

Allows dimethyl ether use in a 4-cylinder diesel engine



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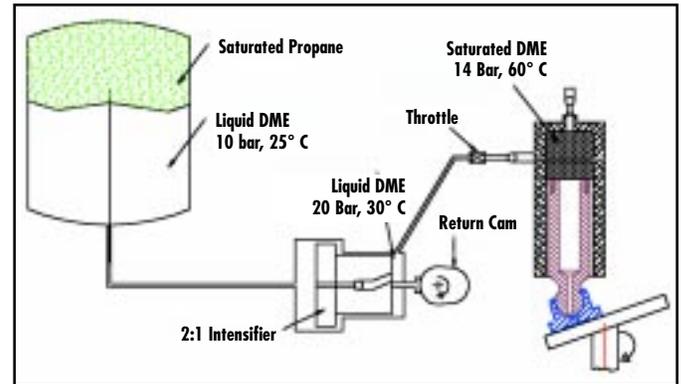
Prototype Fuel Injection System

Challenge

Research has shown that CIDI (compression ignition, direct injection) engines fueled with dimethyl ether (DME) can achieve ULEV exhaust emissions levels while maintaining the thermal efficiency of a conventional diesel.

However, the unique physical properties of DME present challenges to its utilization.

DME is a gas at atmospheric pressure but liquifies under modest pressurization. DME also has very low viscosity, leading to high internal leakage in supply pumps, solenoid valves, and fuel injectors. Such limitations require that significant modifications be made to conventional fuel injection equipment to accommodate the use of DME in a diesel engine.



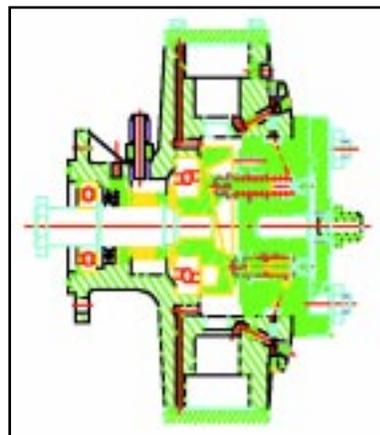
Fuel delivery system.

cylinder. If piston speed is low enough, inlet flow is equal to the piston displacement. If piston speed is high, inlet flow is lower than the piston displacement; the fuel vaporizes and then re-liquifies upon compression by the piston. When all of the fuel is liquefied, pressure rises and fuel flows out.

Technology Description

A high efficiency, variable displacement axial piston fuel pump has been designed for use in DME fueled CIDI engines. The wobble plate actuated pump design permits variable displacement through inlet throttling and high efficiency (low leakage) through positive sealing.

A uniquely designed fuel tank delivers liquid DME under pressure of 10 bar to the pump. A cam actuated intensifier increases fuel pressure supplied to the throttle inlet to 20 bar. As the piston strokes down, fuel flows through the throttle and into the



Variable displacement fuel pump.

Accomplishments

The pump has been integrated into a complete common rail fuel system and packaged for use on a Ford DIATA engine. Additional fuel system components have been designed. These include: fuel injector assembly, rail pressure and back pressure control valve mountings, fuel filter, supply and return lines, and fuel tank assembly.

Benefits

- CIDI engines have the highest thermal efficiency of any demonstrated automotive power plant.
- DME fueled engines could limit harmful emissions without sacrifice to engine efficiency.

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Future Activities

Emissions and performance demonstrations are underway using the developed fuel system installed on a Ford DIATA CIDI engine fueled with DME.

Partners in Success

- AVL Powertrain Technologies, Inc.
- Ford Motor Company
- National Renewable Energy Laboratory

