



THE EXPERT STEWART SANDERSON

Having worked as a tuner for 18 years, Stewart 'Stu' Sanderson is one of the most-respected names in the business.

A Level 5-trained fuel-injection technician, Stu has worked for a Ford Rallye Sport dealer, a well-known fuel-injection specialist and various tuning companies.

Over 10 years ago he joined forces with Kenny Walker and opened up Motorsport Developments near Blackpool (01253 508400, www.remapping.co.uk), specialising in engine management live remapping, as well as developing a range of Evolution chips which are now sold all over the world.

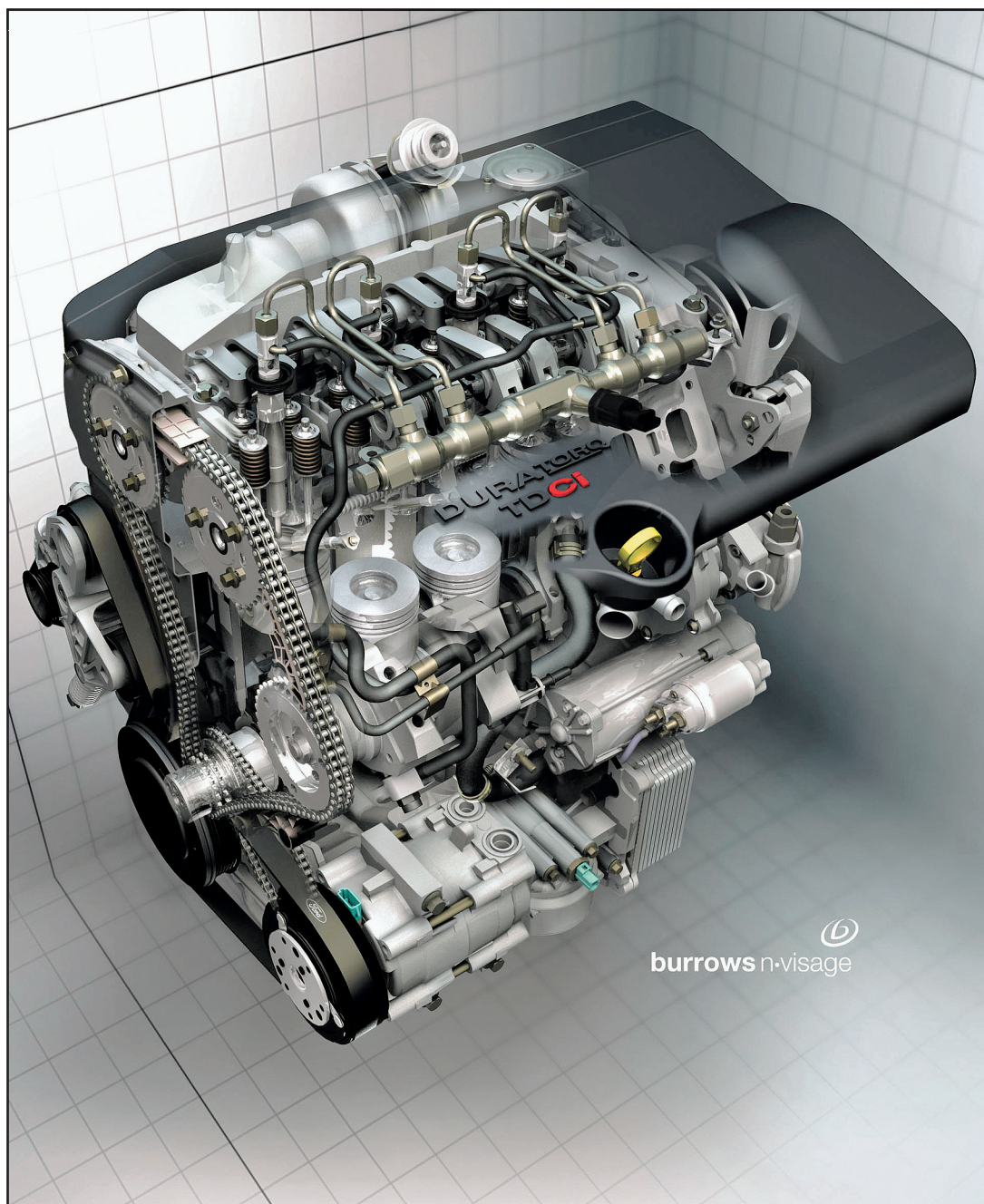
He is the creator and administrator of www.passionford.com, which he started in 2003. It has grown rapidly from a few friends contributing, to one of the biggest Ford communities on the web.

Stu's enviable knowledge of the workings of modern-day Ford performance engines means that every month he's just the man to explain how and why things work, and importantly how they can be improved.

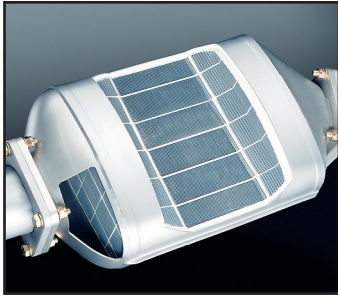
FILTER THROUGH

Words: Stewart Sanderson
and James Wills

THE MSD GUYS EXPLAIN WHY THE DAYS OF SMOKEY DIESELS ARE A THING OF THE PAST THANKS TO IMPROVEMENTS IN FILTERING.



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The modern turbo diesel vehicle is a serious force to be reckoned with. They are fast, reliable, quiet, and importantly, clean. But have you ever wondered what happened to a lot of that black soot we used to associate with the dirty, oil-burning diesels of yesteryear?

Well, injection processes have improved, which we will look at in a future issue, but there is a new technology sitting inside the exhaust that is responsible for a lot of the cleaning. It's called a Diesel Particulate Filter or DPF for short.

WHAT IS A DIESEL PARTICULATE FILTER (DPF)?

In order for a modern turbocharged, diesel-fuelled vehicle to meet Euro 5 emission regulations, several manufacturers started to use Diesel Particulate Filter systems as part of a complicated multi-stage process to clean exhaust gases. The Diesel Particulate Filter part in that process is to catch soot particles and then destroy them.

When working correctly these filters can almost completely stop any particles escaping from the exhaust system, and the result is a very emission friendly diesel engine.

The Diesel Particulate Filters are mounted in the exhaust system but unlike catalytic converters that promote

a chemical reaction, a Diesel Particulate Filter forces the exhaust gases through a filter and physically grabs the soot particles from the exhaust gas. As with any filter, eventually they catch so many particles they become blocked. However, unlike an air filter there is no need to keep changing it. The Diesel Particulate Filter deals with this problem by what is known as its 'regeneration period' where the particulate filter will self clean.

The Diesel Particulate filter is often fitted after a catalytic converter, which can help to increase the exhaust gas temperature as well as create a chemical reaction to rid the exhaust gas of some harmful gases. This in turn will help the regeneration process.

REGENERATION

For the Diesel Particulate Filter to clean itself, or regenerate, the temperature of the filter is increased to physically incinerate the particles from the filter media and regenerate the filter so it can carry on catching particles, while not obstructing the flow of gas through the exhaust. This normally takes place every 300-400 miles but is dependent on the type of use the vehicle gets and the driving style of its owner.

Regeneration is usually done in one of two ways – active or passive. Both methods involve the diesel injection time being changed so as to increase the exhaust gas temp, thus burning the deposits from the filter.

If the vehicle is being used on long journeys, such as motorway runs, the temperature of the filter is often high enough for

WHY DO WE NEED DPF?

Manufacturers of new motor vehicles are forced to design and develop systems to allow new vehicles to meet the ever changing and tightening emission levels in order to gain type approval and meet the current emission regulation, known as Euro 5.

In the last 10 years diesel engine technology and fuel related systems have transformed the way diesel vehicles perform. It's now common to see a turbo diesel car producing 200bhp, and many will easily outperform a standard Sierra Cosworth and still return over 50mpg.

The introduction of common rail injection has allowed manufacturers to control and adjust fuelling very accurately in ways similar to how petrol injection systems have worked for years. This has

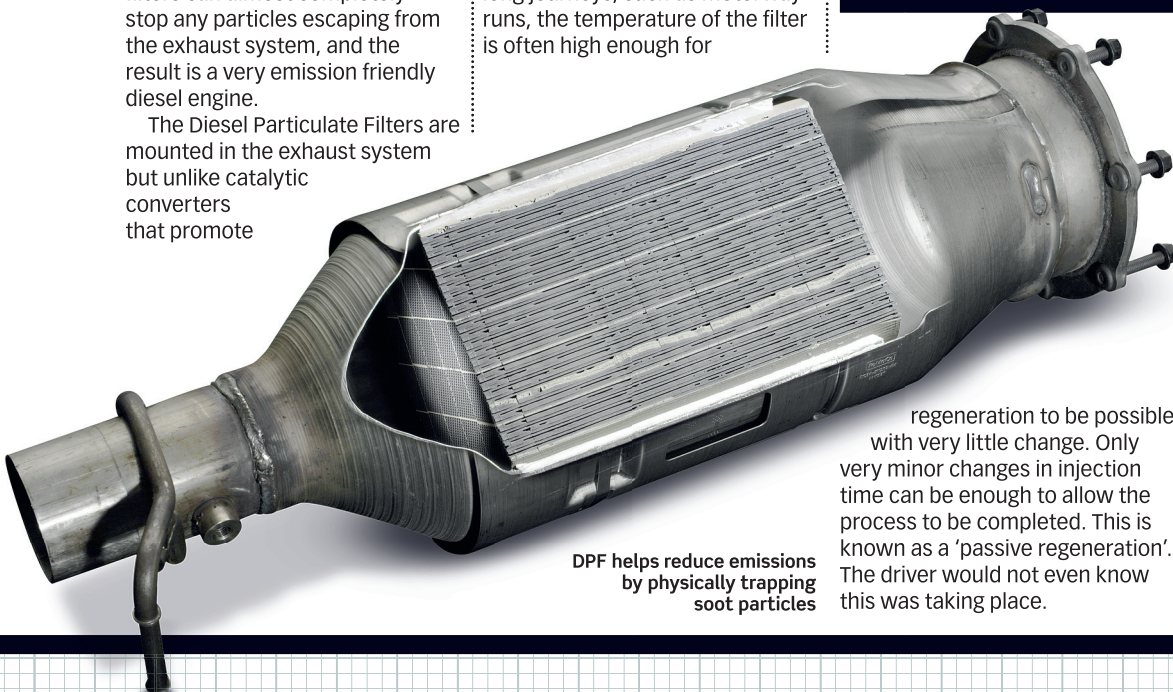
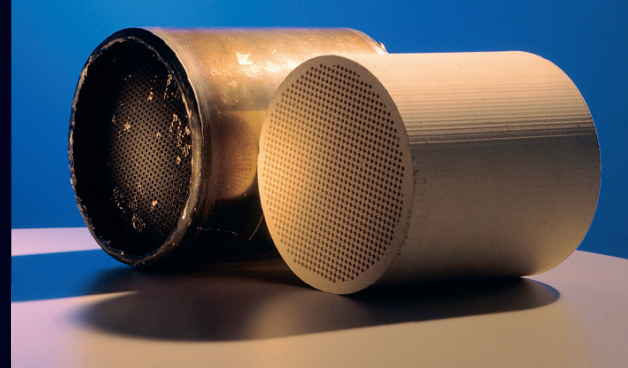
allowed many new types of emission control systems to be developed and used to clean our environment.

Although the Diesel Particulate Filter has been around for many years its use has always been limited and costly. As a result few manufacturers ever used it, but it has become a popular way of cleaning exhaust emissions in the last five years.

Generally speaking manufacturers either fit Diesel Particulate Filters, or use EGR (Exhaust Gas Recirculation) to control emission particles so it's well worth taking a look at the technical data on your vehicle to see what you have fitted!

Some vehicles currently being produced can already meet the Euro 6 regulation, which is not enforced until sometime in 2012.

DPFs are often made from materials such as ceramic to cope with high exhaust gas temperatures involved



DPF helps reduce emissions by physically trapping soot particles

regeneration to be possible with very little change. Only very minor changes in injection time can be enough to allow the process to be completed. This is known as a 'passive regeneration'. The driver would not even know this was taking place.

If the vehicle is only ever used on short runs and journeys then the process can be much more complicated as the temperature of the filter may never reach that required for regeneration to take place during the vehicle's normal use.

In these situations a large change in injection time would be needed to increase the exhaust gas temperature massively. This can affect the running of the engine, so some manufacturers have added a second injector cycle, specifically to superheat the exhaust. This process is known as 'active regeneration' and is where most of the issues associated with Diesel Particulate Filters arise.



ACTIVE REGENERATION

Usually the driver wouldn't be aware an active regeneration was taking place. However, if the exhaust temperatures don't get hot enough, or the journey isn't long enough, for the regeneration process to be completed the engine management light will come on. This will make the driver aware that the process hasn't been completed and it has sensed that the filter is partially blocked. Usually the light will not illuminate unless the filter is over 45% blocked.

Often a motorway run will be enough for the regeneration fault to clear and the process will then automatically be completed. However, if the filter has become too blocked, 75% for example, then the vehicle may well have to visit a specialist for a forced regeneration process.

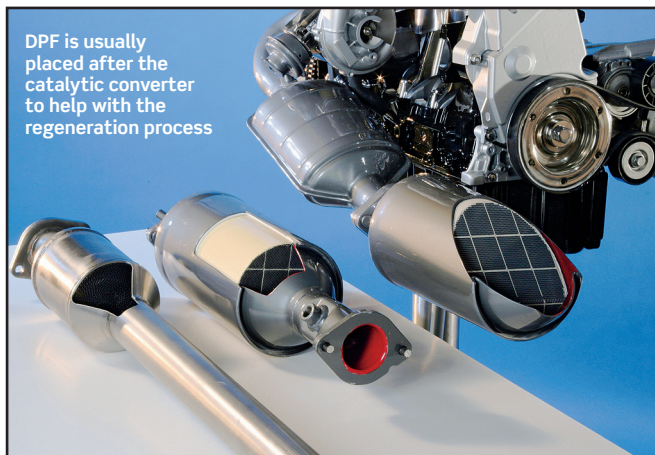
FORCED REGENERATION

This is where we literally take control of the ECU in the workshop and force a regeneration of the filter. The forced regeneration is done with the vehicle static. The exhaust and filter unit can glow red hot during this time as the soot is burnt from the filter. Some manufacturers have now fitted 'static regeneration' as a driver control, so if the vehicle is in need of a forced regeneration it can be performed at home on the owner's driveway.

ADDITIVES

The Diesel Particulate Filter is often used in conjunction

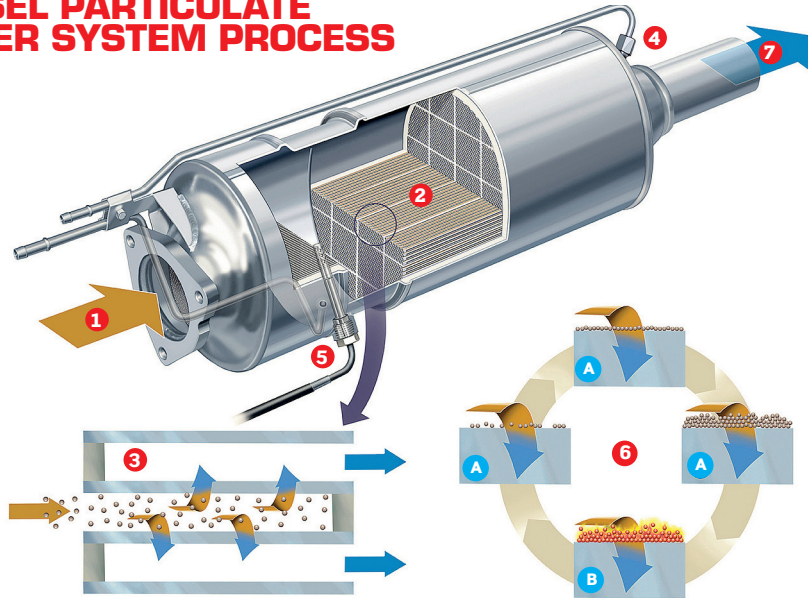
DPF is usually placed after the catalytic converter to help with the regeneration process



DPF REMOVAL

It has become popular for people to remove the Diesel Particulate Filter units from vehicles to avoid costly repairs to blocked or inoperative filters. For this reason several of the well respected tuning/remapping companies can now happily remove the Diesel Particulate Filter function from engine management files, meaning the ECU does not look for the exhaust back pressure created by the filter itself. In turn that means the engine management light will not be illuminated and the vehicle will perform and drive as normal. It is important that the filter itself is removed when this is done or it will become totally blocked because regeneration will not take place.

DIESEL PARTICULATE FILTER SYSTEM PROCESS



- 1 Pre-treated exhaust emissions
- 2 Cross-section of filter-element
- 3 Function of filter element
- 4 Pressure sensors
- 5 Temperature sensor
- 6 Filtration cycle
- 7 Filtered exhaust emissions
- A Filtering phase
- B Regeneration phase

with a fuel additive called Add Blue, which is a pig urine-based liquid. Yes, you read that right. This is injected into the exhaust system downstream of the Diesel Particulate Filter and helps to control and aid the removal of harmful gases.

DPF AND REMAPS
Vehicles fitted with Diesel

Particulate Filters can still be remapped, but there are a few things to be aware of. The amount of soot produced by the engine can be increased massively with poor quality remapping. This means that the Diesel Particulate Filter regeneration will occur more often as the exhaust pressure will increase due to the high filter soot content. This can lead to premature failure of the filter itself. It has even been known for poor mapping to increase the exhaust temperature so much that the area surrounding the exhaust has actually caught fire, obviously leading to a very dangerous but easily avoidable situation. The problem nowadays is that the Diesel Particulate Filter can actually hide bad remapping due to the nature of the system's very existence. It will filter out the sooty smoke that has always been the owner's only visible sign of poor diesel engine remapping!

This has led to an influx of poor quality remaps being sold and written, including many so-called professionals turning off the DPF error light in the ECU so the owner is never made aware it is failing and cannot regenerate. The owner is then completely unaware of its poor quality until it is too late. Be careful as repairs to these systems can easily be into four figures...

