Contractor innovation slashes pollutants from 2-stroke diesel engines on drilling rigs, buses

CLEAN CAM TECHNOLOGY Systems has developed a cutting-edge engine rebuild technology for 2-stroke diesel engines that reduces emissions well below levels stipulated by pollution-conscious California regulators for non-road engines such as those on well-servicing and drilling rigs. The rebuilt engines have clean-air implications not only for the California drilling industry, but other non-road stationary source applications nationwide and, in combination with a **Johnson Matthey** catalytic converter, even mass transit, CCTS officials say. The horsepower range in these categories of engines goes from 76 hp all the way up to as much as 1,100 hp.

The new system is largely the brainchild of CCTS and **Gary Drilling Co** President **Ed Green** and Head Mechanic **Mike Alford**. Noted Ed's son **Gary Green**, Secretary/Treasurer of Gary Drilling and CCTS, the system's NOX emissions approaches that of clean-burning natural gas. Clean Cam Technology Systems is the name Gary Drilling will use to market the new technology.

Fathers of invention: Ed Green (inset) and Mike Alford (right above) were the driving forces behind devising a more efficient burn stroke for 2-cycle engines. The innovation has dramatically reduced emissions of pollutants, tests show.

Test results for other pollutants are even more impressive (see figures). Emissions of hydrocarbons and particulate matter already surpass levels for new engines set by the **US Environmental Protection Agency** and the **California Air Resources Board** on 3 families of **Detroit Diesel** engines—the V92, L71 and V71 series. CO emissions have also been slashed, compared to new-engine standards.

"The rebuild technology gives operators of diesel engines a cost-effective alternative to new engine purchasing, while meeting new engine emissions standards with an older, existing engine," Gary Green explained.

"We kind of get a kick out of the idea that we're a lot of roughnecks out of the field, and we're coming up with ideas to cut pollution," he quipped.

Tests run at a state-of-the-art certified lab in San Antonio, Texas, showed that all emissions on the CCTS modified engines fall comfortably below the 2001 EPA/CARB standards, including a modified Detroit Diesel Electronic Control (DDEC) engine. Further encouraging results were obtained using low-sulfur fuel. In California, however, as CCTS Regulatory Affairs Manager **Terry Ellis** pointed out, use of special low-aromatic, low-sulfur diesel is required. Using CARB diesel fuel will lower NOX by another 7% and particulate matter by 25%, he said.

DUAL EMISSIONS CLEANUP

This dual cleanup of both NOX and particulate matter is a unique feature of the CCTS system, Mr Ellis said. Normally, he explained, reducing emissions of one of these increases the presence of the other. This is because reducing PM means burning more completely, reducing the fuel to pure carbon—and byproduct gases, including NOX. Conversely, cutting NOX means less complete combustion, which generates more particulate matter.

POLLUTION TECHNOLOGY

The basic idea is to increase the efficiency of the fuel burn stroke in the 2-cycle engine. "It seemed like we were getting good results," said Gary Green. "Then, we took our system to an EPA-certified lab and received test results that are now certified by CARB, EPA and patented."

The core of the system includes reengineered camshafts, liners, piston heads and injectors. The new camshaft, along with the other replacement parts, ensure that the piston valves open precisely, and recirculate exhaust gases, thereby optimizing combustion efficiency.

This, Mr Ellis explained, has 2 effects. First, fuel economy is maximized, producing significant fuel savings. Second, and more important, this improved efficiency also reduces emissions.

While the initial focus is on 2-stroke engines, the company anticipates working to adapt the system for 4-stroke engines. Offshore drilling units and medium and large land rigs use combinations of 2- and 4-stroke diesel engines.

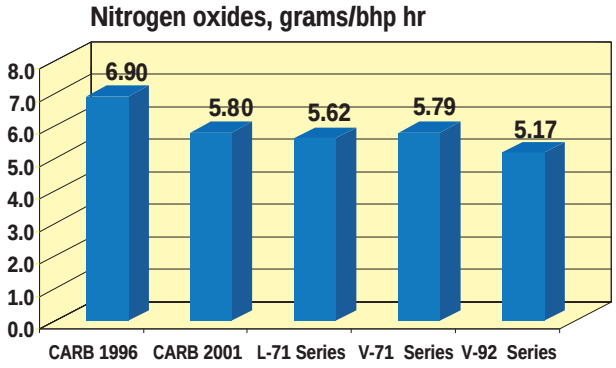
BUSES AND RIGS

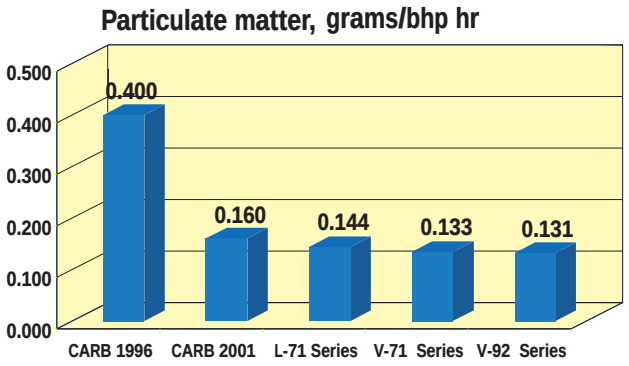
CCTS has bee n certified by CARB, which is excitedd about the technology, the company says. In addition, Johnson Matthey has received certification of the system under EPA's urban bus retrofit program.

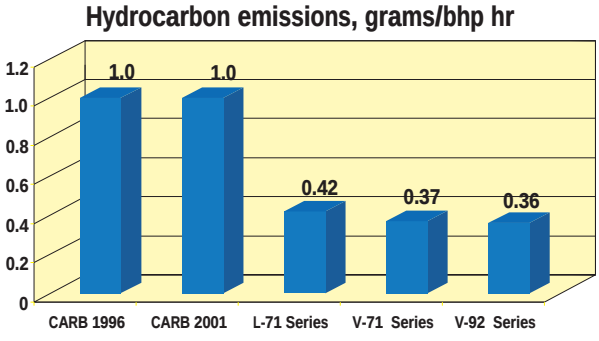
CCTS's early focus on bus retrofitting is why the 6V92 engine, a staple in that industry, was chosen for testing. The urban bus program targets reduction of particulate matter through rebuilding or retrofitting engines of 1993 vintage or older in large dities. To meet EPA's requirements, such buses must be retrofitted with equipment certified by EPA.

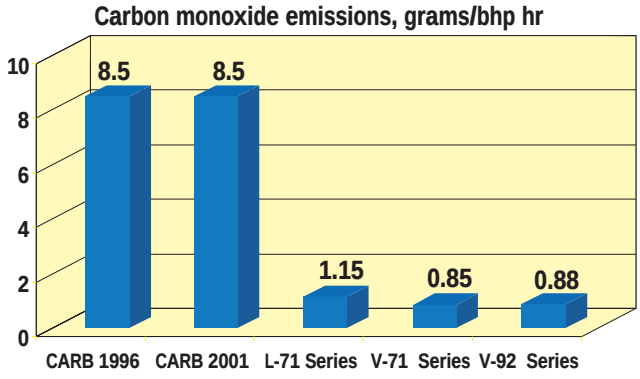
As a result, the race to devise certifiable retrofit kits was on. "The bus program is the only mandated retrofit market out there," Mr Ellis explained. "That's why we went after it first." We have since received 12 CARB certifications for off road-stationary source applications for which patents have been received, while additional patents are now pending.

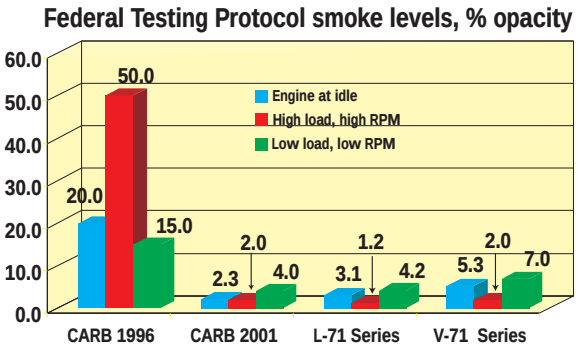
Mr Ellis said that CARB adopted a watershed rule in March 1997 that will allow use of CCTS-retrofitted engines on drilling rigs and other types of portable equipment allowing movement of these units between air districts without re-permitting. Other











states have adopted or are looking at various versions of California's flexible portable equipment program.

He credits the state agency with helping local air districts understand the benefits of this engine rebuild, as well as drilling and well-servicing operations. "CARB has done a great job helping us educate the air districts," Mr Ellis said.

IMPROVISATIONAL MASTER

The driving force behind CCTS has long been Ed Green's ability to improvise mechanically. Thanks to Ed Green's ingenuity and grit, the company has engines running today that were drilling wells when Gary Drilling launched in 1954, Mr Ellis said.

"We are ever so humble to think that our little family-owned drilling company is making such a significant impact on air quality in California, the United States and quite possibly, the world," Ed Green said.

The CCTS website is 222.cctskit.com. Their phone is 805-589-0111. ■