

As ever, fuel filters are the last line of defence against foreign debris entering the engine. Their sheer simplicity, however, can make it easy to forget that. Lucy Radley goes back to basics

# Last resort

Modern common rail injection systems run at very high fuel pressures. For example, DAF's MX-11 and MX-13 engines use PACCAR Common Rail Injection (PCI), which has an operating pressure of up to 2,500bar. That pressure varies based on demand from the driver, but can go far above that figure if something goes wrong - PCI has a safety valve which will mechanically rupture at 3,200bar.

The injectors themselves are manufactured to incredibly fine tolerances, then further calibrated to compensate for any variation which creeps in during the production process. "An injector calibration code is present on the housing and connector of each one, and electronic trim used to make sure all injectors run with nominal timing and fuel delivery," states Andy Mudie, engineering manager of DAF Trucks. "This is achieved by adjusting the beginning and end of the electronic drive waveform for each injector." These codes must be programmed (or reprogrammed) using DAF's DAVIE diagnostic machine to ensure the correct performance.



"The injectors have seven holes in the injector nozzle. The diameter of an injector hole is 0.08mm. Clearance inside an injector pin to sleeve is 0.03mm, and the diameter of the gallery 0.09mm," Mudie says. "To put this into context, the average human hair is between 0.04 and 0.09mm." This means the introduction of even the smallest dirt particles into the fuel system can cause serious problems.

The ideal replacement interval for fuel filters depends on the application, and will vary by manufacturer. For cars and vans, it tends to be 60,000-90,000km, while for trucks and buses the intervals are longer: usually 120,000-180,000km. The exact figures for each model can usually be found in the vehicle manual, and best practice is, of course, to adhere to these. At the same time,



however, no operator wishes to find itself wasting potential filter life, so it can be very tempting to stretch these slightly, not appreciating the greater extent to which this matters in injectors offering the kind of precision detailed by Mudie above.

## UNPLEASANT

"Changing your filter too late can lead to a lot of unpleasant results," says Frank Bartels, product manager (fuel filters) at global manufacturer MANN+HUMMEL. These may begin to appear surprisingly quickly after exceeding the recommended interval. "Typical issues include a decrease of acceleration or power and, especially at low speeds, the engine can start to stutter," Bartels says. "At worst, the engine might not even start. Taking a look at the climate, an overdue filter can lead to a higher CO<sub>2</sub> and fine dust output from your engine."

He also cautions against using full throttle when the filters are overdue, as this could make the vehicle drop into 'limp mode', reducing its maximum speed. "Furthermore, if the recommended replacement intervals are exceeded,

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Jon Roughley

this will lead to long-term wear of your engine.” When replacing filters, it is important to use those which meet OE specification, he adds.

But there are other, less obvious dangers, too. “Using diesel contaminated with a large number of particles can also damage parts of the aftertreatment system,” Mudie warns. This includes the diesel oxidation catalyst (DOC). “From experience, diesel which contains greater than 40ppm (parts per million) silicon or greater than 1ppm metal parts will damage a DOC, and cause efficiency problems in the future. Therefore it’s important to replace fuel filters as per the manufacturer schedule,” he continues, “but also, more importantly, following the guidance and repair information.”

The basic design of the current fuel filter has been used on the DAF range since Euro III, but, over time, it has seen that filters can be damaged during installation when the correct process is not followed. “This can be a costly repair for the service provider (or customer if self-maintained), as it can result in blocked or damaged fuel components,” Mudie tells us. “To prevent this, DAF has written a series of documents on the importance of clean working practices, and the process to correctly drain fuel systems and change filters.”

### **CLEANROOM**

DAF is not alone in being adamant about this. “The Scania XPI fuel system has a very high fuel pressure of up to 2,400bar (nominal), and dirt and small particles in the system can cause serious malfunctions,” states Aaron McGrath, technical manager at Scania




(Great Britain). “It’s therefore very important that everything is as clean as possible when work is carried out on the fuel system, and that technicians use lint-free rags and wear disposable nitrile gloves when working on it.”

In Scania’s workshops, tools are cleaned before they are used, and any areas surrounding fuel filters (Mahle filter module pictured above) or connections are thoroughly cleaned before the system is opened. “Any open fuel connections are immediately plugged or covered to prevent any ingress of dirt,” McGrath states, “and we have a special tool plug kit for this reason.”

To combat issues where debris from the spent filter could potentially contaminate the ‘clean’ gallery of the fuel filter housing, or the newly installed fuel filters themselves, a robust procedure is followed. Performed in steps, this procedure starts by using a fuel extraction suction tool to vacuum any spent fuel or debris from the fuel filter housings. “Once the filter housings are clean, new filters are installed, and we continue to use the fuel extraction suction tool to bleed the fuel system,” McGrath says. “This reduces any issues with startability of the engine.”

Finally, those running light commercial vehicles (LCVs) should not be complacent either, especially as winter approaches. Manufacturer First Line is also advising on the importance of ensuring all filters on these vehicles are replaced during winter service as scheduled. Via its UK parts brand, Borg & Beck, several key components will be more exposed to the elements during colder weather, and consequently more prone to wear and potential failure than during the milder months.

“A clogged fuel filter can lead to fuel starvation, which can cause stalling problems, blocked injectors and have a possible domino effect on other components,” says Jon Roughley, global marketing director at First Line, echoing the advice of heavier vehicle manufacturers.

“To ensure the performance of the vehicle stays as high as possible, and to help reduce wear on other components, such as fuel pumps and injectors, the fuel filter should be replaced at regular intervals, with a premium-quality filter that meets OE specification.” 

### **FURTHER INFORMATION**

*Fuel husbandry Tech Talk - [www.is.gd/pulefi](http://www.is.gd/pulefi)*

*Cleaning DPFs - [www.is.gd/elesem](http://www.is.gd/elesem)*