Information Sheet # 05

CLIFFORD® Power Systems, Inc.

Your Reliable Guide for Power Solutions

To fulfill our commitment to be the leading supplier in the power generation industry, the Clifford Power Systems, Inc. team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

EPA Regulation and Codes Governing the Use of Engines in Power Generation

The Environmental Protection Agency (EPA) opened in December 1970 following the enactment of the Clean Air Act (CAA) during the Nixon administration. It has been the official body for the regulation of exhaust emissions for all 50 states. The act allowed California to pass standards that exceeded those of EPA. California's regulatory body is the California Air Resources Board (CARB). The CAA was strengthened with amendments in 1977 and 1990. The 1990 federal amendment preempts California's authority to control emissions from new farm and construction equipment under 175 hp and requires California to receive authorization from the federal EPA for controls over other off-road sources.

The EPA and CARB exhaust standards that regulate the power generation industry fall under the classification "Non Road." These standards are distinctly different from those specified for highway vehicles.

This info sheet outlines how emissions regulations have been applied, which exhaust elements are measured and regulated, what technologies are used to reduce exhaust emissions, and current and future standards are proposed.

Application of Emission Standards: To allow manufacturers sufficient time to redesign existing products and develop new technologies, emission standards were applied in tiers. Each successive tier specifies cleaner exhaust emissions. Also, tiers are broken down into horsepower and fuel type categories. The EPA worked with manufacturers, manufacturing associations and other interested bodies to determine a practical program of ramping up the exhaust emission standards through the various tiers over several decades. It was initially proposed that EPA regulate both stationary and mobile generator set applications in the 49 states but it only set exhaust standards for mobile sets. California regulates both mobile and stationary applications.

(Diagram # I on back page details current and proposed tiers through the hp bands for diesel and gas powered sets)

Elements of Exhaust Measured: Listed below are the contents of exhaust gas that are measured and regulated and the reason for their regulation:

1) Nitrogen Oxides (NO_x) 2) Carbon Monoxide (CO) 3) Hydrocarbons (HC) 4) Particulate Matter (PM)
5) Carbon Dioxide (CO_2) 6) Sulfur Dioxide (SO_2) 7) Sulfur Oxides (SO_x)

There are three principal reasons for controlling exhaust emissions:

a) Reduction in smog, particularly in urban environments.
b) Stabilization of the upper atmosphere to decrease harmful sun rays and/or their effect on global warming
c) Minimization of substances that research shows are hazardous to health.
Research indicates PM and NO_x emissions could be carcinogenic and contribute to smog.
When all current engine inventory is finally replaced by Tier 4 engines, annual emissions of NO_x and PM will be reduced by 738,000 and 129,000 tons respectively. It is estimated 12,000 premature deaths can be prevented annually by 2030.

Many exhaust emissions tend to be compounds of combustion that are unstable and thus react with oxygen in the atmosphere in its ozone form. Breaking down the ozone layer exposes living matter to increased, more harmful levels of ultraviolet light. Another major area of concern are compounds of exhaust emissions that hang in the atmosphere like a blanket and trap heat that would normally radiate into space. These are called Greenhouse Gases (GHC). GHC elements are CO_2, CO, HC, SO_x and SO_2.

Technology to Reduce Exhaust Emissions: To clean up exhaust emissions, technologies have been applied through the complete combustion cycle, from the fuel used, the method of injection and the combustion process through filtration/conversion.

a) Control of Fuel: Reducing the sulfur content of diesel fuel reduces SO_x & SO_2. (Federal standards require a reduction to 500ppm fuel in October 2007 and 15ppm in October 2010. Biomass fuels can be effective in ppm reduction with a mix of up to 20% by volume).
b) Increasing Combustion Temperatures: This ensures a more complete burn and less elements such as CO & NO_x.
c) Greater Atomization of Fuel: Finer fuel particles have a increased level of burn and result in more stable elements. Technologies such as common rail achieve higher fuel injection pressures on diesel engines.
d) Reduction of Unstable Elements: Catalytic convertors capture unstable elements before they exhaust.
e) Electronic Fuel Injection: Better fuel management has improved combustion and fuel efficiency.

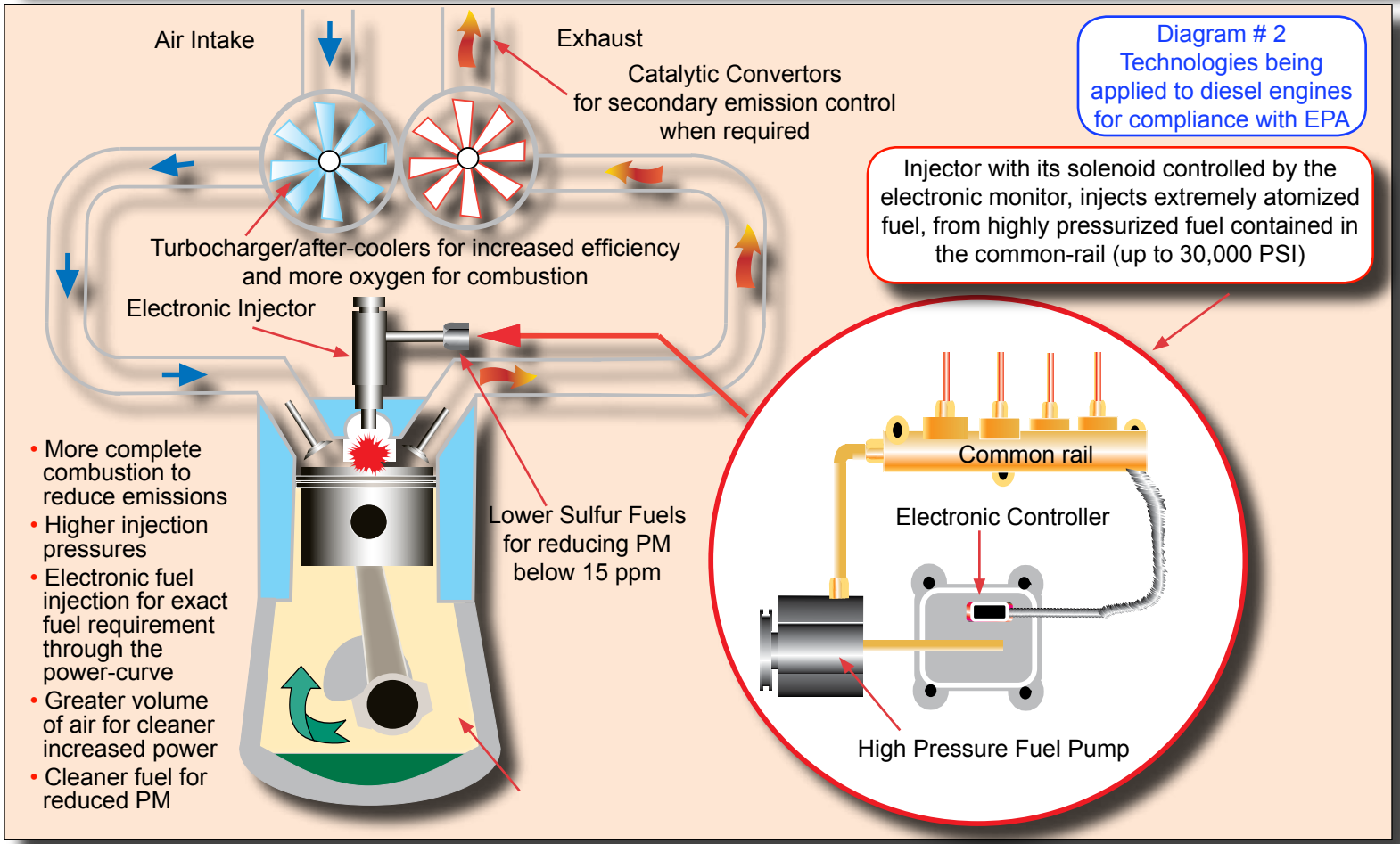
(Diagram 2 on the back page shows the various technologies being applied through the combustion cycle)

Current and future exhaust : Currently non-road stationary diesels are not regulated except in California. There are proposals, to be finalized by June 26, 2006, and to become effective in July 2007 which will bring diesel stationary emissions into line in three stages with EPA's non-road mobile diesel engine exhaust standards. Spark-ignition engines are not covered by this rule. Details can be seen at: www.epa.gov/ttn/oarpg/t3pfpr

HP Range	Tier	Year	CO	NM HC + NO_X	PM	HC	NO_X
< 11 hp	1	2000	6.0	7.8	0.75		
	2	2006	6.0	5.6	0.6		
11 < 25 hp	1	2000	6.0	7.1	0.75		
	2	2005	6.0	5.6	0.6		
25 < 50 hp	1	1999	4.9	7.1	0.6		
	2	2004	4.9	5.6	0.45		
50 < 100 hp	1	1998					6.9
	2	2004	3.7	5.6	0.3		
	3	2008	3.7	3.5	†		
100 < 175 hp	1	1997					6.9
	2	2003	3.7	4.9	0.22		
	3	2007	3.7	3.0	†		
175 < 300 hp	1	1996	8.5		0.4	1.0	6.9
	2	2003	2.6	4.9	0.15		
	3	2006	2.6	3.0	†		
300 < 600 hp	1	1996	8.5		0.4	1.0	6.9
	2	2001	2.6	4.8	0.15		
	3	2006	2.6	3.0	†		
600 < 750 hp	1	1996	8.5		0.4	1.0	6.9
	2	2002	2.6	4.8	0.15		
	3	2006	2.6	3.0	†		
> 750 hp	1	2000	8.5		0.4	1.0	6.9
	2	2006	2.6	4.8	0.15		

Diagram # 1
EPA Tiers 1, 2 & 3
Data g/bhp - hr
† = As tier 2

Diagram # 2
Technologies being applied to diesel engines for compliance with EPA



- More complete combustion to reduce emissions
- Higher injection pressures
- Electronic fuel injection for exact fuel requirement through the power-curve
- Greater volume of air for cleaner increased power
- Cleaner fuel for reduced PM

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