

Based on this research and the customer-led philosophy, Cummins decided to design and develop heavy-duty truck engines for the 1990s. These new products provide truck owners and operators the choice in engine weight and size to match closely their particular equipment, trade cycles, and business needs. Another important part of the customer-led strategy was the decision to offer customers the choice between the new electronic fuel system or the familiar mechanical fuel system with optional electronic controls.

### Electronic Choices

Cummins adds a new dimension for customers with a new electronic fuel system. As more and more owner operators and fleet owners request electronic technology to cover their individual needs. The fuel system is a proven technology featuring electronically controlled unit injectors. It lets truck owners select many performance-improving options.

- Cruise control for increased driving comfort and fuel efficiency. In-cab switches area available for setting and maintaining road speed above 30 mph and 1000 rpm.
- Adjustable low idle speed that can be set up or down in 25 rpm increments.
- Power take-off (PTO) control switches, which provide a convenient method to set and maintain a precise engine speed for a PTO operation.
- Road speed governing which allows you to fix maximum road speed within a range for improved tank mileage. Test results show that for every mile per hour that road speed is lowered, up to one-tenth of a mile per gallon can be saved.
- Gear-down protection that limits maximum road speed to the top gear for greater fuel efficiency.
- An idle shutdown feature that can be adjusted to shut automatically the engine off after a specified amount of idle time between three and 60 minutes.
- A choice of automotive or variable speed engine governors to match driver preference or application.

Standard features on the fuel system include an engine protection system and self diagnostics. The engine protection system monitors coolant temperature, oil temperature, intake manifold temperature, oil pressure and coolant level. This investment protection feature will also alert the driver with a visual and audio alarm when critical conditions appear. Operators will see improved fuel economy through the electronic control of fuel injection timing and metering, excellent cold starting

capabilities, reduced cold smoke and improved driveability.

Keeping individual needs in mind, mechanical fuel systems are available on new engines so customers can choose the most appropriate system for their operation. The mechanical PT fuel system, with it's high injection pressure capabilities, is very efficient at the 1991 emission levels. A wide range of models equipped with the PT system will be offered in 1991, from 260 to 410 horsepower. We anticipate that these mechanical engines will remain the preferred choice of many vocational applications such as dump trucks, refuse trucks, mixers and local pick up and delivery operation. A road speed governor is available and will be popular among line-haul fleets that favor the familiar mechanical fuel system, and value the benefits of electronics in controlling the top speed of their trucks.

### COMMAND Performance

We've paid special attention to the driver as we developed these truck engines. As a result, Cummins is introducing a revolutionary concept in performance which puts the maximum horsepower output in the rpm range where most of the driving gets done. These engines offer a wider operating range than ever before. Maximum power is generated below governed speed, where drivers often cruise and the engine delivers the best fuel economy. At the lower rpm, when in a hard pull, these engines deliver constant peak torque over a wide rpm range, resulting in fewer downshifts and stronger driveability.

### TRAINING REQUIREMENTS FOR MECHANICS WHEN ELECTRONIC DIESEL ENGINES ENTER THE FLEET

*Mike Wilinski, Robert Bosch Corporation*

What happened to the simple engines and systems of yesterday? In the past twenty-plus years we have advanced to what we call total engine management systems - not just fuel injections. Electronics in the motor vehicle has evolved into ignition and timing control, knock control, ABS, ASR, air bags and more. Just switch on your on-board computer and it will give you your average fuel usage, speed, distance traveled and more.

In a typical diesel fuel injection system a low pressure feed pump draws fuel from the tank and supplies it to the injection pump. The injection pump supplies high pressure fuel to the engine mounted injectors. The injectors atomize the fuel directly into the combustion

chamber where it is combined with air and ignited. The speed of the engine is now controlled by an ECU (Electronic Control Unit) or microprocessor. The ECU monitors dynamic engine operating conditions via the use of many sensors. At the driver's foot pedal we now have installed a potentiometer which relates the driver's wishes through a wire--instead of the usual linkage--to the ECU. If there is trouble, it's the responsibility of the vehicle mechanic or technician to determine where the problem is located. He still has to pinpoint the fault of one of the mechanical systems as he has done in the past.

We've added a whole new system or series of electronic circuits that must be diagnosed in addition to the mechanical systems. We've added: sensors, wires and cables, connectors and plugs, and ECUs. So what will it take for the diesel mechanic/technician of the future to correctly service vehicles? Troubleshooting now requires the use of new tools and test equipment, and terms that most mechanics/technicians may never have seen or heard of before. To make the vehicle mechanic's job easier, we have developed plug-in diagnostic scan tools that help to pinpoint problems.

Variables such as loose connections, shorted and open wires, intermittents, bad grounds, weak signals and the like will have to be traced with digital multi-meters and perhaps even oscilloscopes.

Our experience in automotive fuel injection has taught us that very few problems are the fault of the ECU. So just replacing one may not fix the problem. Most often, the only way to find a problem is to trace it through a systematic step by step procedures. If the technician needed help, he looked in the manual. Today there are more than 500,000 pages in the service manuals that the average mechanic/technician must sort through to find an answer to his problem. Good reading ability is now a must.

I've recently talked with educators both in industry and the private sector, and they agree that most diesel mechanics or mechanics in general were educated by the OJT method - on the job training. Today that's not good enough. Today's technician need as excellent understanding of the systems. The demands of OSHA, EPA, DOT, CAFE, SAE, and ISO are steering the automotive and diesel industry to a higher and higher level of sophistication. What will we do when multi fuel engines or electric vehicles become common place - how will they be serviced? The answer is simple. The mechanic/-technician of today must constantly updated by going to school. The technician must be skilled in reading, math and basic electronics.