



# Improved Control and Performance for Cummins Westport Propane Engines

# PLUS electronic system for B5.9LPG platform

Propane: Powerful, Proven, Prevalent

ropane has been used in vehicles since the 1920s and is used today in 280,000 vehicles in the United States and more than nine million vehicles worldwide. Propane fuel, also

known as liquid petroleum gas (LPG), is easy to use and widely available, benefits that encouraged its use in 60 percent of all alternative-fueled vehicles in 2000. However, America's growing need for an economical, low-emission alternative to gasoline has focused even greater interest on propane. Accordingly, the Propane Education & Research Council (PERC) assigns high priority to the continued development of propane engines for commercial fleets.

With the help of PERC funding (**Docket 10568**), Cummins Inc., of Columbus, IN, completed development and commercialization of a new, low-emission LPG engine for use in mid-size trucks and buses. The engine offers a longer engine life than gasoline engines and a 60 percent reduction in ozone-forming emissions—all at a comparable cost per gallon

forming emissions—all at a comparable cost per gallon. The clean and efficient LPG engine is ideal for mid-size delivery and pick-up trucks and transit, school, and shuttle buses.

## **Improved Performance, Decreased Emissions**

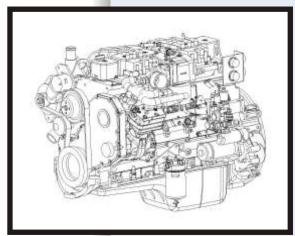
The Cummins B5.9LPG engine, released in 1997, was the first heavy-duty propane gas engine to receive certification to the 1999 Environmental Protection Agency (EPA) Clean Fuel Fleet Vehicle (CFFV) Low Emissions Vehicle (LEV) standard. An evolution of the B5.9 natural gas engine released in 1994, the B5.9LPG was noted for its thermal efficiency.

Introduced in July 2003, the B LPG PLUS improves on this platform by addressing the October 2002 legislated emissions of 2.5 (g/hp-hr) nitrogen oxide and nonmethane hydrocarbon (NOx+NMHC), and allowing operation on HD-10 quality fuel to lower emissions. This modern and powerful system has proven highly successful in the field; the Los Angeles Department of Transportation (LADOT) has been operating B LPG PLUS engines since December 2002 in 30-foot El Dorado buses.

#### **Benefits in Brief**

The enhancements offered by B LPG PLUS are numerous, and should result in more sales due to increased customer acceptance:

- · Increased engine robustness
- Lower emissions
- Improved operation on low grade fuel



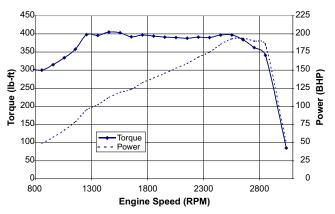


"The B LPG PLUS has shown us that there are significant improvements that help the drivability of the buses... we look forward to seeing more of these engines in our fleet."

> Rick Martorana, senior heavyduty engineer, Los Angeles Department of Transportation



#### Preliminary Torque and Power Curves for B LPG PLUS Engine



## **About the PLUS system**

In brief, the PLUS system consists of:

- Engine Control Module (ECM)
- Ignition pressure sensor
- Oil pressure sensor
- New design for fuel shutoff valve
- Fuel supply pressure sensor
- Revised design for gas control housing
- Electronic throttle actuator
- Harness connection

The PLUS control system has the capability for knock detection and control, as well as other features which facilitate better control capability, improved performance, and potential for lowering engine exhaust emissions. Development included the implementation of drive-by-wire arrangement, which is a new design for this engine and increases applicability in transit/shuttle buses.

"The B LPG PLUS propane project embodies our ongoing commitment to developing the next generation of products for commercial fleet applications."

- Roy Willis, PERC president

Emissions certification documents have been received from EPA & California Air Resources Board (CARB). The B LPG PLUS engine is certified with catalyst to emit 12 percent less oxides of nitrogen and non-methane hydrocarbons and 70 percent less particulate matter than the 2004 ceilings established by the EPA for heavy-duty trucks and buses.

Now available for order, the 195-horsepower Cummins Westport B LPG PLUS propane engine features the same advanced technologies found in the Cummins Westport C Gas Plus, L Gas Plus, and B Gas Plus natural gas engines. The Production Part Approval Process (PPAP) has been completed for all the new parts, and the producing plant is now receiving orders from the production supplier. The engine is available in new vehicles manufactured by El Dorado National, Elgin Sweeper Company, Ottawa Truck, and Freightliner Custom Chassis Corporation.

# Important features of the PLUS technology:

- Improved engine performance with more accurate control, and features adaptive learn algorithms
- Lower emissions capability through HD10 LPG fuel
- Increased engine protection through knock sensing, improved diagnostics, and troubleshooting
- Advanced controls; powerful controller, enhanced capabilities
- Improved and new sensors: robust in application
- Advanced surface mount technology
- Drive-by-wire to replace mechanical throttle
- New customer features: power take off, cruise control, speed governing

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#### For More Information:

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