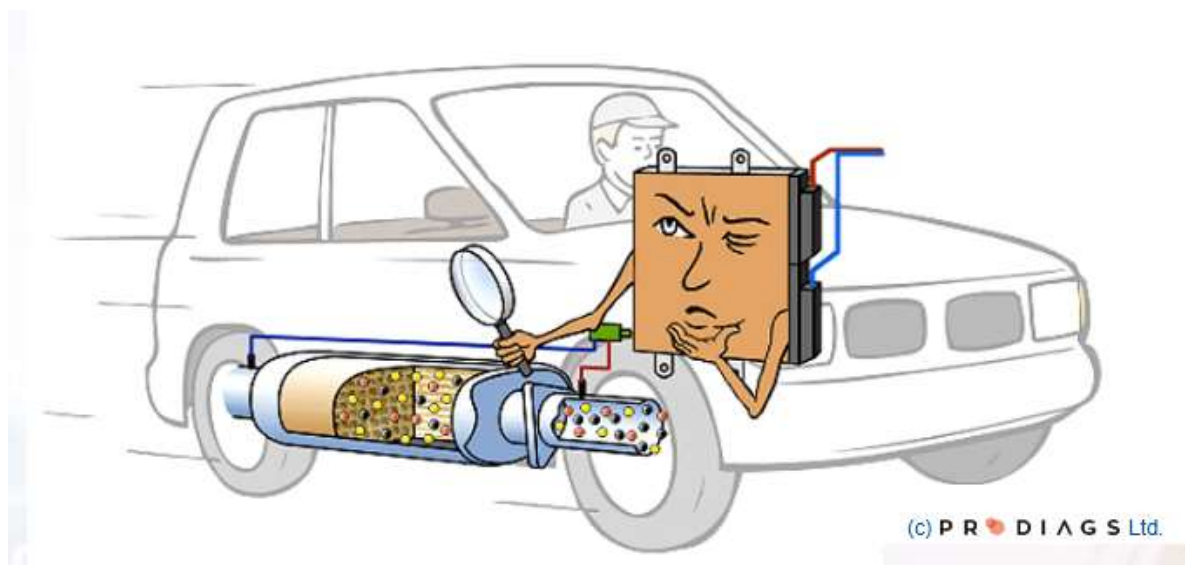


DPF filter regeneration modes

Figures mentioned here are general figures and may vary from brand to brand

The Engine Control Module (ECM) of the engine determines continually the amount of the soot mass (particles) in the particle 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 Regeneration (Also known as spontaneous) During passive regeneration the soot particles are continuously burned without the intervention of Engine Control Module.

This occurs primarily at higher engine load, such as in highway 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 Regeneration (Also known as dynamic)

In a large portion of the 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 Engine Control Module initiates an active regeneration. The soot particles are burned off at an exhaust gas temperature of 550°C to 650°C.

A active regen in 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 additional safeguard to minimize the load condition of the diesel particulate filter

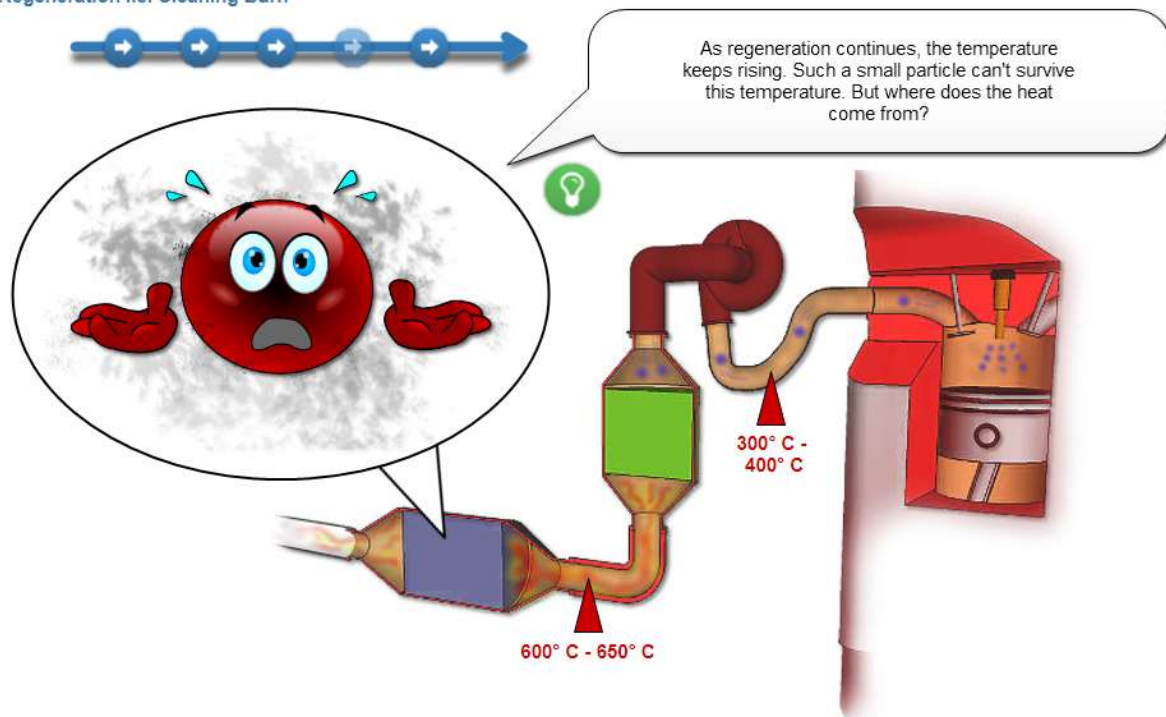
Customer-Initiated Regeneration Drive

Some vehicles may also have what's called a customer-initiated regeneration, if exhaust gas temperatures are not high enough for particulate filter regeneration because of short journeys and the load condition of the diesel particulate filter reaches a threshold value, a diesel particle filter Indicator Lamp in 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 Regeneration (also know as a 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 their workshop. In this case, the Engine Control Module 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.

Regeneration i.e. Cleaning Burn



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

And then we also have some vehicles which use Additional Nozzle (also known as a vapouriser or 5th injector) which injects diesel fuel into the exhaust before the DPF to aid in increasing temperatures

And another system used commonly on PSA engine vehicles is a system operating with an additive, the additive is dosed into the fuel tank, and it is conveyed through the engine all the way to the particle filter. As the filter is in operation, it collects a mixture of particles and additive. 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 particles. Due to the released oxygen, regeneration in systems using additives takes place at approx. 100 degrees lower exhaust gas temperature and in a shorter time

The above is just a general overview of different DPF filter regeneration modes and process and there are many other variations

Images courtesy of Prodiags

Information above is a small part of the items covered in Ryans Automotive Intake and exhaust system 2-day training courses