



Université du Québec

École de technologie supérieure

High Pressure Direct Injection System

- Objective: The EPA laws requires lower emission levels for snowmobile engines
- Impact: Stock semi-direct injected two-stroke engines are not passing today's EPA emissions level.
- Choice: Development of a Direct Injection (DI) prototype similar to an E-TEC system (which passes EPA levels) using of standard, widely available High Pressure Injectors.

High Pressure Direct Injection System

● Advantages:

- High injection pressure (1500 psi) allowing shorter crank angles for mixture preparation.
- Injection in cylinder when transfer port is closed avoids fuel short-circuiting.
- Engine lubrication is done with an electrical oil pump controlled by the ECU, thus variable oil-ratio depending on engine operation is possible.

High Pressure Direct Injection System

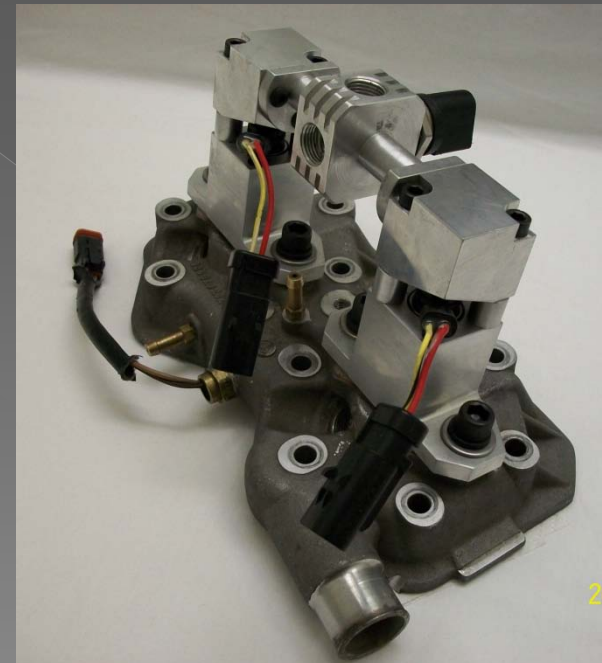
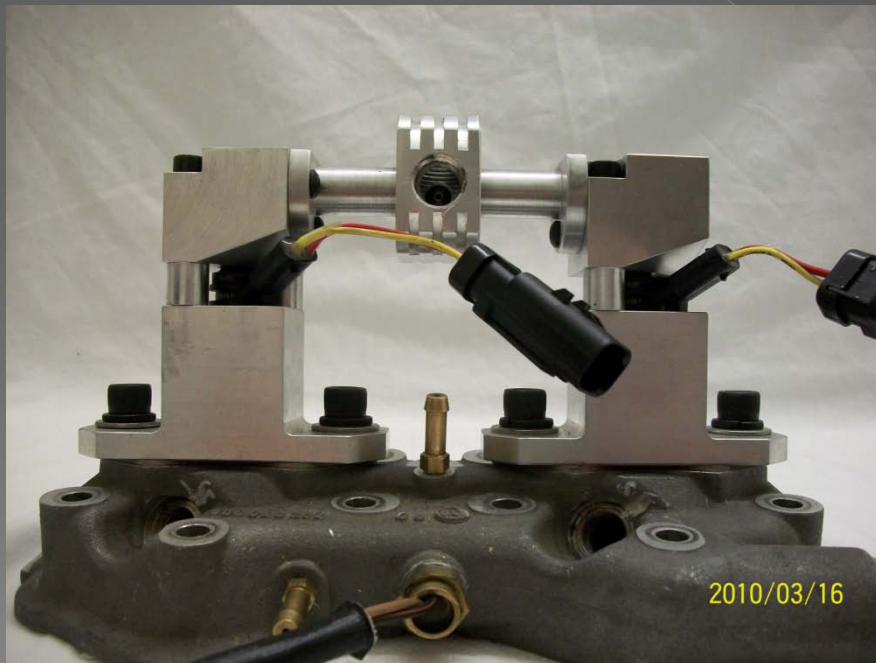
- Fuel injectors

- > Injectors have the same cone characteristic as the E-TEC system
- > Injectors orientation is 10° away from exhaust port to reduce fuel short-circuiting.
- > Peak and hold driver (20Amps peak/8Amps hold) allows quick opening of the injectors even at high fuel pressures.

High Pressure Direct Injection System

Injection location:

Injector installation picture:



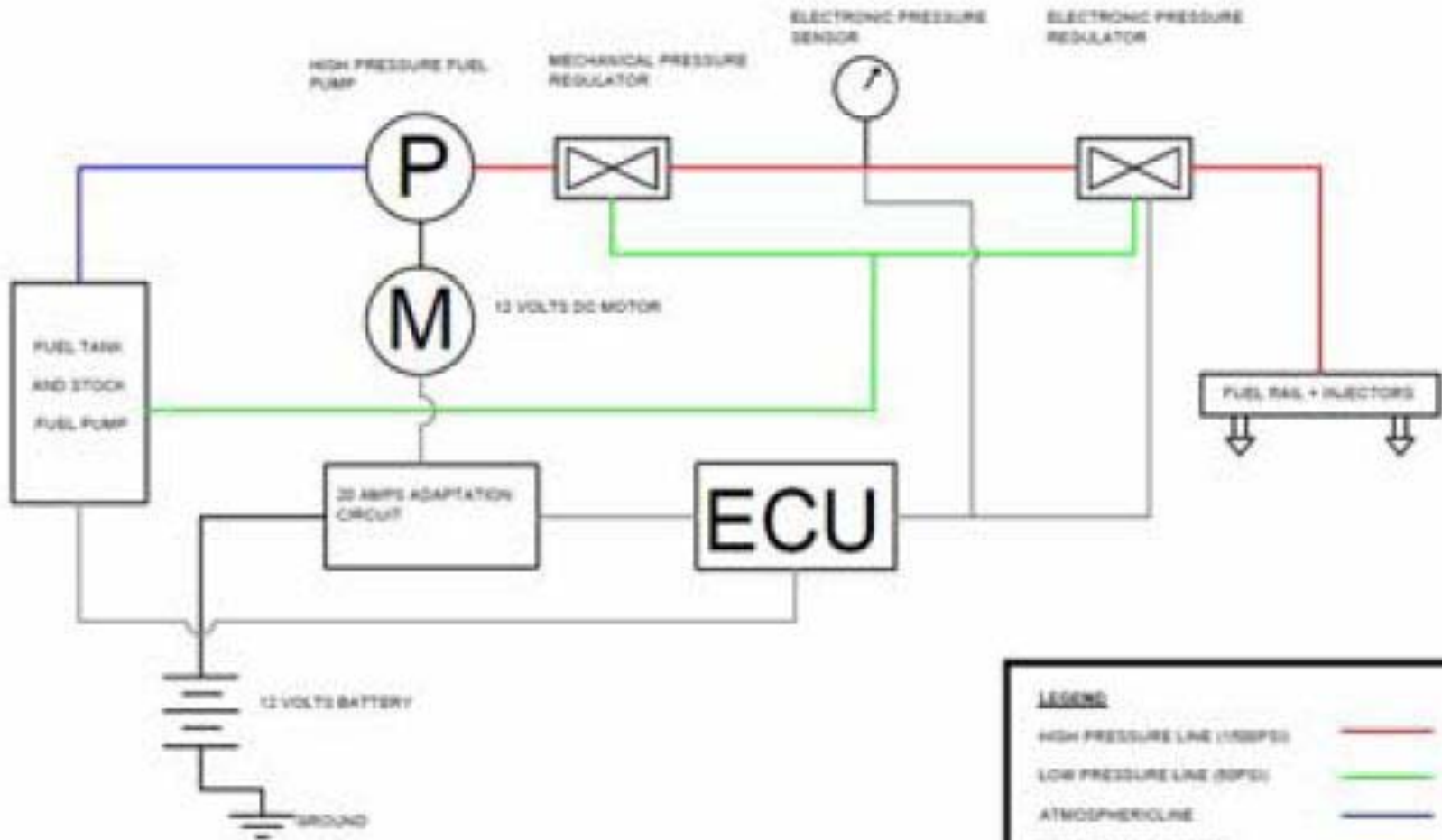
High Pressure Direct Injection System

Gas Pressure:

Installation of a piston pump driven by an electric motor

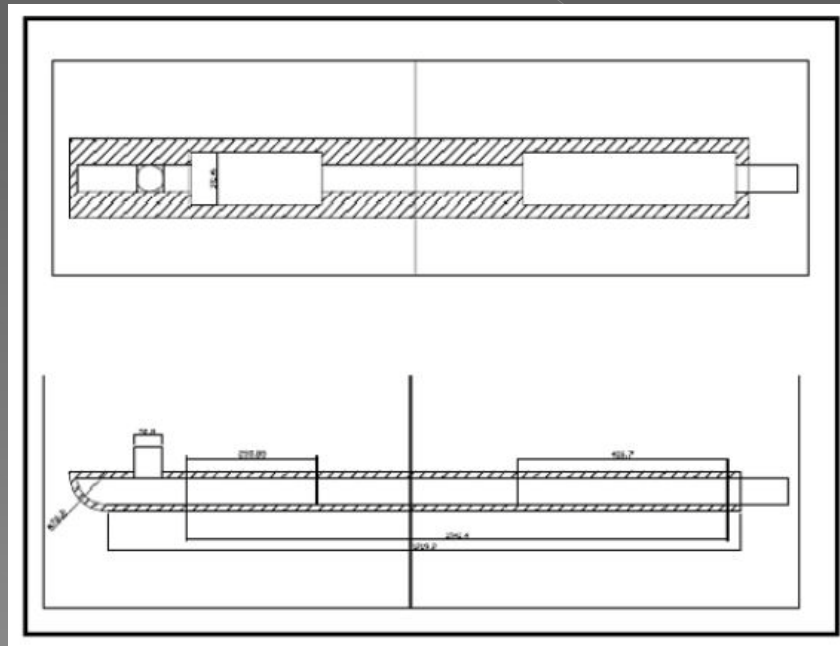
- The Low Pressure pump (original) supplies the High Pressure Pump (HPP)
- The HPP is driven by an electric motor allowing variable flow rates and easier cold starting.
- This unit is located at the end of the snowmobile due to a lack of space in the engine bay.

Fuel circuit schematic



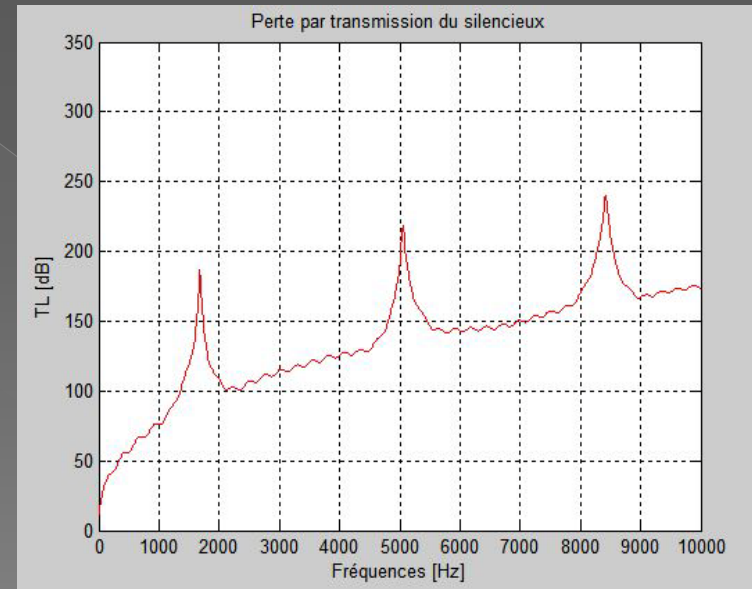
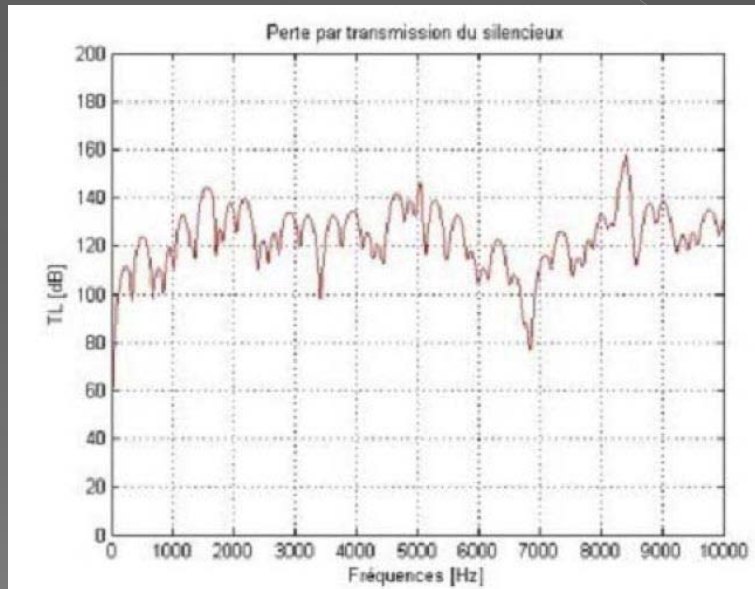
Noise reduction

- New muffler design:
 - > 3 resonators
 - > 2 expansions chambers



Noise reduction

- Muffler sound transmission attenuation



Noise reduction

- ◉ Foam Isolation



- ◉ Line-X recovering the chassis