TEPHGUARD OIL ADDITIVE REPORT

BY

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PHYSIO-CHEMICAL TESTING

An extensive battery of physical and chemical tests was performed on the Tephguard additive in order to determine its composition. Details of these tests are available upon request. See CONCLUSIONS for the results.

AUTOMOTIVE TESTING

The vehicle used for the chassis dynamometer testing of the Tephguard additive was an EPA-owned 1972 Chevrolet Impala 350 CID V-8 with 33,857 odometer miles. The dynamometer inertia weight setting was 4500 lbs. and the dynamometer horsepower setting was 14.0 actual horsepower. Prior to testing the vehicle was carefully tuned to factory specifications with the installation of new spark plugs, points, condenser, distributor cap, and ignition wires. In addition, the air filter, oil, and oil filter were replaced.

Because the objective of this project was to determine the validity of the Tephguard additive claims of improved fuel economy and reduced emissions, the test program was divided into three phases. In the first, Phase I, no additive was present and baseline emissions and fuel economy measurements were determined. In the second, Phase II, 8 oz. of Tephguard additive was added to the crankcase oil according to the manufacturer's instructions, and emissions and fuel economy measurements were subsequently determined. In the third, Phase III, an additional 8 oz. of Tephguard additive was added (for a total of 16 oz. of Tephguard now in the crankcase oil) according to manufacturer's instructions and emissions and fuel economy measurements were again determined. Gaseous emissions including hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), and fuel economy (MPG) were measured.

The test schedule was composed of four separate driving cycles: the Federal Test Procedure (FTP), the Highway Fuel Economy Test (HWFET), the Congested Freeway Driving Schedule (CFDS) and a 55 MPH steady state test (55 MPH). Detailed descriptions of the above driving cycles are listed in the appendix. It should be noted, however, that of the four driving cycles tested, only one, the 55 MPH steady state test, did not utilize a professional driver on the chassis dynamometer. The driving cycles were run in the following daily order FTP - HWFET - CFDS - 55 MPH and were conducted over a period of 4 weeks. During the Phase I baseline testing, the test schedule was repeated 4 times; during the Phase II 8 oz. additive testing, the test schedule was repeated 3 times; and during the Phase III 16 oz. additive testing, the test schedule was repeated 3 times. A summary of the automotive testing performed by our laboratory, is presented below.

Test Phase	Test Description	Test Schedule* Repetitions	Measured Quantities
Phase I	Baseline-NO Tephguard	4x	Auto emissions and fuel economy.
Phase II	8 oz. Teph-guard added to oil	3x	Auto emissions and fuel economy.
Phase III	16 oz. Teph-guard added to oil	3x	Auto emissions and fuel economy.

*Daily Test Schedule: 1) FTP 2) HWFET 3) CFDS 4) 55 MPH

The results of the testing are tabulated on the following two pages. Auto emissions are measured in grams per mile and fuel economy in miles per gallon.

Test Results Discussion

It may appear from a cursory examination of the results listed in Tables 1-4 that the addition of Tephguard to the crankcase oil did affect emissions and/or fuel economy in some cases. However, in order to determine the significance of the test results, one must perform a statistical analysis which takes into account the standard deviations, or error, associated with each value (represented by the ± number listed below the measured quantities in Tables 1-4). When such an analysis, the one-way analysis of variance, is performed upon the test results, one finds no significant reduction in gaseous emissions (HC, CO and NOx) nor any significant increase in fuel economy after the addition of either 8 oz. or 16 oz. of Tephguard. This holds true for all results from all four tests.

Emissions and Fuel Economy Results

Table 1. FTP

FTP	Number of Tests	HC gm/mi	CO gm/mi	NO_x gm/mi	CO_2 gm/mi	Fuel Economy
Baseline	4	2.10 ±.28	27.04 ±7.58	3.40 ±.18	776.9 ± 20.2	10.57 ± .37
8 oz. Additive	3	1.79 ±.03	26.41 ±4.65	3.32 ±.06	773.8 ±12.4	10.62 ± .16
16 oz. Additive	3	1.79 ±.05	24.03 ± .88	3.29 ±.10	794.9 ±11.3	10.40 ± .16

Table 2. HWFET

HWFET	Number of Tests	HC gm/mi	CO gm/mi	NO_x gm/mi	CO_2 gm/mi	Fuel Economy
Baseline	4	1.22 ±.26	14.09 ±1.56	4.75 ±.69	528.0 ±16.4	15.75 ± .40
8 oz. Additive	3	1.14 ±.10	13.69 ± .61	4.82 ±.14	493.9 ± 5.4	16.80 ± .18
16 oz. Additive	3	1.05 ±.16	14.12 ±1.40	4.93 ±.12	521.4 ± 4.5	15.94 ± .18

Emissions and Fuel Economy Results

Table 3. CFDS

CFDS	Number of Tests	HC gm/mi	CO gm/mi	NO_x gm/mi	CO_2 gm/mi	Fuel Economy
Baseline	4	1.32 ± .27	15.78 ± 2.00	4.12 ± .55	573.4 ± 7.8	14.48 ± .14
8 oz. Additive	4	1.25 ± .13	17.65 ± 3.87	4.30 ± .09	568.2 ± 12.7	14.54 ± .36
16 oz. Additive	3	1.25 ± .21	17.12 ± 1.72	4.52 ± .03	590.0 ± 12.8	14.05 ± .37

Table 4. 55 MPH Steady State

55 MPH	Number of Tests	HC gm/mi	CO gm/mi	NO_x gm/mi	CO_2 gm/mi	Fuel Economy
Baseline	4	1.02 ±.12	22.28 ±4.34	4.41 ±.99	478.4 ±13.3	16.88 ± .52
8 oz. Additive	3	1.02 ±.15	22.22 ±8.34	4.99 ±.39	458.3 ±16.7	17.58 ± .92
16 oz. Additive	3	1.10 ±.23	30.44 ±12.11	4.36 ±.57	433.1 ±47.9	18.17 ±2.35

As mentioned before, the FTP, HWFET, and CFDS all used a professional driver on the chassis dynamometer to insure that the test cycle was accurately followed. The 55 MPH steady state test did not utilize a driver, but instead, the vehicle's accelerator pedal was propped mechanically to 55 MPH for 15 minutes. Because there was no driver or observer in the vehicle, it is probable that undetected speed fluctuations occurred during this cycle. These fluctuations are therefore reflected in the large deviations associated with the 55 MPH emissions and mileage results. In summary, within experimental error, all fuel economy and emissions baseline results (FTP, HWFET, CFDS, and 55 MPH) are identical to the 8 oz. and 16 oz. Tephguard additive results.

CONCLUSIONS

Based upon the physical, chemical, and automotive testing performed by our laboratory, the following conclusions can be drawn:

1. Tephguard consists of a ≈ 6% by weight suspension of 6μ - 10μ fluorocarbon particles (probably of the Kel-F terminal chlorine type) in a C_8 - C_{13} petroleum naptha carrier. The suspension also contains a small amount of calcium compounds, perhaps a calcium sulfonate dispersant.

2. Vehicular chassis dynamometer testing revealed NO significant effect of the Tephguard additive either at the manufacturer's recommended 8 oz. dosage or at twice that dosage upon HC, CO, or NOx emissions or upon fuel economy. Consequently, within the short term limitations of these experiments, the manufacturer's claims for improved fuel economy or reduced emissions are not substantiated. That is, from our test results:

    - Tephguard additive <u>DOES NOT</u> appear to increase fuel economy
    - Tephguard additive <u>DOES NOT</u> appear to reduce auto emissions

3. <u>NO</u> information concerning:

    - Horsepower output
    - Wear
    - Internal Friction
    - Durability
    - Long term effects

    can be inferred from our test results.

APPENDIX

Below is a description of the various test cycles we ran on the chassis dynamometer. The daily test schedule was the FTP (Federal Test Procedure) followed by the HWFET (Highway Fuel Economy Test) followed by the CFDS (Congested Freeway Driving Schedule) followed by a 15 minute 55 MPH steady state run.

Federal Test Procedure

This test simulates a 7.5-mile, stop-and-go trip with a speed range of 0 to 56 MPH, and an average speed of 21 MPH. The trip takes 31 minutes, has 24 stops, covering an actual distance of 11.1 miles. Eighteen percent of the trip is spent idling, such as would be expected in the city at traffic lights or in rush-hour traffic. Two kinds of engine starts are used. One is a cold start, which is similar to starting a car in the morning after it has been parked all night. The other is a hot start which is similar to starting a vehicle after having parked it for a short time while shopping. The information from this test is then combined to represent the fuel economy of that vehicle during a realistic mixture of hot and cold starts during urban driving conditions.

Highway Fuel Economy Test

This test simulates a 10-mile, nonstop trip that begins with the vehicle warmed up. The trip has an average speed of about 48 MPH and lasts 13 minutes. The speed during testing ranges from 0 to 60 MPH.

Congested Freeway Driving Schedule

This test simulates a 13.5 mile stop-and-go congested freeway driving cycle that begins with the vehicle warmed up. This test lasts 23 minutes with an average speed of 35 MPH. The speed during testing ranges from 0 to 57 MPH.

Steady State 55 MPH Test

In this test, the warmed up vehicle's accelerator pedal is propped mechanically to 55 MPH for 15 minutes. The speed during testing remains at a steady 55 MPH.

The FTP, HWFET, and CFDS procedures use a professional driver on the chassis dynamometer to insure that the test cycle is accurately followed, therby simulating real-life type driving patterns with a real driver. With the 55

MPH steady state test, no professional driver is used and, consequently, this test is more of a simulated mechanical exercise than a representation of a real-life driving pattern.

DU PONT industry news

Du Pont Company / Public Affairs Department / Wilmington, Delaware 19898

WILMINGTON, Del., Feb. 1 -- The Du Pont Company today announced it will immediately discontinue supplying its "Teflon" fluorocarbon resins or untrademarked fluorocarbon micropowder for use as ingredients in oil additives or oils for lubricating internal combustion engines.

The decision was reached after a review of data available within the company and from outside sources showed, in Du Pont's opinion, that these resins are not useful in such products.

During the past several years, numerous oil additive or engine treatment products have been introduced in the United States and abroad. Promotion for some of these products claims improved engine performance, increased fuel economy and reduced emissions, citing Du Pont's "Teflon" fluorocarbon resin as the active agent.

As the number of oil additive products has increased, so have the inquiries Du Pont has received as to the utility of "Teflon" resins in such applications.

"Teflon" is Du Pont's trademark for its polytetrafluoroethylene (PTFE) products.

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