

## Directstart device for starting an internal combustion engine

The new method for direct injection of natural gas and hydrogen into the combustion chamber allows the use of the directstart in spark ignition engines with small numbers of cylinders. The method delivers sufficient energy into the combustion chamber where the first combustion occurs to achieve a very fast and silent start of the engine.

### BACKGROUND

Up to now the use of the directstart was only possible in engines with four or more cylinders. This is because smaller numbers of cylinders effect a higher demand of energy for the first combustion and an assist of electrical machines (e.g. a starter) was necessary. This slows the speed of the start, generates unnecessary noise and the onboard power supply systems has to be stabilized.

### TECHNOLOGY

Direct injection of compressed air into the combustion chamber in which the first combustion occurs, makes it possible to bring in more fuel gas (methane, hydrogen, etc.) and increase the energy of the first combustion. This method will ensure that the directstart (conventional and extended) is applicable in internal combustion engines with small numbers of cylinders. For the injection of compressed air as well as natural gas the same injector is used. Because of that no additionally device is necessary to increase the charge. With this starting method it is possible to realise a fast, silent and comfortable engine start which works without any assist of electrical machines (a starter for example).

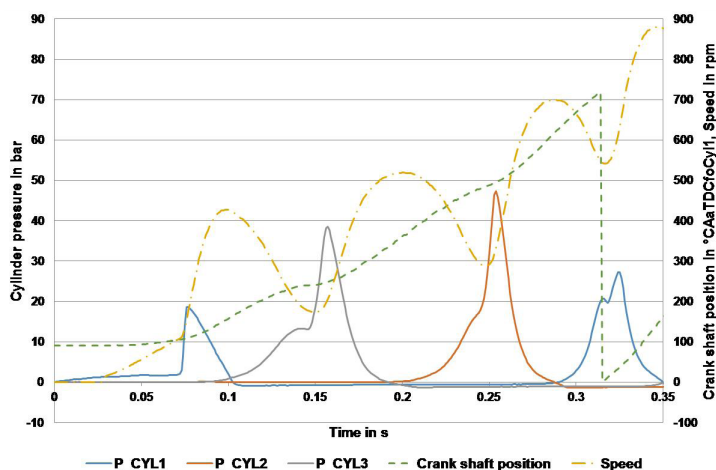


Fig 1: Conventional directstart with air injection into cylinder 1

### ADVANTAGES

- very fast start
- no stabilization of onboard power supply systems necessary
- starter is not needed
- very silent start

**REFERENCE:**  
M012/2016

**APPLICATIONS:**

For starting a spark ignition engine with direct injection of natural gas or hydrogen

**DEVELOPMENT STATUS:**  
prototype available

**KEYWORDS:**

Directstart, air injection, natural gas, hydrogen, direct injection of natural gas

**OPTIONS:**

- R&D - Cooperation

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