FUEL ADDITIVES

Fuel

Fuel is a natural product that even after being refined, still needs additional help to make it efficient to use in today's motors and machines. How much improvement is needed depends on the origin of the fuel, equipment that will use it, and where it is being used.

Fuel Additive Characteristic/Benefit Requirements

In order to determine the quality of the fuel additive, you have to determine which of these six characteristics/benefits it contains/provides. A complete multifunctional additive should incorporate the first four and then depending on specific need, the 5th or 6th would be included, in addition to #1-4.

1. Detergents
2. Dispersants
3. Lubricants
4. Microbiocide
5. Cetane Improvers
6. Flow improvers: *Cloud Point, Pour Point, and Cold-Filter Plug Point (CFPP)*

The incorporation of the proper amounts of these chemical additives in the base diesel fuels will guarantee optimum performance and dependability at the most economical price.

1. Detergents

Additive *detergents* are used as cleaners to remove carbonaceous and gummy deposits from the fuel injection system and prevent further formations. It helps control varnish, injector deposits, ring deposits and rust by keeping insoluble particles in colloidal suspension and in some cases, by neutralizing acids. Fuel "gum" causes sticking of the moving parts in the fuel system especially close tolerance components such as injector needles and plunger pistons. These lacquer and carbon deposited on the injector needles restrict the fuel flow, distort the spray, and often totally block one or more of the holes in a multi-hole injector.
The result is disruption of smooth fuel injection, poor atomization of the fuel droplets, and incomplete burning of the fuel. These fuel combustion problems ultimately result in vehicular problems experienced as misfiring, power loss, engine knocking, increased fuel consumption, elevated engine smoking along with more unburned hydrocarbon and particulate emissions.

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2. Dispersants

Fuel and water *dispersant* function is to restrict the size of fuel and water particles, and reduce the fuel's surface tension. By lowering the surface tension of the fuel, it causes the fuel droplets to breakup and atomize more easily. Because *dispersants* are surfactants, they also are adsorbed onto metallic surfaces and provide a buffer barrier to prevent future deposits and keep the surfaces of the combustion chambers and injection nozzles clean. By reducing water tension in the fuel, it causes the water droplets to breakup, disperse and improve atomization of the fuel.

3. Lubricants

Lubricity is a measure of the fuel's ability to lubricate and protect the various parts of the engine's fuel injection system from wear. Majority of the fuel used today is considered ULSD (Ultra Low Sulfur Diesel) at 15ppm sulfur, vs the LSD (Low Sulfur Diesel) which has 500ppm, in order to reduce vehicle emissions. Now while Sulfur is not a lubricant in of itself, it can combine with the nickel content in many metal alloys to form a low melting point eutectic alloy that can increase lubricity. The process used to reduce the sulfur also reduces the fuel's lubricating properties, hence the need for *lubricants*.

4. Microbiocide

A microbiocide is any biocidal compound or substance with the ability to destroy and prevent the growth of microorganisms in the fuel. It should have the ability to stop the growth and destroys bacteria and fungi in diesel. The water in the fuel provides the opportunity for the presence and growth of microbes. Once the bacteria establishes itself in the fuel, as a thick layer deposit, it will plug the filters, clog injectors, and damage the fuel storage tank producing corrosion and leakage.

5. Cetane Improvers

The diesel fuel Cetane Number rating is an important part of any Premium Diesel Fuel. When the Cetane Number is raised, the ignition delay after injection is minimized and the unused fuel (resulting from long ignition delay times, thus poor combustion) can be more fully utilized by the engine. Shortening ignition delay improves fuel combustion in the cylinders and increases engine power production.

As such, the Cetane Number ultimately determines the potential for projecting such things as "improved power production", "enhanced fuel combustion", "less exhaust smoke", "lower unburned hydrocarbon emissions" and "smoother engine operation".

6. Flow Improvers

At low temperatures, wax crystals begin to develop in diesel fuel. If untreated they can grow to plug the filters and injectors. *Flow improver* additive improves the flow of fuel during cold weather by either depressing the fuel's cloud point or pour point without negatively affecting engine performance. Not all cold flow improvers are made the same though. Be sure to check what added degrees of flow improver the additive provides and with what ratio of additive to fuel.

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Fuel Additive Bases – Petroleum, Alcohol, Toluene, and Synthetic & Organic compounds

Fuel additives, like all products can be derived from different base materials. Depending on which base material, it can have different affects or characteristics. These are just a few of the main bases used for creating fuel additives.

1. Petroleum Based
   - Similar to the fuel itself, however with small adjustments/improvements and therefore the petroleum based fuel additives have proven to be inefficient in the vast majority of the cases.
   - Does not eliminate the effect of water/disperse water. Depending of the base, it may be flammable and difficult to transport. It will ignite at a different temperature than diesel.

2. Alcohol Based
   - Isopropanol/alcohol additives will dry the system. For many years, alcohol in the fuel was a non-starter.
   - Alcohol will disperse water but will dry out the injection system and damage the injectors. The flash point of these product makes them flammable and difficult to transport them. It will ignite at a different temperature than diesel.

3. Toluene Based
   - Toluene is mostly used as a solvent and an additive in gasoline to improve octane ratings.
   - Doesn't eliminate/disperse water. It is highly explosive, Toluene is also used to make trinitrotoluene, which is the explosive TNT. The flash point of these product makes them flammable and difficult to transport them. It will ignite at a different temperature than diesel.

4. Synthetic & Organic Compounds Based
   - Synthetic organic compounds are manmade (anthropogenic) organic compounds created through industrial synthesis. A substance behaves or reacts based on how it was created, in other words, how the atoms and molecules are formulated. Therefore, synthetic and organic compound based fuel additives can be designed to meet the specific needs of the final user.
   - Each developer of fuel additives, creates their formula to meet the specific demands of the consumer and based on the changing needs, hence why not all synthetic fuel additives are the same. Xp3 fuel improvers fall in this category of fuel additives.

(1.) Petroleum base vs (4.) Synthetic & Organic Compound base
   - Flexibility of design and specific design purpose is the main difference between the two bases. Unlike the synthetic/organic compounds, the manufacturer of Petroleum Base additives can't create specific formulations to meet **all** or specific needs of the end consumer. However, because the Synthetic/Organic Compound base is synthetic and formulated to meet specific needs, it can meet most if not all the desired needs.

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Xp3 Fuel Additives

Our fuel treatments can help reduce fuel consumption, maintain fuel injectors clean, stabilize light and heavy oils, disperse existing water, greatly reduce fumes and emissions, has a detergent and antioxidant effect, work as an effective biocide, improve the pour point, reduce the corrosion problems generated during and after combustion, reduce maintenance costs, prolong the life of the machine, and increase the fuel's lubricity for fuels low (LSD) and ultra-low (ULSD) in sulfur fuels.

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