

TEST REPORT OF "POLO DIESEL SMOKE KILLER"

POLO DIESEL SMOKEKILLER is a premium quality diesel fuel improver with proven benefits when applied continuously in conjunction with sound maintenance practices.

MINIMUM SMOKE EMISSIONS

Millions of miles of service on diesel fuels treated with POLO Diesel SmokeKiller (levels range from 0.50% to 0.75% by volume) confirm the outstanding smoke reducing properties and additional benefits of this additive.

Evaluations performed at Southwest Research Institute indicate that this additive is a very effective smoke suppressant and will retain its effectiveness in service. This ability is due to the additive acting as a surface inhibitor, which prevents the dehydrogenation and cracking of the fuel to form carbon particles, during the pre-ignition phase of the combustion cycle. The amount of smoke reduction depends on the particular diesel fuel in use together with the condition of the engine itself. However, Bosch Smoke Spot Reading tests show an average of 53.8% reduction. When combined with good maintenance programs, POLO Diesel SmokeKiller will ensure minimum smoke emissions and maximum engine life.

IMPROVED INJECTOR CLEANLINESS

Test data have shown significant injector cleanliness as a result of continuous use of fuel treated with POLO Diesel SmokeKiller. One of these tests involved 47 transit mix cement trucks powered by Cummins C-180 engines. Of these units, 20 were operated on fuel treated with the additive while the remaining operated on untreated fuel. The results of this test are summarized below:

POLO Diesel SmokeKiller Treat Rate	Total Fleet Operating hours	Average Hours Per Engine	No. of Injector Changing	Average Hours Per Injector Change
None	66,541	2,464	16	4,159
0.50%	52,557	2,628	2	26,278

Fuel treated with POLO Diesel SmokeKiller extends injector life by more than 6 times.

A further test using a GM 6V-71 two-cycle engine revealed that, after 266 hours under cyclic conditions, the treated fuel kept the S60 injectors free of varnish and carbon deposits and still exhibiting the proper spray pattern. With untreated fuel, carbon deposits were found in all injector tips thus interfering with the fuel spray.

Continuous use of POLO Diesel SmokeKiller will contribute to clean injectors which permit engines to operate at optimum power, ensure operational efficiency and minimizing exhaust smoke.



**ANTI-WEAR PROTECTION**

The alkaline composition of POLO Diesel SmokeKiller enables it to provide anti-wear protection by neutralizing acids formed during combustions. The extent of wear protection provided by POLO Diesel SmokeKiller is illustrated in a study conducted by the Institut Francais du Petrole which indicated that treated fuel contributed to a 26-fold reduction in injector plunger wear and 70% reduction in piston ring wear.

These significant reductions in injector and ring wear ensures sustained new engine condition thus prolonging engine life and enhancing power and economy.

**IMPROVED FUEL ECONOMY**

Actual field experience shows beneficial improvements in fuel economy when using diesel fuel treated with POLO Diesel SmokeKiller.

The fuel economy is the result of cleaner injectors providing more efficient fuel spray.

Field operating summary of a fleet in the Great Lakes Region using treated fuel shows the following:

No. of Trucks	Make	Mileage Range Per Truck Using Treated Fuel	Increase in MPG
11	Cummins	10,281 ~ 31,218	7.4%
12	Mack	11,362 ~ 30,111	5.2%
4	General Motors	18,736 ~ 28,982	5.7%

Engine design and mode of fuel injection are important factors in obtaining fuel economy benefits from fuel treated with POLO Diesel SmokeKiller. Average improvement in fuel economy of 4.3% has been observed but it has been found that the additive is particularly effective in direct injection type diesel engines.

**INTERNAL ENGINE CLEANLINESS**

Numerous tests and field experience with engines operating on fuel treated with POLO Diesel SmokeKiller have shown general improvements in overall engine cleanliness.

A CRC L-1-545 test, in which untreated diesel fuel (1% sulfur) was compared with the same fuel treated with POLO Diesel SmokeKiller (0.60%). Both tests were run using a MLL-L-2104A crankcase oil. The test on the untreated fuel was stopped after 200 hours because of excessive lacquer deposits on the piston. The treated fuel was subjected to 720-hours test time and on inspection, it was found that there were no noticeable increases in piston deposits. The piston rings, combustion chamber, exhaust and intake ports were clean.



A fleet of Cummins engine powered tractors operating in California further reinforces the benefits of POLO Diesel SmokeKiller on overall engine cleanliness. Inspection data for one of the units are shown below:

Test Condition:	Test Engine	Cummins NH-250
	Test Mileage	147,533
	Gross weight	76,800lbs
	Cargo	Dry Cement
	Test Fuel	Diesel Fuel (0.38% sulfur) + 0.5% POLO Diesel Smokekiller

Test Result:	Injector Maintenance	None
	Injector Spray Pattern	As new
	Injector Fuel Delivery	1.2% above normal
	Dynamometer Horsepower at 147,533 miles	205 @ 50 mph
	Rated Horsepower(New vehicle)	195-200 @ 50 mph

Clean engine promotes sustained power output, longer engine life and improved economy.

**IMPROVED FUEL STABILITY**

There are generally two areas affecting diesel fuel stability. The first is the tendency for the fuel to degrade on storage, leading to formation of insoluble residues. The other involves the diesel fuel system itself as a portion of the fuel is used to cool the injectors and fuel pump and is returned to the vehicle fuel tank. Heat stressing the fuel at the injectors and pump causes insoluble to form. These insoluble have been shown to cause premature blockage of fuel line filters.

Laboratory tests have indicated excellent thermal and oxidation stability properties for fuels treated with POLO Diesel Smokekiller. The purpose of the 90 Minute 300°F Accelerated Stability Test is to evaluate the stability of middle distillate fuels with respect to color degradation and sludge formation after ageing. Typical results obtained were :

POLO Diesel SmokeKiller Treat Rate	ASTM color(Fuel)		Filter Pad Rating		Stain on Tube (Visual)
	Before Ageing	After Ageing	Before Ageing	After Ageing	
None	0.5	4.0	1	10	Slight
0.50% Vol	0.5	1.5	1	1	None

Data indicate that a treatment of 0.50% POLO Diesel SmokeKiller markedly improves the stability properties of the fuel.

**APPLICATION AND HANDLING**

Vehicle condition and fuel system cleanliness (distribution and storage) are two very important factors in determining the effectiveness of POLO Diesel SmokeKiller. IT CANNOT BE USED AS A SUBSTITUTE FOR GOOD MAINTENANCE PRACTICES.

**Vehicle Condition**

The fact that the engine must be in a good state of repair when switching to treated fuel is substantiated by field experience. When a fleet of buses in New York City area began using the treated fuel (0.50%v), excessive smoking was observed. On inspection, most of the exhaust ports were found to be 90% plugged. The excessive smoking were believed to be caused by removal of the deposits and this was confirmed by laboratory tests which indicated that POLO Diesel SmokeKiller was involved in valve port and exhaust system clean-up.

In another test with a diesel tractor powered by a Cummins NH220 engine, POLO Diesel SmokeKiller initially had little effect on smoke emission. The engine was returned to the manufacturer for inspection and maintenance which resulted in replacement of all the injectors and the fuel pump. On completion, the effectiveness of POLO Diesel SmokeKiller became immediately apparent.

**Fuel System Cleanliness**

To realize the benefits from POLO Diesel SmokeKiller and ensure efficient operation, the facilities for the transportation and storage of the treated fuel must be free of water and contaminants. Bulk treatment and storage of fuel may cause the water separation properties of the additive to promote suspension of debris in the fuel. However, the powerful detergent-dispersant nature of POLO Diesel SmokeKiller together with the relatively high treat rate are controlling factors. These factors give the high treated fuel ability to clean up tankage and other distribution system components and to carry the contaminants through the delivery chain. The engine fuel system filters will safeguard and prevent solid debris in the fuel from finding its way to the fuel pump or injectors.

However to maximize benefits of the treated fuel and ensure trouble-free service, it is necessary to deliver clean fuel to the engine tank and to follow a proper maintenance schedule on fuel system filters.

POLO DIESEL SMOKEKILLER - A COMPLETE MULTIFUNCTIONAL ADDITIVES  
FOR DIESEL FUELS - WHEN COMBINED WITH GOOD MAINTENANCE PROGRAM  
WILL PROVIDE OPTIMUM ENGINE EFFICIENCY. REDUCE DOWNTIME AND

- \* MINIMISE SMOKE EMISSIONS
- \* ENSURE CLEANER, LONGER LIFE ENGINES
- \* IMPROVE FUEL ECONOMY
- \* MAINTAIN FUEL QUALITY