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Year of the SCR System

This year marks the onset of widespread commercial application of selective catalytic reduction systems for on-highway diesels, to reduce nitrogen oxide emissions per U.S. EPA regulations. Researchers say there are no short-term negative effects from using biodiesel blends in diesel SCR systems, but long-term performance is much less understood.

By Ron Kotrba

For diesel exhaust system suppliers, the past several years have been consumed by development and fine-tuning of emission control technologies so that original equipment manufacturers (OEM) can meet very strict U.S. EPA regulations on particulate matter and nitrogen oxides (NOx). That huge body of work culminates in the 2010 production year as unprecedented design and function result in ultra-sophisticated commercial systems. Liquid urea and a storage tank, injectors, mixers, catalysts and sensors are just some of the items many aftertreatment systems utilize to convert NOx into nitrogen and water. Upstream from NOx control in many designs is a diesel particulate filter (DPF), which traps virtually all of the black soot typically associated with diesel trucks. Before the DPF, most systems have a diesel oxidation catalyst (DOC) to oxidize the hydrocarbons.

Much like a catalytic converter for gasoline systems, or a DOC, the body of the selective catalytic reduction (SCR) catalyst is a cylindrical honeycomb-like substrate with an extremely high surface area through which exhaust gases can flow encountering minimal backpressure. The material can be copper zeolite or iron zeolite. In Europe, vanadium pentoxide is used. A catalytic wash coat is applied to the body of the substrate. Depending on exhaust temperatures, urea dosing occurs via an injector and mechanical mixer in the exhaust to help atomize the fluid and disperse it evenly across the inlet face of the catalyst. The catalyst can also store a certain amount of ammonia, which, in certain conditions, can temporarily preclude the need to dose more fluid until the stored amount decreases. In a chemical reaction with the exhaust heat, the urea is transformed to ammonia and byproducts such as HNCO. The exhaust passes through the catalyst and reactions take place all along its surface, changing NOx into nitrogen and H2O.