

DPF Regeneration Modes

A Diesel Particulate Filters (DPF) traps soot that naturally occurs during normal diesel combustion. Several modes are used by manufacturers to burn the trapped soot into ash. Ryan Automotive's Seamus Ryan provides an overview of the various modes and how they function.

The Engine Control Module (ECM) continually determines the amount of the soot particles in the particulate filter and estimates the remaining operational range. The determination is based on the amount of intake air, injected fuel and load factor. This gives a computational estimate about the exhaust flow, which the Engine Control Module (ECM) compares to the counter pressure created by the particle filter. When the counter pressure reaches 200 to 300 mbar (depending on manufacture), cleaning should start. Regeneration is needed every 300 - 800 km (200 - 500 miles), depending on driving style.

Passive (Spontaneous) Regeneration

During passive regeneration, soot particles are continuously burned without the intervention of the Engine Control Module. This occurs primarily at higher engine loads, such as high speed driving, when exhaust gas temperatures range from 350°C to 500°C.

At these temperatures, the soot particles are converted into carbon dioxide through a combustion reaction with nitrogen dioxide.

Active (Dynamic) Regeneration

In many driver's operating range, the exhaust gas temperatures are too low for a passive regeneration. Because soot particles can no longer be eliminated passively, soot accumulates in the filter. As soon as a specific soot load has been reached in the filter, the ECM initiates an active regeneration. The soot particles are burned off at an exhaust gas temperature of 550°C to 650°C.

An active regen is initiated based on feedback from the following sensors: DPF pressure sensor, exhaust temperature sensors and in some vehicles the air mass sensor.

Distance Regeneration

Some vehicles may also have a "Distance regeneration" which is a distance-dependent regeneration of the particulate filter. The Engine Control Module initiates an active regeneration automatically, if during the last 750 to 1000 km of travel, no successful regeneration has taken

place, regardless of the load condition in the diesel particulate filter. Distance regeneration serves as an additional safeguard to minimize the load condition of the DPF.

Customer-Initiated Regeneration Drive

Some vehicles may also have what's called a customer-initiated regeneration. If exhaust gas temperatures are not high enough for regeneration because of short journeys, and the load condition of the diesel particulate filter reaches a threshold value, a DPF Malfunction Indicator Lamp on the instrument panel may light up. This signal prompts the driver to perform a regeneration drive. The vehicle must be driven for a short period of time at increased speed to ensure that an adequately high exhaust gas temperature is reached. The operating conditions must remain constant over the period for a successful regeneration, the driver should follow manufactures instructions in owner's manual.

Service (Forced) Regeneration

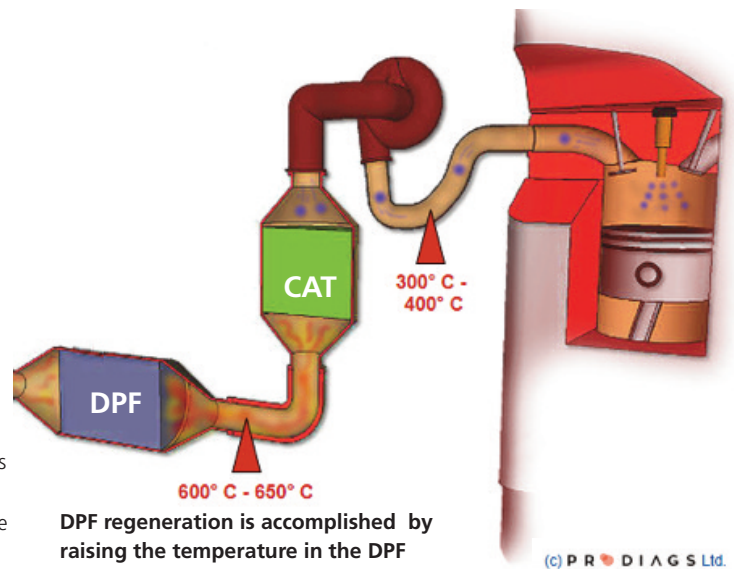
If the regeneration drive is not successfully completed, and the load condition of the diesel particulate filter has reached its limit, the ECU will log a fault for DPF loading.

This prompts the driver to visit a garage. In this case, the ECM blocks active regeneration of the diesel particulate filter to prevent damage to the filter and the particulate filter can only be regenerated by service regeneration with a diagnostic tool.

During active regeneration, distance regeneration, customer-initiated regeneration drive and service regeneration, the ECU is controlling various different components to help increase the engine load and temperatures

Some of these are:

- Preheating is activated
- The electrical load (charge) of the vehicle is maximised



- Injection timing is adjusted
- Post injection pulses are added
- The intake flow is regulated by the throttle valve
- And others depending on make and model

Other Systems

Some vehicles which use an Additional Nozzle (also know as a vaporiser or 5th injector) which injects diesel fuel into the exhaust before the DPF to aid in increasing temperatures

Another system, used commonly on PSA engines, uses an additive such as PAT fluid or Eolys. The additive is dosed into the fuel tank, and is conveyed through the engine all the way to the DPF. The additive collects in the DPF in a mixture with the particulates. Regeneration starts when the load of the engine is elevated and the regeneration injection is performed. When the temperature has risen to approx. 500 degrees, the collected additive breaks up, releasing oxygen. The oxygen being released inside the particle filter starts a catalytic reaction, which in turn produces heat. This accelerates the burning of particulates. Due to the released oxygen, regeneration in systems using additives takes place at approximately 100 degrees lower than usual and in a shorter time.

This information is a small part of the items covered in Ryan's Automotive Intake and Exhaust System 2-day training course. For more details about this and other courses, contact Ryan's Automotive on 051-424-799 or visit ryansautomotive.ie.

