Associated Power Inc. Diesel Emissions Data

Glossary of terms

Compiled by Associated Power Inc. from known facts regarding the terms used in this document.

B5 or B5 biodiesel
A fuel blend made of 5% biodiesel and 95% conventional low or ultra low sulfur diesel fuel.

B20 or B20 biodiesel
A fuel blend made of 20% biodiesel and 80% conventional low or ultra low sulfur diesel fuel.

B100 or B100 biodiesel
A fuel type consisting of 100% biodiesel and 0% conventional diesel fuel.

C.A.R.B. (CARB)
California Air Resources Board, Implements and enforces air pollution control rules and regulations within the state of California.

CO_2
Carbon Dioxide: classified as the major greenhouse gas and emitted proportional to amount of fuel consumed. With inherently higher fuel efficiency, diesel engines produce lower levels of CO_2.
The EPA does not regulate CO_2 emissions from diesel engines.

CO
Carbon Monoxide: a regulated diesel emission produced by incomplete combustion. CO is emitted at very low levels from diesel engines.

Common-Rail
Fuel Injection
Fuel delivery system that maintains a high injection pressure regardless of engine speed, using high-pressure fuel stored in a single “common” rail that connects to every fuel injector on the engine.

DOC
Diesel Oxidation Catalyst: consists of a catalytic coating on a honeycomb substrate for oxidizing particulate matter (PM). Operates in a “passive-only” mode without active regeneration, so is less efficient at PM reduction than the DPF.

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DPF
Diesel Particulate Filter: Captures particulate matter (PM) in a semi-porous medium as the material flows through the exhaust system. Available in “passive” or “active” configurations, active DPFs use a control system to actively promote regeneration events.

EGR
Exhaust Gas Recirculation: Technology that diverts a percentage of the exhaust gas back into the cylinders, thereby lowering peak combustion temperatures and reducing NOx.

EPA also USEPA
Environmental Protection Agency: Among many duties, the U.S. government agency is responsible for governing engine emissions at the federal and or national level.

Exhaust Aftertreatment
Any technology which removes harmful emissions from the exhaust gas flow.
(Catalysts, Catalytic Converters)

HPCR
High Pressure Common Rail, fuel injection system. *(Also see Common-Rail Fuel Injection on Page 1)*

NMHC
Non-Methane Hydrocarbons: a regulated Diesel engine emission which is primarily unburned fuel in the exhaust stream, commonly described as Hydrocarbons and or (HC). Hydrocarbons are present in the exhaust stream of any internal combustion engine.

NOx
Oxides of Nitrogen: a regulated Diesel engine emission which is a collective term for gaseous emissions composed of nitrogen and oxygen.

NOx Adsorber *(See Full Definition on Page 4 of This Glossary)*
Aftertreatment technology that; uses a catalyst to capture and then convert NOx to harmless nitrogen gas and water vapor.

NRTC
Non-road transient composite test cycle introduced for Tier 4 emissions certification.

PM
Particulate Matter: a regulated diesel emission composed primarily of carbon soot and other combustion by-products.

SCR
Selective Catalytic Reduction: an aftertreatment technology that uses a chemical reductant (urea) injected into the exhaust stream where it transforms into ammonia and reacts with NOx on a catalyst, converting the NOx to harmless nitrogen gas and water vapor.

Sulfur or Sulphur
A natural element in diesel fuel which; has been linked to particulate matter and acid formation in the atmosphere.

Terms for Approximately Equivalent Exhaust Emissions Standards

U.S. EPA ..... EU (European Union)
Tier ..... Stage I
Tier 2 ..... Stage II
Tier 3..... Stage IIIA
Tier 4 - Interim ..... Stage IIIB
Tier 4 - Final ..... Stage IV

ULSD
Ultra-Low Sulfur Diesel: Diesel fuel which; contains less than 15 parts per million (15ppm) by volume of sulfur. Mandated October 2006 for EPA on-highway, September 2010 for EPA off-highway and expected by 2009 in the EU.

Urea
A chemical usually made from natural gas, which is commonly used in fertilizers. Urea solution used for SCR aftertreatment breaks down into ammonia and reacts with NOx in the SCR system to produce harmless nitrogen gas and water vapor.

VGT
Variable Geometry Turbocharger: Turbochargers that constantly adjust the amount of airflow into the combustion chamber, optimizing performance and efficiency.

Adsorber (Article Excerpt From Wikipedia, http://en.wikipedia.org/wiki/NOx_adsorber)

A **NO_x adsorber** or **NO_x trap** (also called *Lean NO_x trap*, abbr. LNT) is a device that is used to reduce oxides of nitrogen (NO and NO_2) emissions from a lean burn internal combustion engine.

Purpose and function of a NOx adsorber

A NO_x adsorber is designed to reduce oxides of nitrogen emitted in the exhaust gas of a lean burn internal combustion engine. Lean burn engines, particularly diesels, present a special challenge to emission control system designers because of the relatively high levels of O_2 (atmospheric oxygen) in the exhaust gas stream. The 3-Way catalytic converter technology that has been successfully used on Rich Burn internal combustion engines (typically fueled by petrol but also sometimes fueled by LPG, CNG, or ethanol) since the middle 1980s will not function at O_2 levels in excess of 1.0%, and does not function well at levels above 0.5%. Because of the increasing need to limit NO_x emissions from diesel engines technologies such as exhaust gas recirculation (EGR) and selective catalytic reduction (SCR) have been used, however EGR is limited in its effectiveness and SCR requires a reductant, and if the reductant tank runs dry the SCR system ceases to function.

The NO_x adsorber was designed to avoid the problems that EGR and SCR experienced as NO_x reduction technologies. The theory is that the zeolite will trap the NO and NO_2 molecules—in effect acting as a molecular sponge. Once the trap is full (like a sponge full of water) no more NO_x can be absorbed, and it is passed out of the exhaust system. Various schemes have been designed to "purge" or "regenerate" the adsorber; injection of diesel fuel (or other reactant) before the adsorber can purge it—the NO_2 in particular is unstable and will join with hydrocarbons to produce H_2O and N_2. Use of hydrogen has also been tried, with the same results, however hydrogen is difficult to store. Some experimental engines have mounted hydrogen reformers for on board hydrogen generation; however fuel reformers are not mature technology.

NO_x adsorbers are experimental technology as of early 2006, and thus extremely expensive. Whether or not this technology will be successfully commercialized is open to question—only time will tell. A NO_x trap is used on the VW Jetta Clean TDI and the VW Tiguan concepts. Both are projected to be introduced into the American market by 2008. They will be marketed as part of the BlueTec program from Audi, Daimler-Chrysler, and Volkswagen.

Follow the link below for more on "NOx Adsorber" technology (Johnson Matthey Corp.)

http://ect.jmcatalysts.com/site.asp?siteid=833&pageid=867