



Researchers at the Universitat Politècnica de València develop a system to optimize the performance and fuel consumption of engines operating at altitude, through laboratory tests

- The device simulates the pressure and temperature conditions at high altitude of the air that is sucked into a reciprocating internal combustion engine and evaluates its performance through a test bench.
- The system also helps prevent possible malfunctions of engines and optimize pollutant emissions reduction.
- The system, patented by the UPV, can be applied in both the aeronautical and the automotive industries.

Researchers at the Universitat Politècnica de València's CMT-Heat Engines Institute have developed a system that, in a laboratory test bench, reproduces the pressure and temperature conditions at high altitude of the air that is sucked into a reciprocating internal combustion engine, and evaluates the engine's performance in a comfortable, safe and controlled environment.

These simulations help prevent possible malfunctions of (aircraft or car) engines under certain conditions, as the malfunction can be diagnosed in the laboratory before the engines are used in actual service conditions. They also facilitate carrying out optimization studies of fuel consumption –which is affected by the characteristics of the air that is sucked into the engine– and pollutant emissions reduction, as well as checking whether a given engine part is working properly.

According to the UPV's CMT-Heat Engines Institute researchers, when designing engines that have to operate at a certain altitude above sea level, it is necessary to take into account the significant reductions that occur in temperature and atmospheric pressure as altitude increases. Such variations affect air density, and all these parameters affect the engines' performance.

"The system was developed initially for the aeronautical industry, but its design and features allow us to also use it to evaluate the performance of those engines that are used for ground transportation at high altitude, as in the case of transportation in the mountains, or mining or any other industrial activity that takes place at high altitude above sea level", said José Ramón Serrano, a researcher at the CMT-Heat Engines Institute.

The device, patented by the Universitat Politècnica de València, can be used in any institution's test benches to carry out comprehensive analyses of pollutant emissions and engine consumption, and also to evaluate the effects on engine performance of snow and/or ice formation without the need for the test benches to be located at high altitude, which would lead to a huge increase in the cost of tests. In addition, in aircraft design, the device can be used for developing and/or optimizing small engines in private jets and/or small unmanned aircraft.

There are currently no other devices on the market with the same characteristics as the system patented by the UPV. In the case of the engines of land vehicles travelling at high altitude, current devices separate the process of cooling from that of vacuum generation, which makes them much more expensive. In the aeronautical



industry, these tests take place in large chambers within which, thanks to a vacuum pump and huge refrigeration units, the temperature and pressure conditions that occur in air navigation are reproduced. The cost of achieving these operating conditions, the equipment and the facilities needed is very high.

“The energy consumption of our device is lower than in any of the alternative or equivalent solutions. Moreover, it keeps the advantages of other devices and incorporates additional improvements in implementation, maintenance and operation costs, which makes it a unique device on the market. And there is a cost reduction in the parts, too”, says José Galindo, a researcher at the CMT-Heat Engines Institute.

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Anexos: