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Modifications of a spark ignition engine to operate with hydrogen and methane blends

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Extended abstract. While hydrogen fuel cells achieve enough maturity, hydrogen could be used in internal combustion engines to contribute to a smooth transition to the hydrogen economy which is approaching as an energetic alternative economy. Good hydrogen properties and easy modifications of the machinery with low costs permit to convert an Internal Combustion (IC) engine in hydrogen fuelled engine. This strategy may play a relevant role in this energetic economy transition. The properties of hydrogen involve that the improvements provided of use as fuel are better in Spark Ignition (SI) engines. On the other hand, the properties of hydrogen used as fuel generates some problems in SI engines, as the backfire, the knock and NOx emissions, which have to be controlled. In order to that, some modifications are necessary to carry out in engines, as the implementation of thermal dilution systems. All the systems together new fuels require a flexible controller system to be managed for every hydrogen and methane blend used. Therefore, it's worth studying in depth the performance of SI engines fuelled with hydrogen pure or blended with other fuels. For this reason, an investigation project is carrying out in the Department of Mechanical Engineering of the Zaragoza University with the aim to analyze deeply the performance of SI engines fuelled with hydrogen and methane blends in the widest range of operation conditions. This project comprises two phases. This paper is focused to the first one, which expose the selection of engines to achieve the aim of the investigation project, the modifications and sensorization that engines require for hydrogen and methane blends and testing (Fig. 1) and the gaseous fuel supply line implemented in the testing bench under the most strict safety and efficiency conditions according to technical specifications of installations and equipment for hydrogen (Fig. 2).

Key words. Hydrogen and methane blends, Spark ignition engine, NOx emissions, Lean operation conditions, Thermal dilution.

Fig. 1. Some modifications made in the inlet manifold. (1-Air inlet manifold; 2-Secondary manifold; 3-Cylinder head; 4-Gaseous fuel injection system; 5-Gasoline fuel injection system)

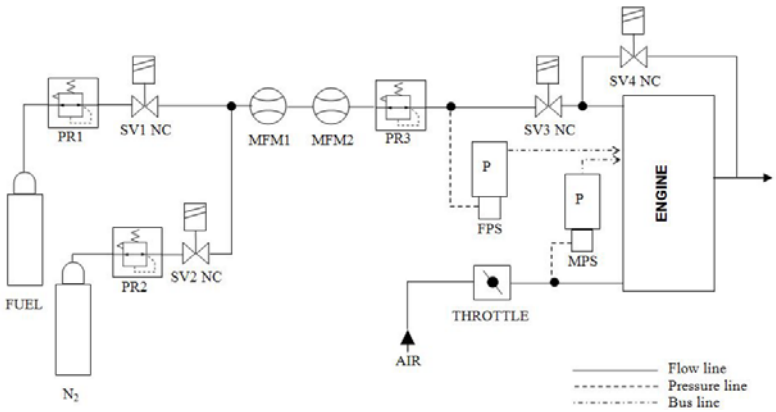

Fig. 2. Scheme of fuel supply installation. It includes the N2 vent system