

Hydrogen injectors for IC engines

The comeback of hydrogen fuel prompted Hoerbiger to restart development of related H₂ injectors, reports **Julian Buckley**



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BERNHARD ZEMANN,
Hoerbiger

Engine Technology is one of the six business units which make up global component specialist Hoerbiger. This division concentrates on development of injection and ignition components for engines used in industrial applications.

"Industrial is not like automotive, there's not one company delivering the whole system," says Bernhard Zemann, head of division. "Customers are looking for individual suppliers with the best products, single components, and they go on to build their systems from those parts."

Hoerbiger has been developing and manufacturing gas valves for 125 years – an impressive timeframe for any company producing reciprocating machinery parts. Zemann says that about four years ago the company noted that hydrogen was making a comeback and decided to restart development of injectors intended for hydrogen internal combustion engines (ICEs).

"Hydrogen is not just fuel cells," observes Zemann. "There are plenty of applications which need the robust tech of the internal combustion engine. We'll see those engines in heavy goods trucks and off-highway vehicles. Applications which would be far from ideal for a fuel cell stack."

SECOND SHOT

This is not the first time Hoerbiger has looked into developing an H₂ injector. In 2004, the company delivered the components used in the H7 project, a BMW 7-Series using a 3.0-litre engine adapted to run on hydrogen gas. Zemann says that while that results from the project were "very promising", it was a breakthrough before its time. Now, with EU targets covering fleet CO₂ reductions almost impossible to achieve with diesel, he believes H₂ as a fuel has come of age.

Hoerbiger has partnered with engine specialist Keyou to trial the hydrogen injectors. So far, the company has fitted prototype hydrogen ICEs to a modified coach and a Mercedes-Benz Actros truck (see opening photo). Once these vehicles have type approval they will begin testing on roads around the company's home base in Munich.



Keyou prototype with H₂ fuel engine
PHOTO: KEYOU GMBH

Zemann says that there's no carryover from any diesel or petrol injectors; the models under development are unique. "It's why we're a leader in this market, we've dealt with gas for 125 years!" he underlines.

PFI AND DI

The upcoming range of injectors will be available for a variety of engine sizes and applications, from truck engines to stationary gen sets. They will be available for port injection (PFI) and direct injection (DI) cylinder heads.

Zemann says that as PFI uses a common rail injection system located outside the engine, calibration can be completed more easily. PFI also supports the combination of a standard diesel engine block with a head developed to use H₂. He says that DI requires more effort and deeper integration, with the whole engine adapted to use the H₂ fuel.

"[With direct injection] you need to examine the head, the cylinders. The whole engine needs to be adapted to support hydrogen," he says. "That means more development cost, but that can be countered by DI being more economical."

Bringing the H₂ injectors to this stage has involved development of some new technologies. One is related to the effect the corrosive hydrogen gas can have on some materials, a process known as hydrogen embrittlement. Zemann says that the injectors use a special alloy able to resist the chemical interaction with the gas.



Even injection of the gas had to be examined, to achieve the correct fuel/air mix. “It’s not like diesel, where you do everything with the nozzle end. You can’t bring the gas from just one side and use it efficiently. You need to boost the energy of the injected gas to achieve the best mix,” explains Zemann.

ENGINE LONGEVITY

The development team had a strict brief when developing the new H₂ injectors – they must be comparable in longevity to those used in diesel engines. According to Zemann, the injectors are capable of reaching equivalent distances.

**H2DI
GV7
injector**



“We’re dealing with the same lifetime requirements as a [diesel] heavy truck, about 1.2 million kilometres. We were convinced we could do it and we’ve made very good progress,” he says.

As it stands, development of the new H₂ gas fuel injectors has been progressing for four years and it will be another two before they’re available to the market. But beyond having prototypes ready to show potential OEM customers, Zemann says there’s a wider goal: “It’s one of the major decarbonisation strategies for the future.” **dpi**

Mitsubishi launches PowerPackPlus range

Mitsubishi Turbocharger and Engine Europe (MTEE), part of the Mitsubishi Heavy Industries Group, has launched its PowerPackPlus range to support gen set OEMs in Africa.

According to MTEE, PowerPackPlus was developed under the ‘Mitsubishi & Partners’ initiative and involves the consolidated supply of a Mitsubishi diesel engine and radiator, together with an alternator from Linz Electric alternator.

Four variants of the PowerPackPlus are currently available: 15 kVA 50 Hz Prime, 20 kVA 50 Hz Prime, 28 kVA 50 Hz Prime, and 40 kVA 50 Hz Prime. In addition to the engine, radiator and alternator, the PowerPackPlus range includes intake, assembly and connection kits, which allow the provider to tailor specification to match customer needs.

MTEE explained that the Mitsubishi & Partners initiative combines the Japanese company’s proven technologies with partner systems to create best-practice solutions. MTEE stated it had partnered with Linz Electric due to its high-quality alternators and strong engineering support.

MTEE specialises in delivering integrated engine solutions from 5 to 15,400 kW, for electrical power generation, material handling machinery, construction and agricultural equipment, pump drives and marine propulsion.

Linz Electric delivers alternators and rotating welders from its plant in Arcole, Italy. All of the main alternator

components, including windings, pressure-cast parts, shafts, electronic regulators and inverters, are made on-site.



PowerPackPlus from Mitsubishi and Linz

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