

Contents

Part	ies involved	2
Prea	amble	2
۱.	Summary of the results and conclusion of these tests	3
1.	Reduction of fuel consumption	
2.	Reduction of polluting gas emissions	5
3.	Conclusion of these tests	6
н.	The variables used for these tests	6
1.	Conduct of the test protocol	7
2.	Vehicle put in situation during the tests	
3.	Driving conditions	
4.	Instrumentation used	
III.	Appendix	11

2sul

Parties involved

Controller	Applicant	Place of test
BUREAU VERITAS	ECONOKIT	MF POWER
685 rue Georges Claude	361 avenue des romarins	COMPETITION
CS 60401	-Ecoparc-	rue Jean de Guimarand
13591 AIX EN PROVENCE	34130 SAINT AUNES	13858 AIX LES MILLES

Preamble

This document aims to present, in summary, the consistent benefits and developed measured by the system Econokit, in terms of reduction of fuel consumption and reduction of polluting gas emissions.

Informative sources used are derived from:

- Measurement and controls carried out by *Bureau VERITAS* of Aix en Provence¹ (independent certification organism).
- Information sent over the sensors installed by the manufacturer, and collected through the OBD² plug of the vehicle.
- Measurement software integrated with the dynamometer on which the vehicle was placed.

All measurements were systematically carried out by the engineer of the *Bureau VERITAS*, in order to certify their accuracy.

The vehicle chosen for these tests is representative of the European fleet because of its capacity, power, and its year of manufacture³, to provide a baseline eloquently for the reader.

The first part of this report summarizes the results of these tests in terms of reduction of fuel consumption and polluting gas emissions, while the second part of this report details the procedure of these tests, the vehicle characteristics used in these tests, and instrumentation that allowed the statement of the measures described and discussed throughout the report.

¹ BUREAU VERITAS : 685 rue Georges Claude, CS 60401, 13591 AIX EN PROVENCE cedex 03 ² OBD: On Board Diagnostic, set of hardware diagnostic capabilities that are embedded in the vehicles with heat engine since 2001 (petrol engine) and 2004 (diesel engine), and used by automobile manufactures in Europe.

³ Complete Technical specification of the vehicle available on page 7 on this report.

Summary of the results and conclusion of these tests.

These efficiency tests of Econokit have allowed to scientifically demonstrating its impact in terms of:

- Reduction of fuel consumption of the vehicle (-27% diesel consumption⁴),
- Reduction of the volume of exhaust gas emissions (-15,5% CO₂)
- Reduction of the concentration in polluting gas (-17, 3% Carbon Monoxide and -33, 9% Oxides and Nitrogen Oxides).
- Reduction of particles emissions of 73, 4%⁵ (Diesel engine).
- Significant reduction of carbon deposits in the combustion chamber (unburned residues, EGR valve)

The action of Econokit increases the energetic efficiency of the fuel injected in the engine:

- 1. Under the action of Econokit, the same amount of fuel provides more energy to the motor.
- 2. With similar developed power, we accelerate less with Econokit.
- 3. This reduction of acceleration leads mechanically a reduction of fuel consumption.
- 4. The reduction of fuel consumption leads itself :
 - a. A reduction of production of exhaust gas
 - b. A reduction in volume of CO2 emitted

The effectiveness of Econokit is correlated at carbon deposit level⁶ of the engine:

- This is unique to each vehicle; it inevitably involves a variation in the efficiency potential of Econokit.
- More the engine is clogged with carbon deposits; more the Econokit will clean and reduce the fuel consumption of the vehicle.
- A year of manufacture equal, the reduction of consumption observed will be more important on a used vehicle than a new vehicle.

⁴ Information from the onboard computer of the vehicle, through the OBD plug. Screenshots of diagnostic software provided in the appendix of the report.

⁵ Summary table in page 5/25 of the full report of Bureau VERITAS

⁶ Carbon deposit: Sooty residue resulting from the engine combustion, which is deposited particularly on the cylinder walls and on the valve seats.

1. Reduction of fuel consumption

Normally, an engine, which is not equipped with an Econokit system, does not burn completely the fuel which is injected: it appears black smokes in the exhaust and many mechanical parts are covered of carbon deposits (thin sheets of carbons resulting from incomplete burning). These deposits clog the engine, reduces the volume of the combustion chamber and it needs to consume more fuel over time to clear the same drive power.

Because of its ionizing action, Econokit allows the engine to burn fuel more efficiently which is injected: it needs less fuel to develop the same drive power

The tests of BUREAU VERITAS showed that:

The Fiat Grande Punto (2006 model, turbo diesel engine with a mileage of 78 000km) without an Econokit and mounted on a brake bench, need to consume 9.1L/100km to maintain a constant speed on a road, a slope at 2%; 130 km/h speedometer (121 km/h real speed) at 3000 rotation per minutes (rpm), for a developed power of 25 horsepower. To maintain this speed, it is necessary to push the accelerator pedal to 74% of maximum displacement (right column « LOAD » below).



Table 1 : First test phase without Econokit⁷

During the second tests phase (after a period of driving for 950km equipped with Econokit), the fuel consumption of the vehicle was measured under the same conditions as the first phase.

⁷ Enlargement of the picture available in page 22/25 of the complete report of *Bureau VERITAS*

<u>Results</u>:

To develop the same power of 25 horsepower with an engine speed of 3000 rotation per minutes (rpm) for a real speed of 121 km/h, it is necessary to push the accelerator pedal to 64% of its maximum (instead of 74% before), while the engine consumes now only 6.6L/100km (i.e. a reduction of 27% of the vehicle consumption compared to the first phase of the test).



Table 2: Second phase of the test with Econokit⁸

NB: Through these tests, it appears that the action of Econokit on fuel consumption of the vehicle only begins when the Econokit reactor temperature reached its operating temperature start at 200°C.

2. Reduction of polluting gas emissions

In order to generate sufficient energy to move, a vehicle needs fuel (Gasoline, LPG Bio Fuel, and Diesel) and a combustive (oxygen).

Ideally, the formula for perfect combustion of diesel (for example) is:

$$2 C_{16}H_{34} + 49 O_2 = 32 CO_2 + 34 H_2O$$

We should have only CO2 and water in the exhaust.

In fact, this combustion is never perfect and many harmful gases are produced by this combustion: Nitrogen Oxides (Nox), Carbon Monoxide (CO), as particles (unburned fuel).

The installation of Econokit enabled to *Bureau VERITAS* to record significant decreases of concentration in polluting gas contain in the exhaust of the vehicle used as a basis for these tests. Pragmatically, CO_2 emissions were reduced by 15,5%

⁸ Enlargement of the picture available in page 23/25 of the complete report of *Bureau VERITAS*

while NOx emissions were reduced by 33, 9%. CO emissions, on the other hand, have been minimized by 17, 3%, but it is the release of unburned carbon particles that were the most significantly reduced: 73, 4%.

These reductions in polluting gas emissions are the results of the optimization of fuel combustion injected into the engine: less unburned fuel by the vehicle invariably involves a reduction of the pollution emitted by it.

3. Conclusion of these tests

The reduction of the polluting gas emission recorded by *Bureau VERITAS* between the first and second phase of the tests well demonstrates the ecological and economic action of Econokit system as follow⁹:

- \rightarrow -15,5% of the emissions of Carbon dioxide (CO₂)
- → -33,9% of the emissions of Nitrogen Oxides (NOx)
- → -17,3% of the emissions of de Carbon Monoxide (CO)
- → -73,4% rejection of unburned carbon particles (TVOC)

The improvement of the fuel combustion injected into the engine can develop a similar power for the same speed while requiring less fuel. This in practice means a decrease in:

→ -27% of fuel consumption (Diesel)

These measures were observed in the real conditions of the vehicle detailed on page 7 of this report, and claim to be variables according to the use of the vehicle, of its motorization, its origin consumption and the condition of carbon deposit scaling of the engine.

This reduction in fuel consumption by improving its combustion makes it possible to significantly reduce the concentrations of unburned hydrocarbons (TVOC), polluting gas (Knox, CO) and greenhouse gas emissions (CO_2).

II. The variables used for these tests.

This second part aims to summarize the details of the test protocol used and the technical specification of the vehicle observed, as to present the instrumentation used to record the measures analyzed, in order to justify the results presented in the first part of the report.

⁹ Summarize table available in page 5/25 of the complete report of Bureau VERITAS

1. Conduct of the test protocol

The test performed was conducted in two days + a period of driving through 950km.

First phase of test

Intermediate driving (950km)

04/01/2012

From 04/01/2012 to 16/01/2012

Second phase of test

16/01/2012

The first and second phase of the tests were performed on a brake bench in the premises of MF Power Compétition¹⁰ company, in order to measure accurately and identically the fuel consumption of the vehicle as the polluting gas emissions, without Econokit installed and with Econokit installed.

Details of actions realized during the two phases of tests and the intermediate driving on road, open to traffic.

First phase of test	-Measure of the fuel consumption of the vehicle and polluting gas emissions (see part 4: conditions of driving) without the installation of Econokit system.
	-Installation of Econokit system at the end of the first phase of the test.
Intermediate driving (950km)	-Use of the vehicle in normal condition, city/ national road and motorway, in order to allow Econokit system clean the engine progressively by its action.
Second phase of test	-Measure of the fuel consumption of the vehicle and polluting gas emissions in the same conditions as in the first phase of the test. -Statements of the differences between
	phase 1 and phase 2.
¹⁰ French company located in 55 Rue	e Jean de Guimarand 13290 Aix-les-milles. FRANCE

2. Vehicle put in situation during the tests

A single vehicle was used during the two phases of test to ensure the accuracy of the differences announced during the first and second phase of tests. The vehicle selected, is representative of the majority of European fleet, to provide a data interpretable and easily assimilated by all.

Technical details of the vehicle used during the two phases of tests:

Vehicle make	FIAT	
Commercial name	GRANDE PUNTO	
Year of first registration	2006	
Engine capacity	1,4L (multijet turbo)	
Power in fiscal HP	4	
Horsepower DIN	75	_
Vehicle mileage	78 000 km	
Vehicle mass	1150 kg	

Technical details of Econokit installation on the vehicle used for these tests:

Kit used

Accessories added

- Econokit

- Heater probe 12 volts - Econokit deflector

3. Driving conditions

In order to reproduce a real situation of a vehicle during a normal use, the vehicle was placed on a brake bench to simulate in a constant and controlled way, the natural variables that the vehicle would have to meet on the road (air resistance, elevation, natural resistance of the road). These constants are reproduced identically in the first and second phase of tests to ensure the accuracy of the observed differences in part 1 of the report.

The driving parameters selected during the two phases of test and maintained at constant level are the followings:

Coefficient of rolling resistance	0,0125	
Apparent surface aerodynamic (Cx)	0,8	
Slope grade (%)	2	
Constant speed on the meter (km/h)	130	
Constant speed through OBD plug (km/h)	121	
Constant engine speed (rotation per minutes)	3000	
Gear engaged (5-speed gearbox)	5	
Developed power by the engine on bench (horsepower)	25 (fixed reference value)	
Tire pressure (kg)	2	
Capacity of oil pan (lifters)	5	
Duration of test phase 1 (minutes)	10 (after motor heating)	
Duration of test phase 2 (minutes)	10 (after motor heating)	

Meaning of these parameters:

The vehicle travels at a speed of 130 km/h (speedometer) for a constant engine speed of 3000 rotation per minutes (rpm) during 10 minutes. At this speed, 25 horsepower (i.e. 1/3 of his engine power available) are needed to keep the vehicle at that speed. The coefficient of air penetration of the vehicle is 0.8 (air resistance of the body), while the road grip of the tires of the vehicle produces a resistance of 1.25%. The simulation of rolling, meanwhile, takes place on a constant slope of 2%.

4. Instrumentation used

<u>MF POWER COMPETITION Company</u>: **Brake bench ROTRONICS** allowing the measurement of power (torque and the wheel), calculation of pressure drop by the software, road simulation (determines the available power depending on the ratio gearbox engaged, the aerodynamics, the slope).

<u>ECONOKIT company</u>: **Diagnostician OBD**, OBDLink brand, and OBDWiz¹¹ software, allowing the measurement in real time, the flow of fuel injected into the engine, the pressure on the accelerator pedal, the engine speed and the vehicle speed, as well as more than 90 parameters from the information taken from the vehicle's OBD.

<u>Independent expert BUREAU VERITAS</u>: Measurements made through the equipment described and discussed on page 11/25 of the full report of *Bureau VERITAS*.

¹¹ References available through : <u>http://www.scantool.net/obdlink.html</u>

III. Appendix



Photo 1: FIAT GRANDE PUNTO used for the tests



Photo 2: Control screen of the polluting gas emissions (Bureau VERITAS)



Photo 3: Control screen of the bench power (MF POWER COMPETITION)



Photo 4: Bureau VERITAS equipment to realize the dust samples, manual samples and continuous gas



Photo 5: Measuring equipment (Bureau VERITAS)



Photo 6: PC tablet with OBDLink software (ECONOKIT Company)





UBIQUITY ECONOKIT Worldwide 361 Av. des Romarins - *Ecoparc* 34130 SAINT AUNES - FRANCE Tel: +334 99 52 52 11 Fax: +334 99 52 52 19 Email: contact@econokit.fr Website: www.econokit.fr

