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AgipPetroli

EuronTechnical Report

FPC-1 ADDITIVE FOR DIESEL FUEL
(Fuel Performance Catalyst)

EVALUATION OF THE EFFECT ON EMISSIONS AND CONSUMPTION

SUMMARY AND CONCLUSIONS

Following a specific request of AgipPetroli a test was conducted for the purpose of evaluating the effect of a fuel additive called FPC-1.

This additive, called a "combustion improver" should produce an improvement in emissions and a reduction in consumption; further, the complete effect should be observed only after an adequate period of conditioning of the motor using the fuel additive.

The evaluation conducted consisted of measuring the emissions and consumption of a "light duty truck", a FIAT Ducato 14-2.5 D van, during and after an accumulated mileage of 5000 Km, using a commercial diesel fuel treated with the product being tested. The emission levels and the fuel consumption thus obtained from the measurements were compared with those obtained before treatment, using the same commercial diesel fuel.

The results of the test have shown that, according to the test conditions and the vehicle used, the additive appears effective in reducing emissions of HC, CO and PM, although in notably different quantities. To the contrary, a net worsening was observed in the emissions of NOx. In addition to the results, the size of the variations depend on the kilometers traveled, tending to stabilize after 3000 kilometers. At the end of 5000 kilometers the levels of emission showed the following variations respective to the initial values:

CO: -14%

HC: -33%

Nox: +30%

PM: -12%

With regard to fuel consumption, a small reduction was observed (generally of about 2%), and was also confirmed in the CO2 emissions.

INTRODUCTION

According to the information reported in the documentation that illustrates performance, the additive FPC-1 is a combustion velocity modifier, that among other things acts to reduce fuel consumption and emission pollutants. A characteristic of the additive, as evidenced also in the documentation is that the effect should manifest itself in its entirety after an adequate period of conditioning of the motor using additive treated fuel.

Following a specific request of AgipPetroli, to the end of evaluating the real effect of the additive an opportune test was conducted in Euron, which method is described in detail below, to measure the fuel consumption and the emission pollutants of a commercial vehicle (light duty truck) fueled with diesel fuel containing the additive FPC-1.

In particular, the test provided an accumulated distance of at least 5000 kilometers carried out with a test vehicle fueled with treated fuel, and a series of emission measurements according to legislative cycle ECE+FUDE carried out every 1000 kilometers and at the end of the accumulated distance.

The designated fuel in the test was a diesel fuel with characteristics corresponding to the specifics in force as established on 01/10/96 from the Directive 93/12/EEC and which principle characteristics are listed in Table 1.

The untreated fuel was used to perform two emission tests prior to the start of the accumulation test in order to establish the base line level of pollutants and fuel consumption.
The diesel fuel was subsequently treated with the product FPC-1 in a mixture ratio of 1:5000, according to the amount listed on the label of the additive container.

SETUP AND TEST PROCEDURE

Accumulated kilometers

The kilometers were accumulated in a climatized room on a bank of rollers equipped with a Schenk dynamometer to electrically simulate the inertia at the following conditions:

-Ambient temperature of about 10 degrees C.

-Constant velocity equal to about 110 kilometers/hour.

The driving distance was accumulated intermittently, fueling the test vehicle with diesel fuel containing the additive FPC-1.

Measuring emissions and consumption

Emission and consumption measurements were obtained operating the vehicle according to the legislative cycle on a bank of rollers with a Clayton dynamometer ECE50.

The emission tests were conducted according to cycle ECE 08 modified (cycle MVEG), already designated in program EPEFE. The modification consists of the suppression of the first 40 ks of conditioning, with the sampling of the gas that has initiated from the acceleration of the motor. This procedure will become effective on 1/1/2000.

The level of regulated pollutants HC, CO, NOx and PM were measured.

For HC, CO and NOx the emission data are available for the urban portion of the cycle (ECE 15) and the non-urban (EUDC); for the particulate the only data available are relative to the combined cycle (ECE15+EUDC).

For the sampling of the exhaust gases a CVS manufactured by CGM Italia (model CFV308) was used and for the analysis the following detectors were used:

* CO: Horiba IR non dispersive analyzer

* NO: Horiba model CLA 22E chemiluminescent analyzer

* HC: Horiba flame ionization detector (FID)

* PM: The particulate was recovered on filters and measured by weighing.

The fuel consumption was determined both by weight and through calculations based on the measured emissions.

The test procedure was as follows:

FIAT Ducato			Emissions Test			
Accumulated Kilometers	0	1000	2000	3000	4000	5000
Test Fuel	1-1	2	2	2	2	2-2

Fuel 1: Reference fuel

Fuel 2: Reference fuel + FPC-1 additive (mix ratio 1:5000)

Technical characteristics of the vehicle used

A FIAT Ducato 14-2.5 D van was used, which principle characteristics are listed in table 2.

The results obtained for regulated pollutants (HC, CO, NOx and PM) and fuel consumption are as follows:

Regulated pollutants

The regulated pollutant emission level values are shown in Fig. 1 as a function of the kilometers accumulated.

The two values measured at 0 kilometers were obtained by fueling the vehicle with diesel fuel without additive.

The graph places above all the evidence of how the emissions of the vehicle were really influenced by the additive in the fuel and that the value of the effect varies with the kilometers traveled. In particular, the effect of the additive begins to manifest itself only after the first 2000 kilometers and then remains almost constant after 3000 kilometers.

All of the pollutants, even with different methods, were influenced by the additive; the effect appears very evident above all for CO and HC in which resultant levels were noticibly reduced. Also the particulate result decreased, although in a lesser amount. NOx, to the contrary, increased an appreciable

amount, a testimony to the fact that the additive acts essentially as a combustion improver.

In figures 2 and 3 the emission values are reported relative to the urban part of the legislative cycle (ECE-15) and to the non-urban part (EUDC).

The improvements already observed for the combination cycle are substantially confirmed; always, in the non-urban portion the increase of NOx emissions appears less pronounced.

Fuel consumption

Fig. 4

Fig. 4 shows the improvements in consumption and emissions of CO2 to correlate.

The fuel consumption values obtained by weight and the emissions obtained by calculation are recorded.

The graph indicates a decrease in fuel consumption and consequently in the CO2 emissions that appear to have a tendency to increase with the kilometers traveled. Further, with respect to the measured fuel consumption, the calculated values show a larger total decrease.

CONCLUSIONS

The performance of a "combustion improver" additive for fuels was evaluated by carrying out an emissions test utilizing a "light duty truck" diesel vehicle.

The test was conducted so as to compare the emissions obtained with untreated fuel to those measured during and after an accumulation of 5000 kilometers using fuel treated with the additive.

Limited to the test conditions adopted to the vehicle selected, the following conclusions can be drawn:

- The additive appeared to be effective in reducing CO, HC and Particulate emissions.
- The amount of reduction varies from pollutant to pollutant, and in addition is a function of the kilometers traveled.
- By contrast there was an increase in NOx emissions

Fig. 5 is a summary of the percentage variations in the emissions levels and fuel consumption observed at the end of 5000 kilometers, compared to the values measured at the beginning when fueling the vehicle with untreated diesel fuel.