



Prolonging the life of

# Emissions Hardware

By Blaine Ballentine

As emissions have tightened in recent years, diesel engine manufacturers have added additional hardware to comply. Each additional part means there is another part that can fail.

Below is a brief discussion of some of the emissions related pieces, and an easy way to prolong their life and reduce the cost of owning them.

## Particulate Mater

The engine and the EPA have a common enemy—soot. The EPA calls it particulate matter, but it is incompletely burned fuel, more commonly known as soot.

To keep nitrogen oxide emissions low, engine manufacturers use exhaust gas recirculation. Unfortunately as one type of emission is lowered, another increases, and in this case that emission is particulate matter. This soot can build up on components, causing them to plug or fail.

Engine operation, injector cleanliness, and fuel quality are variables in the production of soot. The engine produces more soot at idle than when under load, so prolonged idling should be avoided. Obviously, clean injectors provide more complete atomization, a more complete burn, and consequently less soot. Higher cetane fuels ignite more readily, burn more completely, and thereby, produce less soot.

Not all soot is created equal. Although soot is incompletely burned fuel, the degree of incompleteness can change the characteristics of the soot. A wet sticky soot is more problematic than a dry powdery soot. Idling at low temperatures will tend to produce a wetter soot than working at normal speeds

and loads.

Cetane is a measure of diesel fuel combustibility, and low cetane fuels produce more soot. The Truck and Engine Manufacturers Association states that “higher cetane generally enables improved control of ignition delay and combustion stability, especially with modern diesels which use high amounts of exhaust gas recirculation (EGR).”<sup>1</sup> Although the government requires a minimum cetane of 40, testing by Ford engineers shows that cetane levels in the mid 30s are commonplace<sup>2</sup>. Engine manufacturers have requested that the ASTM raise the minimum cetane requirement in the U.S. from 40 to 43<sup>3</sup>, but they really want cetane levels of 53 to 55<sup>4</sup>.

## EGR

To keep nitrogen oxides low, some of the engine’s exhaust gas is recirculated into the intake.

Of course, exhaust gases are hot and raise the temperature of intake air, affecting its density. Therefore, manufacturers use an EGR cooler to lower the temperatures of exhaust gasses before they enter the intake stream.



The EGR cooler is like a radiator inside a pipe, except engine coolant is used to cool the air instead of the other way around. You are probably

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remembering the last time you burned yourself on a radiator and wondering how the hot coolant can lower



### Variable Vane Turbochargers

Manufacturers use variable geometry turbochargers to improve throttle response and increase efficiency. These turbos have vane extensions that pivot to change the pitch of the vanes. Essentially, they change the size of the fan catching the exhaust stream to vary the amount of boost.

The variable pitch vanes work in the sooty environment on the exhaust side of the turbo. When they become encrusted with excessive soot, they stick. Then the “check engine” light comes on, signaling an expensive repair.

Once again, if you use a Cen-Pe-Co fuel additive that increases cetane, the engine runs more efficiently, producing less soot, and the variable geometry turbo charger lasts a lot longer.

### Diesel Particulate Filters

One final piece of hardware we will discuss is the diesel particulate filter. This filter is in the exhaust pipe, and as the name suggests, it is designed to catch particulate matter—soot. Soot is mostly carbon, and when the filter becomes really hot, the carbon in the soot is converted to carbon dioxide,

exhaust gas temperatures. Keep in mind that although coolant is hot to the touch, it is much cooler than exhaust gases leaving the cylinder.

Soot can plug EGR coolers. Since incompletely burned fuel is the culprit, burning the fuel more completely will prolong EGR cooler life. If you use a Cen-Pe-Co cetane improving additive, the engine operates more efficiently, creating less soot, and the EGR cooler lasts longer.

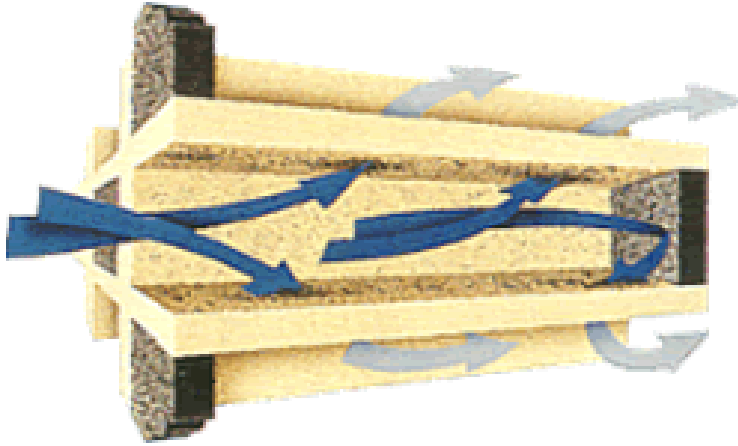
The amount of exhaust gas recirculation needed varies with load and RPM. It is controlled by the EGR valve. Soot can plug the valve or cause it to stick, and it has to be removed and cleaned or replaced. Again, if you use a Cen-Pe-Co cetane improving additive, the engine operates more efficiently, creating less soot, and the EGR valve lasts longer.

That is why Ford recommends a cetane improving additive to maintain smooth and efficient operation of EGR valves in their diesel pickup trucks<sup>5</sup>.



which will pass on through the filter. So, when the diesel particulate filter becomes plugged with soot,

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getting it really hot will unplug it.

Temperatures in the filter are generally high enough when the engine is working hard to prevent plugging with soot. However, when the engine is idling or lightly loaded, the diesel particulate filter begins to plug. A dash light illuminates, telling the driver that the DPF needs to be regenerated. During regeneration, diesel fuel is burned in the exhaust pipe, either from an additional injector in the exhaust pipe or regular injectors firing as the exhaust valve opens. Regeneration gets the DPF really hot, converting carbon to carbon dioxide and cleaning the filter.

Regeneration should not be a problem in highway trucks or field tractors as their operation keeps the DPF hot. Passenger vehicles, garbage trucks, delivery trucks, dump trucks, and other diesel vehicles that are lightly loaded and/or spend a lot of time idling need to regenerate their DPFs periodically.

Not only is regeneration a waste of fuel, it is a waste of time. You are sitting in a parking lot waiting for your DPF to regenerate instead of making deliveries. Or worse yet, you are paying someone

to sit in a parking lot to wait for the DPF to clear instead of making deliveries.

If you use a Cen-Pe-Co fuel additive that raises cetane, the engine runs more efficiently, produces less soot, and the DPF does not need to be regenerated as frequently, reducing cost and downtime.

### Conclusion

Cen-Pe-Co diesel fuel additives have always paid returns to their users. As diesel fuel injection systems and emissions systems become more complicated and expensive to repair, our diesel fuel additives yield higher returns.

Cen-Pe-Co fuel additives increase cetane, allowing the engine to burn fuel more completely. More complete combustion means less soot, prolonging the life of emissions equipment and variable geometry turbochargers, and diesel particulate filters do not need to regenerate as often.

Of course, the other side of burning the fuel more completely is that more of the fuel is converted to power, increasing fuel efficiency. And we have not even mentioned injector cleaning, lubricity, fuel stabilization, rust inhibition, fuel filter plugging, productivity, or other benefits.



### References

1. "The Worldwide Fuel Charter, Proposed 5th Edition," EMA Publication, Truck and Engine Manufacturers Association, 12/2012
2. Motorcraft Cetane Boost Video, [http://www.youtube.com/watch?v=tVq\\_-5xhIP0](http://www.youtube.com/watch?v=tVq_-5xhIP0)
3. "North American Ultra Low Sulfur Diesel Fuel Properties," EMA Position Statement, Truck and Engine Manufacturers Association, 8/18/2005
4. "The Worldwide Fuel Charter, Proposed 5th Edition," Ibid.
5. Motorcraft Cetane Boost Video, Ibid.



*Above: Manning the booth at the 2013 Ohio Power Show (from L to R) Duane Tooman, OH; Milt Boerger, OH; Dale Thomas, OH; and Dave Fitzpatrick, OH.*

*Right: The Silver Bullet Pulling Tractor on display at the 2013 Ohio Power Show. The Silver Bullet was a big draw for potential customers at the show. Thanks to the Lustik's for helping out and answering many questions at the show.*



*Left: Pete Hikel from Diesel Fuel Systems Inc. helps work the Cen-Pe-Co booth at the 2013 Construction Expo of Maine. Pete's expertise in the diesel fuel injection and performance industry provided great insight to those that stopped at the booth.*

