

High cost savings: new scalable and modular hybrid drive from MAHLE

- Integrated, scalable hybrid solution for vehicles from B-segment through to large J-segment SUVs
- Modular approach for tailoring performance to a specific application, while retaining maximum component commonality
- Newly developed, highly efficient combustion engine especially designed for use within hybrid drives

Stuttgart, August 29, 2019 – MAHLE has developed a new, fully integrated and modular hybrid drive that can be tailored to suit a wide range of vehicle applications. The MAHLE Modular Hybrid Powertrain (MMHP) is a fully integrated, plug-in hybrid drive that incorporates a highly efficient 2- or 3-cylinder, turbocharged gasoline engine featuring the latest technologies from MAHLE. In comparison with established hybrid technologies, it offers several advantages: it is more cost-efficient, more compact, and lighter.

The performance of the electric powertrain used in MMHP reduces the requirements for the combustion engine, enabling the development of a cost-optimized “Dedicated Hybrid Engine (DHE).” The engine concept was designed exclusively for hybrid applications and benefits from the latest innovations made with the passive MAHLE Jet Ignition (MJ^I) system. The passive MJ^I system consists of a small prechamber, which houses a conventional spark plug fitted within the engine’s combustion chamber. It generates hot radical jets, which create a very short combustion event within the engine’s cylinder, thus enabling a high compression ratio and a high exhaust gas recirculation rate, leading to reduced fuel consumption. The use of port fuel injection (PFI), a single overhead camshaft (SOHC) without variable valve timing control, and simple two-valve per cylinder technology serve to minimize the costs.

“In order to avoid penalties, vehicle manufacturers must comply with the EU’s legislative target of fleet average CO₂ emissions of 59.4 g/km by 2030. Electrification is leading the way as the industry’s chosen technology to achieve this,” says Dr. Martin Berger, Director at MAHLE Powertrain, MAHLE’s Engineering Services business area. “The advancement of hybrid technology is crucial for the industry as a whole to achieve future emissions targets. As a result of the focus on reduced emissions and strict schedules, new vehicle and technology development must occur within a much tighter timeframe. The MAHLE Modular Hybrid Powertrain (MMHP) offers vehicle manufacturers a low-cost and quick, off-the-shelf solution, easing the process.”

The dual-mode hybrid arrangement has been selected for the MMHP, as it combines the best features of both series and parallel hybrid architectures. It allows for flexible vehicle operation, while providing optimal NVH behavior. When battery SOC is high, the vehicle can operate as a pure EV, whereas when SOC is low and at slow driving speeds it can switch to series hybrid mode. At higher vehicle speeds, however, the combustion engine can be connected directly to the wheels in a parallel hybrid arrangement.

Thanks to a gearbox with customizable transmission ratios, the engine can run flexibly at any given vehicle speed. Options for 1-, 2-, and 4-speed transmissions are available, depending on application requirements. As a result, the fully integrated, electric traction motor is directly connected to the wheels at all times, facilitating uniform performance and a dynamic driving experience with uninterrupted torque delivery. The motor can also be designed with different power/torque outputs. Coupled with optimized battery sizing, this allows full scalability of the hybrid powertrain for all applications.

“The modular hybrid powertrain from MAHLE features the perfect combination of efficiency, performance, and range without

jeopardizing driving pleasure,” concludes Dr. Berger. “The powertrain’s compact size can also help comply with design-related packaging constraints, while the relatively low weight enhances efficiency and performance.”

The hybrid drive is suitable for a variety of applications—from B-segment through to large J-segment SUVs. The engine itself has achieved ultralow specific fuel consumption figures of 207 grams per kilowatt hour in early stage testing. In the future, fuel consumption of around 195 grams per kilowatt hour in lean operation is realistic by using an active MJJ[®] system. When applied to a compact crossover SUV, WLTP-weighted CO₂ emissions are calculated at 18 grams per kilometer. The weight of the hybrid powertrain is similar to a current 4-cylinder gasoline engine with 6-speed manual transmission. The specially designed combustion engine offers potential cost savings of up to 30 percent.

About MAHLE

MAHLE is a leading international development partner and supplier to the automotive industry as well as a pioneer for the mobility of the future. The MAHLE Group is committed to making transportation more efficient, more environmentally friendly, and more comfortable by continuously optimizing the combustion engine, driving forward the use of alternative fuels, and laying the foundation for the worldwide introduction of e-mobility. The group’s product portfolio addresses all the crucial issues relating to the powertrain and air conditioning technology—both for drives with combustion engines and for e-mobility. MAHLE products are fitted in at least every second vehicle worldwide. Components and systems from MAHLE are also used off the road—in stationary applications, for mobile machinery, rail transport, as well as marine applications.

In 2018, the group generated sales of approximately EUR 12.6 billion with more than 79,000 employees and is represented in over 30 countries with 160 production locations. At 16 major research and development centers in Germany, Great Britain, Luxembourg, Spain, Slovenia, the USA, Brazil, Japan, China, and India, more than 6,100 development engineers and technicians are working on innovative solutions for the mobility of the future.

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