

RED LINE OIL

Complete Fuel System Cleaner

TECHNICAL INFORMATION

RED LINE Complete Fuel System Cleaner (CFSC) contains the most powerful high-temperature detergent available to clean gasoline fuel injectors, carburetors, and intake valves. CFSC can clean injectors to nearly 100% efficiency with one application and CFSC will typically provide a 90-99% reduction in intake valve deposits compared to detergent unleaded gasoline, improving performance and fuel economy considerably. Clean air regulations and the change from leaded fuel to unleaded has left refiners short of adequate octane capacity, which forces them to use cracking and oxygenates such as alcohols and MTBE (methyl tertiary butyl ether) to supplement octane. This has created a tremendous problem of coking of fuel injector tips and intake valve deposits which can cause problems within 1000 miles of driving. Alcohol-containing fuels have been demonstrated to cause between 3 to 5 times more deposits on valves than fuels without such oxygenates. Modern electronic engine technology has enabled auto manufacturers to provide performance while meeting emissions requirements by using computers which keep the engine operating at the lean limit of combustion. Unfortunately, fast burn/lean burn engines are much less tolerant of deposits than were older engines which operated at richer mixtures. Intake valve or fuel injector deposits can alter the air/fuel mixture in individual cylinders, causing a lean misfire. Since the electronic sensors sense an average signal in the exhaust, this causes a further leaning to the point of significant hesitation and stumbling, especially while accelerating. Many refiners are not willing to treat all their fuel with high temperature detergents to clean dirty injectors, but instead use larger doses of less costly carburetor detergents, which can partially clean simple cases, but the poor stability of these detergents cause another, equally serious problem - they break down and form deposits on valves, causing a restriction of intake air and poor driveability. Many other fuel additives try to achieve cleanup using solvents which can clean in a very concentrated form, but provide very little effectiveness when diluted in a fuel tank. Solvents have the potential drawback of causing swelling and degradation of seals and hoses in the fuel system. Red Line Complete Fuel System Cleaner uses surface active chemistry which cleans effectively and safely.

BENEFIT SUMMARY

- Cleans injectors and carburetors to like-new efficiency
- Prevents fuel system rust
- Cleans intake valve deposits
- Lubricates upper cylinder and valves
- Reduces pre-ignition and run-on
- Cleans emission control systems
- Stabilizes gasoline and prevents carburetor icing
- Safe for all gasoline vehicles

CLEANS INJECTORS AND CARBURETORS

Powerful thermally-stable detergents contained in Red Line Complete Fuel System Cleaner are capable of cleaning fuel injectors and carburetors to nearly 100% efficiency. Red Line's detergents are so concentrated that this degree of cleanliness can be achieved with one treatment. Figure 1 shows the cleaning ability of CFSC's high temperature detergents. Injector plugging problems can be manifested as sluggishness, hesitation, poor idling, and poor fuel economy. Use Red Line Complete Fuel System Cleaner instead

SI-1 INJECTOR CLEANUP

AVERAGE 98.5% CLEAN

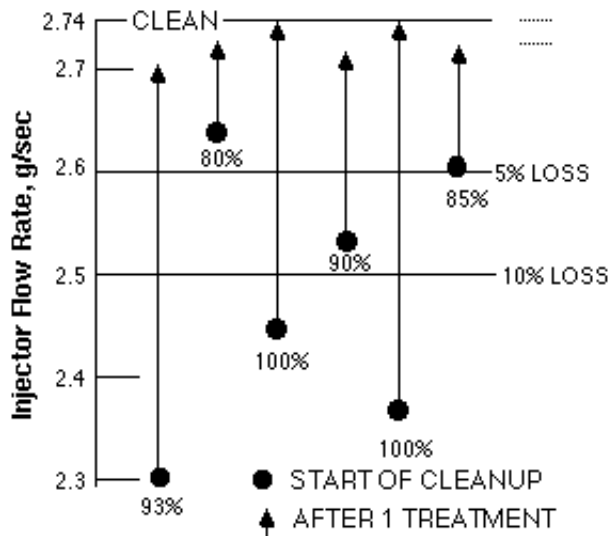


Figure 1: The use of one 15 oz. of CFSC can clean fuel injectors to nearly 100% efficiency. GM 3.8L V-6.

SI-1 Fuel Economy Improvement

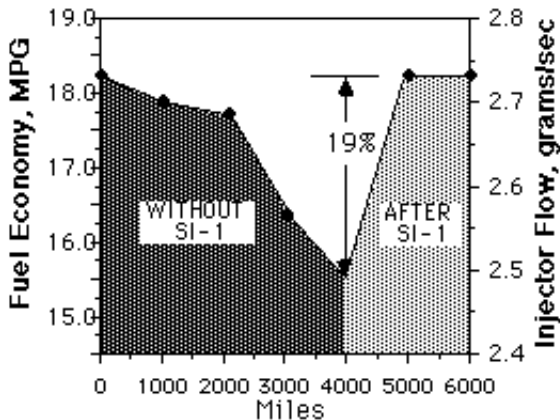


Figure 2: The deterioration of fuel economy and injector flow with subsequent restoration using one bottle of CFSC.

Fuel Injector Deposits Reduce Wide Open Throttle Acceleration

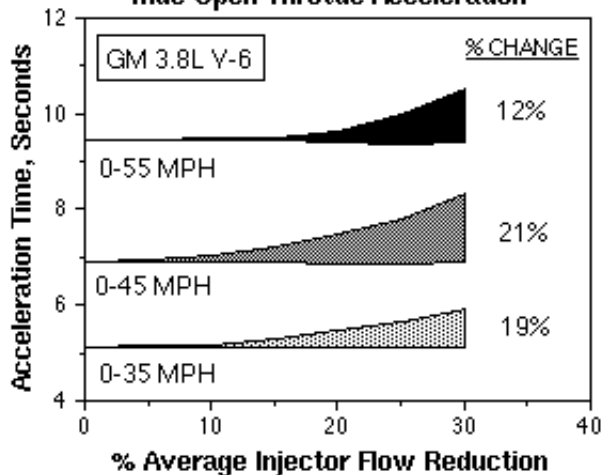


Figure 3: By reducing injector plugging, CFSC can improve acceleration times as much as 20%.

of taking the car in for a shop injector cleanup. CFSC is just as effective as pressurized solvent treatments at a fraction of the cost and trouble. Red Line Complete Fuel System Cleaner is also very effective at cleaning carburetor deposits which can cause poor performance and run-on.

IMPROVES PERFORMANCE AND FUEL ECONOMY

Fouled injector tips can provide poor fuel spray patterns, causing incomplete combustion which results in poor performance and fuel economy. Modern microprocessor-controlled feedback systems compound the problem by sensing an average rich condition, leaning out all cylinders to the point of lean misfire. Figure 2 shows how cleaning the fuel injectors in a 3.8L V-6 with Red Line CFSC restored fuel economy - an increase of 19%. Regular use of CFSC will keep optimum fuel economy and performance. Figure 2 shows how rapidly deposits can form and how Red Line CFSC effectively cleans up deposits on fuel injectors, restoring performance, fuel economy, and emissions compliance.

Figure 3 shows the significant effect fuel injector deposits have on acceleration. Unequal plugging is indicated by the upper line of each set and the lower line indicates the effects if injectors are equally plugged. In a GM 3.8L V-6, 0 to 45 MPH acceleration times can increase by as much as 21% and fuel economy can be reduced as much as 20% when injectors become unequally plugged. Red Line Complete Fuel System Cleaner rapidly cleans these plugged injectors to like-new condition, restoring the power of the engine and eliminating hesitation and stumbling. CFSC works equally well on the deposits created in higher temperature turbocharged engines.

ENTIRE INTAKE SYSTEM CLEANLINESS

Unstable hydrocarbon mixtures present in today's fuels along with detergent additives added to gasoline by many refiners in order to claim the ability to clean fuel injectors has created an entirely new problem - intake system deposits. These fuel components and additives decompose readily at the higher temperatures of the intake valves. This results in sticky deposits which restrict the intake air and cause fuel to condense on their surface, making the mixture too lean to provide proper acceleration. Red Line Complete Fuel System Cleaner not only prevents these deposits, but the synthetic oils and detergents can actually wash these deposits away. Figure 4 shows a set of valves which have used low levels of CFSC (15 oz/100 gal) on a regular basis compared to a set of valves from an engine operated on detergent unleaded. Figure 5 shows how intake deposits can significantly reduce power and performance in modern engines.

Detergent Unleaded

Treated with Complete Fuel System Cleaner

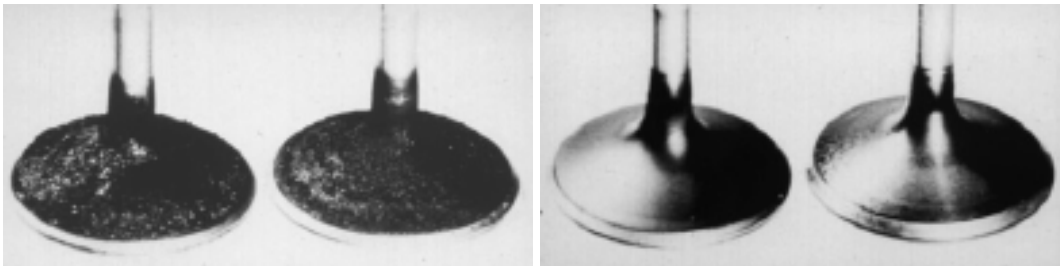


Figure 4

Effect of Intake Valve Deposits on Power, Emissions, and Fuel Economy

1.8 L CARBURETED JAPANESE ENGINE - CITY DRIVING CYCLE

20% Restriction (18,000 Mi)

50% Restriction (30,000 Mi)

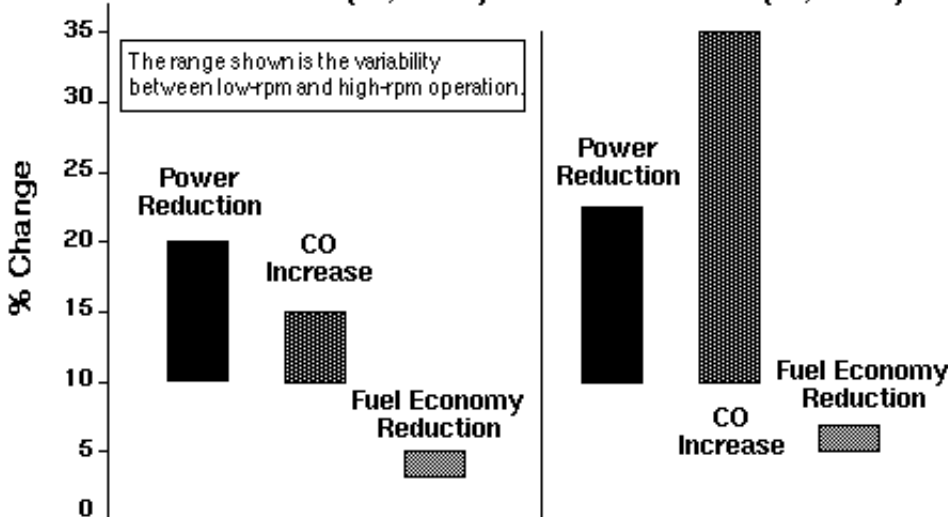


Figure 5

SI-1 Keeps Intake Valves Clean In A Variety Of Engines

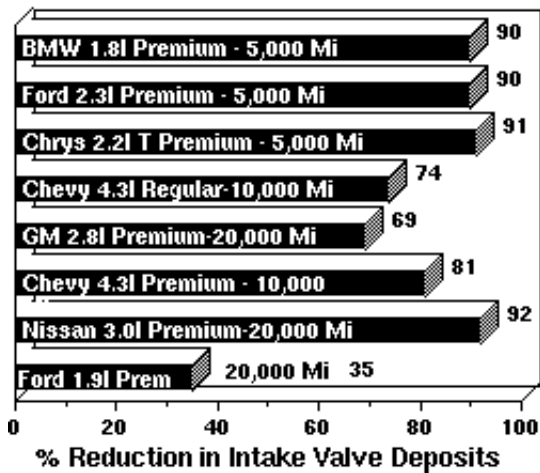


Figure 6: Demonstrates the effectiveness of CFSC to provide intake valve cleanliness in a variety of engines.

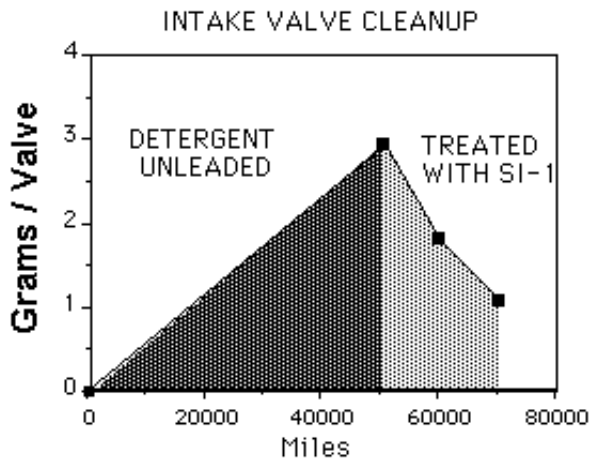


Figure 7: Shows the ability of CFSC to cleanup existing deposits on intake valves.

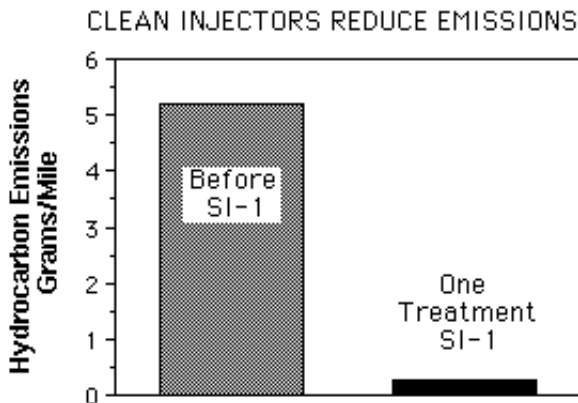


Figure 8: Complete Fuel System Cleaner can help reduce air pollutants by cleaning the intake system and emission control devices.

CLEANS INTAKE VALVES

Red Line Complete Fuel System Cleaner is effective in a wide variety of fuels and engines. Figure 6 shows the reduction in intake valve deposits evaluated in many different engines, including turbocharged engines which see much higher intake temperatures. Figure 7 demonstrates how the detergents and synthetic oils in Red Line CFSC can wash away existing intake valve deposits when used on a regular basis. This will allow the engine to breathe better, restoring power and eliminating hesitation.

CLEANS EMISSION CONTROLS

Dirty injectors and carburetors can cause significantly greater exhaust emissions than allowed by state and federal requirements. Red Line Complete Fuel System Cleaner can help reduce these emissions by cleaning the carburetor, injectors and the emission control system. The graph below demonstrates the ability of Red Line Complete Fuel System Cleaner to reduce hydrocarbon emissions in a GM 3.8L V-6. Carbon Monoxide emissions experienced a similar reduction. Oxides of nitrogen were also reduced, but to a lesser extent. The detergents used survive the combustion process and clean the PCV valve and the EGR port as well as cleaning deposits in the combustion chamber.

PREVENTS RUST

The major problem with water in fuel is the rusting of the fuel system which will occur. Even the slightest rust on the injection metering valves can require a new metering system or injectors. Red Line Complete Fuel System Cleaner will disperse small amounts of water such as condensation water into the fuel. The rust inhibitors contained in CFSC will prevent rust even in the presence of large amounts of water as demonstrated in Figure 9, a 24 hour rust test compared with untreated gasoline.

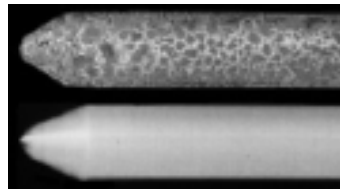


Figure 9

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