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THE MAKING OF PREMIUM DIESEL FUEL

Supplemental

What Is Really Needed?

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AMALGAMATED, INC®.

"Friendly, Experienced, & Dependable"

IF YOUR GOAL IS PREMIUM DIESEL FUEL - MAKE IT PREMIUM!

Introduction

Since the early 1990's, the fastest growing market in the petroleum industry of North America has been premium diesel fuel. While this is true from a marketing point of view, the actual fuel products sold as being superior in quality and performance to No. 2-D diesel fuel often are quite different and vary significantly. This situation stems from the lack of an industry standard or even an accepted definition of precisely what a "premium" diesel fuel is or should be in the North American marketplace. While the comments herein are directed at No. 2-D diesel fuels for on and off-highway applications, many of the same comments can be made for both light and heavy distillate fuel oil products. Insights into these fuels will be provided at a later date.

In an endeavor to rectify this situation and provide some needed assistance to the marketplace the author of this editorial recently published an all inclusive article fully detailing every aspect of premium diesel fuel titled "**THE MAKING OF PREMIUM DIESEL FUEL**". This article explicitly itemized the different performance parameters of diesel fuel and detailed precisely how to make each parameter better for the user.

The following pages are provided in an effort to further assist all aspects of the developing premium diesel fuel market and hopefully prevent the non-productive posturing activities which are currently underway by various factors within the fuel and fuel additive industries.

These posturing activities are specific attempts to limit the scope of premium diesel fuel marketing by venturing to sway the marketplace into believing that **(1)** most diesel fuels currently produced are already very nearly "premium in stature" and, therefore, should need no performance enhancement, **(2)** those fuels that might need performance quality improvement can be "enhanced with only a small amount of effort and cost", and **(3)** there is "no substantial need to identify premium diesel fuel as a separate and distinct product" which would require segregated storage and handling.

The above mistaken beliefs are the cause of the failures by those who have previously undertaken the challenge to provide premium diesel fuels. And, these same untrue assumptions are the essence of the arguments put forth by those who constantly attempt to minimize the developing markets for premium diesel fuels in North America. The underlying question is why these same people would go to such lengths to prevent something good from being made available to the fuel consumer? Could it be that a truly "better quality diesel fuel" would in fact reduce the overall consumption of diesel fuel and thus decrease total diesel fuel sales?

Today's premium diesel fuel buyer presents a much different and more knowledgeable picture than in the past. He wants performance benefits that he can notice and a payback for the extra money he spends to purchase a better quality diesel fuel. Today's premium diesel fuel buyer is intelligent and he is willing to pay for a more cost effective diesel fuel, if it truly is better. But, the fuel supplier must be willing and ready to supply a product that is "truly premium in quality", and the product must perform much better than an average diesel fuel product. Yesterday's "smoke and mirrors" marketing tricks and gimmicks should be a thing of the past.

What Can Be Done To Make Better Fuels?

There are several physical test parameters in typical diesel fuels which can be augmented to enhance the operation and performance of the fuel in a diesel engine. Each of these performance characteristics can be improved to better suit older engines as well as the more modern equipment with sophisticated electronically-controlled fuel injection systems. Most of these performance items are quite easy to alter with the simple addition of performance enhancement chemical additives at the time of production or at some point in the distribution chain. However, certain of these items (particularly in specifically produced fuel products) may require manufacturing decisions on the part of the petroleum refiner.

The test parameters which can easily be improved for the diesel fuel purchaser and user include:

- a.** Cetane Increase (provides better combustibility and improves engine startability)
- b.** Detergency (insures fuel system cleanliness and enhances fuel atomization)
- c.** Stability (retards fuel degradation and prevents varnish and sludge formations)
- d.** Lubricity (enhances lubrication value of fuel and prevents fuel system wear)
- e.** Corrosion/Rust Inhibition (prevents fuel system deterioration)
- f.** Cold Flow (prevents winter operating problems caused by fuel paraffin content)
- g.** De-Ice (eliminates fuel system icing and fuel line freeze-ups caused by water)

Other diesel fuel operating properties which can easily be altered to improve the performance and acceptability for the diesel fuel purchaser and user include:

- h.** Deposit modification (minimizes combustion chamber and fuel system build-up)
- i.** Smoke reduction (reduces unburned hydrocarbon and particulate emissions)
- j.** Combustion efficiency (limits the unburned hydrocarbon content in the exhaust)

Each of these items when modified correctly will contribute to the production of more horsepower by the engine through the optimization of the energy conversion process. And, even the most modern diesel engine has a great deal of BTU energy conversion efficiency that can be improved. But, the fuel provider must take an action which actually yields positive results. The fuel will not perform better just because a marketer "wishes" it to do so, and advertises it. The fuel provider (producer, marketer, supplier) must make a decision to offer a fuel that performs to a higher level and take the steps necessary to make a better quality diesel fuel. The gasoline market must meet stringent "premium" quality requirements, why shouldn't the diesel fuel users in North America receive the same attention to product quality?

What Should The Added Cost Be?

The cost of making a truly premium diesel fuel will depend greatly on the starting point of the base diesel being upgraded. This is particularly true of the base diesel fuel cetane number, since raising the cetane number will require the most volume of any diesel fuel additive component to be added to the base diesel fuel.

Based on a typical (44 - 45 cetane) diesel fuel, the petroleum refiner/producers or the supplier/marketers should expect to add between **1.5 to 2.5 cents per gallon** of premium diesel fuel they sell. This cost would allow for a 4 to 5 cetane number increase, superior detergency augmentation, optimum stability protection, adequate lubricity enhancement, satisfactory rust and corrosion inhibition, and ample cold weather safeguards.

The added cost to make a “truly” premium diesel fuel is more than enough to provide the diesel fueluser with a product that yields noticeable improvement in engine performance. And, if the operator feels a difference, the equipment owner reaps the long term benefits from premium diesel fuel. Coupled with a good delivery service program on the part of the fuel supplier, a “truly” premium diesel fuel will retain a customer for a long timeperiod.

What Are the Real Benefits of Premium Diesel Fuel?

A “truly” premium diesel fuel should furnish the diesel engine with an energy source devoid of all negative operating characteristics. Without these negative aspects the engine energy conversion process represents an opportunity for maximizing horsepower production with a minimum amount of unburned (wasted) fuel. That translates into peak fuel economy (MPG) and reduced downtime hours for the equipment.

Each cylinder in the engine will fire properly and the fuel will burn more completely with less visible smoke and fewer exhaust particulate emissions. Additionally, the fuel delivery system (pumps and injectors) will be lubricated properly and the fuel supply components protected allowing them to perform to the design specifications.

In the winter time, a “truly” premium diesel fuel will keep the engine from experiencing cold weather operating difficulties and no fuel blending (mixing of lighter, lower BTU kerosene or No. 1-D fuel with No. 2-D) will be required even at sub-zero temperatures. This alone can cut downtime operating costs and save several thousand dollars per year for the typical fleet.

If a premium diesel fuel does the job intended, there should be no fuel related operating problems for the equipment operator throughout the entire life of the engine. The equipment should operate as designed for the length of service interval stated by the original engine manufacturer. This is the functional definition of a “truly” premium diesel fuel.

What MPG Improvement Can Be Expected From Premium Diesel Fuel?

While much has been documented about how the improvement in power production of a diesel engine directly relates to increases in fuel combustion efficiency, little has actually been changed in the fuel to help the energy conversion process within the engine combustion chamber. In fact, with the advent of catalytically cracked petroleum products, the physical properties relating to diesel fuel combustion have actually deteriorated during the last 25 years.

The BTU fuel energy conversion process in a diesel engine combustion chamber (and all other types of internal combustion engines) is never completed with 100% efficiency. A substantial amount of heat energy is lost out the smoke stack, leaked into the lubricating system as raw fuel, absorbed by the internal components of the engine cylinders, or assimilated by the engine cooling and lubricating systems. A better burning premium diesel fuel minimizes these losses.

Additionally, optimum BTU energy conversion in the combustion chamber is negatively effected by poor fuel quality. Consequently, a substantial amount of horsepower production (energy) is never realized from the fuel. The net effect is a decrease in fuel economy (efficiency) and an increase in fuel cost to the diesel user when premium diesel fuel is not used.

As it relates to diesel fuel quality, the best example of decreased fuel economy is the blending of diesel fuels. When No. 1-D (or kerosene) is added to No. 2-D fuel as a means of lowering the wax content of the No. 2-D fuel, the BTU content is only lowered by about 1 to 3 percent. But, because of the lower power production from the reduced energy content, the engine does not perform to designed standards, and the fuel economy suffers as much as 5 to 10 percent.

Additionally, since the engine is not producing the “normal” horsepower expected, a driver compensates by down shifting the transmission which increases the RPM of the engine and lowers the fuel economy even more. **A reduction in fuel economy in excess of 15 percent is the typical result directly caused by blending No. 1-D (kerosene) fuel with No. 2-D fuel.**

At \$3.25 per gallon for diesel fuel, and an average of 5.5 MPG, a 15 percent reduction in the fuel economy would raise the fuel cost of operation from \$0.5909 to \$0.6951 per mile - an increase of \$0.1043 for every mile driven. And, at higher fuel prices, the cost per mile of operation is even greater as shown by the following chart:

Fuel Cost / Gallon (Base Cost plus Tax)	Base MPG	Base Cost Per Mile	Increased Cost Per Mile From 15% Less MPG
\$2.50	5.5	\$0.4545	\$0.0803 (8.03 cents/mile)
\$2.75	5.5	\$0.50	\$0.0882 (8.82 cents/mile)
\$3.00	5.5	\$0.5455	\$0.0962 (9.62 cents/mile)
\$3.25	5.5	\$0.5909	\$0.1043 (10.43 cents/mile)
\$3.50	5.5	\$0.6364	\$0.1123 (11.23 cents/mile)
\$3.75	5.5	\$0.6818	\$0.1203 (12.03 cents/mile)
\$4.00	5.5	\$0.7273	\$0.1283 (12.83 cents/mile)
\$4.25	5.5	\$0.7727	\$0.1364 (13.64 cents/mile)
\$4.50	5.5	\$0.8182	\$0.1444 (14.44 cents/mile)

If a premium diesel fuel is made which eliminates the need for blending fuel in the winter-time and does, in fact, accomplish this goal then a direct savings of 15 percent in fuel economy will be realized during cold-weather operation with premium diesel fuel. At a 15 percent savings with diesel fuel at \$3.25 per gallon, the diesel owner can afford to pay **8.86 cents extra per gallon for the premium diesel fuel**, far above the cost of treating, and have a net gain in fuel costs.

AND, this figure does not take into account the expected fuel economy improvement with premium diesel fuel during the summer months. Nor does the figure include any maintenance cost reductions or other operating cost savings attributed from using a better quality premium diesel fuel on a year-round basis. These long-term cost savings can only be assessed with continued and consistent use of a good premium diesel fuel for the life of the engine.

How Can A Fuel user Verify Premium Diesel Fuel Claims?

The only means for the fueluser to prove the claims made by a premium diesel fuel supplier is to test, test, test, and test those claims. Since premium diesel fuel has not yet been given a universal industry definition, the fueluser must decide in his own mind what he wants from a premium diesel fuel (or the additives used to upgrade a diesel fuel to premium status).

Once the fueluser decides what is needed, he should undertake specific laboratory tests such as SLBOCLE lubricity, DuPont F-21 Long-Term Oxidation Stability, Carbon Residue, Cetane Engine, Gas Chromatography Detergency Review, CFPP, Pour Point, Cloud Point, Anti-Wax Settling Photographic Review, and Freeze Point tests in a reputable petroleum fuels laboratory.

If the laboratory testing does not prove the claims made by the supplier, the fueluser should forever eliminate that particular supplier as a source of premium diesel fuel.

Summary

While some fuel producers will argue the costs to make “truly” premium diesel fuel are too high, everyone agrees that making diesel fuel which performs better does cost money. The only question is how much cost is required to raise the performance of typical diesel fuel to the optimum level expected by the fueluser. If the fueluser really does want better quality diesel fuel, it can be produced. But, the fueluser must demand that it be produced to the specifications he wants, and he must agree to pay a reasonable price for the better quality fuel.

The payback for the fueluser from a “truly” premium diesel fuel is real and can be justified. However, if premium diesel fuel is not produced to deliver the maximum payback potentials, the fueluser will not see the benefit and he will remain skeptical about paying the extra money. Whether you are the fuel producer/refiner, the fuel marketer/supplier/jobber/distributor, or the actual fuel buyer/fueluser, your goal should be the same. **IF YOUR GOAL IS PREMIUM DIESEL FUEL - MAKE IT PREMIUM!**

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