The Cleaning Crew

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The diesel particulate filter (DPF) clock has been ticking for more than two years now. Fleets that bought trucks with EPA 2007 engines will be reaching their maximum 250,000 mile service intervals soon and need to be removed from their trucks and cleaned.

"I think this has missed a lot of people," says Frank Nicholson, director of maintenance at Olathe, KS-based TransAm Trucking.

"The dealer that we have, MHC, which is one of the largest PACCAR dealers in the nation, they weren't even thinking about it until we started pushing on it," he says. "And it took me a while to think about it, so I think that the industry as a whole is just dealing with the everyday fires and I think this is just going to be Pandora's Box when it starts hitting hard and heavy.

"Due to the fact that we have so many of these DPF-equipped units on the road, I have done my share of due diligence on the subject, and see some disturbing problems."

Where are the DPF cleaners?

Disturbing is putting it lightly. TransAm bought 300 2007 trucks, and when some of them started coming due for their first-ever DPF cleaning, Nicholson immediately started running into trouble.

"We're finding that, across the country as a whole, there are not but a handful of dealers that have any idea what they're doing," he says. "And I'm speaking specifically about our specific fleet, meaning a PACCAR product with a yellow engine.

"Not every one of the distributors is going to have one of these machines, so you're stuck trying to get it cleaned only where there is one," Nicholson goes on. "And a distributor's hours may be different from a dealer, which is 24/7. So you've got to wait until that place is open to get your DPF cleaned.

"And, the knowledge (of DPFs) across the country is very, very limited; it's not as simple as rolling in, pulling the unit off, sticking it on the machine and getting it cleaned, at least not with Caterpillar."

On the contrary, Nicholson explains: when a truck is taken in for a DPF cleaning, it must first go through an active or a forced regeneration, to burn off the material in the DPF. Only then can the filter element be taken off the truck and placed in the machine for cleaning. After it's cleaned, the DPF's flow rate must be tested to make sure it matches the manufacturer's setting. If it passes, it can be reinstalled and the truck can be on its way.

But here's the catch: the truck's computer has to be reset to show that the DPF has been cleaned. "If somebody doesn't reset that and you put the DPF back on then it's done you no good," Nicholson explains. "And we know that, because the ones we've cleaned, the dealers didn't know that it had to be reset. We were actually checking them, following them, tracking them, and the fuel economy didn't get any better, and I thought,

'What the heck?' Well, after we got to digging into it, we realized that our engine manufacturer said, 'Oh yeah, by the way, this is what you've got to do.' Not even everybody at the engine manufacturer knew! We went back and got them reset, and now the fuel economy's starting to gain on these units."

Thermal Events

You may be wondering what exactly happens when a DPF reaches the ripe old age of 250,000 miles. Frank Nicholson can tell you.

"We sat through those cleaning presentations, and one vendor in particular said that while most fleets are concerned about fuel economy degradation, what they don't realize is that the farther you run these DPFs without cleaning them, (the more) you're going to start to deteriorate the DPF itself," he says. "Then you take a chance that, when you reach a point where you can't drive the vehicle anymore and you go to clean it, it's not cleanable. Not necessarily because they can't get it out, but it's had so many 'thermal events' inside the DPF that it basically breaks down the inside of the DPF and you have to replace the whole thing.

"Now you're looking at several thousand dollars to replace the DPF instead of several hundred dollars (maybe a thousand, depending on who you go to) for the cleaning."

The problem became real for Nicholson earlier this year when he had his first "thermal event breakdowns."

"Some trucks have had failures," he says, "and it's been a progressive failure, meaning that it had some injectors or turbo take a dump, and it doses that DPF with either fuel or oil, so when that happens, that's not the normal process of soot and ash that the DPF is supposed

to be handling. It now has oil or fuel in it. We've had some where they have done so many regenerations and have gotten to the point where they are restricted because they're at that 250,000 mile range, and we've had to pull them off and get them cleaned.

"That needs to be factored in," Nicholson stresses. "It's not just the fuel economy, although that's a big deal, your're also damaging the DPF."

"A Sophisticated Garbage Can"

After some early missteps, Nicholson has found what seems to be a winning strategy. He has persuaded his Kenworth dealer in Olathe, MHC, to purchase DPF cleaning units from Granite Falls, WA-based FSX, Inc. a process that has recently begun.

In late June, FSX co-owner Drew Taylor spent some time at MHC, where he trained technicians from both the dealer and the trucking company on the proper use of the new DPF cleaning machine, and he offers a description of the cleaning process that is both simple and complicated:

"A diesel particulate filter--also referred to as catalyzed regenerating technology--is the heart and soul of clean diesel technology," says Taylor. "What you have here is a very sophisticated garbage can, that's about the only way I can put it. It performs a very, very vital function, and it does it very, very well. It strips and burns off most of the hydrocarbon that is found in diesel emissions, and it does a very good job of protecting you and I, the truck drivers and the community at large from this very damaging, very toxic carcinogen. But there are some wrinkles that are starting to appear, that pose a threat to the bottom lines and the balance sheets of those that rely on this equipment--the fleets--that need to be addressed."

As Taylor describes it, the DPF operates in 'out of sight, out of mind' mode, and so drivers and fleet managers don't think about the build-up of ash inside the filter until the dash indicator comes on. The DPF can inventory a great deal of ash, but in time the ash reacts with the crystalline substrate of the filter, a ceramic wall that consists of billions of small pores between 11 and 15 microns in size.

"As long as these pores remain open the DPF breathes well," Taylor explains. "The hydrocarbon enters the DPF, and impinges itself on the substrate, and because it's such a high temperature--about 750 degrees Fahrenheit--it burns off there and leaves more or less harmless gasses to pass through to the other side. As long as that process goes on, everything's fine. But there are residues from the engine oil that do not pass through, and do not burn off, that continually, at a linear rate, build up. This is the ash."

Ash contains potassium and the calcium. "Those are the real bugaboos," says Taylor, because, between them, they cause the pores in the DPF to glaze over with a glass-like substance and clog up.

"So, it's very important to get the ash out, sooner than later," Taylor goes on. "You don't want to just sit there and let it build up, or you place your whole DPF pool at risk. The fleet owner needs that like he needs two heads. He's suddenly presented with a gigantic cost that he did not anticipate as he starts to see these DPFs go down right and left.

"There's a false sense of security out there, because people think they're getting their filters cleaned by the various processes that are out there, but, unfortunately, the processes that first came on the scene leave a lot of ash behind, and this process of 'sintering' goes on unabated," he explains.

Cleaning Solution

Frank Nicholson has considered cleaning machines from the three manufacturers on the market--SPX, Donaldson and FSX--but chose FSX because their machines have been cleaning DPFs on transit buses since 2005.

At his request, MHC Kenworth has installed its first FSX unit in Olathe, and will soon be installing a unit at a Texas dealership that also serves TransAm. After that, MHC will install the units in other facilities as demand increases.

"We don't have an option," says Nicholson. "We've already had some of these units that have failed, that have been cleaned, and it's better to be proactive and have scheduled downtime than it is to have unscheduled downtime. On-time is what we're all about. We're a 100 percent refrigerated carrier, and we don't have the option to have late loads."

In the end, Nicholson felt the most comfortable with the FSX machine because it uses "Knife Technology," in which an air knife blows through every single one of the 6,000 tubes in a DPF, from both sides of the unit. To Nicholson it's all about the efficiency of the filter after it's been cleaned.

"That's another thing that I think most people don't realize: if they don't pay attention to what they're really doing and don't do their homework and find out how efficient that (cleaning) device is before they get that DPF put back on, there are several different things that could be affected," he says. "One is fuel economy. Two is the second life of that DPF--in our case, it's a 200,000-250,000 window of life--but if it's not cleaned to 90 percent or better efficiency, we're not going to get that; in fact we'll get far less, in the second life. And then third, if it's not cleaned properly, you're going to get more of these thermal events that are happening, and then you have to look at not just cleaning the DPF but having it replaced."

How Clean Is Clean?

Would you be able to tell if a DPF was really clean? There are ways to tell, and, according to both Nicholson and Taylor, a DPF should never be returned to a truck without first being fully tested and certified.

"A service provider must have three things, to be able to successfully service a fleet," says Taylor. "He's got to first and foremost be able to clean to OEM spec'. That means you've got to hit all 6,000 holes, from both directions. And you've got to clean them to as close to OEM spec' as you possibly can. In our case, it's been proven that we're into the high '90s on that score, if we get the filter early in its life-cycle.

"The second thing is, you've got to be able to apply that level of cleaning to all the different shapes and sizes and makes of DPF that are out there, both on- and off-road, and do it with a fingertip control," he says. "If you end up with a technology that varies widely and wildly, from how it cleans a small filter versus how it cleans a large filter, you really don't have anything because it's inconsistent.

"The last thing is, you've got to be able to certify that level of recovery, to the degree that your customer knows that he's got a good chance of an excellent service life at a certain level."

The FSX testing and certification process follows a three–step system, starting with a simple visual inspection for defects. The visual inspection is continued during the first couple minutes of the pneumatic cleaning process with a unique diagnostic feature that will identify broken cell walls. According to Taylor, most of the ash builds up on the outer edges of the DPF, so the pneumatic cleaning can be focused there with the custom cleaning feature.For the second step, the filter must be tested on a flow tester to compare its airflow to that of a new, clean DPF. "You're able to take a dirty DPF, put it on there, see what kind of a flow profile you have, and then, after you've put it through a Stage One pneumatic cleaning, place it back on and see what kind of flow recovery you've got," says Taylor.

"The third step is what we call a mechanical certification," he continues. "That's where we plot by the hours on a clock around the outside edges of the DPF, and we'll drop a round, stainless steel pin into the cell and we'll get a mechanical measurement of how much open area we have versus how much closed area we have down the depth of that cell. That's something that we do on a spot basis. Once we've done that, we have a very good idea of what kind of condition this DPF is in.

"We use all three tests to certify the DPFs before we send them back to our customers," he says. "Because we've been doing this so long, we've been able to plot these results vs. time in service, to see just what kind of service life we can expect. For example, when we do hit the Green Tag range--very near OEM spec'--that's very good because we've gotten almost everything out of there, and you're not leaving ash in your filters that causes problems.

"When you get it restored to OEM spec,' you take one variable out of the equation; that's one less thing the fleet manager's got to worry about," Taylor says. "Now, his expensive DPFs that averaged between $5,000 and $8,000 apiece, are being properly restored to OEM spec,' and you can get years of life beyond warranty if you clean them this way. If you don't

clean them right and certify them, then you've got a ticking time-bomb in these trucks. For example, Mister Nicholson's fleet of 900 Caterpillar-powered Kenworth trucks, he's looking at a DPF on every one of those. He's looking at literally millions of dollars worth of DPFs that need to be properly cared for, and if they're not, then he's facing, not too far out, another variable cost that could be devastating to his bottom line. That's why it's critical that he get them cleaned to OEM spec' and then have to records to back it up."

Exchange Program

There is a simpler way to approach DPF cleaning, of course. A DPF exchange program, such as the one now offered by Mack Trucks, allows customers to bring in a truck for DPF service and simply have the dirty filter element swapped out for one that has already been cleaned. It's a much faster service, obviously, and will appeal to a great many users who simply don't want to be bothered with lengthy, inconvenient DPF cleaning experiences.

Nicholson, for his part, is skeptical that any fleet operator would be willing to take this route. A fleet maintenance manager who has a top-flight maintenance program might not like the idea of trading a DPF from a truck that he knows has been well taken care of for one from unknown origins.

"If you get somebody else's unit, that has had various thermal events that have happened throughout the life of that DPF, you might get one that's a grenade waiting to go off," he says. "It's a big difference for us because we are a 100 percent APU-equipped fleet. Why does that make a difference? Well, because our idle time is nowhere near what a normal fleet's, that idles all the time, might be. So if I roll in someplace, do I really want to take the chance of getting somebody else's DPF from a fleet that has an average of 45 to 50 percent idle time when ours is in the single digits? No, I really don't."

Taylor, whose company makes the DPF cleaners used in Mack's exchange program, sees it both ways. "Many fleets want their own DPF coming back to their own truck, and they want to be able to keep a database on it of cleanings and recoveries and they want to track it from cradle to grave," he says. "Others need the convenience of an exchange program to reduce downtime."

Tick, Tick, Tick

There's that tick again. Is it an alarm clock, or a time bomb?

When Frank Nicholson heard the ticking, he decided to be proactive, and even though he's had his share of DPF troubles, he seems to have averted disaster. He's got the DPF cleaning routine down to four hours, and his dealer is ready to start servicing the first of his 900 DPF trucks. Will the rest of the industry be so lucky?

"Early on, the information we got was that you roll this device up, you hook it up on the truck, and that's all you do, but that's not necessarily the case," Nicholson says. "As far as cleaning, it could be anywhere from $500-600 to, we've had some close to $2,000. You get into these situations where sometimes you're at the mercy of a dealer where you might not be as important to them as the next guy. In our area and at certain dealerships, we're a big fish in the sea. But when we get out to the west coast, we're a little minnow, we're nobody. So it makes a difference, unless you've negotiated a deal. That's what we've done; we've done some negotiating with our facing dealers, and we've said that we're going to support them by sending our units to them, and they're telling us that they're going to support us by giving us negotiated prices, but I think the industry needs to know that if you're just going to roll in anywhere and get your DPF cleaned, that's not going to be the case."

Here's something else the industry needs to know: how will a DPF affect the residual value of a truck? "There's going to be a secondary life, and there's going be some sort of residual value on a vehicle whenever it's sold, with a DPF that has either been 1) cleaned, 2) replaced, or 3) had nothing done to it," Nicholson says. "At this point nobody's thinking about it, but it's going to be part of everybody's life once these units start getting traded. If it was me, I'd be questioning if I'm going to have an expense when I get the unit to have the DPF cleaned or replaced."

Fair Warning

It's not like nobody saw this coming. So why has the industry been so slow to come to grips with the fact that hundreds of thousands of DPFs will need to be taken off the road, removed from trucks and cleaned over the next few years?

Could it be that everyone was hoping someone else would solve the problems before they had to? If so, the industry can rest easy, because Frank Nicholson is on the case.

"There are a lot of people who sat out and didn't get these EPA engines that have the DPFs, but if they're going to stay in the game they're not going to have that option anymore," Nicholson says. "And those of us who did purchase, we're now at the mileage where DPF cleaning is right at our door."

It's not too late to defuse the time bomb. Get educated. Get proactive. Get on your dealer or distributor. And, if all else fails, start sending your trucks to Olathe. We hear there's a dealer there that does a bang-up job cleaning DPFs.