PLATINUM X4
FUEL TECHNOLOGY

Technical Data

Test Performed By:
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San Antonio, TX

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Introduction

Platinum X^4 is a premium diesel fuel additive that offers a large number of performance benefits. It also can be tailored to meet individual marketers' needs.

Platinum X^4 has been extensively tested both in the laboratory and in the field with impressive results. This report highlights some of the testing and many of the benefits. The benefits of **Platinum X^4** include:

- Excellent injector cleanliness as shown by the Cummins L10 and Pugeot XUD-9 tests for injector deposits
- Lower operating costs due to improved fuel economy
- Reduced exhaust emissions compared to base fuels
- Superior corrosion protection
- Excellent fuel stability in storage
- Exceptional lubricity for reduced fuel system wear
- Reduces water entrainment and prevents stable emulsion formation
- Excellent anti-foaming characteristics

There are clear and measurable advantages to incorporating a multifunctional diesel fuel additive into diesel fuel. The end user of **Platinum X^4** treated fuel will appreciate the differences in terms of:

- Improved drivability
- Increased fuel efficiency
- Reduced combustion noise
- Reduced emissions output
- Increased maintenance intervals
- Longer component life
- Reduced operating costs

Test data presented in this report utilized **Platinum X^4** at 500 ppm.

Cummins L10 Depositing Test

Background

Cummins had a field problem that occurred in some fleets. Certain engines developed injector deposits that led to a noticeable decrease in power. Cummins analyzed the driving patterns of the affected fleets and a laboratory test method was developed to simulate these deposits. The test can be used to discriminate fuel/fuel additive quality. (Reference SAE paper No.912331.)

Test Summary

+ Two L-10 Cummins engine in tandem
+ 2300 RPM, 50-60 HP
+ 15 second cycle – one engine driving, the other being driven. The roles are reversed for each 15-second cycle.
+ 125 hour duration
+ Rating
  - Percent flow loss
  - CRC visual rating of plunger deposits

Cummins Criteria

Acceptable -	CRC rating <25+SD Flow loss <5%
Superior -	CRC rating <10+SD Flow loss <5%

(CRC rating goes from 0 to 100 with 0 being totally clean.
Standard Deviation (SD) = 2.0)

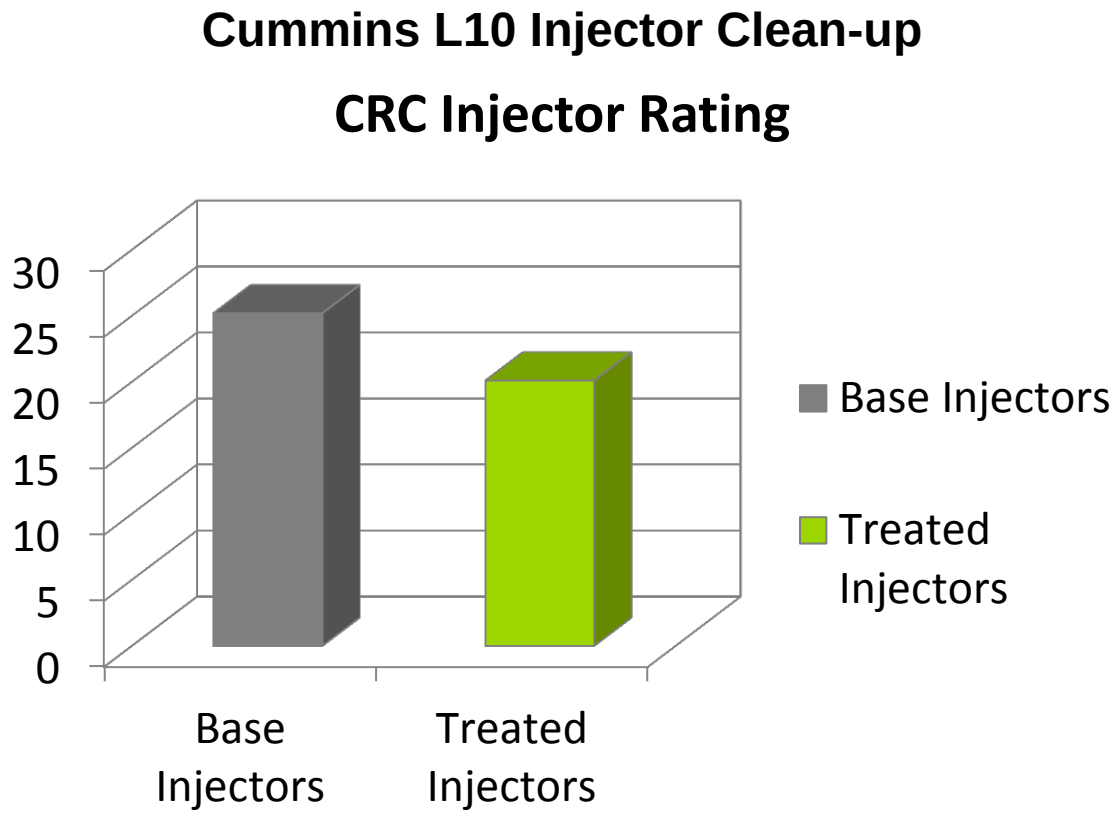
CRC Injector Rating Method

- Based on CRC piston and ring rating system as described in CRC manual 18
- Scale runs from 0 to 100, 0 is perfectly clean
- All six injectors rated individually and then averaged across the set in the Cummins L10 Depositing Test Procedure

Test Results

Injector Clean-up Data

The ability of **Platinum X^4** to clean-up existing injector deposits was evaluated through the use of the Cummins Injector Depositing Test Cycle. A set of injectors were run in the Cummins L10 Injector Depositing Test Cycle using untreated Cat1-H fuel and then rated. The same injectors were rerun in the Cummins L10 Injector Depositing Test Cycle using Cat-H fuel treated with **Platinum X^4**. This test showed an average reduction in injector deposits of 20.3 percent.



Cummins L10 Injector Depositing Test Cycle	CRC Rating (Avg.)
Initial baseline Cummins L10 Test (untreated fuel)	25.2
After Cummins L10 with **Platinum X^4** (treated fuel)	20.1

Cummins L10 Injector Emissions Testing

Test Procedure

+ Run Cummins L10 Injector Depositing test with base fuel and fuel treated at 500 ppm of **Platinum X^4**.

+ At the conclusion of the test, remove injectors and place them in another L10 engine.

+ Run the Engine on the transient emissions cycle. (The test is considered representative of real world driving conditions.) This cycle is used for on-highway certification of trucks in the USA and it has four phases that simulate driving in:

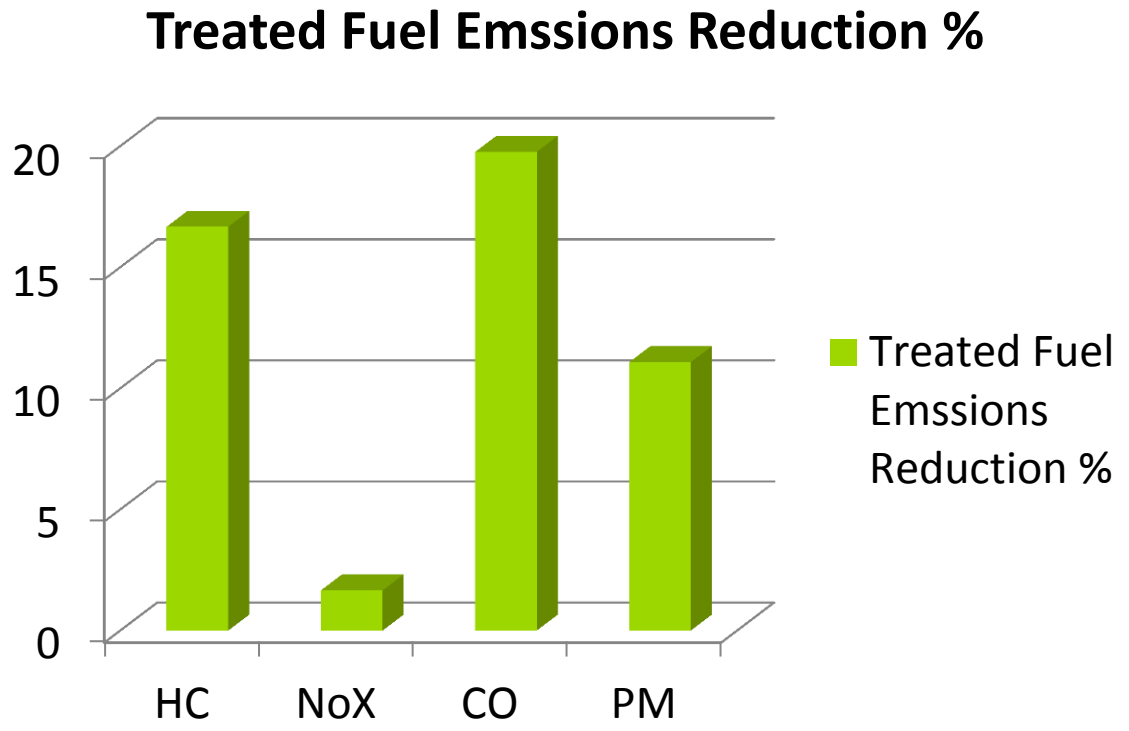
  - New York City highway
  - New York City urban
  - Los Angeles highway
  - Los Angeles urban

+ Emissions, fuel consumption and power are measured. Results of these tests are graphically represented on the following page.

Composite FTP Emissions Improvement

Conclusion

Platinum X^4 Premium Diesel Additive significantly reduces emissions compared to un-treated fuel, and provides excellent cleanliness within the engine. **Platinum X^4** detergent and lubricating properties help maintain engines in “like new” condition, which maintains power and increases fuel efficiency.



	HC	NoX	CO	PM
% Reduction From Base	16.7	1.66	19.76	11.08
	Hydrocarbon	Nitric Oxide	Carbon Monoxide	Particulate Matter

Peugeot XUD 9 Nozzle Coking Test

This test is the recognized industry evaluation of deposits in an indirect injected passenger car diesel engine and was developed in Europe by Group PF 26 of the CEC

Test Parameters

Engine:	Peugeot XUD 9
Cylinders, swept volume:	4, 1.9L
Speed:	3,000 RPM
Load:	58 NM
Duration:	6 Hours

Test/Criteria Summary

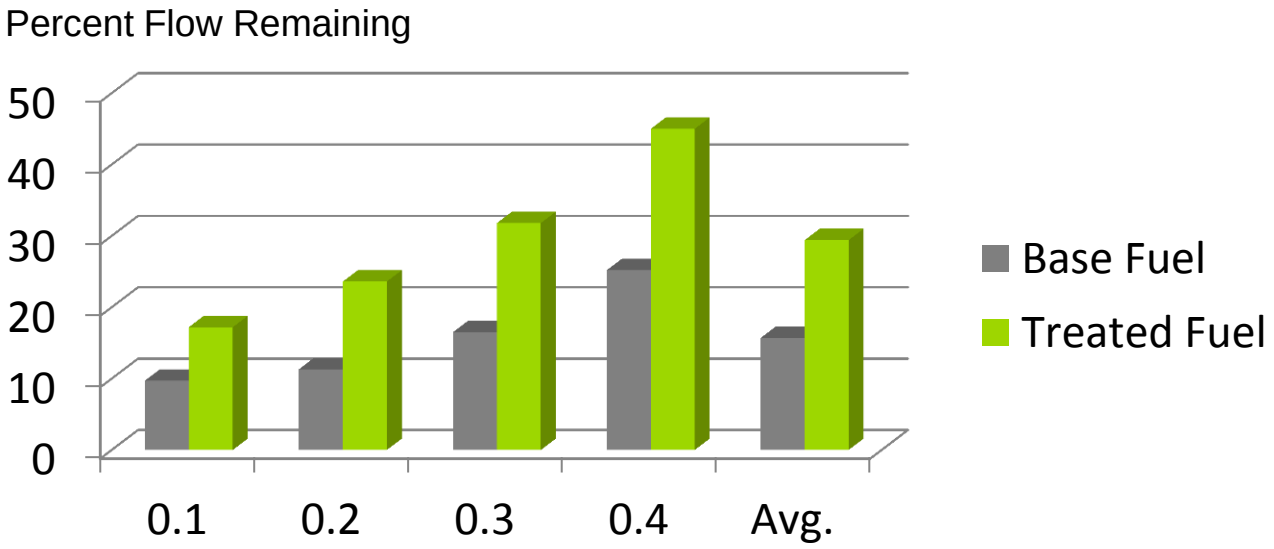
New nozzles are flowed with air and measurements are taken at lift points of 0.1, 0.2, 0.3, 0.4 mm. The nozzles are reassembled on the engine. The engine is warmed up to test conditions and then run for 6 hours. Nozzles are the reflowed and compared to the initial flow rate. A French OEM group CFCA, has developed a pass/fail criteria: greater than 15% remaining injector flow as compared to original flow at 1.0 mm of pintle lift.

Results

The attached graphs detail the excellent results for **Platinum X^4**.
Platinum X^4 treated fuel gave an 87% improvement in average residual flow and passed CFCA requirements.

Peugeot XUD 9 Nozzle Coking Test

Pintle Lift (mm)



Pintle Lift (mm)	0.1	0.2	0.3	0.4	Average
Base Fuel (untreated)	9.7	11.3	16.5	25.2	15.7
X^4 Treated Fuel	17.2	23.6	31.8	45	29.4

Laboratory Bench Tests

The following laboratory bench tests can also be used to evaluate diesel fuel quality and additive effectiveness. Below is a short description of each test. The following pages give test conditions, equipment schematics and test results using **Platinum X^4**. **Platinum X^4** offers excellent wear protection, oxidation stability, corrosion protection and water separation.

ASTM D 5001, BOCLE TEST: measure of a fuel's lubricity characteristics.

ASTM D 6079 HIGH FREQUENCY RECIPROCATING RIG TEST (HFRR): measure of a fuel's lubricity characteristics.

ASTM D 2274, FUEL OIL STABILITY TEST: measure of the oxidative stability of a diesel fuel.

NACE RUST TEST (NACE: National Association of Corrosion Engineers): measure of the anti-corrosive ability of a fuel.

ASTM 1094, WATER TOLERANCE: measure of a fuel's ability to separate from water.

ASTM D 5001 BOCLE TEST

Test Parameters

Base Fuel:	Isopar M (50ml)
Temperature:	25° C (77°F)
Relative Humidity:	10%
Test Conditions:	Non-rotating ball applies 1000g force To cylinder rotating @ 240 RPM 30 minute duration
Performance Criteria:	Measure wear scar on ball

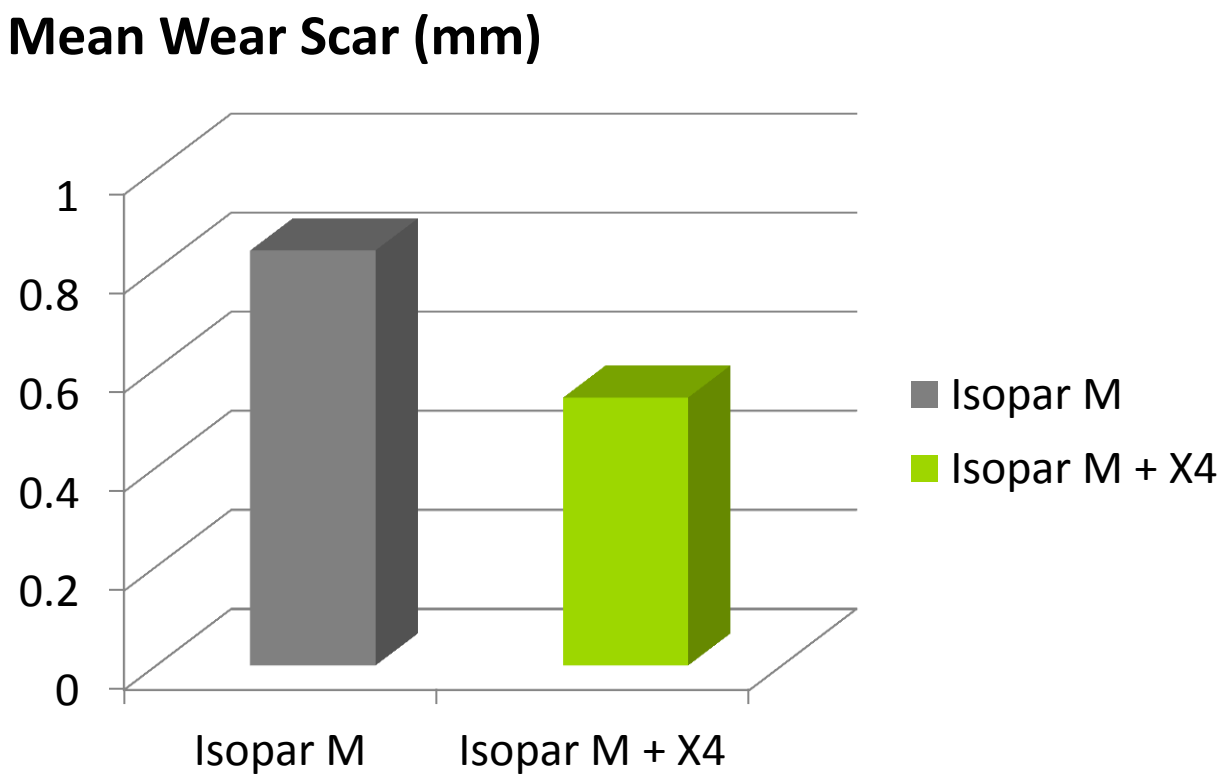
Test Results

Fuel	Mean Wear Scar (mm)
Isopar M	0.838 (838 microns)
Isopar M + **Platinum X^4**	0.541 (541 microns)

ASTM D 5001 BOCLE TEST

Conclusion

Platinum X^4 Premium Diesel Additive, when added to Isopar M reference fuel, provides excellent anti-wear performance as measured by the ASTM D 5001 BOCLE TEST (35% improvement). The BOCLE test was developed to evaluate lubricating properties of aviation fuels. The wear mechanism is corrosion-related, which may not simulate the fuel wear mechanism in a diesel engine.



Tested Fuel	Mean Wear Scar (mm)
Isopar M	0.838 (838 microns)
Isopar M + **Platinum X^4**	0.541 (541 microns)

MODIFIED ASTM D 5001 BOCLE TEST

Test Parameters

Base Fuel:	Isopar M (50ml)
Temperature:	25° C (77°F)
Relative Humidity:	**50%**
Test Conditions:	Non-rotating ball applies **7000g** force to cylinder rotating @ **300** RPM 2 minute duration per loading
Performance Criteria:	Measure wear scar on ball

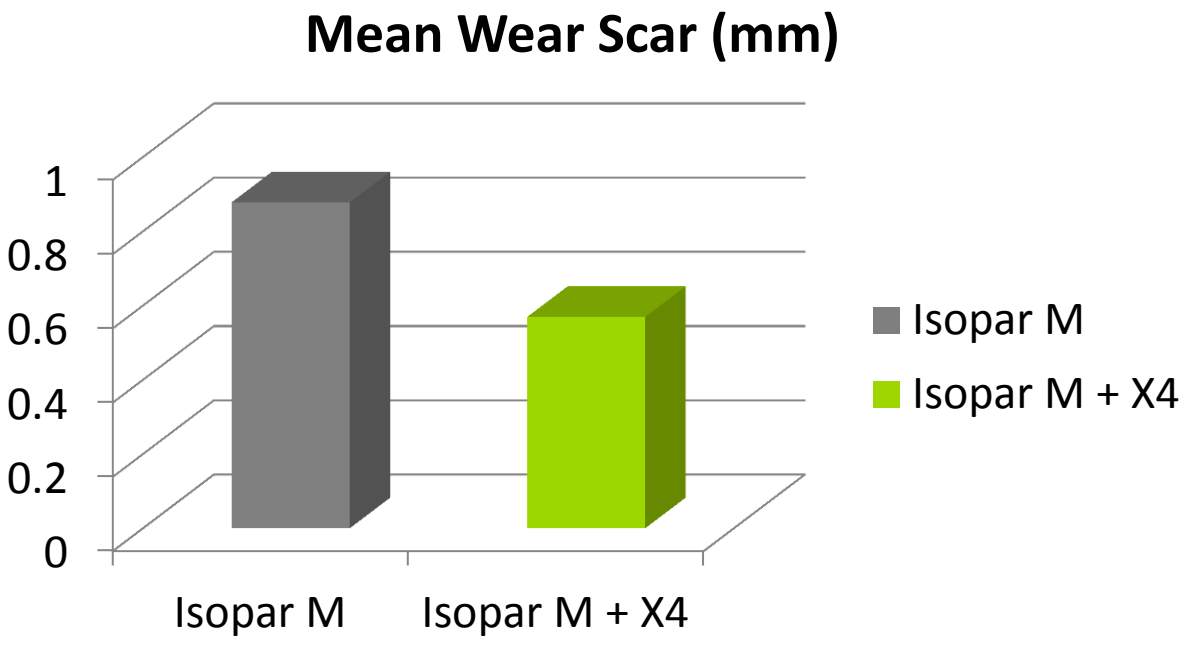
Note: ***Highlighted*** parameters are modifications from the ASTM D 5001 BOCLE test. Test conditions better represent the scuffing wear in a diesel engine.

Test Results

Fuel	Mean Wear Scar (mm)
Isopar M	0.838 (838 microns)
Isopar M + **Platinum X^4**	0.569 (569 microns)

CONCLUSION

When added to Isopar M reference fuel, **Platinum X^4** provides excellent anti-wear performance as measured by the modification of the ASTM D 5001 BOCLE TEST.



ASTM D 6079 HIGH FREQUENCY RECIPROCATING RIG (HFRR) TEST

Test Parameters

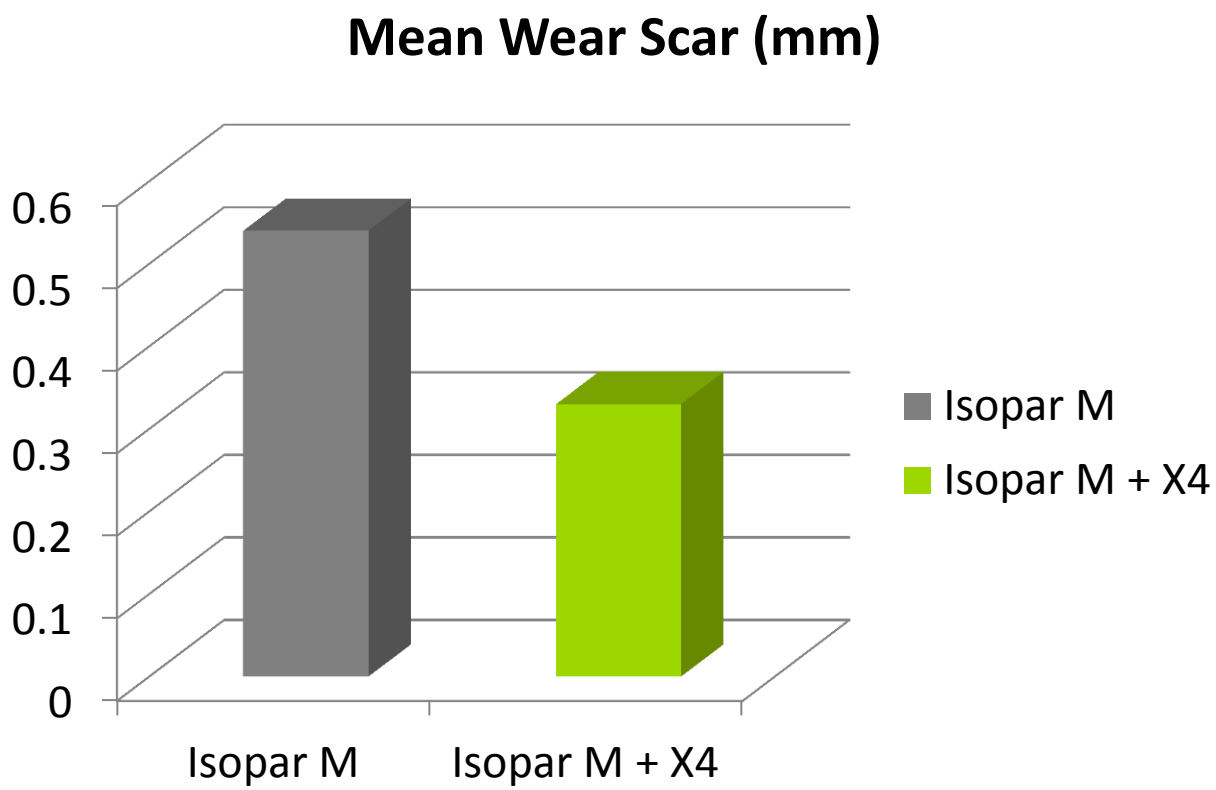
Base Fuel:	Commercial No. 2 Diesel Fuel
Temperature:	0° C (149°F)
Test Conditions:	A 50 HZ reciprocating ball with a stroke of a length of 1mm is brought into contact with a stability disk. The load is 200g and the duration is 75 minutes.
Performance Criteria:	Measure wear scar on ball

Test Results

Fuel	Mean Wear Scar (mm)
Isopar M	0.54 (540 microns)
Isopar M + **Platinum X^4**	0.33 (330 microns)
Pass/Fail Limit (EMA)	.45 (450 microns)

Conclusion

Adding **Platinum X^4** to base diesel fuel improved lubricity performance by 39%. This performance enhances the wear protection of fuel pumps and other fuel system components.



ASTM D 2274 STABILITY TEST

Test Parameters

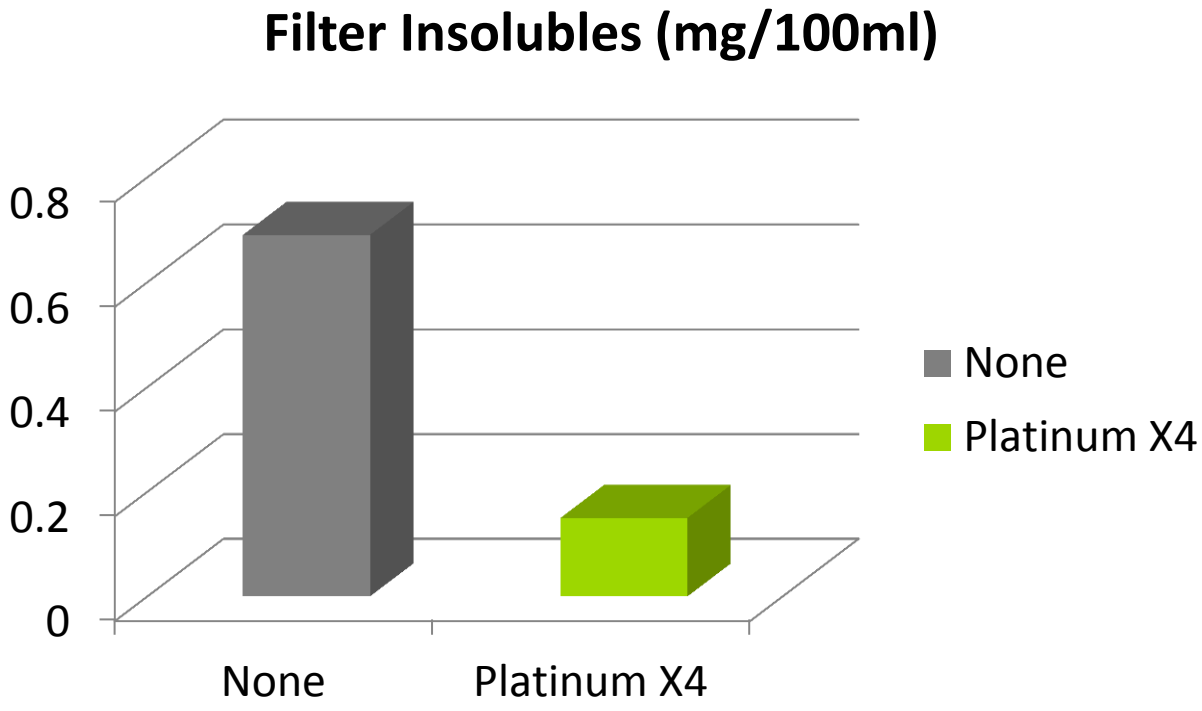
Base Fuel:	Commercial No. 2 Diesel Fuel
Temperature:	95° C (203°F)
Test Conditions:	Oxygen is bubbled through a sample at a rate of 3 liter/ hour
Performance Criteria:	Amount of insolubles and the fuel color change

Test Results

Additive	Initial	Final	(mg/100ml)
None	L0.5	L1.5	0.69
Platinum X^4	L0.5	L0.5	1.15

Conclusion

In the ASTM D 2274 FUEL OIL STABILITY TEST, **Platinum X^4** provides excellent stability as illustrated by the 78% reduction in fuel insoluble and strong color stability. Oxidation of diesel fuel can cause the formation of gums, which can increase the formation of deposits and increase the chance of filter plugging. **Platinum X^4** protects against oxidation and stabilizes fuel for storage.



NACE RUST TEST

Test Parameters

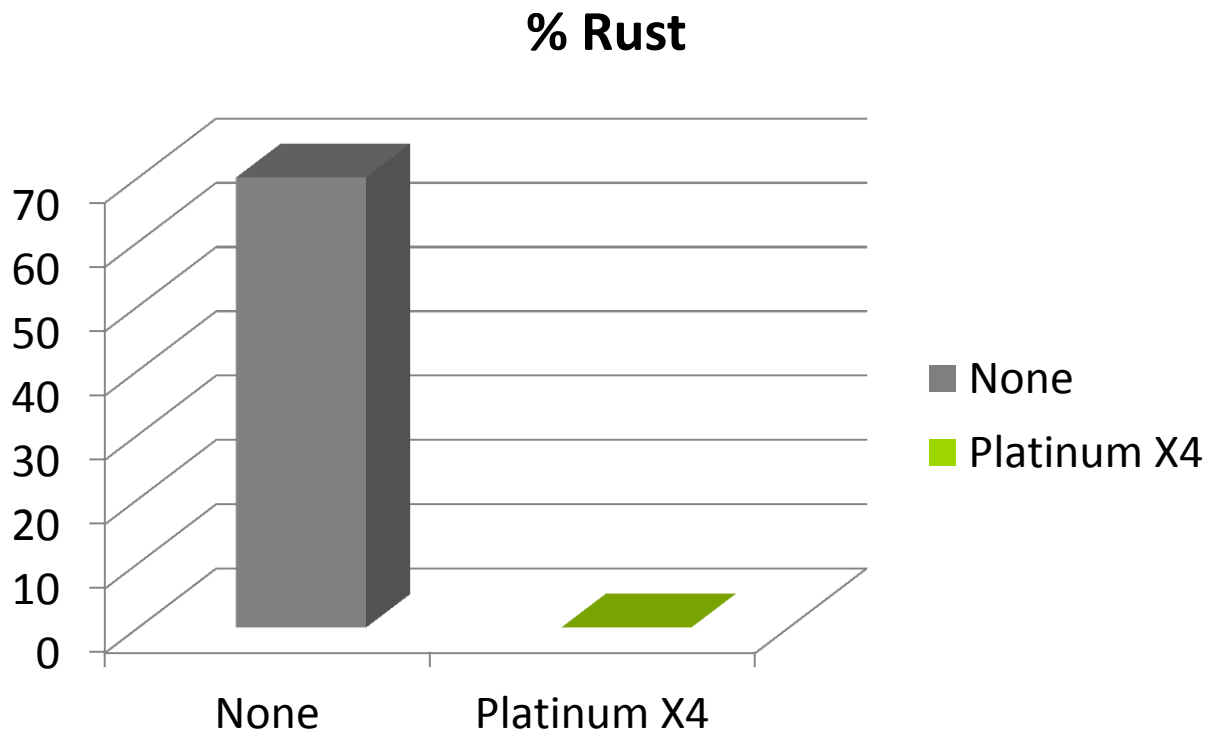
Base Fuel:	Depolarized ISO- Octane
Temperature:	37.8°C (100°F)
Water Phase:	Distilled
Fuel/Water Contact:	Stir fuel 30 min., stop, introduce water, stir 3.5 hrs.
Steel Spindle:	Polished, Cold Rolled SAE 1020, ½"
Performance Criteria:	Visual evidence of rust

Test Results

Additive	Visual Rating	% Rust
None	D	50-75%
Platinum X^4	A	None

Conclusion

Platinum X^4 provides superior anti-corrosion protection in Depolarized ISO-Octane fuel. This characteristic ensures superior anti-rust protection to storage facilities, fuel handling systems and end users of diesel engines.



ASTM D 1094 WATER TOLERANCE TEST

Test Parameters

Base Fuel:	Commercial No. 2 Diesel Fuel
Temperature:	25°C (77°F)
Water Phase:	Distilled
Fuel/Water Contact:	Hand shaken for 2 min. (80 ml of fuel, 20ml of water)
Settle Time:	5 min.
Performance Criteria:	Degree of fuel/water separation, clarity of phases, interface rating

Test Results

	Rating after 5 min.		Time required
Additive	Interface	Separation	to settle (min.)
None	3	3	10+
Platinum X^4	1	1	2

Conclusion

Platinum X^4 improves the fuel/water separation performance of base fuels to ensure trouble-free handling after any contact with water. **Platinum X^4** ensures that emulsions will not readily form, thus not causing drivability and rusting concerns.