

## A QUICK GUIDE TO UNDERSTANDING DIESEL PARTICULATE FILTER (DPF)

### WHAT'S IN THE AIR

- **NOx and Soot** – these have the most impact on our environment
- **NOx ( Nitrogen oxides)** are a group of highly reactive gases containing nitrogen and oxygen in varying amounts
- **Nitrogen dioxide**, along with particles in the air, can often be seen as a reddish-brown layer over many urban areas
- Particulate matter (Soot) is the visible exhaust from the engine.
- Soot is made up of unburned fuel, carbon, and other solid material

### MEETING 07 EPA LEVELS

- To meet EPA '07 levels for particulate matter, all manufacturers turned to an exhaust after-treatment system
- The technology in this after-treatment system is the “**Diesel Particulate Filter**”.
- Instead of exhausting soot into the atmosphere, the DPF traps the soot, and then uses heat to oxidize it. So what exits the exhaust is much cleaner air.



### HOW DOES IT WORK

- The DPF is actually a **ceramic filter** that has thousands of tiny channels. As the exhaust passes through these channels, soot is trapped along the channel walls and is prevented from exhausting through the stacks.
- The ceramic filter looks like a **honeycomb structure**.
- This structure is covered with a layer of chemical catalyst that contains small amounts of precious metal, usually **platinum** or **palladium**, that interact with and oxidize pollutants in the exhaust stream (CO and unburned HCs), thereby reducing poisonous emissions.
- Soot trapped along the channel walls prevent it from exhausting through the stacks.
- Every once in a while, the DPF must remove the soot that has built up along the channel walls to remain effective.
- This process is called “**Regeneration.**”
- Regeneration is an **oxidation process** that uses heat to remove the soot from the filter.
- The regeneration process is actually pretty simple.
- There are two stages in this process: 1) **ACTIVE** & 2) **PASSIVE**

### PASSIVE REGENERATION

- Passive regeneration **occurs naturally** under steady driving, when the engine achieves the required operating temperature.
- The DPF contains an oxidation catalyst that is coated with precious metals.
- Under normal highway driving, passive regeneration takes place as the catalyst in the DPF heats up enough to oxidize the soot and turn it into CO<sub>2</sub>.

- The CO<sub>2</sub> exits through the exhaust stack.
- Any residues left behind are converted into harmless ash that collects in the DPF canister.
- **The process is continual**, so whenever the vehicle reaches operating temperature, the DPF will begin passive regeneration.
- Passive regeneration occurs naturally under steady high engine loads.
- Catalyst in DPF oxidizes soot when exhaust temperatures reach about 600°F

### **ACTIVE REGENERATION**

- Over time, passive regeneration is not enough to prevent soot from building up in the DPF and that's when the second stage of cleaning is used. This is called "**Active Regeneration.**"
- The truck engine computer indicates that the DPF needs cleaning, and if the operating temperature is high enough, it **automatically** initiates an active regeneration.
- In general, active regeneration begins when a small amount of fuel is introduced into the exhaust stream between the turbocharger and the DPF.
- This fuel is atomized into an extremely fine spray that does not burn. Instead, when it makes contact with the catalyst on the DPF, it generates intense heat –upwards of 1100 degrees Fahrenheit --that oxidizes any remaining soot on the ceramic filter.
- Again, the soot is oxidized and CO<sub>2</sub> exits the stacks and ash collects in the canister.
- Small amount of fuel is introduced into the exhaust stream to create intense heat –upwards of 1100 degrees Fahrenheit – to oxidize any remaining soot.
- Active Regeneration **may take place once a day**, depending on the type of driving.
- Each regeneration **can take 30 minutes or more**.
- If you stop or slow down, the regeneration **may be interrupted** and **may need to repeat**.

### **AUTOMATIC REGENERATION**

- In general, after treatment systems are **self-monitoring**. When the soot level is high enough, the system automatically initiates an active regeneration.
- Vehicle idle speed may increase when stopped to maintain proper regeneration conditions.

### **PARKED REGENERATIONS**

- There will be times when drivers will need to perform a **manual** or "**parked**" regeneration. This may be because they cancelled a regen, or an automatic regen had started, but was interrupted when the vehicle was stopped.
- Parked regens are active regenerations **initiated by the driver** when the vehicle is stopped, engine running, with the parking brake applied. Usually there is a dash switch or software based method for initiating a parked regen
- **Cautions**
  - Extremely high exhaust temperature during active regeneration.
  - Stay clear of combustibles and people
    - Crowded worksites, fueling stations, tunnels

### **DRIVING WITH DPF**

- Two mounting options
  - Mounted on frame close to turbo exhaust
  - Back of cab

- Fuel requirements
  - DPF requires use of **Ultra Low Sulfur Fuel** and approved **diesel CJ4 engine oils**
- Cleaning
  - DPF requires professional cleaning every 150,000 –250,000 miles

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