



**RED LINE®**

**Fuel System  
Water Remover  
& Antifreeze**

**and**

**RL AntiGel**

**Technical  
Manual**

Red Line Fuel System Water Remover and AntiFreeze is an additive designed to disperse controlled amount of water in diesel fuel or gasoline in order to eliminate contamination and condensation in fuel tanks and to prevent the water from freezing in the fuel lines and fuel filters - a major cause of cold-weather engine shutdown. One ounce per 20 gallons is recommended and with moderate agitation will disperse one ounce of water into very tiny droplets and will reduce the freezing point to -5°F (-20°C). Greater concentrations can be added to reduce the freezing point even lower or to remove greater concentration of water from the fuel. Synthetic lubricants in this additive will lubricate both the water and fuel phases, preventing damage to the injectors and fuel pump. In fact, this additive will improve the lubricity of the water phase enough that it will provide lower friction and wear than untreated diesel fuel alone. Synthetic lubricants in this additive will reduce the friction sufficiently even in dry fuels to provide diesel engine efficiency improvements between 2-3% based on fleet and dyno tests.

**BENEFIT SUMMARY**

- Disperses water in diesel fuel and gasoline
- Reduces the freezing point of water in fuel
- Lubricates both water and fuel phases
- Cleans injectors and carburetors
- Improves diesel engine efficiency 2-3%
- Prevents rust and corrosion
- Contains no harmful alcohol
- Removes water, a necessary ingredient for microbial growth which can cause diesel filter plugging

**Removes Water & Reduces Fuel Line Freeze**

Red Line Water Remover and Antifreeze is designed to actually remove water from a diesel or gasoline fuel system. It also works to significantly reduce the freezing point of water in the fuel system. There are many products on the market which claim to remove water and prevent fuel line freeze. Most can even demonstrate their effectiveness by adding equal amounts of water directly to the fuel additive which shows complete solubility of the water in the additive. Usually these tests are completely misleading. The water and additive combination will behave differently when added at the recommended concentration in the fuel, and these materials which demonstrate an ability to dissolve the water will not dissolve water in the fuel at concentrations lower than about 5%. Most of these products are based on alcohols or glycol ethers. Alcohols like methanol and isopropyl alcohol will not dissolve water in the fuel and will instead partly go into the water phase, actually

increasing the volume of the water phase and significantly making the water more corrosive. However, these alcohols will reduce the freezing point of the water in the fuel. Methanol and ethanol are more effective, but they are also more damaging to the seals and fuel system components. Isopropyl alcohol is now more popular, but it requires large amounts to reduce the freezing point and it will actually increase the friction in the injectors and pumps. The glycol ethers are less damaging to the fuel system components, but they are also less effective at reducing the freezing point of water.

Red Line Water Remover & Antifreeze does not attempt to dissolve water to remove it, but instead disperses controlled amounts into microscopic droplets, which will easily pass through the filters. Agitation of the fuel tank through normal driving is required to achieve the dispersion of droplets. These dispersed droplets will not cause injector and pump damage, in fact, water lubricated with this additive has much better friction and wear properties than diesel fuel alone. The Water Remover also contains a very effective corrosion inhibitor to prevent rust and corrosion of the fuel system components. Water Remover will disperse approximately an equal amount of water into the diesel fuel. A typical treatment to remove the water of condensation is a 12 ounce bottle to 250 gallons of fuel. This treatment will also reduce the freezing point of the water normally present in diesel fuel below -20°F. For larger amounts of water in the fuel it will reduce the freezing point to -5°F when an equal amount of Water Remover is added. As a reference, 55 gallons of diesel fuel which is clear and shows no signs of water can actually contain one ounce of water dissolved in the fuel. As the temperature is reduced, this water falls out of the fuel and if it is below freezing, ice crystals will form. Larger amounts of water can be present in a fuel tank if the truck was filled soon after the underground storage tank was filled, thereby mixing the bottom water into the fuel. Even at this rate, one bottle per 250 gallons should take the fuel to 0°F, unless a large slug of water was pumped into the fuel.

A unique feature of the Red Line Water Remover & Antifreeze chemistry is that most of the active ingredient goes into the water phase, permanently reducing the freezing point of the water, even if untreated fuel is added to the tank. A competitive product shown as Additive P in Figures 1 and 2, which is based on isopropyl alcohol, will reduce the freezing point of this normal water in diesel to 0°F when used at one pint per 15 gallons, but since the water is not removed in the process, and if untreated fuel is then added to the tank,

the freezing point for this water in the fuel is now 23°F. In other words, this alcohol chemistry requires large concentrations of very expensive chemistry to be used continuously in order to be effective.

**Reduces Friction**

Figure 1 shows the significant reduction in friction obtainable with these synthetic lubricants when added to diesel fuel at the recommended concentrations. Red Line Water Remover can reduce the steel on steel friction of diesel fuel by 28%. What is very interesting is that Red Line Water Remover can make WATER slipperier to steel surfaces than diesel fuel. This was evaluated by adding equal amounts of water and Red Line Water Remover to diesel fuel and extracting the dispersed water by centrifuge. The extracted water mixture had better friction and wear properties than diesel fuel alone. Some additives such as a commercial water antifreeze and fuel conditioner can actually increase the coefficient of friction as shown in Figure 1.

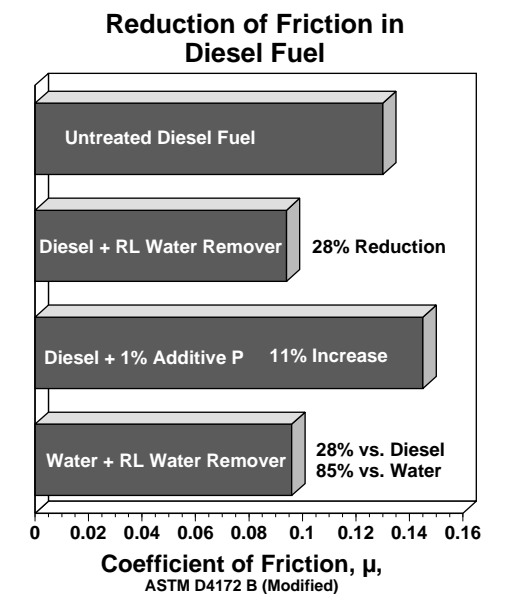


Figure 1: Reduction of friction in diesel fuel with treatments of Red Line Water Remover. Note the reduction in friction of water to a value significantly lower than diesel fuel alone.

**Reduces Wear**

Figure 2 shows the wear volumes which result in this bench wear test. Red Line additives can significantly reduce steel on steel wear as demonstrated in this test and as proven in the field by significantly increasing the

life of the injector and reducing scoring on the injector plungers by a factor of two-to-three, which corresponds very well with these test results. Red Line Water Remover reduced the steel on steel wear of diesel fuel by 80% and most important, it reduced the wear of WATER to a value 82% lower than the wear obtained with diesel fuel alone.

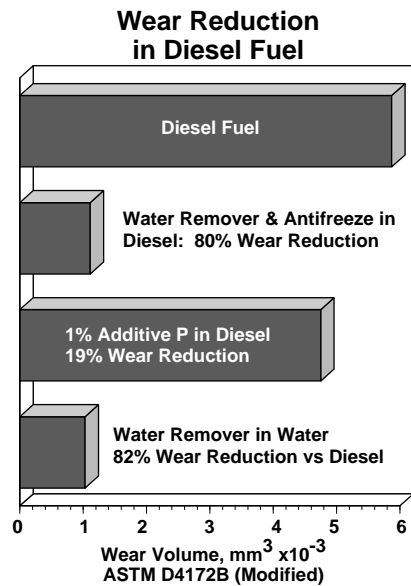


Figure 2: Reduction of steel on steel wear in diesel fuel with treatments of Red Line Water Remover. Note the reduction in wear of water to a value significantly lower than diesel fuel alone.

#### Cleans Injectors

Red Line Fuel System Water Remover and Antifreeze cleans diesel and gasoline injectors and carburetors.

#### Reduces Rust and Corrosion

Red Line diesel additives contain a corrosion inhibitor which will help control fuel system corrosion even in the presence of water.

#### Stabilizes Fuel

Red Line Water Remover contains stabilizers which slow the degradation of diesel fuel and gasoline and dispersants which will help prevent insoluble decomposition products from forming sludge and varnish. Red Line Water Remover will also clean sludge from old storage tanks. Good filtration should be in place on the fill hose from the storage tank. Red Line Water Remover & Antifreeze is an excellent product to add to fuel tanks for seasonal storage.

#### RL Antigel Improves Low-Temperature Flow

RL AntiGel contains a unique wax modifier which will improve the low-temperature operation of a diesel engine by 10-15°F compared to even the current high-quality low-temperature flow improvers. RL AntiGel will not only lower the pour-point, but will prevent the settling of wax in the fuel. Conventional flow improvers for diesel will significantly reduce the pour point of the fuel, but pour point does not predict the low temperature operability of a diesel fuel. Conventional flow improvers work by interrupting the crystal structure of the wax, forming much smaller crystals, many of which will pass through the fuel filters. However, upon sitting overnight, this wax settles to the bottom of the fuel tank and since the fuel pickup is on the bottom, very large concentrations of wax are drawn to the filter on startup. If the engine is starting below the cloud point (wax crystallization temperature) of the fuel, it is then a race to try to warm the fuel and fuel filter above the cloud point before the filter plugs and halts the flow of fuel to the engine.

RL AntiGel prevents this settling for at least one week, which means the fuel delivered to the engine at startup will have much less wax to plug the filters. RL AntiGel can allow diesel engines to operate at least 10°F lower than conventional flow improved fuel. This unique chemistry has the same effect as reducing the cloud point of the fuel in the bottom of the tank. This reduction in cloud point was previously only obtainable by blending in kerosene which is more costly and provides a 10% reduction in fuel economy due to the lower heat value. Kerosene also provides much less lubricating ability, which can increase injector and pump wear dramatically. RL AntiGel also contains an anti-icing additive which will lower the freezing point of water in the diesel fuel. Typically diesel fuel contains 100-150ppm water. When the fuel is chilled, this water freezes and can plug the fuel filters. RL AntiGel reduces the freezing point of this water to approximately -20°F.

Figure 3 demonstrates the results from a filter-plugging test using a complete Cummins fuel system in a cold room capable of reducing the temperature of all the components. A 50 gallon fuel tank was used and the filter was a LuberFiner LFP-1101F cartridge type. The fuel used was blended to a Cloud Point of 7°F and had a Pour Point of 5°F. The Flow-Improved Diesel in this chart is a high-quality conventional flow improver which reduced the pour point of this fuel to -38°F. As you can see, the pour point has little influence on the operability temperature.

RL AntiGel is the perfect product for fleets which operate in very cold areas. It is also a good idea to carry

a bottle in the truck to use when a cold snap is expected overnight. One 15 ounce bottle is recommended to treat 100 gallons at normal cold temperatures for the climate and 1 bottle to 50 gallons is recommended for extreme cold snaps.

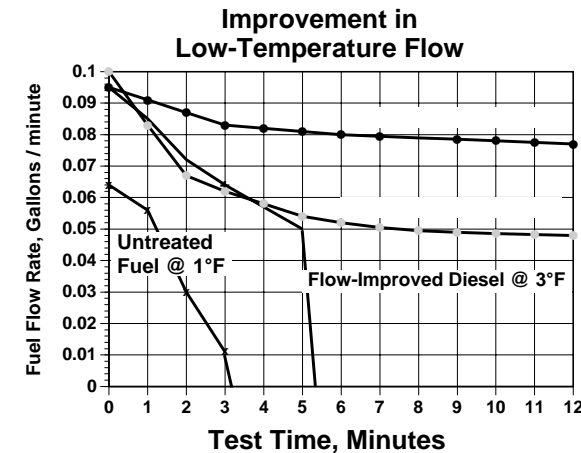


Figure 3: RL AntiGel improves the low-temperature operation and startability of this diesel fuel, reducing the operability temperature at least 10-15°F below conventionally "Winterized" fuel.

#### BENEFIT SUMMARY

- Reduces the pour point of diesel fuel
- Reduces the freezing point of water in fuel
- Reduces the operability temperature of even "Winterized" diesel fuel
- Lubricates both water and fuel phases
- Disperses water in diesel fuel
- Improves diesel engine efficiency 2-3%
- Contains no harmful alcohol
- Removes water, a necessary ingredient for microbial growth which can cause diesel filter plugging

#### Directions for use:

Red Line Fuel System Water Remover and Antifreeze and RL AntiGel should both be added to the fuel tank while it is above the freezing point of water or wax in the fuel. Fuel being added from an underground storage tank is usually above 40°F, well above the freezing point of water and wax. Just prior to fueling is the ideal time to add these products so that excellent dispersion is obtained immediately. Most fuel systems recirculate a considerable quantity of fuel through the engine which raises the fuel temperature, so these products may also be added during an operating cycle as long as the vehicle is driven to distribute the product in the fuel tank.

#### DESIGNED FOR PERFORMANCE

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

- WATERWETTER® Cooling System Heat Transfer Agent
- RL-2 & RL-3 Diesel Ignition Improvers
- Diesel Fuel Catalyst
- RL Smoke Suppressant
- 85 Plus Diesel Fuel Additive - with Cetane Booster
- Diesel Fuel Biostat - Antimicrobial Agent
- SI-1 Fuel Injector & Intake Valve Detergent
- SI-2 Injector & Valve Detergent Lead Substitute
- Motor Oils - 5W30, 10W30, 10W40, 15W50, 20W50
- Diesel Engine Oil - 15W40
- Race Oils - SAE 5, 10, 20, 30, 40, 50, 60, 70
- High-Performance Two-cycle Lubricants
- Gear Oils - Lightweight, 75W90, 75W90NS, 75W140NS, 75W140, 80W140
- MTL - Manual Transmission / Transaxle Lubricant, MT-90
- ATF - D4 ATF, High-Temp ATF, Racing ATF
- CV-2 CV-Joint and Wheel Bearing Grease
- Compressor Lubricants

For further information please contact: