CASE STUDY

Gas analyser helps optimise carbon canister performance

Many Signal Group customers employ the company's gas analysers to measure the combustion emissions from engines that are under development. However, internal combustion engine vehicles also represent an opportunity for evaporative emissions, so vehicles are fitted with a carbon canister to prevent such releases. MAHLE ANAND Filter Systems – India, a leading global manufacturer of carbon canisters is using a flame ionisation detector (FID), Signal's S4 SOLAR analyser, as part of its ongoing research and development programme, to optimise the performance of the carbon canisters which it supplies to global and domestic automotive manufacturers.

Based at the MAHLE ANAND Filter Systems facility in Pune, India, test laboratory manager Sagar Awate has been using Signal's heated FID analyser for over two years for measuring total hydrocarbons (THC). "The S4 SOLAR FID Analyser is an important instrument within our research and development programme," he explains. "We are constantly trialling new fuels and investigating the emission level (DBL – diurnal breathing loss) of our carbon canisters over a range of different temperatures as per the CARB and EPA procedures which are used worldwide. A temperature profile gradient is created with the use of a programmed environmental chamber.

"By collecting and analysing evaporative emissions from the carbon canister over a specific temperature profile, we are able to fully assess the canister's bleed emission level. The analyser therefore plays a vital role in finding the THC ppm value from the gas sample collected inside a Kynar bag, and we are pleased to report that S4 SOLAR FID Analyser has performed very well. With a user-friendly interface and operating software that is simple to configure, our staff are very comfortable with the use of the instrument."

Carbon canisters

The main function of carbon canisters is to reduce the amount of air pollution that vehicles create, whilst also increasing fuel efficiency. Hydrocarbon vapours arise from fuel in the fuel tank, even when the engine is turned off, and carbon canisters are designed to trap that vapour and feed it back into the engine.

THC measurement setup at MAHLE

Carbon canisters are filled with charcoal or carbon pellets that are able to adsorb hydrocarbon vapours. The canister input (tank port) connects to the fuel tank, while the canister output (purge port) connects to the purge valve in the vehicle's intake manifold. The vent port of the canister is open to the atmosphere.

When a vehicle is turned off, there is a pressure imbalance within the fuel tank which causes fuel to evaporate. As the tank is connected to the canister by means of hoses/pipes, all of the vapours generated inside the fuel tank enter the carbon canister. In line with the canister's design capacity, it holds the vapours coming from tank whilst the vehicle is in the parked condition. Whenever the engine is started, the purge valve opens and the vapours inside the canister are desorbed into the air passing to the engine, where they are combusted. This process is known as "purging" of the carbon canister. During the purging process, fresh air from the atmosphere enters into the canister through the vent port and flows toward the engine, carrying fuel vapour with it. It takes a few minutes to complete the purging process; after which the 'fresh' canister is able to absorb vapour from subsequent cycles. Canisters remain functional while vehicles are running.

Monitoring evaporative hydrocarbons

The carbon canister tests are based on the procedures

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outlined in the United States Council for Automotive Research (USCAR) LEVIII / TIER 3 Bleed Emission Test Procedure (BETP) Recommendations: (https://uscar.org/wpfd_file/uscar-lev-iii-tier-3-bleed-emissions-test-procedure-2/).

The USCAR procedure enables equipment manufacturers to produce repeatable and reproducible results. Two methods of hydrocarbon capture are specified in the document; the Bag Method and the SHED (sealed housing evaporative determination) Method; both of which require the use of a FID. Signal Group is able to provide FID analysers for both methods.

FID is a standard reference method for the analysis of gaseous hydrocarbons. The FID is a highly sensitive but non-selective sensor which employs a flame to strip hydrogen atoms from a hydrocarbon molecule, forming carbon radicals and electrons. This is usually a short-lived condition with the charged components quickly recombining, however, in an electrostatic field, components with opposite charges are driven towards electrodes. This creates an effective current within the flame, which is proportional to the number of molecules of hydrocarbon present.

The SOLAR range of FIDs are the latest 4th generation design; benefitting from knowledge and experience gained over 40 years to deliver accuracy, reliability and ease of use. Commenting on the advantages of this latest technology Signal Group Managing Director James Clements says: "Every S4 analyser is supplied with software to enable operation of the analyser remotely using LAN/RS232. This means customers can access their monitoring data from anywhere and at any time, and if they have any service questions, we are able to log in remotely."

For more information or to request a quote on our S4 SOLAR analyser, please contact our sales team at sales@signal-group.com or call us on +44 (0) 1276 682 841.

S4 SOLAR - Heated FID VOC analyser

Flame Ionisation Detector (FID) for measuring Total VOCs, Methane and Non-Methane hydrocarbons.

- Fixed and portable versions
- Trace PPM measurements standard
- High range % available
- 'Hot' and 'Cold' version
- Totally automatic operation
- Precision monobloc FID

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