



RED LINE®
85 PLUS
DIESEL FUEL ADDITIVE
with CETANE BOOSTER
and FUEL LUBRICANT

TECHNICAL
MANUAL

RED LINE 85 PLUS™ is designed to improve fuel combustion and prolong the life of the fuel system. Red Line 85 Plus contains powerful thermally-stable detergents which clean fuel injectors and the compression ring area which can become filled with partially-burned combustion products. Lubricity additives lubricate fuel pumps and injectors and leave a coating in the upper cylinder, reducing friction at the critical point where the rings change direction - providing increased power. A cetane booster is incorporated which will improve cold-weather starting and reduce knocking and smoke.

BENEFIT SUMMARY

- Cleans injectors
- Cleans high-temperature deposits
- Lubricates injectors, pumps, and cylinder walls
- Reduces detonation
- Improves power and fuel efficiency
- Helps condition seals in the fuel system
- Provides easier cold starting
- Reduces operating costs
- Stabilizes fuel
- Prevents rust
- Disperses water in fuel
- Winterized version reduces fuel pour-point
- EPA registered for use in diesel fuels

IMPROVES POWER AND EFFICIENCY

The ability of Red Line 85 Plus to improve power and efficiency was demonstrated in a field test using ten vehicles operating on Red Line 85 Plus and ten vehicles operating on untreated fuel. Both sets of trucks were operated on the same fuel and both saw the same service. All were equipped with the Cummins VT-903 engine and all had approximately 200,000 miles on the

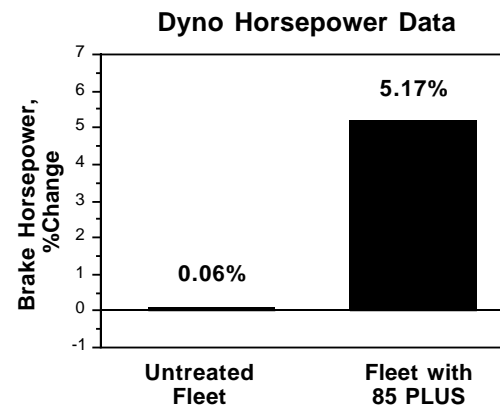


Figure 1: Red Line 85 Plus improved the average power output of the fleet greater than 5%.

engine. New injectors were installed at the beginning of the test. The distance put on each truck during the test was 100,000 miles. Brake horsepower and fuel efficiency were compared on a dynamometer before and after the field test. The results showed an improvement in power and efficiency of greater than 5% compared to the fleet which used untreated #2 diesel. The data are illustrated in Figures 1 and 2. This improvement in fuel efficiency is not due to injector cleanup, since new injectors were installed in both fleets before the test, but instead as a result of fuel lubricity, and compression ring-groove cleanup. A separate test in a John Deere engine showed an immediate 4.2% increase in power with 85 Plus.

Dyno Fuel Consumption Data

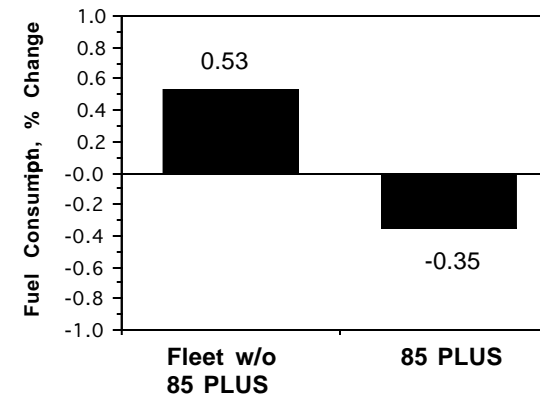
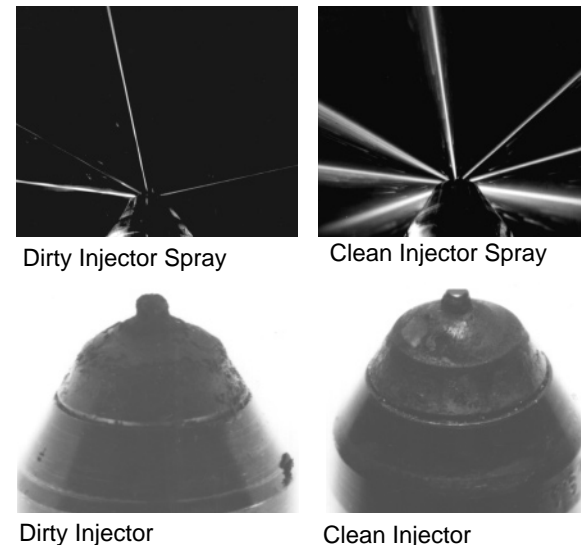


Figure 2: Red Line 85 Plus improved the fleet fuel efficiency greater than 5%.



Figures 3: Powerful detergents clean injectors providing perfect spray patterns and optimal combustion.

INJECTOR CLEANUP
2.2L Diesel - Pintle Nozzle

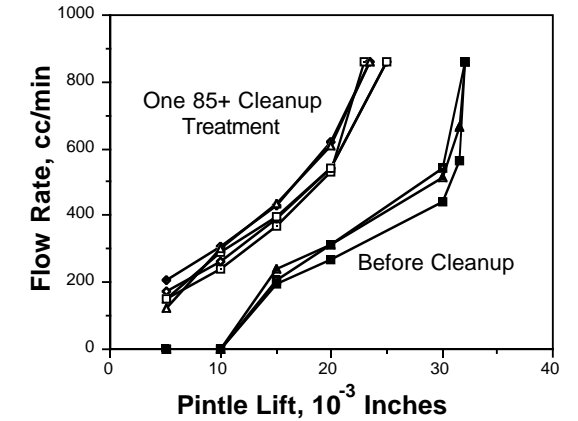


Figure 4: One 12 ounce bottle of 85Plus restored the injector flow to normal, renewing performance and reducing knock.

CLEANS INJECTORS

Powerful detergents contained in Red Line 85 Plus clean injectors and keep them clean, even when using low-quality diesel fuel. Figures 3, 4, and 5 show how Red Line 85 Plus can restore injector flow, providing perfect spray patterns which will provide optimal power and economy while reducing engine noise and smoke dramatically. Small amounts of 85 Plus can be very effective in clean-up of fouled injectors and regular use can prevent injector deposits.

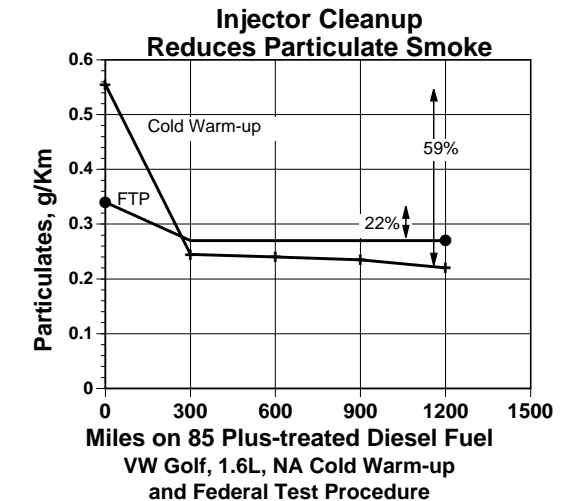


Figure 5: Particulate (smoke) reductions as measured in a Federal Test procedure (warmed-up) and Cold Start/Warm-up Test after 4 ounces 85Plus in 33 gallons.

LUBRICATES FUEL SYSTEM & UPPER CYLINDER

On October 1, 1993, the US EPA required all diesel fuels to contain no more than 500 ppm Sulfur. Previous fuels were in the range of 3,000 - 5,000 ppm. Sulfur has been relied upon by the diesel industry as a very effective antiwear additive for the injection system. With only 500 ppm sulfur, many injection systems are destined to have more rapid injection pump failure. Many diesel injectors rely on the lubricity of the fuel to prevent injector wear. Red Line 85 Plus reduces friction and wear in the fuel pump, injectors, and upper cylinder. 85 Plus can reduce wear in diesel fuels to levels significantly below the older high-sulfur fuels and this can be accomplished with as little as 12 ounces per 100 gallons. This can be demonstrated in tests designed to measure the coefficient of friction and wear between two sliding metal surfaces. The Low Velocity Friction Apparatus shows that untreated diesel fuel exhibits a 40% greater coefficient of friction compared to fuel treated with 85 Plus. ASTM D4172B (Modified) shows five-times as much wear in untreated low-sulfur fuel as in the fuel treated with 85 Plus (Figure 6). This reduced friction and wear means an improvement in fuel efficiency and an increase in fuel component durability. Red Line 85 Plus will not increase the sulfur content of diesel fuels and is EPA registered for use in diesel fuel.

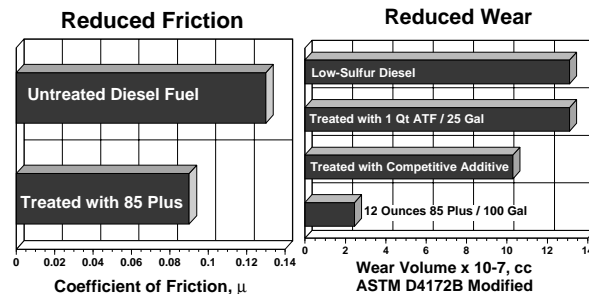


Figure 6: 85 Plus can reduce friction and wear in diesel fuels to levels below high-sulfur fuels.

SEAL CONDITIONING

With the EPA requirement of 500 ppm Sulfur in diesel fuels comes another unexpected consequence. Most de-sulfurization processes also reduce the aromatic content of diesel fuels. In California, it has been mandated that aromatic contents be reduced from a typical of 30% to a maximum of 10%. The seals in the fuel system rely on aromatics in the fuels to provide a certain degree of seal swell. Removing these aromatics will cause the seals to shrink. If the seals shrink too much, leakage of the pump and injection system can occur, resulting in a costly repair bill. Red Line 85 Plus contains materials which can swell seals, but the degree

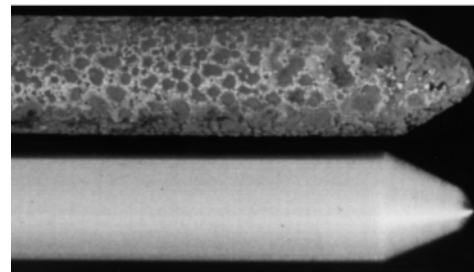
of swelling when added to a large tank of fuel is minor. However, we have found a significant ability to swell the seals enough to stop the leakage in some vehicles and reduce it in others. In many borderline cases, 85 Plus can have an effect on the leakage of seals. To determine whether 85 Plus will swell the seals enough to stop leakage, first try one bottle in a full tank and allow this to contact the seals for several days. If leakage is stopped, then try reduced dosages, down to as little as 12 ounces per 100 gallons. Regular useage will probably be required to keep the seals from leaking again.

BOOSTS CETANE

The cetane rating of diesel fuel is a measure of the lag time between injection and combustion - the higher the cetane rating, the quicker the ignition and consequently the quieter the combustion. The cetane quality of the fuel determines the intensity of detonation and also the ease of starting in cold weather. The cetane quality of diesel fuels has deteriorated in recent years. The US average has declined from a cetane average of 50 during the beginning of the 70's to an average of 44.5 for 1985, with many dropping below 40. A good cetane quality for passenger car diesels is 50. The minimum allowable cetane for Mercedes-Benz diesels is 45. Red Line 85 Plus contains a cetane booster which can raise the cetane rating 3 to 9 cetane numbers when used at 12 ounces per 30 gallons and 1 to 4 cetane numbers when used at 12 ounces per 100 gallons.

PREVENTS RUST and ABSORBS WATER

The major problem with water in diesel fuel is the rusting of the fuel system which will occur. Even the slightest rust on the injection metering valves can mean a new injection pump or injectors. The use of small amounts of alcohols does not significantly dissolve water into the fuel, but only adds to the volume of the water phase and makes the water phase more corrosive. Red Line 85+ will disperse 25% of its volume of water (12 ounces disperses 3 ounces) without the use of alcohol and will safely carry condensation water through the fuel system, while preventing rust even in the presence of larger quantities of water as shown in Figure 7.



STABILIZES FUEL

There are two areas of concern regarding fuel stability. One is the tendency for the fuel to degrade on storage, forming insoluble deposits. The other is that a portion of the fuel which reaches the injectors is recirculated in order to cool the injectors and fuel pump. Heat stressing causes accelerated thermal degradation and oxidation of the diesel fuel, causing deposits to form, resulting in fuel system sludge and filter plugging. Red Line 85 Plus significantly increases the stability of diesel fuel by inhibiting oxidation, thus providing greater filter life and a cleaner fuel system. Red Line 85 Plus is excellent to stabilize diesel fuel or heating oil for long-term storage .

POUR POINT REDUCTION - WINTERIZED

Winterized Red Line 85 Plus contains a wax crystal modifier which improves the cold-weather flow properties of diesel fuel. This wax crystal modifier interrupts the interlocking structure of paraffin wax, causing the formation of much smaller crystals which pass through the filter, and reduces the temperature at which the fuel will gel. The winterized version reduces the pour point of an average fuel by 25°F. A water crystal inhibitor will reduce the freezing point of condensation water in the fuel (180ppm) approximately 25°F. The reduction in operability temperature depends on fuel system design and filter porosity.

USE DIRECTIONS

Initially use 1/2 ounce per gallon of diesel fuel for rapid cleanup of fouled injectors and as a seal conditioner. Treatment can be reduced on subsequent fill ups to one ounce per 10 gallons. Optimal fuel economy and injector cleanliness are obtained with continuous usage. Treatment levels as low as one ounce per 10 gallons will still provide excellent injector cleanliness and lubricity; however, reduced levels may not be as effective at reducing detonation and controlling seal leakage. 85 Plus is available in 12oz. bottles, 1-gallon jugs, 5-gallon pails, and 55 gallon drums. It is also available as Winterized 85 Plus.

DESIGNED FOR PERFORMANCE

Red Line Synthetic Oil Corporation is the leader in lubricant and fuel system chemistry. Red Line sets the standards for equipment durability and increased performance. Red Line manufactures a full line of automotive products which are designed to provide noticeable improvements in performance:

- WaterWetter® SuperCoolant
- Diesel Fuel Catalyst
- Diesel Fuel Biostat - Antimicrobial Agent
- SI-1 Gasoline Injector & Valve Detergent
- Fuel System Water Remover and Antifreeze
- Lead Substitute
- Motor Oils - 5W30, 10W30, 10W40, 15W50, 20W50
- Race Oils - SAE 5, 10, 20, 30, 40, 50, 60, 70
- High-Performance Two-cycle Lubricants
- Gear Oils - Lightweight, 75W90, 75W90NS, 80W140
- MTL, MT-90 - Manual Transmission / Manual Transaxle Lubricants
- ATF - Synthetic Dexron IIE/Mercon, High-Temp ATF
- DOT 5 Silicone Brake Fluid
- CV-2 CV-Joint and Wheel Bearing Grease

For further information please contact: