Diesel Emission Retrofits

The EPA established new stringent standards for model year 2007 and later heavy-duty diesel engines. The regulations consist of two components, which included new emission standards and new diesel fuel regulations. The standards were phased into the sales of 2007 and later engines. Fleets with pre-2007 diesel vehicles can voluntarily reduce emissions by retrofitting vehicles with emission control devices.

Diesel emission retrofit devices are designed to minimize particulate matter (PM) including PM smaller than 2.5 microns (PM 2.5), hydrocarbons (HC), carbon dioxide (CO₂), and carbon monoxide (CO) from diesel engine exhaust. The pollutant reduction is achieved by capturing and/or destroying these particles. These devices provide immediate and significant pollution reductions with no new infrastructure requirements. They are a cost effective, voluntary alternative to improve an existing fleet's emissions.

Approximately one third of diesel emissions are a result of on-road diesel vehicles. Three highly effective diesel retrofit devices capable of reducing emissions are diesel oxidation catalysts (DOCs), diesel particulate filters (DPFs), and closed crankcase ventilation systems (CCVs).

Retrofit Quick Facts:

- Diesel exhaust is a major source of PM2.5 emissions in urban areas. Approximately one third of diesel engine emissions are a result of on-road vehicles.

- More than 100 million Americans live in areas where PM2.5 levels exceed the EPA's standard. Exposure to high levels of fine particulates poses a significant health risk to the public.

- A DOC is a porous honeycomb-like device that is covered with materials that catalyze a chemical process in order to break down pollutants in the exhaust stream into less harmful compounds. DOCs can be used with regular diesel fuel. However, effectiveness can be increased if used with ultra low sulfur diesel fuel.

- A DPF is a ceramic device that collects particulate matter in the exhaust stream. The ceramic structure heats up due to the high temperature of the exhaust stream, which then allows the particles within the exhaust stream to oxidize into less harmful compounds. DPFs must be used with ultra low sulfur diesel fuel.

- A CCV is designed to capture and return the crankcase gases that have leaked through the engine piston rings. These crankcase emissions can be substantial. A CCV is used to control the flow of gases and return the emissions to the engine for combustion. This effectively prevents the crankcase emissions from entering the atmosphere.

- DOCs are best suited for retrofitting older vehicles, whereas DPFs are highly efficient at reducing PM2.5 emissions where ultra low sulfur diesel fuel is available.

- Most DOC and DPF retrofits come with a 100,000 - 150,000 mile warranty and can last between 7 and 15 years.

Continued on next page
<table>
<thead>
<tr>
<th>Technology</th>
<th>Est. Cost</th>
<th>Maintenance Requirements</th>
<th>Emissions Reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOC</td>
<td>$1,000-$2,000</td>
<td>NONE</td>
<td>PM 20-50%, HC 60-90%, CO 60-90%</td>
</tr>
<tr>
<td>DPF</td>
<td>$4,000-$10,000</td>
<td>Yearly cleaning to remove built up ash</td>
<td>PM 80-90%, HC 60-90%, CO 60-90%</td>
</tr>
<tr>
<td>CCV</td>
<td>$1,200 - $2,000</td>
<td>Periodic filter replacement</td>
<td>PM 10-15%, HC 30-40%, CO 50-90%</td>
</tr>
</tbody>
</table>

Each of these diesel retrofit technologies developed by the manufacturer must go through an independent verification of their effectiveness. This is done by either the Environmental Protection Agency (EPA) or the California Air Resources Board (CARB). The purpose of this verification is to confirm that they are effective in reducing emissions such as PM, Nitrogen Oxides (NOx), and CO. Additionally, testing is performed to verify how long these technologies can continue to reduce emissions. This essentially determines how effective each emission control technology is in reducing emissions for an extended period of time.