



Gary Stamberger – Training Director
Magnaflow Exhaust Products

DIESEL AFTER-TREATMENT SYSTEMS

A couple of months back we opened the window to Diesel emission regulation and control. To continue that discussion, we will focus on after-treatment systems, primarily Diesel Oxidation Catalyst (DOC), NOx Absorber Catalyst and Diesel Particulate Filters. The exact configuration of components and the application of various sensors and support components vary among OEM's. With this in mind it is always a good idea to acquire specific description, operation and testing data when attempting to repair any system.

Looking at a typical Diesel exhaust configuration on a newer vehicle ('06 and up), the first component in line will most likely be a Diesel Oxidation Catalyst. A DOC has two primary functions. First to oxidize Carbon Monoxide (CO) and Hydrocarbons (HC) and secondly to build heat into the exhaust system which is essential to the regeneration process. This catalyst functions much the same as a converter found on a gas powered vehicle but without the NOx reduction capabilities.

The next component in line may be a NOx Absorber Catalyst (NAC) or a Selective Catalytic Reduction Catalyst (SCR). Those systems that do not utilize an after-treatment device for NOx reduction typically rely on Exhaust Gas Recirculation (EGR) or Variable Valve Timing (VVT) to control NOx emissions at the point of combustion. NAC's utilize the heat and gases exiting the DOC to trap the Oxides of Nitrogen and then during PCM controlled regeneration, convert them into carbon dioxide, nitrogen and water. This process can not be accomplished under normal driving conditions. It requires the PCM to command a rich fuel mixture which will create the increased temperatures necessary to complete the reaction. Obviously this is a negative aspect for those closely watching their fuel mileage.

The second system, SCR, requires the use of Diesel Exhaust Fluid (DEF) which is stored in a separate tank on the vehicle. This fluid is injected into the exhaust just before the SCR catalyst. When heated the fluid atomizes, mixes with the NOx and as it enters the catalyst it converts the NOx into nitrogen and water. The advantage here is that reduction occurs under normal driving conditions. The downside is the necessity to maintain (fill) the DEF tank.

As noted in our earlier discussion EPA and CARB regulation calls for Diesel Particulate Filters (DPF) to be part of all on-road diesel emission packages. A DPF is a trap system that collects Particulate Matter (PM) that is then periodically burned away through a regeneration process. This process can be Normal (passive) or Service (active) Regeneration. Passive regeneration occurs under normal driving conditions, typically steady speeds over 30mph for 20–30 minutes and can be accomplished as long as a pre-calibrated exhaust temperature (500°C) can be maintained. If normal regeneration can not be accomplished then a Service Regeneration will have to occur which will require the vehicle to be serviced at a repair facility. Usually a Scan Tool is needed to perform this service and all manufacturer procedures need to be followed.

The PCM relies on information from many sensors to create the proper environment for all these components to work; Oxygen sensors, Exhaust Gas Temperature sensors, Differential Pressure sensors and to a much lesser degree, NOx sensors. There are also DEF Injectors on SCR systems and Exhaust Coolers integrated into tail pipes. Understanding the relationships of all these components to one another is essential to a proper diagnosis of any problem.

As with gasoline powered vehicles, Diesels are going through many changes and the exhaust system is again playing a major role. Magnaflow will continue to stay on the cutting edge and always strive to get you the information you need to grow your business.

Cleaning up the environment...one converter at a time

Gary

