Why Diesel TEK CL-8?

Our two part system was developed to address EGR and its effects on diesel engine longevity, fuel economy and potentially harmful engine conditions.

Our industry lives from oil sample to oil sample. Oil samples are used to determine necessary maintenance procedures, diagnostics and current diesel engine conditions.

What is soot and what causes it?

Soot is a by-product of the combustion process in a diesel engine — a carbon residue formed from fuel air and moisture in the combustion chamber after ignition. Soot particles are held in suspension by dispersant additives in the oil preventing the soot particles from agglomerating (sticking together) and attaching to the rings, pistons and liners. These suspended particles are what turn diesel engine oil black. When too much soot is generated and the additives can no longer keep it suspended, deposits will form on the rings weakening the seal between the pistons and cylinder liners. Upper end wear to rings, liners and pistons begins and if not corrected, will eventually cause severe lower end wear to the main and rod bearings, crankshaft, camshaft, cam bushing and turbo bearing. **Direct Quote: Polaris Laboratories**

Cummins ISX piston with EGR at Pittsburgh Power
The rings are stuck from soot and carbon causing it to destroy itself

Detroit Series piston 60 at Pittsburgh Power with the same issue

The problems with EGR in use on diesel engines today after the previous last decade are as follows: Raw dirty exhaust is circulated back into the combustion process through the EGR system. This raw exhaust consists of unburned fuel particles, soot, particulate matter, carbon particles and other solids and gaseous materials. The EGR system was federally implemented to reduce oxides of nitrogen (NOx). EGR elevates engine oil operating temperatures causing greater demands on engine lube oils. EGR causes higher levels of soot content in the lube oil. We can use the following formula to determine an approximate amount of continuous soot contamination:

Soot will enter the lubrication oil at the rate of .0048 oz for every gallon of fuel burned. A truck will burn 1,786 gallons of fuel every 12,500 miles, at 7 mpg. During this 12,500 mile interval, more than half a pound (8.75oz) of Soot will enter the oil. Direct reference: Society of Automotive Engineers

Soot is a solid; it is very abrasive and will cause damage to engine components and turbo chargers that depend on a steady supply of good clean lube oil.

The typical Cummins ISX engine equipped with EGR found in use today will leave up to a half a gallon of used lube oil inside the engine during a normal oil change service. This filthy, sludge filled soot contaminated mass immediately mixes with the new, fresh lubricating oil replaced during a standard preventative maintenance service. This is in our opinion anything but normal, but this is the normal standard that the industry operates at today. The old oil degrades the new oil the moment the engine is started.

When we outline what is normal diesel operation, EGR further ads to the engine degradation by providing more and more contaminates to the combustion process as we move on a forward engine service life timeline. Through normal diesel operation, more and more contaminants are produced and consumed during the combustion process. A typical 15 liter diesel can consume one gallon of lube oil for every 10,000 miles driven.

A look at soot and the operation of the diesel engine:

Excessive Oil Contamination

This occurs when the oil's limit for handling combustion contaminants is exceeded. Filters plugged in this way have a heavy buildup of organic sludge. This kind of contamination is caused by fuel soot, oxidation products, and products of combustion which have accumulated in the oil to the point that the filter is no longer able to function. Causes of this kind of plugging include excessive oil change intervals, poor maintenance practices, and high blow-by.

During normal engine operation, the engine oil becomes contaminated from combustion, as well as from wear debris and oxidation products. Engine oil filters do **not** plug during the normal oil drain interval as long as the engine oil remains suitable for use in an engine. A filter that plugs is performing its intended function of removing particulate matter and sludge from the oil. Filter plugging is the result, **not** the cause, of an engine or lubricating oil problem.

Causes of filter plugging **must** be investigated, as a plugged filter can indicate a serious engine problem that **must** be corrected.

Direct Quote: Cummins Corporation Service Bulletin 3810340-06

Diesel TEK Quote: ***An oil filter that plugs causes a drop in oil pressure. We have worked with fleets and owner operators that have had their engines shut off from plugged oil filters. This is a safety hazard on any road or highway and low oil pressure will destroy a diesel engine.***

Recently, an engine oil sample was tested to determine the root cause of a failure that resulted in an engine seizing. Initial observation of the oil sample showed it was thick and almost gel-like.

Common causes of engine oil thickening include highly oxidized oil, glycol contamination, thermal degradation and **severe soot contamination**. Initial analysis of the oil sample revealed that the oil was relatively new (additive elements were similar to the reference oil), it did not appear to be oxidized (reasonable acid number), and there was no sign of glycol contamination or wrong oil added (no unusual additive elements were present in the used oil that did not show up in the reference oil).

To sample for soot load, a pentane and toluene coagulated insolubles test (ASTM D893) was run on the sample and results indicated less than 1 percent solids in the sample. However, when a thermogravimetric analysis (TGA) test (ASTM D5967) was run, it reported about 15 percent soot, a huge discrepancy. Generally, results of these tests should correlate, but in this case they seemed to disagree with each other. To investigate further, two additional pentane insolubles tests by membrane filtration (ASTM D4055) were run.

Direct Quote Noria Corporation Article

Navistar

The EGR systems on Navistar's proprietary MaxxForce engines reduced engine efficiency, caused them to overheat and **produced an excessive amount of soot inside the engines**, the lawsuits claim, and the 15 MaxxForce-powered International trucks Americorp bought in 2011 **had to be taken to the shop for repairs more than 100 separate times**, the carrier says

The downtime and repair costs run counter to Navistar's assurance to Americorp that the trucks "were in perfect working order and without defects" at the time of purchase, according to the lawsuit.

Americorp and the other carrier say the engines cost them loss of profits; downtime expenses and losses; diminished resale value; out-of-pocket repair expenses; fuel expenses incurred in excess of represented amounts; towing expenses, lodging expenses for drivers; rental car expenses; unreimbursed driver downtime; loss of revenue; and other damages - See more at: http://www.ccjdigital.com/carriers-sue-navistar-over-alleged-defects-of-its-egr-only-maxxforce-engines/#sthash.bg4ZQlTl.dpuf

EGR has an impact on the engine oil in three main ways: – Increased Soot Levels

• Abrasive wear

• Deposit and sludge formation

• Viscosity increase and loss of pumpability – Increased Acid Levels

• Accelerated depletion of the oil's TBN

• Increased risk of corrosion – Increased Heat Levels (10% to 40% more) • Accelerated rate of oxidation • Increased deposit formation

• Viscosity increase and loss of pumpability

• Creation of more acidic compounds

Soot Levels

• Increasing use of EGR to control NOX has resulted in more soot being introduced into the engine oil – Type of soot that is produced by EGR engines is different than that is produced by non-EGR low emissions engines – More prone to agglomeration and build-up in the engine oil

• If soot is not properly managed and dispersed by the engine oil's additive chemistry it can: – Cause excessive wear

• Crosshead of the slider cam follower or cam roller followers, camshaft lobes, pistons, piston rings and cylinder walls – Deposit formation

• Valve decks, in the oil pan and on the pistons and rings – Excessive bore polishing

• Loss of oil control Increase and thickening in viscosity

• Viscous to flow during high and low temperature operation

Direct Quote: **Lawrence Ludwig, Jr. CLS, OMA, CMFS**
HEAVY DUTY DIESEL ENGINE OIL CHALLENGES
Prepared for Schaeffer's Oil Corporation

The Big Issues

According to technicians, maintenance managers and service managers, different engines have different issues.

Cummins engines have had troubles with the EGR valves, as can be seen by the different locations with each generation of the ISX. In the earliest EGR engines, the valve was located on the hot side of the engine. For 2007 it moved to the opposite side of the engine, but by all accounts this has not eliminated all problems with the valve. So for 2010 there is a complete redesign of the way the valve works.

(On one occasion, early in the evolution of EGR on the Cummins 15-liter, we had a fleet service manager tell us that they had great success in dispensing with the EGR valves altogether and running the engines without the backflow of exhaust. This of course, is not how the system was designed to work, **and they were running out of emissions compliance**. But as this fleet manager told us, at least they were running.)

The ISX has also had turbocharger issues of late, reported a senior diesel mechanic with a large dealership group. The problem is with the sliding member within the turbo sticking, possibly **due to coking of oil** that gets by the seal. Since this turbo is also used on Volvo, Mack and Detroit Diesel DD 13 and 15 engines, this may start to appear on them, too.

Direct Quote: http://www.truckinginfo.com/article/story/2010/01/engine-of-opportunity.aspx

1. **Solid Particle Contamination:**
   The trucking industry has generally recognized, backed by numerous tests and studies over the last 40 years, **which particulates within the 1 - 15 micron range are responsible for "normal" wear and tear within an engine**. Detroit Diesel specifically found that particle sizes below 2 microns had little to no effect on engine surfaces while **particles between 3 and 22 microns are responsible for the majority of engine wear damage**. As stated, this should concern many engine owners because a full-flow filter only effectively removes particles in size of 40 microns, and some new filter specs as low as 25 micron and larger. **By removing these contaminants, the oil will offer a better seal between the rings and liners and therefore reduce the amount of "blow-by" during the combustion process. "Blow-by" contributes to the amount of oxygen, unspent fuel, and moisture within the engine oil.**
   Direct Quote: http://www.lubetrak.com/newsletter/May12HTML.html

   As we research the attached materials we find that EGR, Soot and all of the other contaminates have a destructive effect on diesel operation since the introduction of EPA Federal mandated emission control systems.

   EGR produces excessive soot causing lube oil viscosity issues that lead to excessive heat. Soot is a solid and a know abrasive that is run through “free flow” oil filters that are recommended by the engine manufacturers. These free flow filters trap particles 40 micron and above leaving 3 to 22 micron abrasive particulates to run free and destroy the engines polished surfaces such as premature camshaft failures in the Cummins ISX engines.

   We have seen evidence referenced above that say very clearly that particles from 3 to 22 micron in size cause engine wear and eventual damage.

   We have quoted industry experts and can clearly state “diesel engine contaminates, specifically soot will cause premature engine wear and excessive downtime”.

   Our Motto:

   A clean engine operates at peak performance

Our Diesel TEK solution

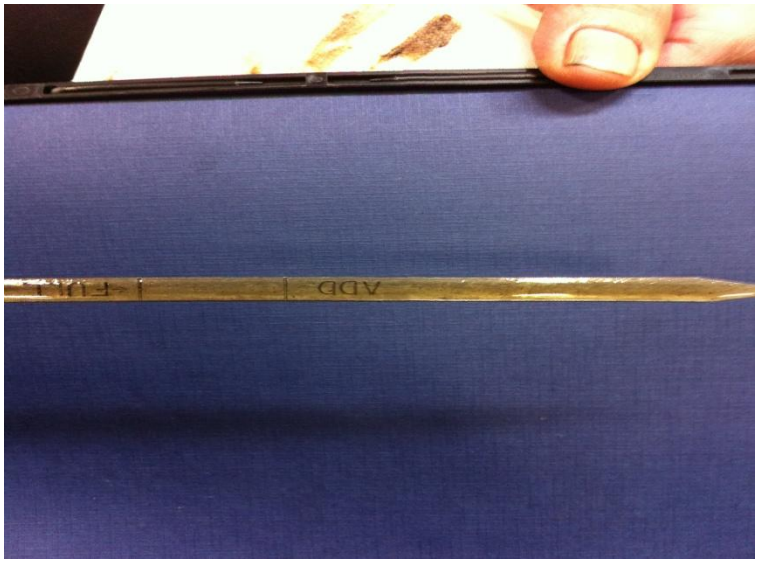
Diesel TEK has developed the CL-8 Engine Cleaning Machine that utilizes a propriety cleaning solution made from a light lubricating oil and cleaning detergents found in high grade diesel motor oils. The second part is a fuel treatment that adds a lubricating quality and detergents to the diesel fuel.

With our equipment we create a closed loop controlled environment to remove carbon, soot and all of the other contaminants caused by diesel operation and specifically EGR.

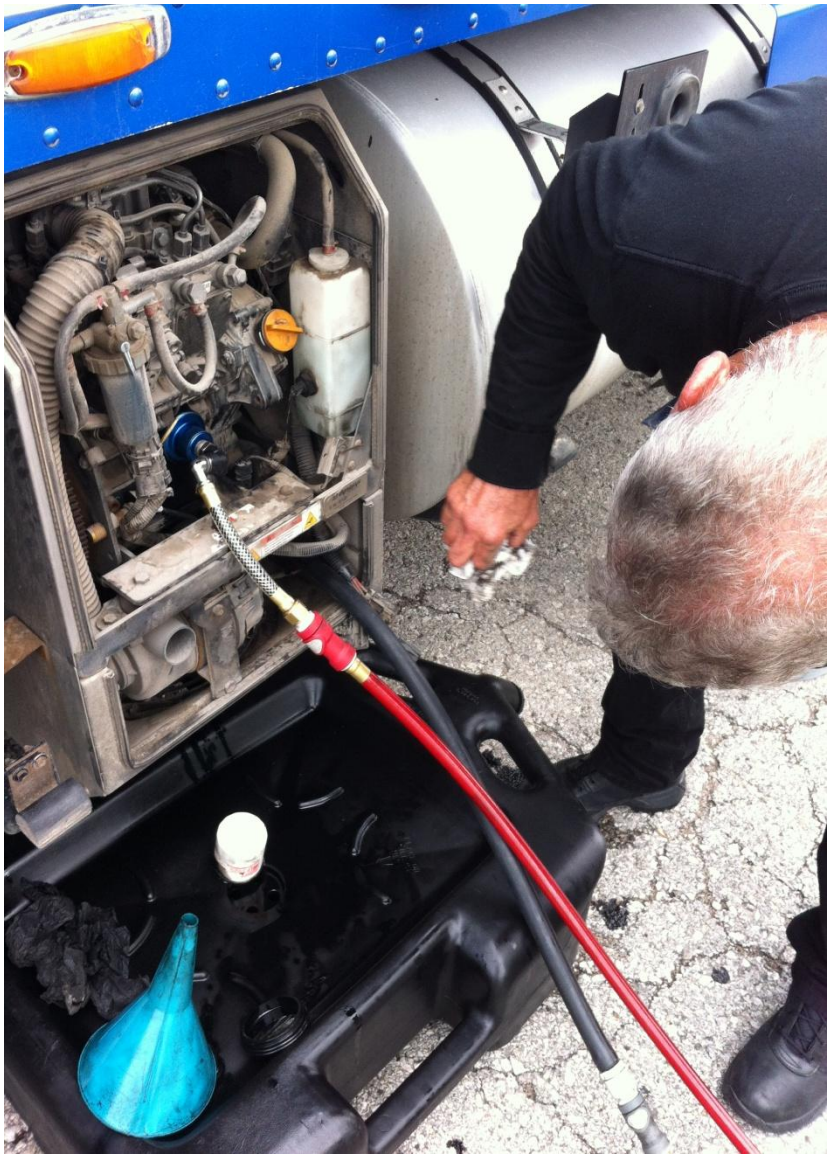
The red line (pressure line) is hooked to our patented adapter that is threaded onto the oil filter housing. The black line (evacuation line) is hooked to our patented drain plug adapter.
Our equipment is used with 24 gallons of our cleaning solution. Through the red line we first run our cleaning solution through a 3 micron filter as it is pushed from our tank ensuring that only clean light lubricating oil with our detergents are entering the engine. The solution is pushed at 38 to 42 psi up through the top half of the engine and run back down into the oil pan. When the cleaning solution is pushed down into the pan it is backflushing the oil passages, oil pump and oil pump pick up screen removing any contaminant buildup that could reduce operational oil pressure.

The solution is then evacuated from the oil pan through the drain plug and run through another 3 micron filter. This service is a “static” cleaning service. This service is broken out into 4 equal pumping, soaking, evacuating cycles and it takes approximately 21 minutes from start to finish.

In the laboratory at Pittsburgh Power
Caterpillar C15 with 1.3 million miles



Our result, no contaminates, just clean clear oil

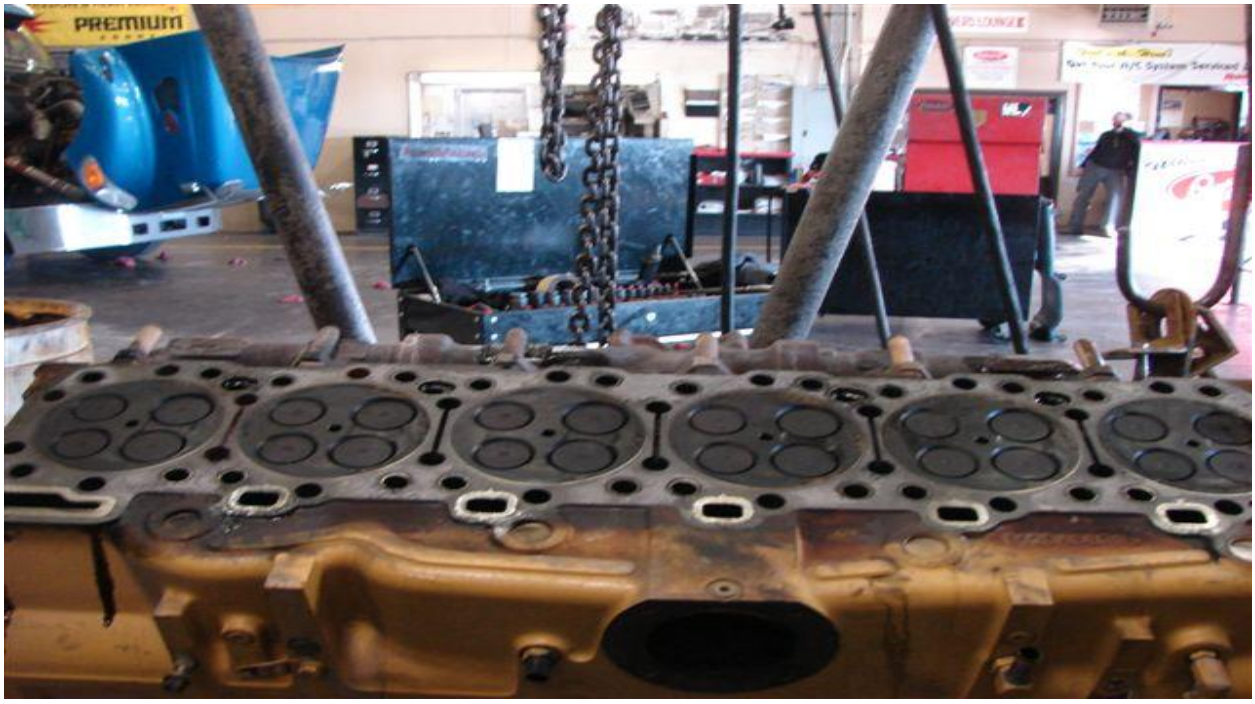


Cleaning a two cylinder APU generator after servicing the Cummins 15 liter main power plant

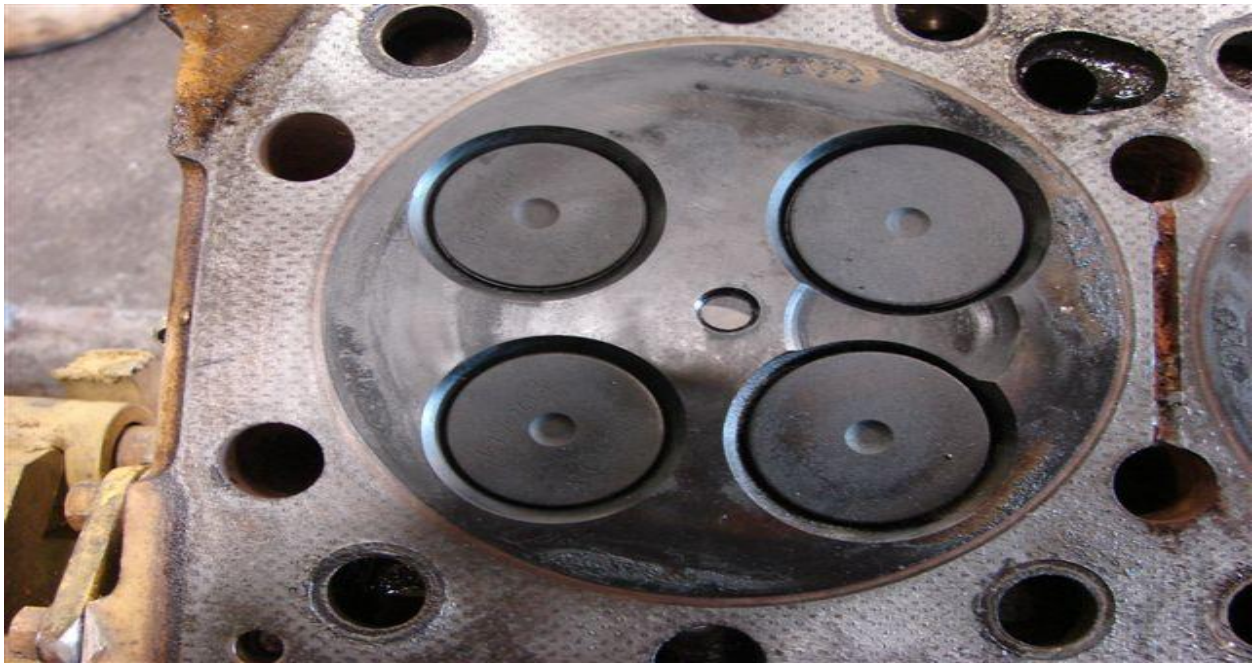
We recently cleaned a number of trucks and APU generators at a private training event in Kansas City, MO

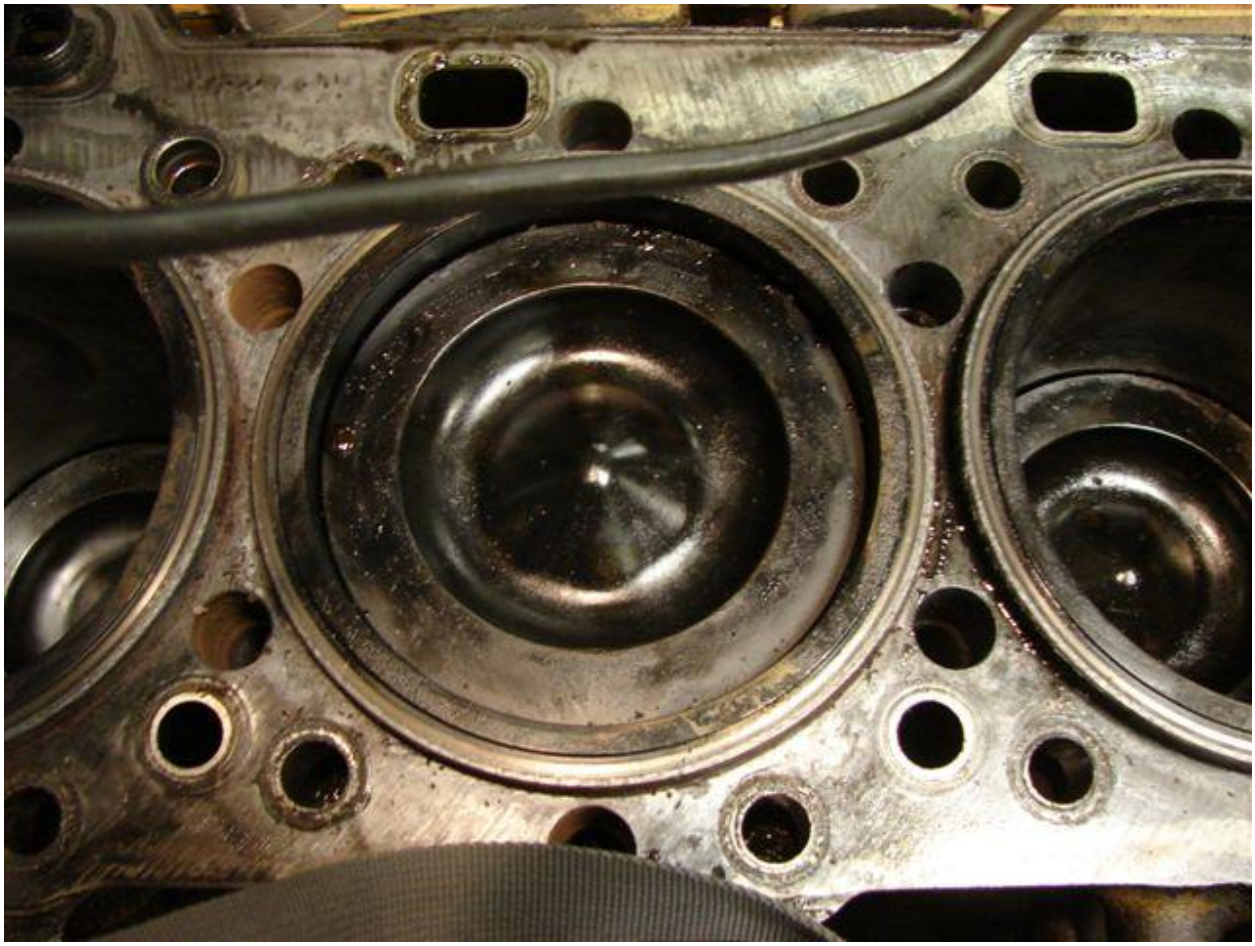
We have received reports from the owners of these truck that their oil stayed clean like the picture above for 5,000 to 8,000 miles before getting any color in it. David Olafson reported back to us that his oil sample came back from the second sample since our service with contaminate levels of a brand new engine, his Caterpillar engine has 1.2 million miles on it. David also reported his oil consumption is also back to what a new engine should be, he reported adding one gallon at 12,000 miles. Prior to our service he-

was adding one gallon of oil at 8,000 miles and was preparing for a rebuild and the associated downtime.



This is a Caterpillar C15 with over 500,000 miles on it that used our products for the last 120,000 miles. The Paccar factory technician at Joplin Peterbilt told us that this engine was so clean that he didn't need to clean it before putting it back together





We have worked with Peterbilt, Kenworth, Freightliner dealerships throughout the United States. We have worked with Pittsburgh Power, Speedco, Fleetpride and fleets like Coca Cola, 7Up, Swift Transportation, independent owner operators, the marine industry, the yellow equipment industries throughout our research and development stage.

We believe that we are the solution for the EPA federally mandated emission control systems that have created billions of dollars of financial burdens in downtime, training and hard asset parts during the past decade.

The Navistar lawsuits state hundreds of breakdowns, towing costs, lodging, deadheading, fuel costs and a host of other expenses from the issues described throughout the above materials.

We are resetting the bar for the oil sample industry. They have acceptable levels of contaminates. **We believe the only acceptable level of contamination is ZERO or as close as we can keep it to ZERO as possible.**

We are Diesel TEK a company created by technicians for technicians that solve real world issues that were created by our clueless federal regulators and idiotic Government bureaucrats.

We would like the opportunity to discuss our solutions with you, please let us know when we can have a few minutes of your time?

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