

## **Balancing heat and cold for improved cruising range, performance, and comfort in electric vehicles**

- MAHLE's thermal management technology paves the way for electric mobility
- Cruising range of electric vehicles increased by up to 20 percent thanks to MAHLE solutions
- Thermal management thus influences decisive acceptance factors for e-mobility
- Presentation of the holistic approach at IAA 2017
- Refined thermal management approach in the "MEET" (MAHLE Efficient Electric Transport), the 48-volt vehicle concept from MAHLE

Stuttgart, August 23, 2017 – E-mobility will be a key component of CO<sub>2</sub>-neutral individual transportation over the long term. MAHLE aims to be one of the innovation drivers in this field too. The refined management of the occurring heat flows is the foundation for the performance, cruising range, and service life of electric vehicles. At this year's IAA Cars in Frankfurt, MAHLE will be illustrating its holistic approach to innovative thermal management and presenting the appropriate product solutions. MAHLE Thermal Management will also be available to experience in the 48-volt concept vehicle MEET.

### **What was simple cooling is now complex thermal management**

Until a few years ago, the most urgent task in engine cooling was to protect the engine block against overheating, especially under high loads. Since then, the demands placed on consumption, emissions, and passenger comfort have changed, and the electrification of the powertrain has continued to advance. As a result, the cooling of the powertrain is transforming more and more into complex thermal management.

Thermal management is also a key technology for the acceptance of electric mobility, extending battery service life, increasing cruising range and drive system performance, and providing added passenger comfort. In order to address the various thermal issues, coolant circuits at different temperature levels are required. The primary task of thermal management is now to provide optimal media temperatures to meet demand for efficient energy utilization.

**Critical heat sources are no longer available—MAHLE has the solutions**

At first glance, the step to a purely electric powertrain seems to simplify thermal management. Although the number of circuits is reduced, the powertrain loses its most important heat source, the combustion engine. Particularly in winter, this is a challenge for interior temperature control, which relates to comfort and safety. In a first step, a high-voltage heater from MAHLE installed on the air side or the coolant side can ensure passenger comfort without great effort. This comes at a cost for the cruising range, however, as in both cases the battery is loaded at 100 percent. If the low yet present waste heat from the electric motor and power electronics is used in conjunction with a coolant/coolant heat pump from MAHLE, the cruising range (at 0°C) can be increased by up to 20 percent in comparison.

**Fast charging—crucial for acceptance of electric mobility**

Modern electric mobility will only find widespread acceptance when significantly shorter charging times for the electric energy storage can be achieved, which are currently still quite long. MAHLE already offers high-performance components that make fast charging possible.

In contrast to filling a tank with fuel, charging a battery is subject to losses. The faster the charging process, the higher the electrical current needed and thus the higher the losses due to heat. In order to rapidly charge the battery, while protecting it from

premature aging, it must be subjected to active cooling that incorporates all existing cooling circuits, depending on the outside temperature. For rapid charging, for example, the air conditioning must provide up to 12 kW just for battery temperature control when the outside temperature is high. By way of comparison, current systems, dedicated solely to interior cooling, use about 8 kW.

**Improved cruising range for electric vehicles in urban traffic**

MAHLE has also put a refined thermal management approach to the electric powertrain into practice in MEET, the 48-volt vehicle concept for urban mobility. The technical focus of MEET is on maximum energy efficiency, which increases as a result of the combination of various energy-saving technologies in the powertrain and thermal management system. This leads to a significant improvement in the cruising range of the vehicle—especially at low external temperatures. As already announced, MEET will celebrate its world debut at this year's IAA.

**Holistic solutions from MAHLE for all types of drive**

Holistic and intelligent thermal management is thus a basic prerequisite for acceptance of battery-powered electric mobility. Crucially, it will also become increasingly important for other types of drive, such as fuel cells. MAHLE is able to use its experience and expertise to develop and implement integrated solutions in this area. The company provides the products and systems needed for such complex thermal management of hybrid and battery-powered electric vehicles, or those with fuel cell powertrains.

MAHLE will be presenting its vision for innovative thermal management at this year's IAA Cars from September 14 to 24, 2017, in Frankfurt at Stand C40 in Hall 8.0. Here, you will also have the opportunity to experience our 48-volt vehicle concept. The press conference will take place at the MAHLE stand on September 12, 2017, from 2:45 p.m. to 3:10 p.m. Please note this

date in your editorial calendar. We look forward to seeing you there!

### **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 2016, the group generated sales of approximately EUR 12.3 billion with about 77,000 employees and is represented in 34 countries with 170 production locations. At 15 major development centers in Germany, Great Britain, Luxembourg, Spain, Slovenia, the USA, Brazil, Japan, China, and India, 6,000 development engineers and technicians are working on innovative solutions for the mobility of the future.

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