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FPC[®] PRODUCTS AND MULTI-FUNCTIONAL ADDITIVE PACKAGES

The following is a response to a letter received by a customer regarding a multi-functional additive package. The paper discusses the difference between most multi-functional additives and FPC[®] catalyst.

I. The Multi-Functional Additive Package

Multi-functional additive packages are typically a combination of two or more of the following: detergent, fuel-stabilizer, lubricity, cetane booster, and/or corrosion inhibitor additives. In colder climates, an antigel additive may also be part of the package. These are typical fuel additives that can be purchased from a number of manufacturers, and private labeled for resale purposes. **These additives are also added to the fuel (except perhaps lubricity additives) by the oil refiners.** These are not unique, unlike FPC[®] products. The following discusses their purpose.

1) Lubricity Additives

Lubricity additives are intended to replace the natural lubrication in diesel oils that theoretically are removed in the refining process.

In October of 1993, the low sulfur requirement for over-the-road diesel came into effect. Some isolated injector seal failures created a wave of concern that the refining and blending process to produce the low sulfur fuel was removing the lubricating properties of the fuel. Some lubricity additive vendors used this as a springboard to market their products. However, after studies were done, it was determined that fuel lubricity was not the problem, but rather the aromatic content of the fuel which reduced the swell of the seal material. The attached letters from independent sources (Phillips 66 and AMOCO) are examples of these studies.

Lubricity additives have no effect upon engine performance and bring no return in terms of fuel cost reductions.

2) Corrosion Inhibitors

Rust and corrosion inhibitors are added to fuel to prevent rust and corrosion to pipelines, fuel storage

tanks and vehicle fuel systems. These are particularly useful when the diesel has a high retained water content (molecular water), or where water bottoms are allowed to form in large bulk storage tanks. The use of high quality diesels (low molecular water content), good fuel rotation and tank management methods minimize the need for corrosion inhibitors.

These are usually amines and amine phosphates. Corrosion inhibitors have no effect upon engine performance and bring no return in terms of fuel cost reduction.

3) Fuel Stabilizers

Fuel stabilizers are amines or other nitrogen compounds that prevent sediment formation at ambient temperature by interfering with acid-base reactions. These additives are not used in straight run diesels but, if the diesel fuel contains cracked gas oil, a fuel stabilizer might be desirable, especially if the fuel is to be stored for a long period of time. **These stabilizers are very specific in their action and need to be selected to suit a particular fuel to be treated.**

These additives are not needed in most high quality fuels. They also bring no return to the end users in terms of fuel cost reduction.

4) Detergents

Detergents are polyglycols and basic nitrogen compounds that control the formation of deposits where they might have a detrimental effect upon engine performance. These chemicals are typically added to the fuel by the oil refiner or the oil supplier, and pertain mostly to lower quality fuels.

Detergents act to remove or prevent gummy deposits that can cause sticking of injector needles. They also remove carbonaceous deposits that build up on injector tips when poorer quality fuels are used. Carbon deposits reduce the amount of fuel injected and alter the injector spray pattern, causing reduced power and increased smoke. When heavy deposits form on injector tips causing power loss and engine smoking, the removal of these deposits can restore the engine to designed operation. **Once the initial cleaning has taken place, no amount of detergent added to the fuel will add to the performance of the engine, it simply maintains engine performance closer to the designed level.**

The use of a detergent can create a reduction in fuel consumption, especially in **certain types of engines**, and where engine performance has already been affected by injector tip deposit formation. Laboratory studies by Exxon Chemical International (Automotive Fuels Handbook, Chapter 17, page 435) using an **indirect-injected** 1.6 liter diesel in a passenger vehicle showed that even with severe injector tip shrouding, only a 3.7% fuel savings was realized. This kind of improvement is improbable with today's modern **direct-injected, heavy-duty diesels** used commercially in the US.

5) Cetane Boosters

Cetane is defined as the ability of a diesel fuel to auto-ignite, a desirable property in compression-

ignition engines, to a point. Faster auto-ignition means easier cold starting, especially in cold climates, and reduced engine smoking. Oil refiners add cetane boosters (nitrates and peroxides) to off-spec fuels at 500 to 1,000 ppm to raise the cetane number from 3 to 5 points.

Cetane boosters are expensive, and can be detrimental to engine life and emissions, if added in excessive amounts. Engine manufacturers do not recommend the use of cetane boosters in diesel fuels that already have cetane numbers of 40 or higher for this very reason.

Cetane boosters generally do not provide cost reducing benefits in terms of improved engine efficiency.

6) Antigels

Diesel fuels tend to thicken as the air temperature becomes colder. If the temperature falls below the gelling point of the fuel, it will solidify, starving the engine of fuel and bringing the equipment to a complete stop. Getting the fuel and engine moving again is a costly and time consuming operation that all fleet operators want to avoid.

Frequently, the problem is avoided by blending lighter fuels (#1 diesel, kerosene, cutting kero) with #2 diesel to lower the fuels gelling temperature. Though effective, it is expensive and becoming more expensive with the demand for more low sulfur diesel for the over-the-road market. Antigels can be used to reduce the need for blending winter grade fuels, and therefore, may help reduce the overall cost of winter fuels.

Antigels must be tested to determine effectiveness in different types of fuel, but those with proven track records should be safe to use.

II. The FPC Fuel Catalyst

1) The Effect of FPC[®] Catalyst

FPC[®] catalyst contains no additives that are already used by the oil refiner, or that are unnecessary.

FPC[®] catalyst removes carbon deposits and prevents their future buildup through an improved combustion process; therefore, the use of detergent additives beyond the amount already found in the fuel is not necessary.

If injector tip cleanup is the problem, FPC[®] catalyst will not only eliminate this problem, but create additional fuel savings through an improved combustion. The combination of the two actions will create much greater fuel cost savings than the detergent additive alone. **Furthermore, in well maintained and/or newer engines, or where higher quality fuels are used, a detergent has little or no effect, and FPC[®] catalyst will still create fuel savings that more than offset the cost of the catalyst.** This fact is well documented in independent laboratory studies using new or like-new engines

operating on laboratory or reference grade fuels, which are higher quality than commercial fuels.

The emissions reductions claimed by multi-functional package marketers is also a product of the detergent additive cleaning up the injector tips. These improvements are no greater than and, in most cases, are less than those documented in the many tests conducted with FPC[®] catalyst. Again, a detergent will produce no improvement in emissions if no injector buildup is present, while FPC[®] catalyst always reduces exhaust emissions.

2) Independent Testing

Most claims made by private labeled multi-functional additive packages are inflated and cannot be substantiated in the technical literature provided to potential customers. Typically there is no actual test data provided, or the data is not from a recognized, independent testing institution. Often, the claims are supported by testimonials of users who have neither the expertise nor the controls to accurately document product benefits. The reader seldom knows how the data were collected, who collected the data, or how much data were collected. In other words, it is impossible for the reader to ascertain if the test was reliable from the information provided.

There are many factors that influence fuel consumption that have nothing to do with the effectiveness of a fuel additive. These include weather changes, driver habits and changes, changes in load and work cycles, changes in fuel energy content and combustion characteristics, etc. These must be controlled or accounted for, or the test is meaningless.

It is because of the many variables typical to the field that laboratory tests were designed. It is the responsibility of the additive vendor to take his product(s) to one or more recognized independent laboratories and have these laboratories conduct recognized test procedures to verify the vendor's product claims. This is the only way the customer can be certain he is getting what he is paying for.

The FPC[®] catalyst has been tested by at least ten independent laboratories. The benefits of the product are well documented. These tests are available to all potential customers.

Further, the field test used, in cooperation with engineers representing the testing company (customer), is an adaptation of a recognized laboratory test method that controls all variables and produces reliable data regarding the benefits of FPC[®] Catalyst for that specific customer in his equipment fleet.

3) Fuel Additive Policy and Cost Comparison

We recommend all customers and potential customers adopt the attached "Fuel Additive Policy". If an additive vendor cannot comply with the criteria outlined in this policy, it is likely the claims are unsubstantiated, and the cost savings projected by the additive vendor may only be supposition. This being the case, any cost of the additive is an actual cost, with no savings to offset the increased expense to the customers' bottom line. **If that is the case, cost comparisons with FPC[®] Catalyst are not valid.**

With FPC[®] catalyst, the customer knows there is a substantial cost savings. Fuel consumption is reduced enough to bring a return on investment several times the cost of FPC[®] catalyst. Engine component life is extended. Engine wear is reduced. Emissions are reduced. These are all documented benefits from which a customer can project real and significant cost benefits.

III. Conclusions

Much of what the customer is paying in multi-functional additive packages is unnecessary, in fact all of it may be, if the customer is purchasing good quality fuel which already contain these additives. Such additive packages might provide a reduction in fuel consumption when used in poor quality fuel or when used in engines that are older or not well maintained, although this should be substantiated by recognized, independent testing before the additive be considered. There will be little or no fuel consumption reduction in new engines, with new technology, or where good quality fuels are used.

Oil refiners do not add FPC[®] catalyst. It is patented and owned exclusively by RDI, Inc. Where a detergent produces a fuel consumption reduction, FPC[®] catalyst will do the same, and much more, since the catalyst acts upon the combustion process itself, and not upon a symptom of poor fuel quality or engine operation. FPC[®] catalyst will reduce fuel cost well beyond the cost of the catalyst in every engine type and application, and in all fuels of all qualities.

An increase in the amount of detergent additive in the fuel after the initial cleaning takes place is a waste of money in those engines where some fuel savings might be realized. FPC[®] catalyst is effective under all engine conditions, and need not be added in greater concentrations.

In all engines, with all diesel and gasoline type fuels, the customer can be guaranteed of fuel cost savings reductions, and emissions reductions.

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