

## **FR001 (Fuel Oil Additive)** ***Fuel Oil Conditioner Concentrate***

FR001 is a multifunctional fuel oil conditioner concentrate that is based on special additive, aromatic hydrocarbon solvents, organics combustion catalyst and nonionic dispersant. It can be used as received or can be compounded or diluted to provide the user with a specifically formulated product. FR001 is complete fuel oil additive with the components required to prevent problems with associated with all fuel oils, including No. 2 through No.6 – bunker C residual oils.

Problems encountered in the storage, handling, and burning of fuel are varied and complex, and a single component fuel oil additive is usually is not effective in preventing the numerous problems that occurs throughout the fuel-handling system. FR001, however, is a combination of several multifunctional materials. It provides fuel oil stability, sludge and deposits control, and fireside deposits control.

### *Fuel oil stability*

Dispersed water in the fuel oil, as well as the oxidation products of fuel oil contaminants, results in instability of fuel oil when stored for extended periods.

In the shipping, storage, and burning of distillate and residual fuel, it is almost impossible to keep each fuel stock segregated. The mixing of different fuel oil stocks, particularly combining certain straight run fuels with catalytically cracked fuels, can lead to severe problems of incompatibility even during short term storage.

Fuel oil additive containing multifunctional FR001 will help prevent stratification of mixtures of fuel stocks in storage. FR001 also prevent the formation of sludge and others deposits that may result when incompatible fuel stocks are mixed. The formation of deposit caused by oxidation and polymerization of polar and non-polar hydrocarbon in fuel oil is minimized when the fuel oil is treated with FR001 as it put into storage.

Fuel oil treatment containing FR001 can be used to eliminate problems associated with excessive accumulation of water. The FR001 formulation promotes emulsification of water in the fuel. This enables water removal from the system via combustion of the fuel.

### *Sludge and deposit control*

The mechanism of sludge formation in stored fuel oil is complex and depends on several factors that are not readily controlled. Extensive field and laboratory testing has demonstrated that combination of components in FR001 prevent most of the problem associated with sludge and deposits in the fuel oil handling system. This is done in at least two ways:

1. FR001 retards the oxidation and polymerization of substance in the fuel, thereby inhibiting the formation of insoluble substances in the fuel.
2. The highly active dispersing, peptizing, and dissolving properties of FR001 prevent the agglomeration of sludge, and the insoluble materials that do form

in the fuel are kept in a finely dispersed state.

These mechanisms keep storage tank, fuel lines, strainers, and burner nozzles free of deposits. In fact, the continuous use of FR001 in the fuel tends to remove gradually old accumulation already in the system. The effectiveness of FR 001 as a sludge dispersant is illustrated in figure 1.

#### *Corrosion control*

The continuous use of FR001 as an additive to all types of fuel oil prevents corrosion of tanks, lines, strainers, and the other components of fuel handling system.

Corrosion occurs as a result of the accumulation of corrosive substance in the emulsified water in the oil or in the free water that accumulates in storage tanks. Corrosion can also result from the uncontrolled growth of the microorganism in the fuel oil storage system. Corrosion not only cause premature failure of equipment, but also creates rust particles and other debris that clogs strainers or plug burner nozzles. Costly maintenance, shutdown, and equipment replacement can be avoided when step are taken to prevent corrosion.

The FR001 additive forms a thin protection film on metal surfaces contacted by the oil. This film provides a barrier against the corrosion substances in the fuel oil. Moreover, the dispersion or emulsification of water in the system by components in the FR001 reduces the potential for corrosion by eliminating the water from the system.

A reduction in cold end corrosion and stack corrosion is also obtained through the continuous use of fuel oil additives formulated with FR001. The combustion catalyst of FR001 maintain more complete combustion, eliminates soot accumulation, and stabilizes the fuel flow to the firebox. This has direct effect in reducing  $\text{SO}^2$  and  $\text{SO}^3$  emissions and the resultant cold-end corrosion problems. Lower  $\text{SO}^3$  content in combustion gasses permits improve operating efficiency, since burner operation in lower temperature is possible without corrosive acid deposition from combustion end products. Furthermore, the multifunctional components of FR001 do not contain chlorinated hydrocarbon, acids, or other component that in themselves may contribute to corrosion.

#### *Viscosity control*

The active component of FR001 helps maintain uniform fuel oil viscosity, even when mixture fuel oil stocks are added to the same storage tank. Variations in the viscosity of the residual fuel oil contribute to erratic fuel flow and nozzles pressure. This, of course, limits the combustion efficiency and frequently cause increased fuel costs for available BTU yield. No 6 fuel oil treated with FR001 have lower pour point. This can eliminate the need to blend residual fuel oils with more expensive fuel oil (e.g., no 2 fuel oil) to attain a certain fuel viscosity. FR001 also prevent deposits buildup of fouling of fuel pre-heater and thereby helps to maintain more uniform fuel flow. Supplemental amount of FR001 will provide a greater degree of viscosity reduction when fuel handling conditions require it.

### *Fireside Deposits Control*

Soot is residue from incomplete combustion of fuel in the firebox. The accumulation of soot at the burner and in the firebox is both a symptom and a cause of combustion problems. It also causes deposit problems. The accumulation of soot and other fireside deposits contributes to increased stack emissions and cold-end corrosion. Coke and unburned hydrocarbons from incomplete combustion stick to tube surfaces and act as accumulators for inorganics residue from the sulfur, sodium salts, and the vanadium salts in the oil. These materials can cause oil slag formation in the firebox and in super heater sections of some boiler. Cold-end corrosion occurs in the cooler areas of the system because of the deposition of acid sulfate and chloride salts. The slag and corrosion scale decreases heat transfer and causes higher pressure drops in flue gas flow. The net result is wasted fuel, lower BTU yield, and higher fuel cost. This is in addition to the difficulties related to maintenance and stack emissions.

The addition of FR001 multifunctional fuel oil additives to the residual fuels prevents accumulation of soot and other deposits in the firebox. By the use of FR001, which contain a combustion catalyst component, it has been possible to reduce the need for soot-blowing to less than 25% of the former frequency. Operation with reduced excess air is possible with FR001-treated fuel, retarding or eliminating the formulation of vanadium pentoxide accumulations. Extensive field studies have shown that deposits formation is substantially

reduced in the system burning FR001-treated fuel, and those deposits that are formed are easily removed with simple brushing and water-rinsing.

### *Application and handling of FR001 fuel oil additives*

FR001 is liquid that is easy to handling, easy to compounded with another non-aqueous liquids, and easy to dispense from shipping containers by means of chemical metering pump or suitable measuring containers. FR001-based fuel oil additives should be fed into line transferring the fuel from the tank car or tank truck to the storage tank. Alternatively, the FR001 additive can be added manually to the tank before each delivery of fuel oil is received.

Dosage level of FR001 will depend in part of the severity of condition in which it is being used and on the total composition of the formulated additive. Under most condition, FR001 can be used as received at dosage of 1 liter FR001 for every 10,000 to 20,000 liters or fuel oil. Suggested fuel oil formulation based on FR001 are available upon request, including formulations combining supplemental amounts of FR001 with the other multifunctional components of R001.

Typical product characteristic	
Density at 25°c (77°f) .....	0.99 g/ml
Weight per US gallon .....	7.5 lb
Flash point .....	60 °c
Ph (100 ppm in water) .....	6.5-7.5