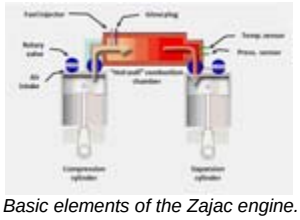
Green Car Congress
Energy, Technologies, Issues and Policies for Sustainable Mobility

Concept: Zajac Motors Proposes Split-Cycle Engine with Separate Combustion Chamber; 15% Improvement on Diesel Fuel Economy

5 August 2008

Zajac Motors is developing a split-cycle engine concept that significantly prolongs fuel burn time through the use of a combustion chamber external to the compression and expansion piston chambers. John Zajac, who presented a poster session on his concept at the Diesel Engine-Efficiency and Emissions Research (DEER) conference this week in Dearborn, Michigan, claims that his engine will deliver 15% better fuel economy than a diesel, run on any liquid fuel, and be essentially non-polluting.



Basic elements of the Zajac engine.

The Zajac engine uses new head parts that are compatible with a standard diesel engine block. The in-block cylinders are split into compression and expansion roles, and connected by an external “hot wall” combustion chamber. The engine presumes the use of new rotary valves, also developed by Zajac. The combustion chamber, valves, and control systems are the core of Zajac’s IP.

By way of comparison, the Scuderi split-cycle engine also divides an engine’s cylinders into discrete compression and expansion roles, but transfers the intake air compressed in the compression cylinder via a high-pressure gas passage to the power cylinder for combustion.

The Zajac compression cylinder takes in air and compresses it, with a stroke 10% longer than that of a conventional diesel engine. The compressed air charge is input into the combustion cylinder where it mixes with the fuel charge, ignites and burns. The combustion chamber’s size, shape and insulating materials create a “hot-walled” environment where fuel, air, and pressure can be maintained at a constant temperature. The size of this energy storage chamber also extends the length of time that gas is held resident in the combustion chamber—10 to 100 times longer than in a traditional engine.

This results in a complete and clean burn. The complete combustion delivers the improvement in fuel efficiency, and also virtually eliminates the production of CO, unburned hydrocarbons and soot. NO_x is prevented by keeping the combustion temperature below the 1700 K formation threshold, Zajac said.

In the expansion (power and exhaust) cylinder, the power stroke is up to 220% longer than that of a conventional engines, allowing full expansion. The Zajac engine exhausts gas at 1.5 psi above atmospheric pressure, reducing waste and minimizing noise.

Zajac has 19 patents pending on his engine and is looking for development partners. Zajac Motors is an IP company, he said, and doesn’t intend to manufacture the engine.