lambda sensors etc. to adjust the fuel going in to keep the ratio the same. Running in lean mix is good for your engine at all, it runs far too hot and can cause your piston to melt and melt spark plugs. Running in rich mix isn't much better either, sluggish performance and horrendous fuel economy.

Euro 6 standards are the standards car manufactures must have their cars emissions to meet for petrol and diesel cars. Euro 6 standards impose a further reduction in NOx emissions from diesel engines by 67% in comparison to euro 5. There are similar standards for petrol engines too. EGR, exhaust gas recirculation has been introduced replacing some of the intake gases which contains a lot of nitrogen, with exhaust gases, this minimises the amount of NOx (nitrous oxide) produced.

Euro 6 diesel cars are also fitted with, a NOx absorber which stores the NOx and reduces it to nitrogen over a catalyst. Selective catalytic reduction which uses DEF (diesel exhaust fluid) containing urea injected into the exhaust to convert NOx into nitrogen and water. The use of cerium, which is a fluid injected into the fuel tank every time the vehicle is refuelled which assists the DPF regeneration by lowering the temperature need for regeneration.

Euro 6 emission limits (petrol)

- **CO** – 1.0 g/km
- **HC** – 0.10 g/km
- **NOx** – 0.06 g/km
- **PM** – 0.005 g/km (direct injection only)
- **PM** – 6.0×10^{-11} g/km (direct injection only)

Euro 6 emission limits (diesel)

- **CO** – 0.50 g/km
- **HC+ NOx** – 0.17 g/km
NOx – 0.08 g/km
- **PM** – 0.005 g/km
- **PM** – 6.0×10^{-11} g/km

The figures above are the levels of emissions that petrol and diesel vehicles have to meet.

4 Conclusion

In this assignment I've shown some good understanding of each sensor, and catalytic converter work and what they are used for and a brief insight to how to improve and why to improve a catalytic converter. With the testing demonstration, I showed a poor understanding with a lack of know on how the process went and what was done.

5 References

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