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Experimental Evaluation of a New Organic Fuel Additive¹

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General

The following report describes the tests being performed on a new organic fuel additive to find its relative efficiency.

Method

To find the relative efficiency of the new organic fuel additive, several tests were performed in various types of engines:

- 1st step: tests on a small generator HP10.
- 2nd step: tests on a large generator KW500.
- 3rd step: repeat tests on the small generator HP10.
- 4th step: tests on a car with a diesel type engine at long trips.
- 5th step: tests on another car with a diesel type engine at long trips.
- 6th step : tests on small cars, with a gasoline engine

The tests on the small generator contained the following phases:

1. Operation of the generator using its normal fuel (diesel) for 60 minutes at constant load.
2. Refilling of the fuel tank and calculation of the fuel consumption.
3. Adding a given amount of the additive to the fuel tank according to the recommendations of the producer.
4. Operation of the generator for 60 minutes.
5. Refilling of the fuel tank while exactly measuring the added fuel.
6. Comparison of the fuel consumption between phases 1 and 4.

The tests on the larger generator had the following phases:

1. Marking the height of the fuel in the tank.
2. Operation of the generator using its normal fuel (diesel) for 60 minutes at variable load.
3. Refilling of the fuel tank and calculation of the fuel consumption.
4. Adding a given amount of the additive to the fuel tank according to the recommendations of the producer.
5. Operation of the generator for 60 minutes at variable load.
6. Refilling of the fuel tank while exactly measuring the added fuel.
7. Comparison of the fuel consumption between phases 2 and 4.

The tests on the diesel cars contained the various steps written before, namely calculation of the consumptions before and after adding the fuel additive.



Data:

The small generator HP10 (see Fig. 1) was operated at a constant power of 4 kW.
The large generator KW500 (Fig. 2) was operated at variable power of 62 to 144 kW.



Fig. 1 Small generator HP10

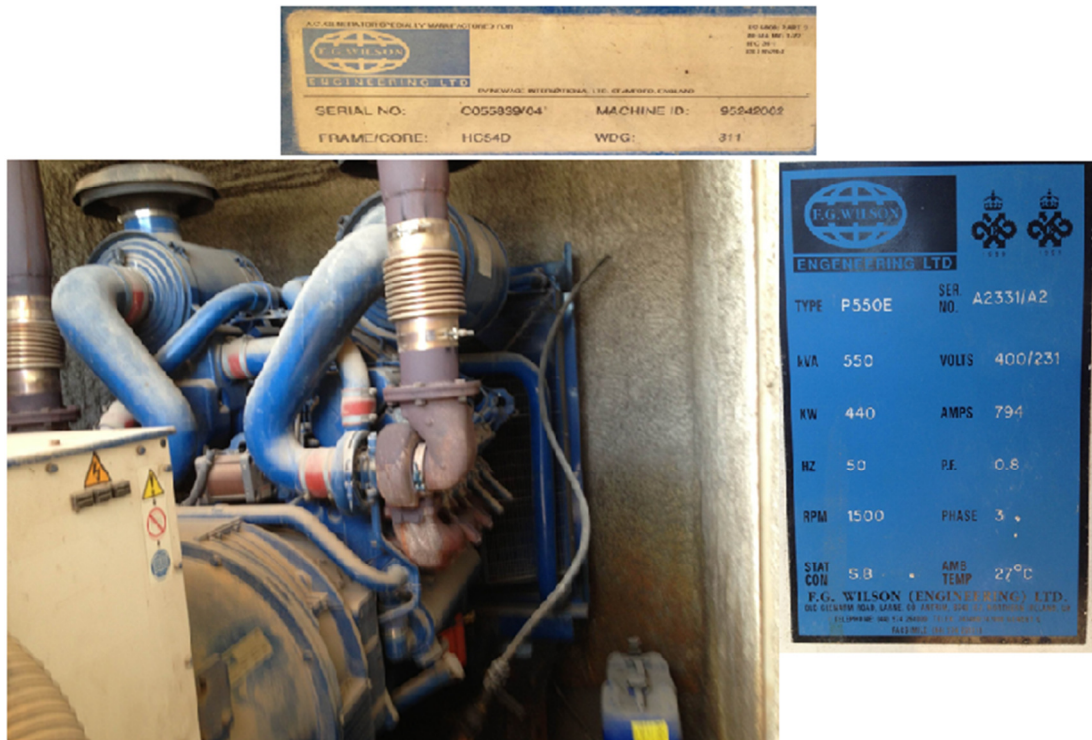


Fig. 2 Large generator KW500 , its label and specifications

The measurement of the fuel level in the tank was performed with a digital caliber. The manufacturer recommendation is to add 2 cm³ for every 40 diesel liters.

Tests

1. Description of the first test – Generator HP10

A brand new generator having a power of 7.5 kW was electrically loaded using a single phase cable connected to 4 kW heating plates.

The fuel tank can was filled up to its maximum capacity of 12.5 liter.

The generator was continuously operated for 60 minutes and then was shut up instantaneously.

The tank was refilled with 1.4 liter to reach again its maximum capacity. The power of the generator was found to be 2.86 kW per liter fuel.

One (1) cm³ of fuel additive was added to the tank, and the generator was operated again using the previous described conditions for 60 minutes. Then the tank was refilled with only 1.1 liter. The power of the generator was found to be 3.64 kW per liter fuel. Then the fuel savings (F.S.) can be calculated to be:

$$F.S. = \frac{1.4 - 1.1}{1.4} 100 = 21.43\%$$

2. Description of the second test – Generator KW500

The larger generator, named Wilson, has a power of 500 kW and was electrically loaded by a variable load between 57 to 142 kWh (most of the time at 90 kWh). The fuel tank of the generators has a symmetric square cross section; therefore the height of the fuel was measured using a transparent tube and a digital caliber (see Fig. 3).



Fig. 3 The transparent fuel tube

Prior to testing, the height of the fuel on the tube was marked,; another mark was added after activating the generator for 60 minutes and its shut up. The amount of 4 cm^3 was added to the tank according to its capacity (40 liter). Then the generator was activated for 60 minutes and then shutting it off. Height differences were measured to be 9.1 vs. 11.4 mm, yielding



$$F.S. = \frac{11.4 - 9.1}{11.4} 100 = 20.18\%$$

3. Description of the third test- repeated tests on the small generator HP10

The same small generator HP10, used and described in phase 1, was again tested. This time, as an additive was already in the fuel tank, due to the fact that it worked in the previous tests, 8 additional liters were added. The tank contained at the beginning of the new tests series 2/3 clean diesel fuel and 1/3 fuel +additive.

This time, the height of the fuel was measured as in the previous tests (No. 2, above) using a digital caliber. The initial height was measured to be 76.2 mm. After an operation of 60 minutes, under a power of 4.6 kW the height was 66.6 mm. One cm³ of additive was added, and the generator was again activated for 60 minutes under a power of 4.6kW. After this operation the height of the fuel was measured to be 53.6 mm. The F.S. was found to yield

$$F.S. = \frac{66.6 - 53.5}{66.6} 100 = 19.52\%$$

4. Description of the fourth test- a Hyundai van having an engine of 2600 cm³

The van underwent two trips to Eilat (the southern city of Israel, on the Red Sea shore) and back. The first trip was done without additive and the second one with the additive. The distance covered by the van in the first trip was 723 km, consuming 58.7 liter, yielding a consumption of 12.3 km/liter.

The distance in the second trip (while adding the additive) was 721 km, using 57.9 liter, thus obtaining a consumption of 12.45 km/liter.

As no significant fuel reduction was obtained, another two trips to Eilat and back were performed, yielding a consumption of 12.1 km/liter.

According to the comments of the additive developer, due to the fact that the van engine was very old with more than 550 thousand km, the fuel additive cannot make a change in the fuel consumption.

5. Description of the fifth test – a Toyota pickup car having an engine of 2600 cm³.

Based on the results of the 4th step, a Toyota 2600 cm³ pickup car, having passed 150 thousand km was tested. This time the trip was to a closer location, Mitzpe Ramon and back. The number of km, passed on the first trip was 356, burning 30.784 liter. The consumption ratio was found to be 11.56 km/liter.

A second trip was then performed, with the same distance of 356 km, after adding the fuel additive at a ratio of 5 cm³ per liter. This time the amount of fuel spent was 28.907 liter yielding a consumption of 12.315 km/liter.



Comparing the two results yields

$$F.S. = \frac{30.784 - 28.907}{30.784} 100 = 6.1\%$$

One should notice that the driving conditions on the 2nd trip were harsher, and the car experienced heavy side winds, which might explain the relative low F.S.

6. Description of the sixth test- Mazda 2 car with a gasoline engine

A Mazda 2 car was rented and tested along 400 km. The fuel consumption was 11.3 km/liter. After filling the tank with 40 liter and adding 10 cm³ of the fuel additive a trip to Eilat was performed along 394 km, with a consumption of 13.3 km/liter. After refilling the tank and adding 10 cm³ of additive, the back trip was started with the same distance 396 km and a consumption of 14.225 km/liter. Comparing the first consumption to the last one yields:

$$F.S. = \frac{396/11.3 - 396/14.225}{396/11.3} 100 = 17.7\%$$

The next day another trip was performed, this time to the north of the country, Metula, while 10 cm³ of additive added to the fuel tank.

The distance to Metula and back was 346 km and the consumption was found to be 14.89 km/liter.

Comparing the first consumption to the last one yielded:

$$F.S. = \frac{346/11.3 - 346/14.89}{346/11.3} 100 = 24\%$$

7. Description of the seventh test- Chevrolet Malibu (2 liter engine) car with a gasoline engine (95 octane)

A trip to Eilat was performed yielding a fuel consumption of 9.84 km/liter (without additive). Another 3 trips were performed, but with additive (8 cc per 40 liter of fuel). The results of the last trip showed a fuel consumption of 12.73 km/liter which means an addition of 2.89 km for each km, compared with the previous fuel consumption. This leads to a fuel saving of :

$$F.S. = \frac{1/9.84 - 1/12.73}{1/9.84} 100 = 22.7\%$$



8. Description of the eighth test- Renault Kangoo (1.9 liter engine) car with a diesel engine

A few trips to Eilat and back were performed. The first trip yielded a consumption of 10.7 km/liter of diesel (without additive).

The amount of 10-12 CC fuel additives was added to 40 liter of diesel fuel. Another 4 trips were performed using the fuel additive. The last trip showed a consumption of 15.02 km for each liter.

This leads to a fuel saving of :

$$F.S. = \frac{1/10.7 - 1/15.02}{1/10.7} 100 = 28.76 \%$$

Conclusions

Based on the preliminary tests performed both on generators and on car engines with either regular 95 octane fuel or diesel fuel, one can clearly see that the new organic fuel additive has good and promising prospects in increasing fuel savings in engines and might reduce their wear, thus contributing to their increased efficiency.

To be able to reach conclusive results and to decide correctly what is the efficiency of the new fuel additive on various applications (generators, engines with other types of fuel, etc.), one has to perform more dedicated parametric tests. Those tests must cover the whole range of engine work, at various rpm, yielding the correct characteristics of the new fuel additive.



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