Technical Bulletin

Diesel Oxidation Catalyst General Information

National Clean Diesel Campaign
www.epa.gov/cleandiesel

Technical Overview

Diesel Oxidation Catalysts, also known as DOCs, are exhaust aftertreatment devices that reduce emissions from diesel fueled vehicles and equipment. Engine manufacturers have used DOCs in different in-use applications for many years, and DOCs are widely used as a retrofit technology because of their simplicity and limited maintenance requirements. DOCs generally consist of a precious metal coated flow-through honeycomb structure contained in a stainless steel housing. As hot diesel exhaust flows through the honeycomb structure, the precious metal coating causes a catalytic reaction that breaks down pollutants into less harmful components.

Diesel Oxidation Catalyst (DOC)

Emissions Reduction

The United States Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) evaluate the emission reduction performance of DOCs and identify engine operating criteria and conditions that must exist for DOCs to achieve those reductions.

DOCs verified by EPA and CARB are typically effective at reducing emissions of particulate matter (PM) by 20 to 40 percent. EPA's Verified Technology List also shows that DOCs may reduce hydrocarbons by 40 to 75 percent and carbon monoxide by 10 to 60 percent. The PM removed by DOCs is largely the soluble organic fraction that comes from unburned fuel and oil. DOCs generally have little impact on elemental carbon and oxides of nitrogen (NOx) emissions. DOCs have also been verified in combination with crankcase ventilation systems for additional emissions reduction.

EPA is aware of concerns that DOCs may increase the nitrogen dioxide (NO2) fraction of total NOx emissions. The NO2 produced by a DOC is dependent on the catalyst formulation. EPA and CARB have established a limit on increases in NO2 emissions from diesel retrofit devices and all DOCs on the lists of verified products comply with this limit.

Application

Verified DOCs are available for nonroad and highway heavy-duty diesel engines including those on buses, school buses, trucks, mining equipment, construction equipment, cargo handling equipment, marine vessels, auxiliary power units and stationary generators.

Each DOC is verified for use with specific engines and/or with specific configurations over a range of model years. In addition to vehicle and engine specifications, the intended application should be evaluated for exhaust temperature, fuel sulfur levels and lubrication oil consumption. EPA and CARB's lists of verified diesel retrofit technologies define the specific engine operating criteria required to successfully apply a particular retrofit technology: www.epa.gov/otaq/retrofit/verif-list.htm.

Fuel

DOCs perform best with Ultra Low Sulfur Diesel fuel (ULSD), and some DOCs are verified for use with Low Sulfur Diesel (LSD). ULSD, which contains up to 15 parts per million sulfur, is required for highway vehicles and will begin to be phased in for the nonroad sector beginning in 2010.

EPA is aware of concerns that DOCs may release some ultrafine particulates. Such concerns are associated with high sulfur levels in diesel fuel and the potential for sulfur

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to accumulate in the DOC and then be released as sulfate particles. This characteristic may also be associated with the precious metal loading and vehicle operation. When used with ULSD EPA does not believe DOCs increase ultrafine PM. Although nonroad diesel fuel will not be required to meet ULSD sulfur levels until 2010, nonroad equipment equipped with DOCs should preferably be fueled with ULSD.

Cost

DOCs generally cost between $600 to $2,000 or more, including installation, depending on engine size, installation requirements or other unique needs. Because a DOC is likely to be heavier than a muffler, it is likely that special mounting is necessary.

Longevity

When properly installed and maintained, DOCs should remain effective for the life of the vehicle, generally five to ten years or 10,000 or more hours of operation. Engine problems with fuel control or oil consumption may quickly deteriorate the performance of a DOC. Consequently, regular engine maintenance is essential to DOC performance.

Warranty coverage is typically part of the commercial contract negotiated between the product suppliers and their customers. Such warranties typically cover defects in materials or workmanship for a specified period defined in years, miles and/or operating hours.

As part of their verification program, CARB has established detailed warranty periods for CARB-verified retrofit technologies as shown in the following table.

California Air Resources Board Warranty Period

Vehicle Category	Warranty Period
GVWR > 33,000 lbs. hp > 250 hp and miles/year > 100,000 Vehicle miles < 300k	Two years; unlimited mileage
GVWR > 33,000 lbs. hp > 250	Five years or 150,000 miles
GVWR 19,500 to 33,000 lbs.	Five years or 100,000 miles
GVWR < 19,000 lbs.	Five years or 60,000 miles

Refuse Truck with Diesel Oxidation Catalyst (DOC)