



Preventative Fuel Solutions

## **FUEL SEMINAR: ADVERSE AFFECTS ON TODAY'S ENGINES** *Protecting DPF's, EGR's, & Injectors – A Simple Solution*





# Why Diesel Buses

- Diesel has the lowest carbon footprint over the operational life of a school bus.
- Diesel is Cost-Effective.
- Diesel is the most fuel-efficient engine type.
- Diesel fuel outperforms other fuels in operating range & fuel economy.
- Diesel buses have better resale value.

**WITH ALL THESE ADVANTAGES WHY ARE SCHOOLS SWITCHING TO GASOLINE RUN BUSES?**

# IT'S THE FUEL



# Diesel Fuel

## ULSD – Ultra Low Sulfur Diesel

**ULSD**



### The Good

- Lower emissions
- Reduction in acid rain

### The Bad

- Attracts water -2X
- Freezing fuel lines
- Causes corrosion
- Lower lubricity
- Creates deposits

### The Ugly

- Bacteria forms clogging filters
- Poor burn causes Component failures
- Injector failure - water contamination

# Overview of Diesel Standards

- Before EPA began regulating sulfur in diesel, diesel fuel contained as much as 5,000 parts per million (ppm) of sulfur. EPA began regulating diesel fuel sulfur levels in 1993.
- Beginning in 2006, EPA began to phase-in more stringent regulations to lower the amount of sulfur in diesel fuel to 15 ppm, known as ultra-low sulfur diesel.

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Highway Diesel Fuel	≤ 500 ppm	80% of pool ≤ 15 ppm				≤ 15 ppm			
Non-Road (NR)	≤ 5000 ppm	≤ 500 ppm				≤ 15 ppm			
Locomotive & Marine (LM)	≤ 5000 ppm	≤ 500 ppm					≤ 15 ppm		

- Collectively, diesel standards reduce harmful emissions from both onroad and nonroad diesel sources by more than 90%, but also created engine performance restrictions and issues.



# Overview of Diesel Standards

## UNTREATED FUEL

- |                              |              |
|------------------------------|--------------|
| • High Sulfur #2 Diesel      | HFRR 350-390 |
| • Low Sulfur #2 Diesel       | HFRR 390-500 |
| • Ultra Low Sulfur #2 Diesel | HFRR 600-800 |
| • Ultra Low Sulfur #1 Diesel | HFRR 700-900 |

**ASTM Minimum Requirement**  
**HFRR 520**

**Engine Manufacturers Association (EMA) suggests:**  
**HFRR 460 or lower**

**A lower # is better for HFRR**

# Less Sulfur Can Create Issues

- The lack of Sulfur in Diesel Fuel creates a lack or complete loss of lubricity, creating more fuel deposits, varnish, wax, sludge and dirty fuel injectors.

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## The Detroit News

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GM

### Lawsuit says GM sold trucks not compatible with U.S. diesel fuel

**Keith Laing** The Detroit News  
Published 1:01 p.m. ET Aug. 7, 2019 | Updated 5:53 p.m. ET Aug. 7, 2019

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General Motors Co. has been hit with a class-action lawsuit alleging it equipped 2011-2016 GMC and Chevrolet diesel trucks with 6.6-liter Duramax engines that are not compatible with American diesel fuel.

The lawsuit, filed Wednesday in federal court in Detroit, alleges GM sold "hundreds of thousands" of diesels with high-pressure fuel injection pumps designed by German auto supplier Bosch that pumped metal shavings into the fuel injection system and damaged the fuel system and engines.

The lawsuit alleges that because American diesel fuel is thinner than European diesel and provides less lubrication, it allows air pockets to form inside the fuel injection pump during operation, which causes metal to rub against metal, generating metal

The lawsuit involves:

- 2011-2016 2500HD Silverado 6.6L V8 Duramax diesel trucks with LML engines
- 2011-2016 3500HD Silverado 6.6L V8 Duramax diesel trucks with LML engines
- 2011-2016 2500HD Sierra 6.6L V8 Duramax diesel trucks with LML engines
- 2011-2016 3500HD Sierra 6.6L V8 Duramax diesel trucks with LML engines
- 2010-2011 Chevrolet Express vans with Duramax LGH engines
- 2010-2011 GMC Savana vans with Duramax LGH engines
- 2010-2011 GMC Sierra trucks with RPO ZW9 (chassis cabs or trucks with pickup box deleted) with Duramax LGH engines
- 2011-2012 Chevrolet 2500HD Silverado 6.6L V8 Duramax diesel trucks with LGH engines
- 2011-2012 Chevrolet 3500HD Silverado 6.6L V8 Duramax diesel trucks with LGH engines
- 2011-2012 Chevrolet 2500HD Sierra 6.6L V8 Duramax diesel trucks with LGH engines
- 2011-2012 Chevrolet 3500HD Sierra 6.6L V8 Duramax diesel trucks with LGH engines



# Water troubles

## •Damage – Bosch said:

- 1 M mile injectors lasting 250k
- Problem – Dissolved water at high pressure.

### Fuel Contamination



- 1 New Bosch valve body.
- 2 Image of corroded valve body

The majority of diesel engine problems stem from contaminated fuel. Common problems include corrosion from excessive water in the fuel, micro fine particles in the fuel and improper fuel storage, which is caused by water in the fuel.

There are two ways in which water can get into the fuel: through the delivery system and through the tank vent.

The common rail system is a major advancement in diesel technology. However, common rail engines are less forgiving of poor quality than older fuel injection technologies. What used to be acceptable in the past can cause the engine to malfunction and often result in a costly repair.

#### The key causes of injector failures are:

- Fuel Contamination
- Poor Fuel Filtration
- Incorrect Installation
- Non-OEM approved remanufactured products

#### Fuel Contamination



- 1 New Bosch valve body.
- 2 Image of corroded valve body

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#### What Can I Do?

**Solution:** Always purchase fuel from a reputable service provider and use a proper fuel/water separator. Periodic inspection of the vehicle's tank vent is also recommended.

#### Poor Fuel Filtration



- 1 Sealing surface for a new Bosch valve body.
- 2 Sealing surface of a competitor valve body showing ball seat erosion.

A common problem with diesel injectors is erosion of the control valve. The heart of the common rail injector is the valve through which fuel passes at extremely high pressure. The passage opening is sealed using a pressurized ball that is only 1mm in size. A proper seal is critical for exact injector performance. Abrasive contaminants, released by inadequate filtration, can erode and damage the control valve and not allowing the ball to seal. This can lead to excessive smoke, starting or idling problems and potential engine failure.

#### What Can I Do?

**Solution:** To ensure exact performance within the designed service life of the injector, use only OE filters or filters having the same OE micron rating and follow the recommended OE filter change interval. Using anything less can cost you more in the long run.

#### Non-OEM Approved Remanufactured Products

Not all remanufactured injectors are the same. The quality of any remanufactured injector depends on the remanufacturing process and components. Some manufacturers sell refurbished/used injectors and market them as rebuilt. However, instead of being rebuilt, they are merely cleaned and polished, and the tips are not replaced. You might get a great deal on these non-OEM approved products, but you are taking a huge risk that these injectors may not be better than the one you are trying to replace.

#### What Can I Do?

**Solution:** Make sure your car is being serviced by a reputable shop and ask about the parts they use on your diesel engine to ensure they are from the OEM or from an authorized Bosch supplier.

#### Incorrect Installation

Missing sealing rings, incorrect tightening torque, incorrect cleaning of the nozzle can cause poor performance, misfiring, black smoke and check engine light (MIL) to come on.

#### What Can I Do?

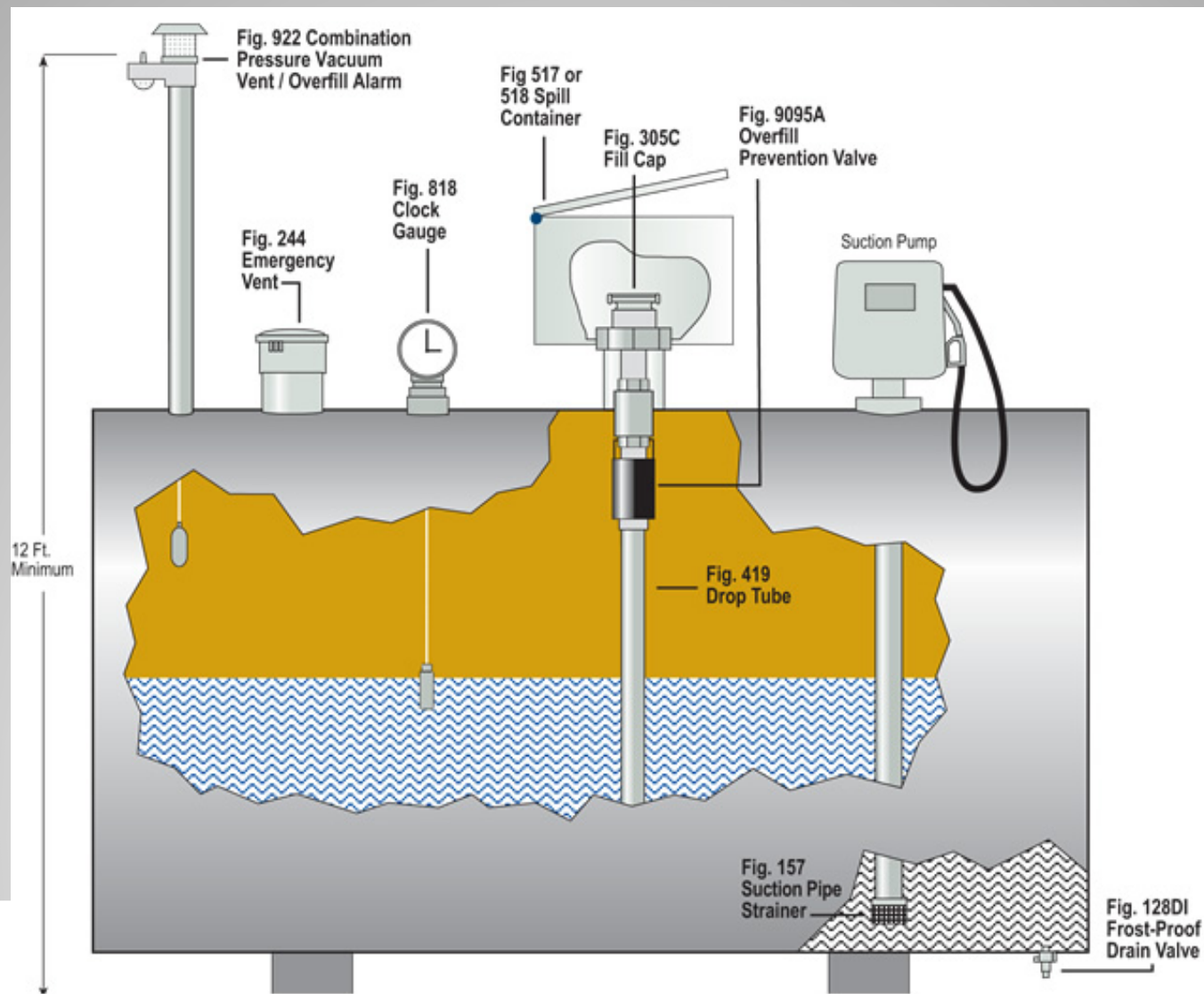
**Solution:** Always follow the engine manufacturer's maintenance procedures and have repair work done by a reputable shop.

Bosch's remanufactured injectors follow the same fit, form, and function as OE injectors. Bosch remanufactured injectors include all OE updates, so they can often be superior to the OE injectors that they replace.

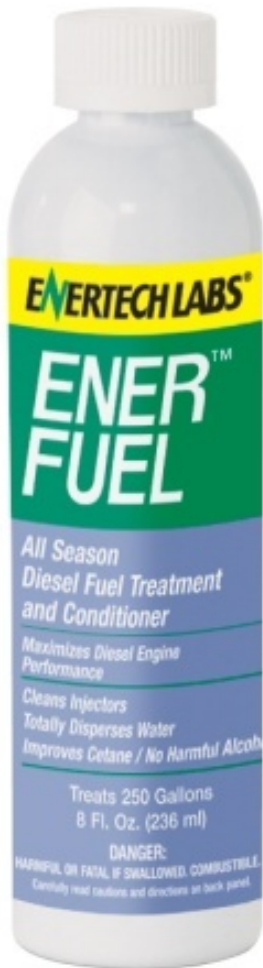




# Tank Entry



# Water troubles



## EnerFuel

- Chemically
- Removes Water
- Disperses Water
- Eliminates Icing
- Prevents Corrosion
- Prevents Bacteria
- Prevents Injector Damage

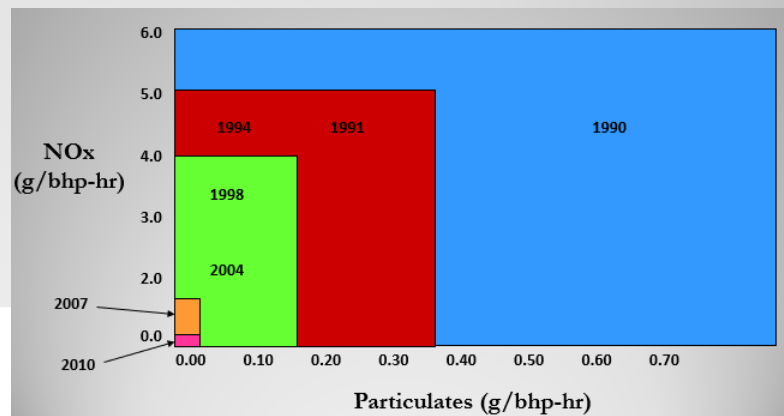
**Clean Burn Technology**

# Phase Separation FIX!



# Regulatory Background: Emission Standards

- The first set of emission standards for heavy-duty engines were adopted beginning from 1974. The standards were tightened on several occasions through the 1980s and 1990s. Some of the important steps included tightening of PM emission limits in 1991 (0.25 g/bhp-hr) and 1994 (0.10 g/bhp-hr), and of NO<sub>x</sub> limits in 1998 (4 g/bhp-hr) and 1994 (5.0 g/bhp-hr).
  - (g/bhp-hr - grams per brake horsepower-hour)
- In October 1997, the EPA adopted new emission standards for model year 2004 and later heavy-duty diesel engines [801]. These standards reflected the provisions of the Statement of Principles (SOP) signed in 1995 by the EPA, California ARB, and the manufacturers of heavy-duty diesel engines. The goal was to reduce NO<sub>x</sub> emissions from highway heavy-duty engines to levels approximately 2.0 g/bhp-hr beginning in 2004.

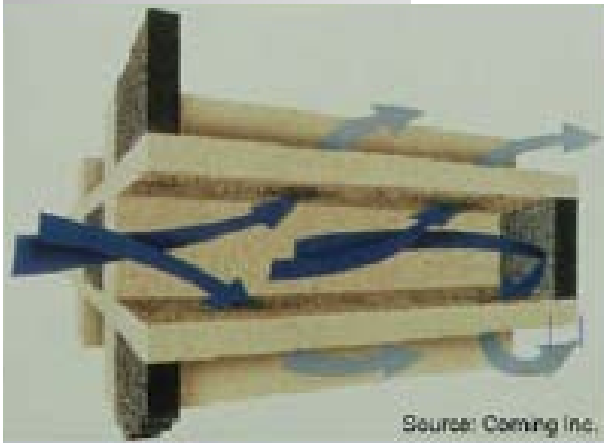
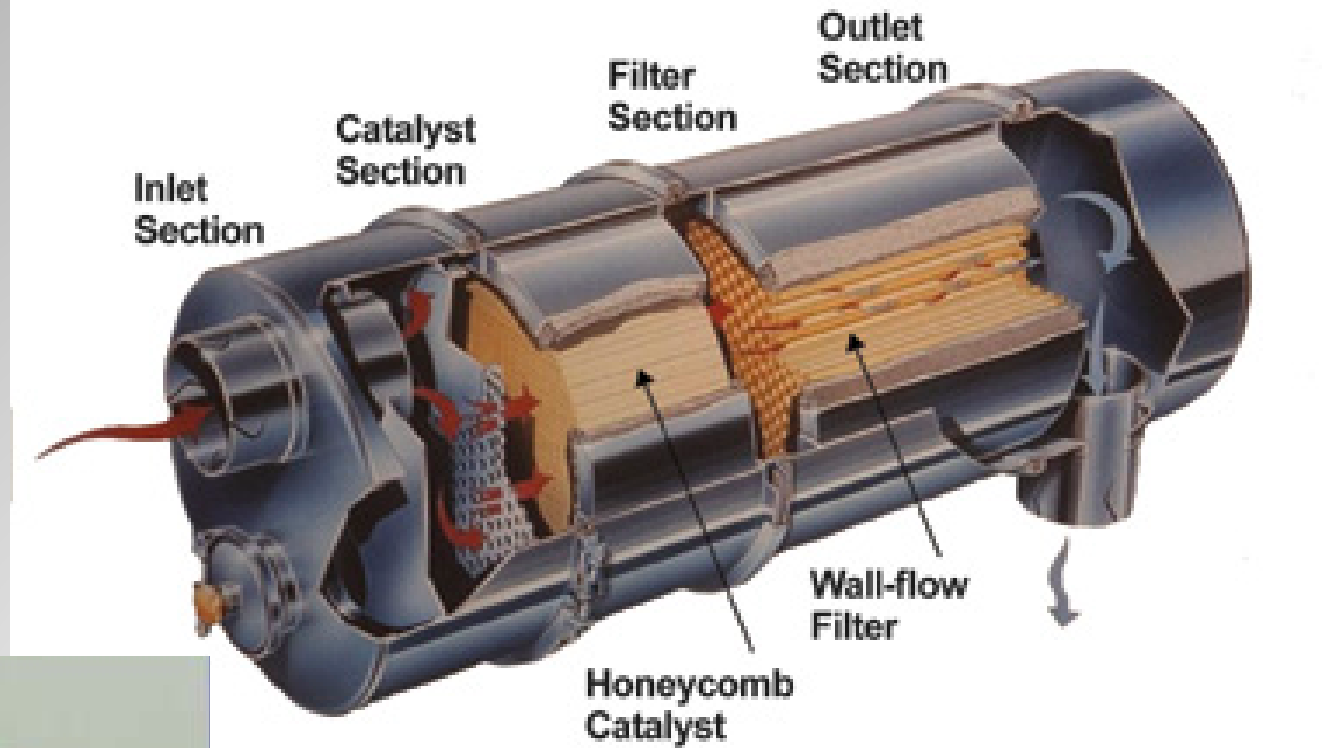


## Regulatory Background: Emission Standards

- In December 2000, the EPA signed emission standards for model year 2007 and later heavy-duty highway engines, with a phase-in schedule over 2007-2010 [1044]. In addition to emission standards, the rule included ultra-low sulfur (15 ppm) diesel fuel regulations.
- In 2020, the EPA and California ARB both published first regulatory documents pertaining to the so-called lower NO<sub>x</sub> emission standards, focused on further reductions of NO<sub>x</sub> emissions from heavy-duty engines and on achieving low emissions under real driving conditions. In January 2020, the EPA issued an ANPR for the Cleaner Trucks Initiative. In June 2020, California ARB proposed lower NO<sub>x</sub> emission regulation for heavy-duty engines. The ARB proposal envisions NO<sub>x</sub> limits (FTP) of 0.050 g/bhp-hr from 2024 and of 0.02 g/bhp-hr from 2027. The proposal also introduces a new low load certification cycle (LLC) and NO<sub>x</sub> limits, as well as extended useful life periods.



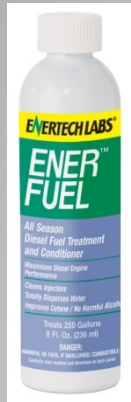
# Catalytic Particulate Traps



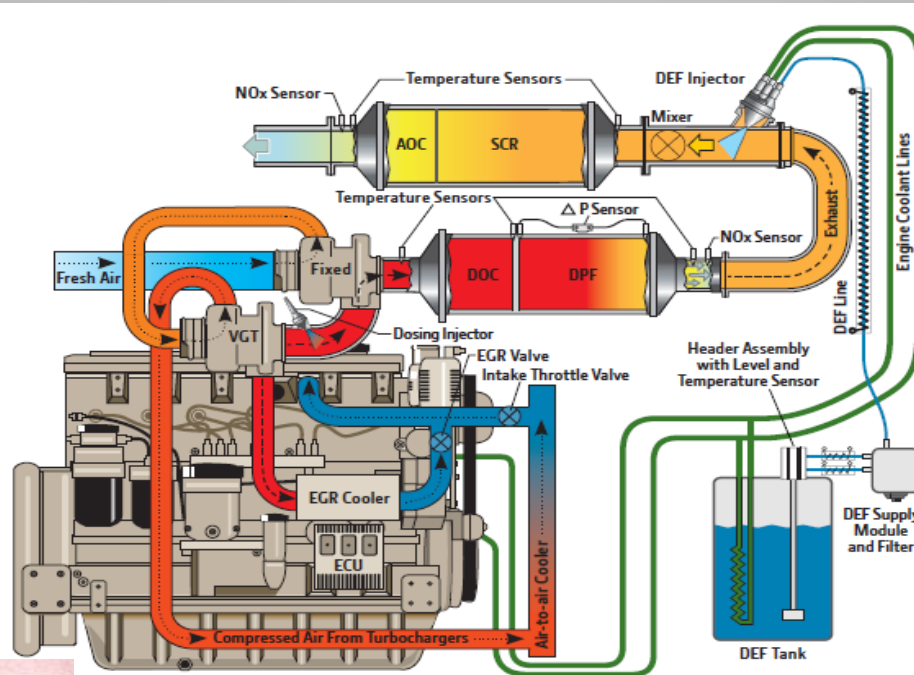
Source: Corning Inc.

**DFP's can eliminate:**  
**90% semi-volatile hydrocarbons**  
**99% of solid particles (soot & metals)**

# Clean Burn = Clean Exhaust



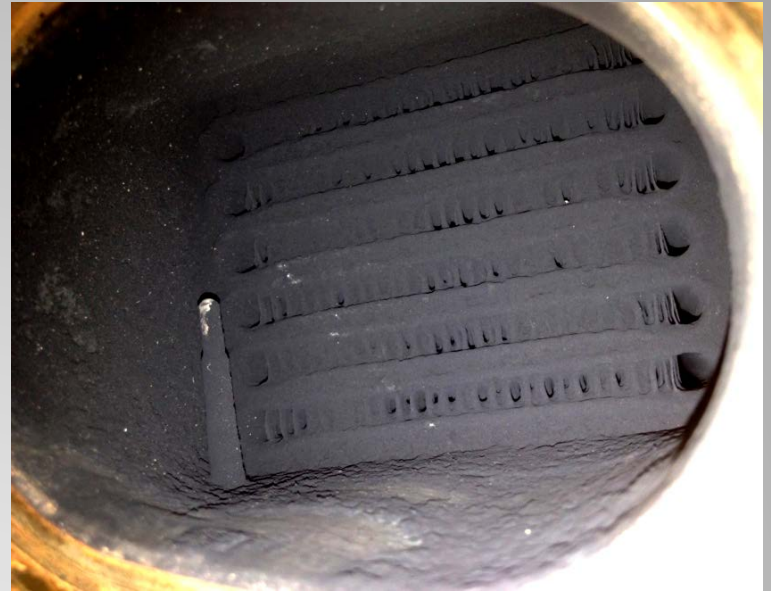
Before Treating



After Treating



# Coking Troubles





# Turbo "Coking" and Corrosion

## Results of High Idle Time and/or Low Fuel Quality:

- Loss or Lack of Power
- Unnecessarily Failed Engine Parts
- Turbocharger Coking
- EGR Valve Coking
- Inefficient Oil and Fuel Filter Change Intervals



# Metal Carboxylates

- Metal carboxylates are salts of carboxylic acids formed when these acids encounter metals such as sodium and calcium
- Potential Sources of Metal and Acid:

## Metals

- Caustic water bottoms in distribution system
- Refinery salt driers
- Marine diesel – ballast water

## Carboxylic Acids

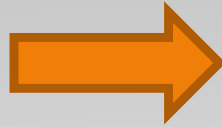
- Oxidized Fuel
- Hydrolysis of fatty acid methyl esters (biodiesel) \*
- Corrosion Inhibitors (present at low levels)
- Lubricity Improvers (present at elevated levels) Mono Acids

\* Carboxylic acid formed during biodiesel oxidation can corrode iron surfaces to yield an iron carboxylic salt layer. This salt layer can then trap other components in the fuel such as polymers that are also formed during biodiesel oxidation [Omori 2011].



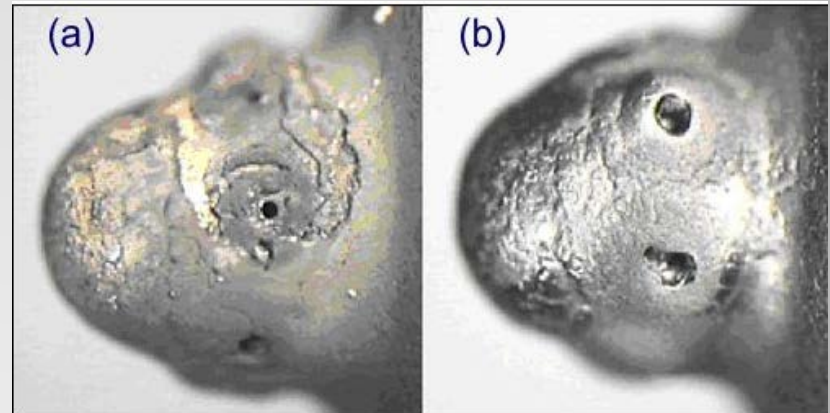
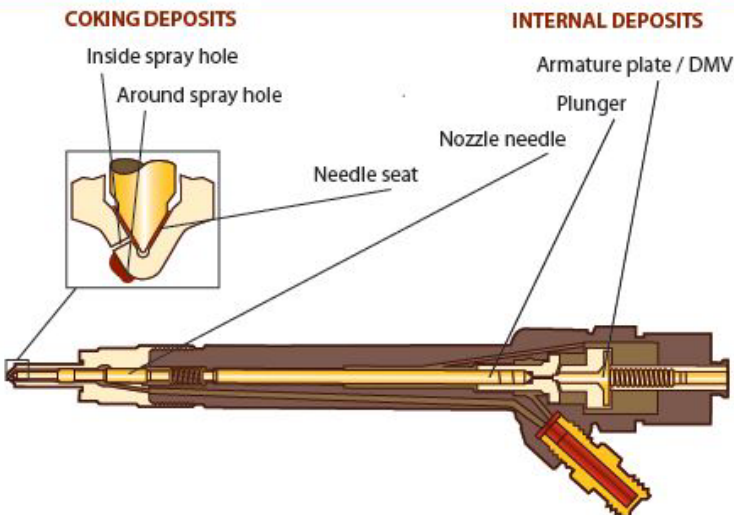
# Injector Functionality

## Metal Carboxylates

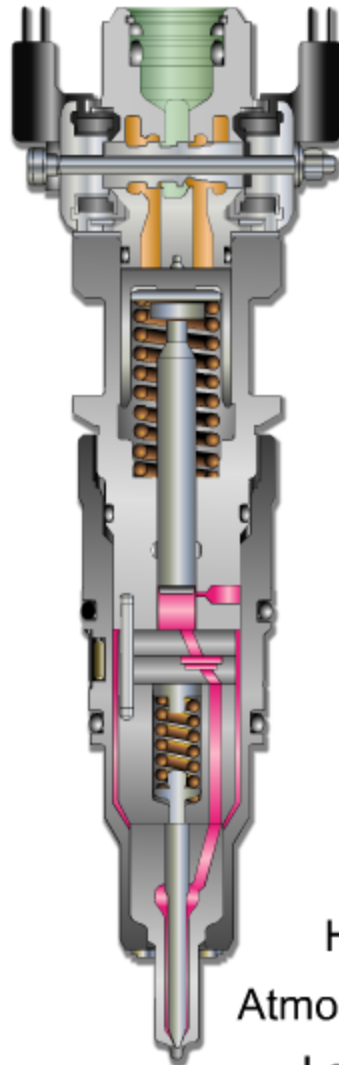


**Service Kits & Inject R Clean**  
**Cleans Injector Deposits.**

### Locations of Internal and External Deposits



# Injector Functionality



High Pressure Oil ■

Atmospheric Pressure ■

Low Pressure Fuel ■

High Pressure Fuel ■

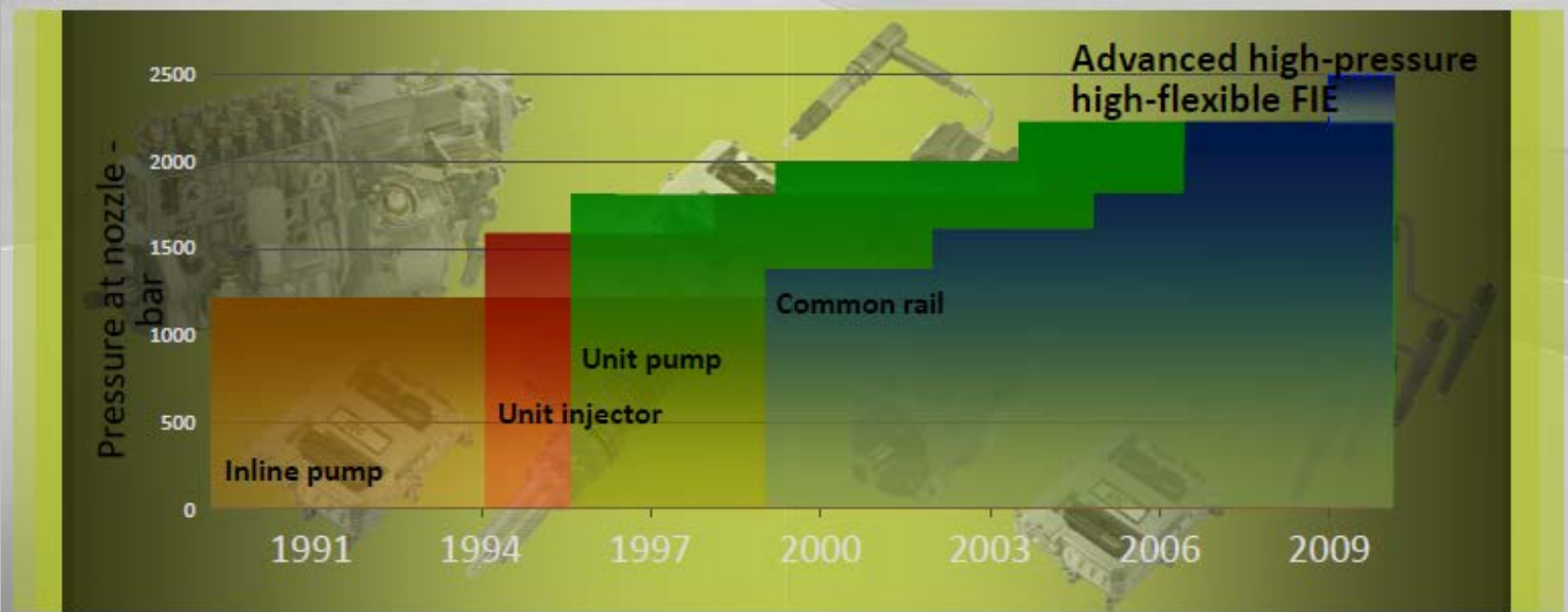
# Asphaltene Deposits



# Carbonaceous Deposits Most Common



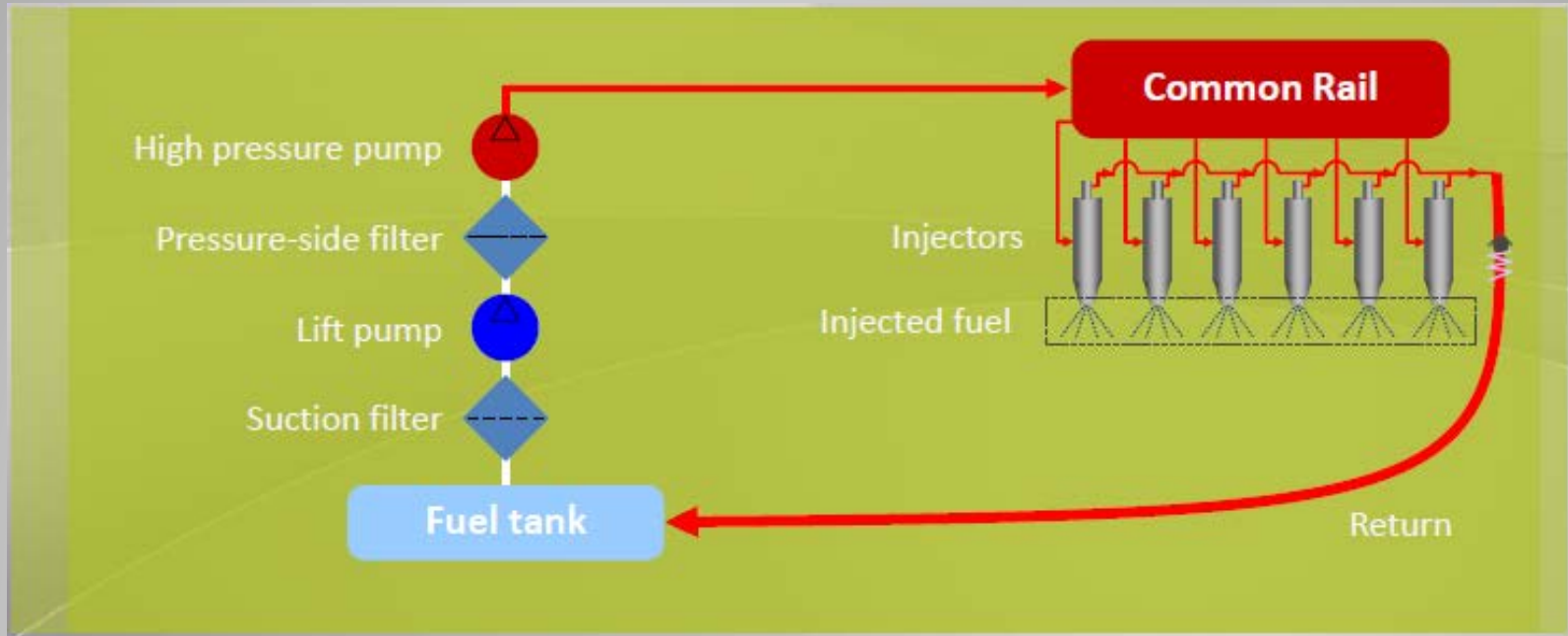
# Evolution of fuel injection pressures



**Bar X 15 = PSI**



# Typical HPCR fuel system



**Fuel Temp inside injector**  
**300°F - 800°F**

# Service Recommendations

## Simple Service Great Results

### ETLM26



**Description** – Typical of fuel related problems including carbon buildup on injectors and exhaust components can be quickly and easily cleaned, restoring rough running or misfiring engines back to proper working condition. Utilizing the cleaning power of Inject-R-Clean plus the continued cleaning, lubrication and Cetane boost of Complete Fuel Treatment provides the perfect No Harm clean up that should be performed at every oil change to keep engines clean - reducing engine downtime.

#### Directions –

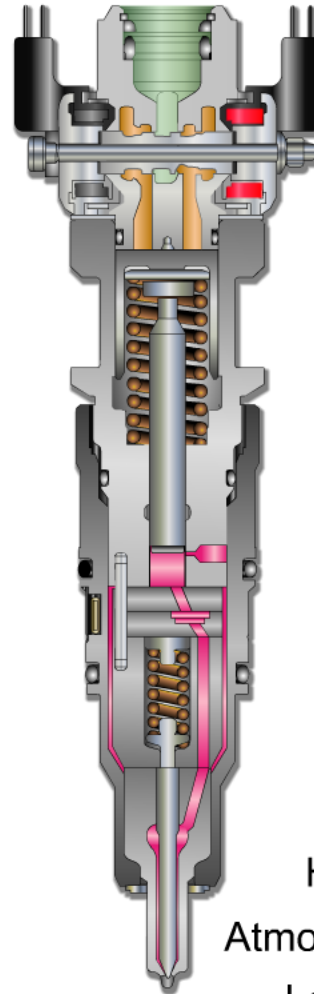
1. Fuel Filter - Fill the fuel filter or fuel filter housing with concentrated Inject-R-Clean (No fuel needed)
2. Fuel Tank - Dose the fuel tank with the recommended amount of Inject-R-Clean. (See Bottle for Treat Rate)
3. Fuel Tank – Dose the tank with the proper amount of Complete Fuel Treatment. (See Bottle for Treat Rate)
4. Run Engine at High Idle (1,100 RPM) for 40 minutes.  
(NOTE: Engine will run rough and exhaust will smoke for first 10 min. of service)
5. Run Engine at idle for 15 min.
6. Test Drive vehicle aggressively (while safely obeying all local traffic laws) to complete cleaning process and ensure proper vehicle operation.  
Run the engine clean.


**Additional Recommendation:** EnerFlush - Poor performance can also be the result of engine oil deposits formed on oil controlled components and sensors such as HUEI injectors, Oil Coolers, and sensors. Once per year or every 25K miles an Engine oil flush with EnerFlush is recommended.

#### Directions: (Every 25,000 Miles or Once per year)

- 1) EnerFlush – Add 2 qt of EnerFlush to 26-32 qts. engine oil. (Can be added to dirty engine oil)
- 2) Run Engine – Run Engine at operating temperature for 30-45 minutes at high idle.  
Note: Do not run engine under load.
- 3) Fully drain oil, replace oil filter and add proper amount of fresh oil to crankcase.
- 4) Return to Service.


# Injector Functionality



High Pressure Oil 

Atmospheric Pressure 

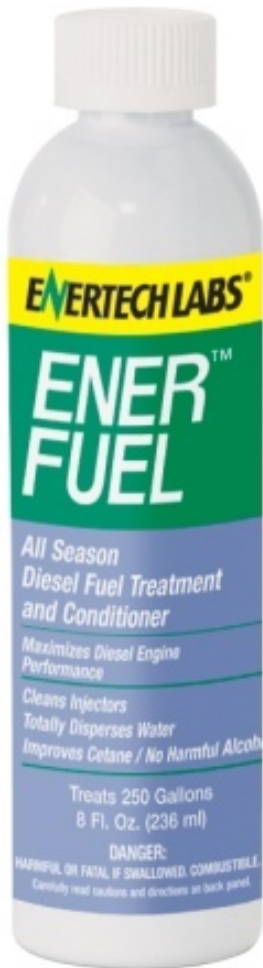
Low Pressure Fuel 

High Pressure Fuel 

**EnerFlush**  
Cleans the  
spool valve  
restoring  
the injector  
to proper  
operation.

Cleans  
“Sticktion”  
Problems

# How to Combat Clogging



Treated With  
Enertech Products

Untreated  
#2 Diesel

## Clean Burn Technology

### Clean Burn

- Helps Atomize Fuel
- Burns Clean
- Prevents Coking
- Easier Starts
- More Power
- Increase MPG

- **Clean Burn Technology**





# What is Biodiesel Fuel

Biodiesel: A fuel typically made from soybean, canola, or other vegetable oils; animal fats; and recycled grease. It can serve as a substitute for petroleum-derived diesel or distillate fuel.



# Biodiesel

## Mandates to Increase the Use of Biodiesel

### Biodiesel in Fuel



#### The Good

- Ag Economy
- Lubrication
- Lowers emissions
- Renewable

#### The Bad

- Attracts water
- Causes corrosion
- Lowers MPG
- 3-5% Lower Torque

#### The Ugly

- Gelling
- Creates Deposits on Injectors

# We Don't Use Biodiesel – Yes you Do

## ASTM Standards

The first national biodiesel specification in the USA was the [ASTM](#) standard D6751, "Standard Specification for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels", adopted in 2002. The D6751 standard covers biodiesel (B100) used as a blending component with petroleum diesel fuels. Requirements and test methods of the D6751 standard are discussed in detail in the [Biodiesel Fuel Standards](#) paper.



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No standards currently exist in the USA that would cover neat biodiesel (B100) for use as automotive fuels. In 2008, ASTM adopted two separate specifications: (1) for biodiesel blends of B5 or less and (2) for biodiesel blends from B6 to B20.

Blends of B5 or less were incorporated into the diesel fuel standard, ASTM D975. Up to 5% biodiesel can be blended into No. 1 or No. 2 diesel fuel so long as:

- the biodiesel component meets the requirements of ASTM D6751 and
- the final blend meets the requirements of D975.

Labeling of the of the finished blend is not required so that it may not be possible for the purchaser to know whether or not the fuel contains biodiesel unless an analysis is carried out.

Requirements for blends from B6 to B20 are covered by the ASTM D7467 specification.

- **Source: ASTM International - international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.**

## Bio-Diesel Fuel Negative Characteristics

- Hygroscopic – Attracts and Holds Water in Suspension (10X normal diesel fuel)
- Gels at Relatively High Temperature
- Unstable – Begins to Oxidize and Breakdown in Relatively Short Time
- Readily Supports Bacterial Growth
- Easily Forms Gum, Varnish, and Carbon Deposits
- Higher Levels of NOx Emissions
- Less energy (Btu's) per gallon (B100 has 89% of #2 FUEL)
- Lower Cetane Rating than manufacturer's recommendations
- Affects Engine Warranties of some Manufacturers

# What is Gelling?

- **Diesel Fuel contains paraffin wax in two forms,**
  - liquid wax that is in suspension in the fuel
  - wax crystals that are floating throughout the fuel.
- **Cloud Point (CP) –**
  - fuel reaches its Cloud Point wax in the fuel has begun attaching itself to the wax crystals making them large enough to be seen with the naked eye. This wax will appear as a cloud-like formation floating in the fuel.
- **Cold Filter Plug Point (CFPP) or Gel Point –**
  - As the fuel temperature drops the wax crystals continue to get larger and will begin to stick to each other. At this Cold Filter Plug Point (CFPP) or Gel Point the fuel will have difficulty passing through fuel filters. This is the critical point at which it can become difficult or impossible to operate an engine or burner.
- **Pour Point (PP), -**
  - As the temperature continues to drop the fuel can become a semi-solid, this is known as the or the point at which fuel will no longer pour.



# Complete Fuel Treatment



**Iced Fuel**



**Gelled Fuel**

## Complete Fuel Treatment

- Removes Water
- Cleans Injectors
- Boost Cetane
- Lubricates
- Stabilizes
- Prevents Gelling
- Prevents Icing
- Inhibits Corrosion
- No Alcohol
- Effective on Bio
- Burns Clean

**Clean Burn Technology**

# KEROSENE FUEL

## Not All it's Blended Up to Be

- The rule of thumb is that mixing in ten percent kerosene will lower the cold filter plugging point of a diesel fuel blend by 2-5 degrees Farenheit. (Assuming it is added correctly by vendor)
- Contains Less Lubricity
- Contains Less Cetane
- Costs More



**Summary – More expensive, less efficient, less power – MORE PROBLEMS!**

# IOWA CENTRAL Fuel Testing Lab

## Base Fuel

## With CFT 1:1000

Iowa Central Fuel Testing Laboratory  
Four Triton Circle  
Fort Dodge, Iowa, USA 50501



### Diesel Certificate of Analysis, ASTM D 975 - 18a

Customer Name: Iowa DOT  
Customer Address: 800 Lincolnway  
Ames, IA 50010  
Customer's Sample ID: #2 Diesel Agriland FS Winterset-no additive  
Sample Type: #2 Diesel

Sample ID: 011719A  
Customer ID: IA DOT  
Received on: 1/17/2019  
Completed: 1/23/2019

Grade 2-D 515					
Test	Method	Result	Unit	ASTM limit	Pass/Fail
Flash point, closed cup	D 93		°C	52, min	
Water and Sediment	D 2709		% volume	0.05, max	
Distillation at 90% rec.	D 86		°C	282 - 338	
Kinematic Viscosity cSt@40°C	D 445		mm <sup>2</sup> /sec.	1.9 - 4.1	
Ash	D 482		% mass	0.01, max	
Sulfur	D 5453		ppm	15, max	
Copper Corrosion at 50°C	D 130		n/a	No. 3, max	
Cetane Number	D 613 <sup>A</sup>		n/a	40, min	
Cetane Index	D 4737 <sup>B</sup>		n/a	40, min	
Cloud Point	D 2500	-11	°C	Report	Report
Ramsbottom Carbon Residue (10% bottoms)	D 524		% mass	0.35, max	
Lubricity, HFRR	D 6079 <sup>A</sup>		micron	520, max	
Conductivity	D 2624 <sup>A</sup>		pS/m	25, min	
One of the following properties must be met:					
Cetane Index	D 976		n/a	40, min	
Aromaticity	D 1319 <sup>A</sup>		% volume	35, max	
Other Tests:					
Biodiesel Content	D 7371		% volume	Report	
Cold Filter Plug Point	D 6371	-13	°C	Report	Report
KF Moisture (coulometric)	D 6304		ppm	Report	
Pour Point	D 97	-36	°C	Report	Report
Notes:					

<sup>A</sup> Performed by outside laboratory.

<sup>B</sup> ASTM D 4737 may be used instead of D 613 if fuel sample is not additized.

Approval: *Michael A. Hart* Title: QMR or designee Date: January 23, 2019

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REC 7.1.3 V-6

Base Fuel – No additive  
CFPP- 13C or +8.6F

Iowa Central Fuel Testing Laboratory  
Four Triton Circle  
Fort Dodge, Iowa, USA 50501



### Diesel Certificate of Analysis, ASTM D 975 - 18a

Customer Name: Iowa DOT  
Customer Address: 800 Lincolnway  
Ames, IA 50010  
Customer's Sample ID: #2 Diesel Agriland FS Winterset-with additive  
Sample Type: #2 Diesel

Sample ID: 011719C  
Customer ID: IA DOT  
Received on: 1/17/2019  
Completed: 1/23/2019

Grade 2-D 515					
Test	Method	Result	Unit	ASTM limit	Pass/Fail
Flash point, closed cup	D 93		°C	52, min	
Water and Sediment	D 2709		% volume	0.05, max	
Distillation at 90% rec.	D 86		°C	282 - 338	
Kinematic Viscosity cSt@40°C	D 445		mm <sup>2</sup> /sec.	1.9 - 4.1	
Ash	D 482		% mass	0.01, max	
Sulfur	D 5453		ppm	15, max	
Copper Corrosion at 50°C	D 130		n/a	No. 3, max	
Cetane Number	D 613 <sup>A</sup>		n/a	40, min	
Cetane Index	D 4737 <sup>A</sup>		n/a	40, min	
Cloud Point	D 2500	-12	°C	Report	Report
Ramsbottom Carbon Residue (10% bottoms)	D 524		% mass	0.35, max	
Lubricity, HFRR	D 6079 <sup>A</sup>		micron	520, max	
Conductivity	D 2624 <sup>A</sup>		pS/m	25, min	
One of the following properties must be met:					
Cetane Index	D 976		n/a	40, min	
Aromaticity	D 1319 <sup>A</sup>		% volume	35, max	
Other Tests:					
Biodiesel Content	D 7371		% volume	Report	
Cold Filter Plug Point	D 6371	-35	°C	Report	Report
KF Moisture (coulometric)	D 6304		ppm	Report	
Pour Point	D 97	-48	°C	Report	Report
Notes:					
Sample #2 Agriland FS Winterset-no additive (011719A) treated with Entertech Labs Additive (011719B) at 1:1000 to create #2 Diesel Agriland FS Winterset-with additive (011719C).					

<sup>A</sup> Performed by outside laboratory.

<sup>B</sup> ASTM D 4737 may be used instead of D 613 if fuel sample is not additized.

Approval: *Michael A. Hart* Title: QMR or designee Date: January 23, 2019

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REC 7.1.3 V-6

Base fuel treated with CFT Single Treat 1:1000  
CFPP -35C or -31F

Temp drop of 39.6F degrees

# Testimonial

## Great Products - Great Results

### •Independent Trucker



2007 International 9900i  
Cummins Engine

### •Enerfuel Treatment

#### •Immediate results

•Customer noticed and increase in power.

•His onboard diagnostic system noted a .3  
MPG increase - 6.1mpg - 6.4mpg



### •Colonial School District



300 Bus Fleet

### •Problem

•Fleet was plagued by EGR, Turbo and injector failures.

### •Solution – Complete Fuel Treatment (Bulk Tank)

- Driver Noticed a performance difference.
- Stopped purchasing winter blended fuel
- EGR Failures Ceased
- Turbo Coking Creased
- Injector Failures Ceased
- After 1 year the fuel buyer noted that 1 less 7,500 gallon delivery was purchased. Yearly mileage to fuel consumption comparison yielded .2mpg increase





# Gasoline

## The Change from MTBE to Ethanol

### Ethanol in Gasoline



#### The Good

- Boosts octane
- Oxygenates fuel
- Lowers emissions
- Renewable

#### The Bad

- Attracts water
- Causes corrosion
- Lowers economy
- Creates deposits

#### The Ugly

- 30 day shelf life
- Phase Separation
- Catastrophic Engine Failures



# Phase Separation

- Phase Separation happens when E10 Gas becomes saturated with water. The water will separate from the Gasoline pulling the Ethanol to the bottom.

- Phase Separated Gasoline

Causes  
Corrosion

Confuses fuel  
systems

Lowers Octane

Removes  
Lubrication



Deposits

- Phase Separated Gasoline Dissolves

Copper  
Bronze  
Brass  
Aluminum  
Fuel Line  
Fiberglass  
And more...



Rusted fuel system



\$2,300 Repair

2005 Escape burning  
phase separated fuel



Oxidized Aluminum





# Thank You

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