



TREATMENT FOR DIESEL FUEL

Xtra Diesel is a package of additives for diesel fuel, it is formulated to solve many problems encountered with the fuel ultra low sulfur diesel ULSD 15 ppm . Sulfur is recognized to be harmful but it is a very good lubricant.

The sulfur now is in very small quantity in the fuel, this lead to a lack of lubricity for the injection pump and premature breakdown occurred.

Xtra Diesel is formulated to increase the lubricity of the fuel and to extend the life of the pump.

In addition to those benefits and the fuel economy *Test Feric 2.86%*, *SAE J1321 Joint TMC/SAE Fuel Consumption Test Procedure - Type II (SAE International 1986)*. Xtra Diesel offers many other advantages:

- Keeps the system clean
- Prevents the corrosion
- Increases the stability of the fuel
- Prevents water to enter in the system
- Increases the cold flow
- Increases the cetane number
- Neutralizes formation of foam
- Increases the life of filters
- Stabilizes the fuel in the tanks
- Reduces exhaust emission
- Prevents lost of power
- Increases starting power
- Destroys bacteria built in the tank
- Compatible with biodiesel
- Compatible with *Selective Catalytic Reduction* SCR systems using urea

Importance of the injector's cleanliness

The cleanliness of the injectors is critical to engine operation. Coke deposits build up in injectors nozzles and cause poor performance. This causes these bad effects; poor atomization, decrease power, increase smoke, poor fuel economy and increase emissions.

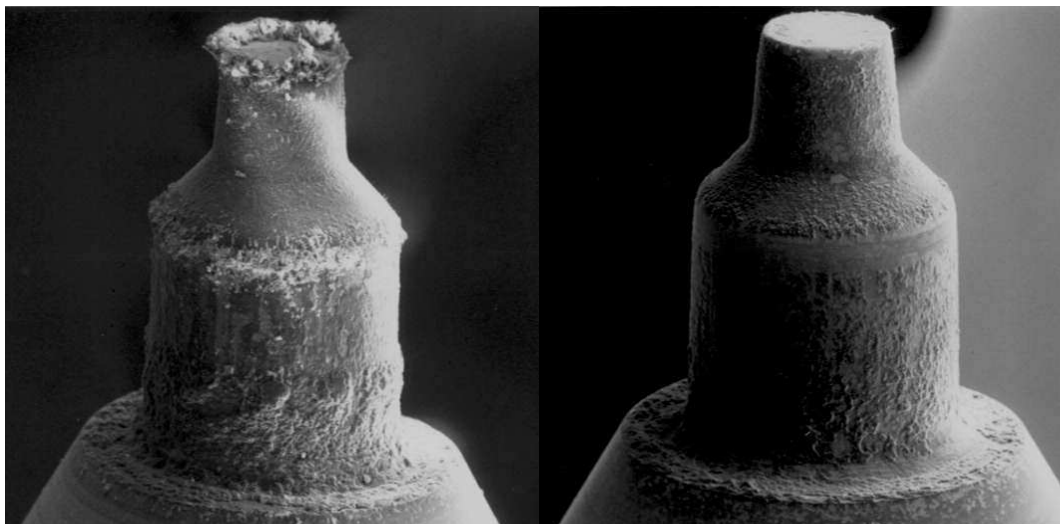
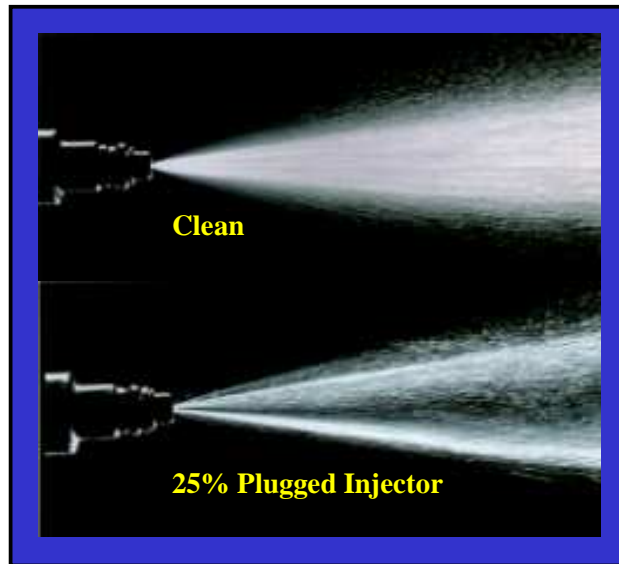
Xtra Diesel allows a better dispersion of the fuel to maximize fuel/air mixing. Good fuel atomization ensures efficient combustion which means less deposit.

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Tests conducted with a Cummins VB-265 engine equipped with PT-C injectors have shown that the use of Xtra Diesel increased the injector's cleanness by 125% in comparison to untreated diesel fuel.



Fuel untreated

Fuel treated with Xtra Diesel

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Diesel fuel economy Test

The objective of the Energotest™ project is to conduct controlled test-track studies of solutions for achieving higher fuel efficiency and lower emissions of greenhouse gases (GHG) in the trucking industry. Energotest not only allows fleets to choose the most efficient solutions, but also allows technology suppliers to better focus their development efforts. The 8th Energotest campaign was held September 20 to 23, 2011, at the **Transport Canada Motor Vehicle Test Centre** in Blainville, Quebec.

Summary on vehicle data

<i>Parameters</i>	<i>Vehicles</i>	
Tractors		
Make and model	Volvo	Volvo
Year	2008	2006
Engine make and model	Volvo D 13	Cummins ISX
Rated power	280 kW (375 HP)	298 kW (400 HP)
Peak torque	1966 Nm (1450 lb-ft)	2102 Nm (1550 lb-ft)
Vehicle test weight	9030 kg	8280 kg
Trailers		
Make and model	Manac	Manac
No of axles	2	2
Year	2002	1998
Type	53-foot Cube Van	53-foot Cube Van
Vehicle test weight	20860 kg	20902 kg

For more information, please refer to the Feric report offer by Lubri-Lab

Test Methodology Fuel Consumption Tests

The test procedure was based on the *SAE J1321 Joint TMC/SAE Fuel Consumption Test Procedure - Type II (SAE International 1986)*. The fuel-consumption test compared the fuel consumption of a test vehicle, operating under two conditions, with that of an unmodified control vehicle. Fuel consumption was accurately measured by weighing temporary tanks before and after each trip.

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Figure 2. Test vehicle.



Figure 3. Control vehicle.



Fuel Consumption Test Results

The baseline stage was conducted on June 03, 2011 before treating the test vehicle with the XTRA-Diesel fuel conditioner. After the baseline test, the test vehicle was treated with the XTRA-Diesel fuel conditioner according to the instructions of the supplier’s representative. The final stage was on September 20, 2011: the fuel treatment was performed by the supplier’s representative at the ratio of 1:1000. Between the baseline and the final test, the test vehicle accumulated 30,030 km (18,660 miles) of break-in distance. For both tests stages, three valid ratios between the two vehicles’ fuel consumptions were obtained with three test runs. Only two temporary fuel tanks were used for the three test runs of the final stage to assure that the fuel used during the tests is uniformly treated with Xtra Diesel.

Summary of test results for the XTRA-Diesel fuel conditioner

Baseline stage, June 3, 2011				Final stage, September 20, 2011			
Valid test runs	Consumed fuel, kg		T / C ratio	Valid test runs	Consumed fuel, kg		T / C ratio
	Control vehicle C1-T5 (102907-413)	Test vehicle C2-T4 (102754-212B533)			Control vehicle C1-T5 (102907-413)	Test vehicle C2-T4 (102754-212B533)	
1	30.70	32.28	1.051	1	30.54	31.00	1.015
2	30.66	31.88	1.040	2	30.10	30.92	1.027
3	30.34	32.14	1.059	3	30.34	30.92	1.019
Average T/C ratio							
1.050				1.020			
T/C ratio coefficient of variation, %							
0.94				0.61			
Fuel saved, %							
2.857							



The result obtained by the XTRA-Diesel additive, **2.86 % fuel savings**, it is superior to the performances shown by other fuel additives: fuel consumption tests conducted by FPIInnovations under the framework of the previous Energotest campaigns showed up to 1.5% improvement in fuel economy (Surcel 2009a, 2009b, Surcel et al. 2009).

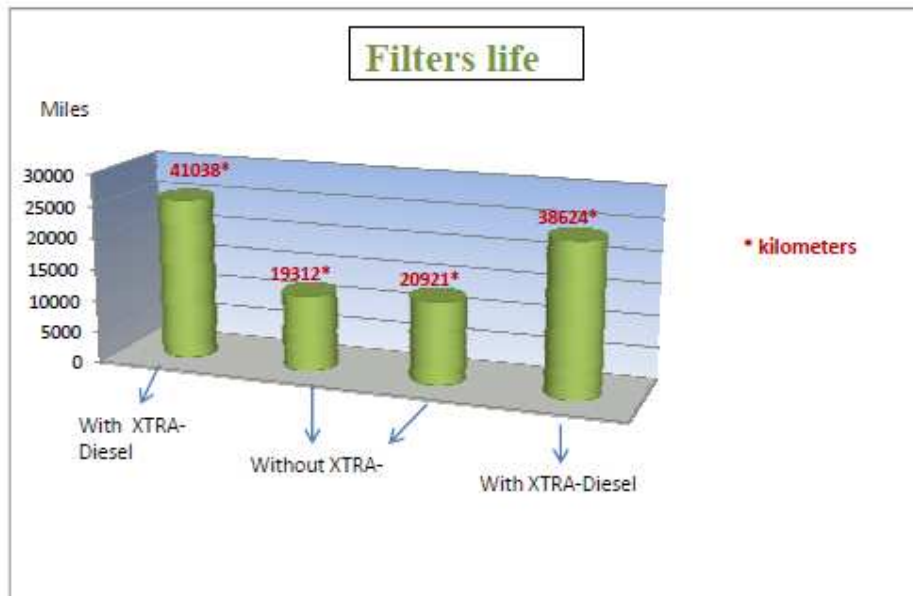
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Fuel Filter Life Extend / Recovery

Tests conducted with a Cummins NH-220 engine have demonstrated that the use of Xtra Diesel diminish the obstruction of diesel fuel filters by 75%. The result is the long service filter life.



Storage Stability

In storage, diesel fuels are attacked by atmospheric oxygen, which can cause color change and varnish deposits. Antioxidants and dispersants are added to prevent such problems. Metal deactivators reduce the catalytic effects of nonferrous metal parts that may be present in the fuel system. In the presence of water bottoms, bacterial action can cause a build-up of "slime" near the fuel water interface in the storage system, leading to filter plugging. Xtra Diesel inhibits the bacterial growth.

Diesel Fuel Stabilization

Xtra Diesel is formulated to provide increased protection against oxidation and increase the thermal stability of fuel. Tests have shown that dispersants and antioxidants in Xtra Diesel may increase the stability index of fuel by 50% or more. The ASTM D2274 "Test of stability of diesel fuel" showed a significant reduction in deposits and oxidation up to 87.5%.

In addition Xtra Diesel is very effective in prevention of formation of stable fuel-water emulsions.

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Corrosion protection

Tests conducted using the NACE TM-01 procedure have shown that regular use of Xtra Diesel efficiently prevents the formation of rust on the crucial parts of the injectors and the injector's pump.

Untreated fuel
Rust at 100%



Fuel treated with XTRA-Diesel
No rust

Exhaust smoke reduction

The combination of detergents and special agents to increase the cetane number in Xtra Diesel allows exhaust smoke to diminish from diesel engines by improving the ignition and combustion properties of diesel fuel and by keeping the injectors clean to ensure good pulverization of diesel fuel.

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Opacity and Emission Measurements

The opacity test procedure was based on the *SAE J1667 Snap-Acceleration Smoke Test Procedure for Heavy-Duty Diesel Powered Vehicles*. The emission measurements were conducted at idle (30 s) and at high engine speed (30 s). Figure 5 presents the test vehicle during emission measurements.

The emissions measured: CO, CO₂, THC, NO_x, NO_x (corr.)

Test Equipment

The following equipment was used during the tests:

- Portable tanks with a capacity of 144 L (38 gallons): Norcan Aluminum 103461.
- Calibrated scale with a capacity of 226.80 kg and a resolution of 0.02 kg: Weigh-Tronix WI-152/DS, S/N 000341, calibration certificate dated May 9, 2011.
- Bosch RTT100 smoke meter.
- Horiba OBS 2200 on-board emission measurement system.
- Weather station: Davis Instrument Vantage Vue.

The repeatability of the scale measurements was periodically checked during the tests using a calibration weight set.



Figure 5. Véhicule d'essai pendant les mesurages des émissions polluantes

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Opacity and Emissions Measurement Results

The average opacity was 7.2% for baseline measurements and 6.2 % for final measurements. It should be mentioned that the legal limit in Quebec is 30% for diesel vehicles manufactured after 1991.

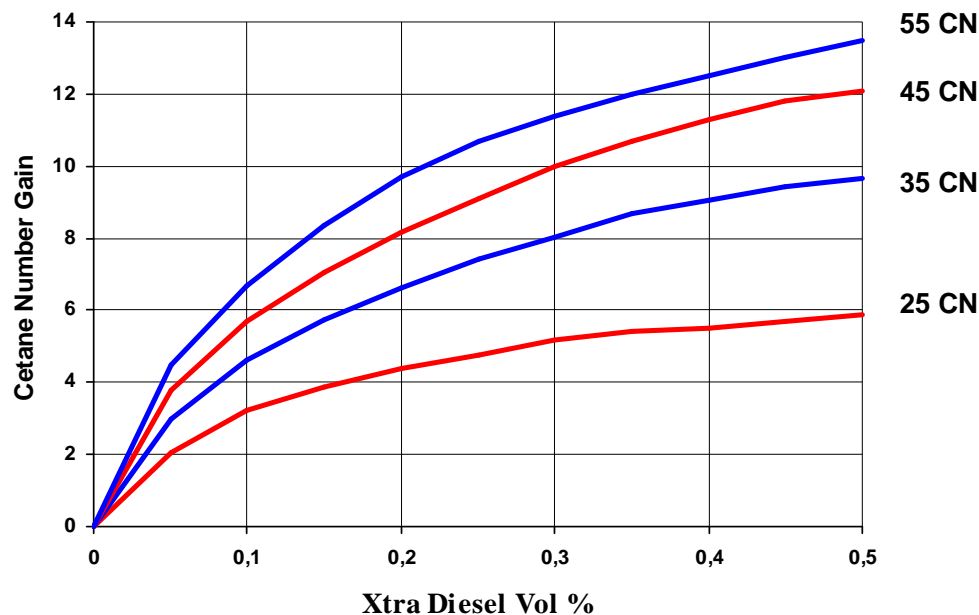
However, it should be mentioned that the results of the baseline (without treatment) were already very good, which is the case for newer vehicles in very good working condition.

Conclusion :

Even with vehicle in excellent condition, Xtra Diesel decrease the emissions by of 1%.

Cetane Number and Ignition Quality

This factor influences ease of starting, duration of white smoking after start-up, drivability before warm-up, and intensity of diesel knock at idle. Studies have correlated ignition quality with reduced emissions. As ignition delay is reduced, the combustion process starts earlier and emissions, primarily carbon monoxide and hydrocarbons, are reduced. Xtra Diesel can boost the cetane number of a fuel and the fuel's performance in engines.



Xtra Diesel increases the cetane rating by 3 to 5 numbers with a typical treatment of 0.1%. The higher the quality of the fuel, the more significant the improvement

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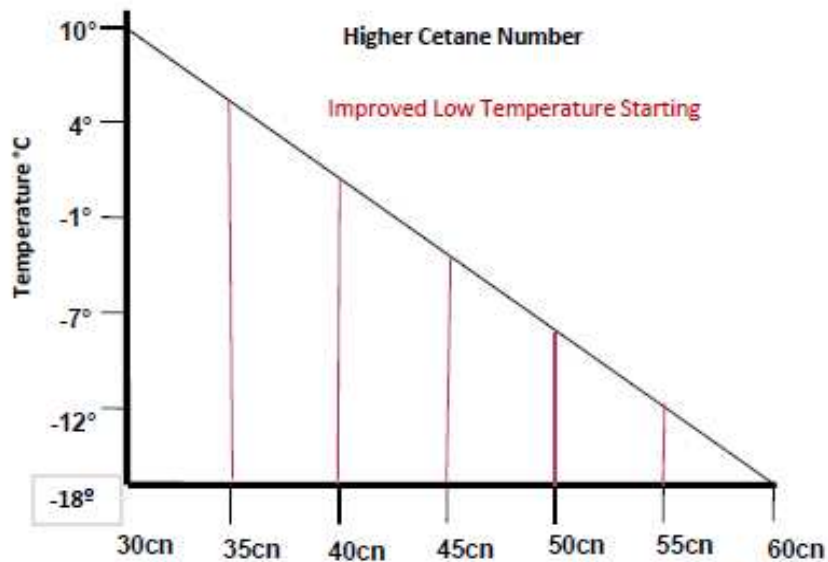


When fuel is enhanced with Xtra Diesel cetane improver, it burns more quickly and completely. More efficient combustion **reduces** :

- Knock and noise
- Misfiring
- Shock loads
- Peak pressure in the cylinder
- Ignition delay
- Stress
- Engine maintenance
- Fuel consumption
- Exhaust emissions
- White smoke
- Crank time

At the same time, better combustion results in:

- better warm up
- better ignition quality
- improved low-temperature start ability
- The result is a quieter, smoother-running engine and longer engine life.



cn: Cetane Number in base fuel

It is possible to lower the starting temperature of engine approximately 1°F (.17°C) for each cetane number

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Lubricity Performance

In diesel fuel systems, the fuel provides lubrication for the fuel pump and injectors. A fuel with poor lubricity can cause excessive wear and premature failure of these components. With reductions in fuel sulfur level, lubricity is becoming a larger concern.

Taking out the sulphur means taking out the lubricity and reduce antioxidancy and other valuable properties which is not good for a diesel engine. The likely result: wear leading to failed injectors. And that translates into breakdowns and repair expenses. Xtra Diesel helps to put back in what came out with the sulfur. It's the proven solution to enhance lubricity in ultra-low sulfur diesel fuel. So diesel engines run at peak performance and are protected from unnecessary wear.

The High Frequency Reciprocating Rig (HFRR) test is now well established as the bench method for evaluation of diesel fuel lubricity additive performance. Xtra Diesel reduces the HFRR wear scar of even the most severe sulphur-free fuel to below the 460 microns limit prescribed in EN590.

Low Temperature Flow

Unlike gasoline, which has a freezing point well below the coldest winter conditions, diesel fuels have pour points within the range of normal winter temperatures. As a fuel approaches its pour point, paraffins in the fuel form wax crystals that prevent it from flowing. Xtra Diesel contains Flow-improver additives that modify the wax crystals, lowering the pour point of the fuel and biodiesel.

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