Frank says, "Always use parts and fittings that

The prime purpose of a diesel particulate filter (DPF) is to capture, contain and convert soot particulates into carbon dioxide. Soot is the product of incomplete combustion of diesel fuel. The requirements for complete combustion are both challenging and difficult to maintain. Essentially it requires an efficient fuel delivery system, an exact supply of air and possibly the most important single element, heat.

To aid the conversion process three methods have evolved over several Euro emissions regulations;

Additive Eloy: An iron rich additive injected in to the fuel storage tank, reduces the effective temperature at which soot combustion takes place.

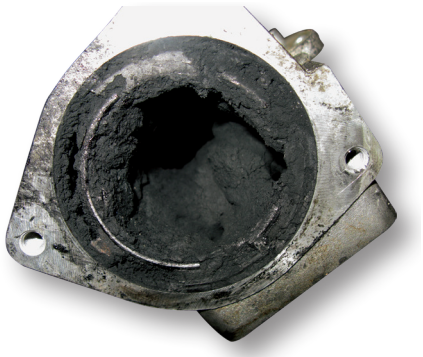
Thermal: By placing the DPF as close as possible to the exhaust exit stream, ideal temperatures (300°C – 700°C) for combustion would be readily available.

Selective Reduction Catalyst (SCR): With the increased demands to reduce diesel emissions still further, additional to the above thermal treatment, a further additive system is fitted to the exhaust system. Introducing ammonia into the NO_x emissions, a chemical conversion takes place reducing NO_x back into oxygen and nitrogen.

The physical location of the Catalyst, DPF and NO_x accumulator may vary according to available space and the choice in oxidation system. Most thermal systems employ an integrated catalyst and DPF in the same housing, some of which use separate substrates, whilst others share a combined substrate. The catalyst and DPF substrates differ in both shape and functionality.

Diesel Particulate Filters remove most of the carbon soot particulates from the exhaust gas. Its function acts as an oxidisation process.

The Diesel Oxidation Catalyst (DOC) cleans the exhaust gas of hydrocarbons (C_xH_y) and carbon monoxide (CO). They are converted into carbon dioxide (CO_2) and water (H_2O).



Two reduction processes take place reducing harmful soot emissions whilst driving.

• Passive Regeneration, a process of soot reduction by natural conversion, this takes place when ideal conditions apply, exit temperatures above 300°C must be maintained.

• Active Regeneration, if optimum exhaust gas temperatures can no longer be maintained then passive regeneration can no longer take place. This can also be known as a Forced Regeneration.

Active regeneration is normally initiated when an excessive back pressure reading normally 65% of the sensor range/value is detected (600mb), or DPF pressure sensor failure occurs.

There are ordinarily 5 key factors involved when active/forced regeneration takes place.

• Increase in turbo boost pressure
• EGR switched off
• Additional fuel injected on the exhaust stroke
• Glow plugs are fired
• Swirl flaps operate

Different systems adopt slightly different methods in order to reach the targeted increase in exhaust gas temperature, such as the bypass of the intercooler circuit on the very popular and often troublesome HDI engines.
Active regeneration causes the carbon stored in the DPF to oxidise at very high temperatures, oxidising the carbon into ash which will inevitably cause a secondary problem with ash accumulation.

This build up of ash can only be treated by physical intervention by direct chemical or, ultrasonically cleaning, steam cleaning or replacing the DPF.

It is vital that after any DPF repair or cleaning process that the Powertrain Control Module (PCM) is correctly calibrated and adjusted so effective passive and active regeneration can take place.
Many of the prime causes of incomplete combustion, leading to excessive soot production, relate to mechanical defects.

For example, there could be a reduction in cylinder compression values due to piston ring gumming or stiction. This can be avoided by additive cleaning products and correct, regular lubrication & servicing.

meet or exceed the quality of the original parts"

Also, components that require free movement such as exhaust gas recirculation valves and intake swirl flaps often suffer from soot fouling adding to incomplete combustion.

Additional to this requirement, it is imperative that the quality and specification of components be maintained to those of the original parts.

Catalyst and DPF filters employ precious metal coatings, such as platinum. These are critical in the passive conversion process. Once damaged by excessive regeneration cycles, inappropriate cleaning methods, or exhausted by ageing, it is impossible to convert soot into carbon dioxide.

Gaskets and fittings ensure high strength and a gas tight seal. The inappropriate use of sealing paste can damage substrates, and lead to localised hot spots.

DPF Servicing

Three stages of DPF treatment & servicing apply; Prevention, Recovery & Repair

Prevention from malfunction includes many choices, including the regular use of chemical additives, quality fuels and lubricants, as well as specifying OE matching service parts. Driving technique and the operating environment are also factors to consider.

Recovery becomes essential when it is no longer possible for the natural process of soot conversion to take place, i.e. the exhaust pressure reaches a value in excess of approximately 65% (600mb). When this occurs a dual error message is illuminated on the instrument cluster.

The DPF and heater plugs indicate a default condition requiring a manual intervention.

Several options are available with the first and most desirable being the application of additive chemical treatments. These treatments aid conversion by loading the DPF with products that help increase temperatures sufficient to oxidise soot. These methods require product knowledge and training if critical damage is to be avoided.

Removal and cleaning of components may be required, prior to attempting regeneration. On no account should regeneration be attempted on an adversely blocked DPF system without additional cleaning to reduce blockage.

Repair is also a consideration and prior to any attempt of regeneration process it is vital that all system components be functional. The following components are used in the control of soot combustion;

- Air Mass Meter
- EGR Valve
- Heater Plugs
- Swirl Flaps
- Injectors
- Lambda Sensor
- Exhaust Gas Sensors
- Oxidation Cat/DPF
- Turbo
- DPF Pressure Sensor

The replacement of the DPF will become necessary when the platinum coating becomes exhausted and or the ash, a natural product of efficient soot combustion, causes the DPF to be blocked beyond recovery (aged). The replacement must be one matching the specification of the vehicle manufacturer original.

Attention is drawn to the need for platinum coating of the DPF. This coating is loaded on the leading edge of the DPF gradually reducing to the rear. Its purpose is to promote soot conversion into CO_2. Storage of the untreated soot remains at the rear of the DPF. During active and forced regeneration the hottest temperature will be found at the rear of the DPF where the stored soot undergoes oxidation by a targeted increase in temperature.

AUTOGEM ***provides a high quality range of DPF fittings, all available upon enquiry.***

Information for this article was kindly supplied courtesy of Frank Massey FIMI & autoinform.co.uk