



Aurobay's MP Miller technology: the future of hybrid engines

Meet the Aurobay MP Miller engine

Following the success of the 145 kW (197 PS) Low Power (LP) Miller engine released in 2021, Aurobay is set to release a 184 kW (250 PS) Medium Power (MP) Miller variant in early 2024. Developed in-house in Aurobay's home Sweden, this engine is a combined evolution of the MP (Otto) and LP (Miller) variants and part of the same two liter, 4-cylinder family.

Base configuration and operation principles

Thanks to the continuous study of the LP Miller engine, we developed an understanding of the possibility of reaching higher power while maintaining much of the fuel efficiency benefit. Through paying significant attention to what components and systems needed to be reworked versus carried over from the base MP (Otto) variant we were able to create a cost-effective Miller concept.

Gas exchange system

We refined the breathing properties of the engine to set up advantageous boundary conditions over the combustion system. Aurobay's MP Miller is developed on carefully selected intake and exhaust valve lift duration and phasing, which are combined with a variable nozzle turbine (VNT) turbocharger. Thanks to this, at higher loads where boost pressure is needed, exhaust back pressure is lower than intake boost pressure. This leads to low pumping losses and improves brake efficiency directly through the cycle's work balance. It also improves efficiency by minimizing trapped residuals and reducing knocking propensity, allowing for more favorable combustion phasing.

Combustion system development

During development, we identified a tradeoff between increased tumble and the resulting increased convective heat losses that it brings. Instead of maximizing tumble, more moderate tumble levels led to higher brake efficiency.

The Miller cycle allowed the geometric compression ratio to be increased from 10,5 to 11,5, which was achieved in-part by designing a new piston with a slightly bowl-shaped surface, similar to the one that proved beneficial in the LP Miller engine.

Using optical combustion diagnostics and CFD calculations we refined the injector spray pattern, resulting in a significant reduction in cold engine particulate emissions.

Exhaust after-treatment system and emission standards

The MP Miller engine is fitted with two different aftertreatment systems. One of them complies with the SULEV30 PM1 emissions regulation without the use of a gasoline particulate filter (GPF). The other one includes a GPF to meet the China 6b and Euro 6e-bis emission regulations.

Catalyst aging is reduced through the lower exhaust temperatures enabled by the Miller cycle and the more uniform flow and temper-

ature distribution of the VNT turbocharger. This allowed significant cost savings through reduced precious metal loading.

From concept to production: Aurobay's process

Having all the necessary in-house capabilities, we were able to bring this engine from concept to final production while retaining full control of the workstream. This, together with the joint effort of our global purchase, manufacturing engineering and design engineering capabilities, allowed us to complete the full engine development within the set timeframe while reaching a significant level of cost reduction, setting a new standard for our future ways of working.

The end result is a 184 kW, two-liter engine with no need for fuel enrichment. This is one of the market's highest specific power levels for non fuel-enriched spark ignition engines. Compared to the Otto cycle predecessor, power output is much less sensitive to low-octane fuel and high-ambient air temperature. brake efficiency remains high in a broad region of the static operating map and the penalty in efficiency is small when valve timing settings deviate from optimum to support engine response in transient situations.

About Horse Powertrain Ltd

Horse Powertrain is a new global leader in powertrain solutions, with 19,000 employees on three continents. It partners with automotive OEMs worldwide to enable a faster transition to cleaner mobility. Each year, its subgroups, Horse and Aurobay, produce c. 5 million next-generation powertrain solutions, including engines, transmissions and hybrid systems.

The company has 17 global plants and 5 R&D centres around the world, serving multiple OEMs including Renault Group, Geely Auto, Volvo Cars, Proton, Nissan and Mitsubishi Motors Company. Horse Powertrain is headquartered in London, UK, and has €15 billion in yearly revenues.

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