Haynes Corp. has introduced the UltraFire ERS Kit, a retrofit emissions reduction system targeting stationary, rail and marine engine applications. Shown here is a display system at the company's Naples, Fla., shop.

RETROFITTING FUEL INJECTION

Haynes UltraFire ERS system designed to replace mechanical fuel injection on older engines

BY BRENT HAIGHT

Targeting emissions/fuel reduction in rail, marine and stationary engine applications, Haynes Corp. has introduced the UltraFire ERS Kit, a retrofit emissions reduction system designed to replace mechanical injection systems with modern electronic fuel injection with EnviroTip technology.

"UltraFire ERS Kit is an electronic fuel injection system designed for heavy-duty diesel engines to meet the new EPA 1033 Tier zero-plus and beyond emission standards, which target locomotives, along with EPA 1042 marine standards," said Greg Schultz, vice president of sales at the Naples, Fla.-based company. Haynes purchased the OEM fuel injection product lines of American Bosch APF from United Technologies, Bendix Diesel Fuel Injection Systems from Allied Signal and the EMD 567/645/710 mechanical design from Diesel Technologies Corp.

"We initially designed the UltraFire ERS Kit for the EMD 645 diesel engine because they have the largest population of locomotive and marine engines in the worldwide market," said Schultz. "When they rebuild these engines in the U.S. market, they have to comply with the new EPA emission regulation standards."

Haynes developed multiple patent-pending technologies when implementing the electronic fuel injection system with its EnviroTip technology. "The EnviroTip technology enables faster response and control, which is necessary in utilizing all of the capability that the electronic system has to offer," said Keith Mulder, manager of engineering, quality and new business development at Haynes. "Electronic signals move much quicker than the fluid can respond, so implementing technology to make the injector more efficient in the decision-making process allows the electronics greater control. This technology enables reduced emissions with improved fuel consumption to become a reality.

"The mechanically injected systems have been around for a long time, and we hold numerous patents on that technology. However, the electronic fuel injection has proven benefits that we have demonstrated to justify the upgrades. We also offer mechanical solutions for those customers who desire it, but we like to start with the benefit analysis to help them make an informed decision. The EnviroTip technology can be provided in both

mechanical and electronic fuel-injected systems, but there is a lot that our electronic injection technology provides that is not possible to replicate in a mechanical fuel system."

Schultz added, "Electronic fuel injection systems with EnviroTip technology is an avenue for customers to comply to the EPA new emission regulations at a reasonable cost with a short return on investment based on the fuel savings obtained over mechanical fuel injection systems."

The UltraFire ERS Kit is an electronic fuel injection system that eliminates mechanical system components. The system components include EUI injectors with EnviroTip technology, an electronic control module (ECM) processor to control the input and output signals and an electronic governor box combined with sensors that measures key engine functions, operating data and the position and speed of the engine at all times.

"The retrofit removes about 500 lb. of metal," said Mulder. "Everything is now accomplished with electronics. The mechanical governor and mechanical injectors and hardware are no longer required for engine operation. Overspeed trip mechanism is also no longer required. All of the spring-loaded valves and hydraulics that used to be required in mechanical systems are now handled with electronics. The electronic solenoid controls when to start firing, how long to fire and when to stop firing in a precise manner, which improves emissions as well as fuel efficiency."

Haynes UltraFire ERS electronic injector with EnviroTip technology applied to an EMD 16-645E3B locomotive engine.

The UltraFire ERS Kit with EnviroTip technology can be programmed to compensate for altitude changes, temperature changes and a comprehensive list of scenarios that is constantly evolving and growing. "UltraFire ERS is completely scalable," said Mulder. "You have a lot of options when you have an intelligent system, something that allows flexibility. The same technology is used to meet various EPA emission requirements — Tier zero-plus, Tier 2 locomotive, Tier 2 marine — but it does not require a hardware change. In our mechanical systems, we design the part, we manufacturer it and for the entire life cycle it never changes regardless of altitude changes, temperature change or regulation changes, unless you go in and completely replace the hardware. With UltraFire ERS that is no longer the case."

"If you can think it, we can make it happen," said Schultz. "Our stationary customers, for example, like to look at rear bearing pressure and if the rear bearing pressure fails, they like to have the engine shut down. We've had customers create a rule in which the system looks at exhaust temperatures on each of the 16 cylinders, and if one of the cylinders doesn't have an exhaust temperature an alarm notification is sent.

"In mobile applications, if equipped with GPS, it could be programmed to operate differently depending on location. For example, if it enters California, it could compensate for that."

According to Mulder, the UltraFire ERS Kit with EnviroTip technology has achieved improved emissions through precise injection timing and fuel delivery. Microprocessor engine control enables programmable timing for emissions and individual injector compensation for balanced cylinder load.

"We can program the system to

An EMD 20-cylinder 645E3B stationary generator set engine ready for conversion to the Haynes UltraFire ERS Emission Solution Kit.

meet or exceed any emissions scenario," said Mulder. "Some customers want a product that will meet what they are facing now. Some want to push the envelope beyond what is already required."

Haynes used Southwest Research Institute (SwRI), an EPA-recognized test facility, to test the UltraFire ERS Kit with EnviroTip technology in a variety of applications. The results validated Haynes' predictions of improved fuel efficiency and reduced emissions, the company said. Certified data from engine tests at SwRI shows that the system succeeded in a 20% minimum NO_X reduction and a 30% PM reduction in both line-haul and switch cycles. The UltraFire ERS System achieved smoke reduction of 50% at steady state and 30-second test intervals, and 70% at three-second (notch transition) intervals when compared to mechanical injected Tier zero-plus emissions locomotive. Steady-state smoke at Notch 8 is 5% (5% and less is not clearly visible to the human eye).

Fuel savings analysis produced a 4% documented fuel savings compared to a mechanically injected Tier zero-plus emissions engine with equivalent configuration on both line-haul and switch cycles, Haynes said.

The software utilized by the UltraFire ERS Kit is provided by Haynes. Software requirements depend on end-user specifications. If the user remains satisfied with the parameters they established at the initial application of the system, the software will last 10 years without an update. "If customer needs do change, we can provide software updates, new sensors, new electronic computer cards, connect remotely and make the updates from here, or whatever is required," said Schultz.

Internet connection allows reports, error codes and warning to be sent directly to the operator. For stationary applications it can be connected 24/7 and generate real-time warnings. Mobile applications can be set up so that when the unit is in a shop, or even in a Wi-Fi zone, data can be sent to the operator.

"We utilize controller area networking," said Mulder. "Tests are done in priority over one line, similar to the electronics system in an automobile. For example, exhaust temperatures can be taken every five minutes, pressures every 30 seconds — it all depends on the parameters required by the customer. Reports can be generated daily, monthly or whenever the engine operator specifies.

"The UltraFire ERS with EnviroTip technology has reduced maintenance thanks to the constant, precise communication this system allows. In addition, we're getting improved NO_X and improved fuel efficiency beyond what mechanical fuel injection can ever achieve." dp