Trucking's Dirty LITTLE SECRET

A MAJOR DIESEL ENGINE PROBLEM HAS GONE UNDETECTED. AND IT'S DESTROYING FUEL SYSTEMS. IT'S DIRTY FUEL.

By Steve Sturgess, Senior Editor & George Morrison, Contributor

The mandate to reduce diesel engine emissions and increase engine performance and fuel economy has resulted in major technological advances in diesel engine fuel system design and sophistication.

The modern diesel engine is smoother running, quieter, more powerful, and yet much more environmentally friendly. The system can even diagnose its own problems.

This is all well and good. But a major diesel engine problem is currently going undetected – and it is destroying these precision fuel systems.

The problem is dirty fuel.

Ten years ago, maximum diesel fuel system pressures seldom exceeded 3,000 psi. Today's state-of-the-art fuel system pressures can be as high as 30,000 psi.

And therein lies the problem.

The issue became apparent some 20 years ago – not in fuel systems – but in newly developed high-pressure hydraulic systems that utilized servo valves. It was noted that hydraulic system component life was drastically reduced in the new high-pressure systems. And for no readily apparent reason.

Pumps and valves that had previously lasted tens of thousands of hours in low-pressure systems were failing in only hundreds of hours in the new high-pressure systems.

How does this relate to you and your vehicles? The modern diesel fuel system is essentially an ultra high-pressure hydraulic system. So the same issues and parts failures apply here.

In the case of the high-pressure hydraulic systems, it was determined that ultra fine particles that had not been a problem in lower pressure (1,000 psi or less) hydraulic systems were the cause of reduced pump, valve and component life.

Particles in the 5 to 10 micron size were determined to be the most abrasive particle size group and were the cause of severely reduced component life.

In particular, the 7 micron particle was the perfect fit between the micro-machined clearances and would grind away on metal surfaces, causing accelerated wear. This would result in reduced pump pressures, servo valve orifice erosion and degraded system performance.

As a result of this hydraulic system research, an International Standards Organization cleanliness coding system was developed that enabled lubrication engineers to establish target cleanliness levels for systems with operating pressures beyond 3,000 psi. By using these cleanliness levels, system life was extended and brought back to normal.

The ISO coding system addressed three particle size groups that were found to most affect high pressure component life – namely the 2 micron, 5 micron and 15 micron size ranges. By utilizing ultra-fine fluid filtration, the harmful particles could be eliminated and systems would be less vulnerable to failure as a result of contamination.

Since the modern diesel fuel system is essentially an ultra-high-pressure hydraulic system, the same requirements for ultra-fine cleanliness should apply directly to our fuel systems, right?

Wrong.

The fuel cleanliness issue begins at the refinery. There, the final fuel output filtration is typically 30 microns. Particles smaller than 30 microns are unfiltered and still remain in the fuel.

And the problem only gets

worse. After the diesel fuel has been taken from the refinery it goes through several transfers until it ends up in its final tank for distribution to vehicles. By this time, the fuel has picked up even more contaminants.

Poor ISO cleanliness levels can mean that for every gallon of diesel fuel entering that fuel system there are 263,719,875 particles greater than 2 microns, 49,163,365 particles greater than 5 microns, and 1,006,810 particles greater than 15 microns.

All of these particles are going right through your fuel pumps and fuel injectors.

Controlling Fuel Quality

Fuel filters at truckstops typically catch only 30 micron units and above. Consequently, they don't filter any of the most abrasive 5- to 10-micron particles.

The same is true for truck engine filters – most of which are nominal 15-micron filters.

For most diesel engines, with every gallon of diesel fuel burned hundreds of millions of abrasive particles have cut their way through the fuel pump and injector system.

As a result of this high amount of ultra-fine dirt contamination, high-pressure fuel pump and injector life is going to be greatly reduced.

Silently and gradually the fuel system degradation proceeds until decreased performance finally becomes noticeable or the truck just quits running.

All during this process the truck uses more fuel, creates more pollution, develops less horsepower, and becomes less efficient each day.

To this point, the typical truck operator is unaware of the problem. But there is much that can be done to protect sensitive fuel systems from dirt and contamination by way of quality control and good housekeeping with fuel stored at terminals.

First, the fleet must test the diesel fuel source to find out exactly what it is purchasing. Diesel fuel is the trucking industry's No. 1 commodity cost of operation. Yet very few companies regularly test their diesel fuel quality.

The recommended fuel tests should be for cetane index plus ISO cleanliness code.

If a trucking or construction company has its own fuel tanks, fuel tests should be run for both incoming and output fuel from the tanks. Often, fuel is being contaminated by dirt already present in storage tanks.

Poorly maintained storage tanks can also contain significant amounts of water, which results in microbe and algae growth that can cause fuel filter clogging. The acidic by-products of microbe life causes tank inner wall corrosion, further increasing fine fuel contaminants.

Once fuel quality and contamination are determined, a plan can be implemented to reduce contaminant levels.

Read the story beginning on page 82 to learn how to clean up that dirty fuel.

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THE HIGH PRICE OF INJECTOR FAILURES

Because of the fine filtration, a two-micron filter clogs easily. Dealing with this problem, fleets simply increase the filter screen, but at the cost of many thousands of dollars in fuel system deterioration that will manifest itself as poor engine performance, fuel dilution of lube oil, failed pumps and, more and more frequently, it seems, failed injectors.

Typically, the injector failure from solids contamination is progressive. A gradual loss of performance and increase in smoke may well go unidentified. However, as the injector spray holes erode, the precise combustion is degraded. Ultimately, wear in the injector leads to slobbering and increased fuel in the lubricating oil. At the same time, fuel economy falls.

Water contamination, though, may well be more dramatic, resulting in the tip of the injector being blasted off.

And over the years, the cost of an injector has escalated in parallel with its increasing complexity and closer manufacturing tolerances. An electronic unit injector is a significant service item. Some maintenance managers are saying injector maintenance is a new line-item in their budgets, with replacement at lower mileages accounting for as much as a 75-cents-per-mile increase in operating costs.

This injector failed due to contaminant exposure. Note the damage to the tip.