

FILTER TIPS

Diesel particulate filters continue to be a maintenance and compliance issue for all sizes of commercial vehicle in the UK. Over the last couple of years there have been some interesting developments, including a new lubricant technology.

But the core issue remains. While a hard-working diesel engine will generate sufficient exhaust heat to continuously burn carbon particles off the filter element, engines engaged in less-aggressive work cycles may see the particles build up faster than they are combusted.

And this is only half the problem. Soot particles can be removed by periodic active regeneration. That is the addition of extra fuel into the exhaust system via either an additional injector situated in the exhaust system itself or additional injection phases into the engine's combustion chamber when the exhaust valve is open, which raises temperatures to the extent that the soot

As engines wear, they produce more of the contaminants that can choke particulate filters. Richard Simpson looks for solutions

burns off. However, active regeneration will not touch the hard metallic ash that also forms on the filter surface. Initially, this ash does little harm. Indeed, it may even aid the filtering process. But as the deposit accumulates, it reduces the filter's ability to pass through exhaust gas. (This is pictured in diagram form above right, where white is air, blue is the filter, black is soot and light blue is ash).

A consequence of this is that as a truck or bus ages, the intervals between regeneration intervals decrease. Typically, a filter will require regeneration when 40% filled. If 20% of the filter's capacity is permanently taken by accumulated ash, then the regen interval is halved, with a consequent increase in downtime and fuel cost.

So, where does the ash come from, and how can its build-up be reduced?

The primary source is engine oil. All engines burn oil. Initially just a small residue of lube is left on the cylinder wall by the descending piston, but as the engine ages, increasing amounts leak into the combustion chamber. The problem here is not the oil itself, but the metallic anti-wear additives used in it to increase engine life.

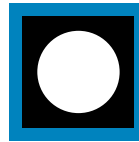
The most commonly used additive is zinc dialkyldithiophosphate (ZDDP), which contains zinc and phosphorous components. As the lube temperature rises, ZDDP decomposes and forms a protective coating on wearing components within the engine.

This is particularly crucial on camshafts, says Brian Hayes, of Chevron Lubricants. "The camshaft is a critical wear area on an engine," he explains. "Cams constantly throw off oil and are wiped by rockers. But anti-wear additives contained in the oil bond with the cam surface, and shear off under load while protecting the cam profile itself."

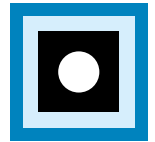
The phosphate in ZDDP plays a crucial role in this, and engine



NO ASH



ASH



manufacturers demand that it is included to protect their products from premature wear. However, it is also the case that ZDDP and other metal-based additives are the source of the metallic ash which clogs PM filters. For this reason, manufacturers now specify low SAPS oils for vehicles equipped with exhaust filters.

Low SAPS (Sulphated Ash, Phosphate and Sulphur) oils contain less of the harmful metallic additives, and use substitute technology to keep wear within acceptable limits. This also extends the life of catalytic converters, which become progressively less effective when contaminated with sulphur and phosphorous. Low SAPS oils are also known as low-ash oils, because their combustion produces 1% ash.

“It’s a balance between the life of the engine, and the life of the filter,” Hayes explains. “As an engine wears, it produces more soot, because combustion is impaired, and more ash, because wear allows more oil into the combustion chamber.”

For the PM filter, this represents a vicious circle. The engine produces more soot, and the filter’s capacity is reduced by accumulated ash. Eventually, it requires cleaning or replacement.

Ash removal can be undertaken using a variety of techniques, usually involving the carefully-controlled application of air or water pressure. Additionally, stubborn soot deposits can be removed thermally.

The required frequency varies according to vehicle application and relative engine and filter size, but typical intervals range from 120,000 to 320,000km.

Research suggests that extended intervals beyond 240,000km can result in the ash deposits becoming hardened, and the risk of damage during cleaning being increased.

IVECO, which eschews the use of exhaust gas recirculation as a means of NOx reduction on most of its engines, says the resultant low particulate output means that active filter regeneration is not required and DPF cleaning intervals can be as long as 600,000km on its Hi-SCR products.

Most truck manufacturers, and some independent providers, offer complete filter ‘cans’ as service exchange products (such as the Daimler model pictured at left). The advantage is reduced vehicle downtime, but the disadvantage is that

the filter elements have a finite life, and the replacement provided may be older than the unit it replaces.

Chevron has attempted to break the circle by introducing an oil which produces much less ash: 0.4%; compared to the one percent of current low-ash oils. It manages this by eliminating the phosphate content altogether. Engine manufacturers were reluctant to approve this oil, which is commercially available under the Texaco Delo 600 ADF label, although Chevron says that in testing in North America it was found to eliminate cam wear on the Cummins ISB engine relative to API CK-4 limits. Delo 600 ADF currently meets ACEA E6 and E9 performance standards, along with API CK-6, CJ-4, CI-4, CI-4 Plus and CH-4 approvals.

Hayes thinks that engine manufacturers need to rethink their requirements to take advantage of the new additive technology, dubbed Omnimax by Chevron. He points to fuel savings of 3% over the life of the vehicle, gained both by fewer active regeneration events and by reductions in exhaust back-pressure. [TE](#)



FURTHER INFORMATION

Cleaning DPFs - www.is.gd/elesem

Engine tuning pro and con -

www.is.gd/fipilo

API CK-4 engines - www.is.gd/jucuze

Eminox UNECE Reg 49 approval -

www.is.gd/uxiviv

CERAMEX OPENS £3M DPF REFURBISHMENT FACILITY

Diesel particulate filter (DPF) cleaning and refurbishment service provider Ceramex has more than doubled its operating capacity with the opening of a brand-new facility in Reading, which will be able to process more than 2,500 DPFs per week.

Representing an investment of over £3 million, the 67,000 square-foot Reading site’s opening was delayed because of the COVID-19 lockdown earlier this year.

But in early November, Colin Lewis, managing director of Ceramex, commented: “As early signs of market recovery emerge, we are starting to return to pre-pandemic levels of DPF cleaning volume, due in part to increased logistics fleet activity.”

