

Press release

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MAHLE supports Liebherr in developing hydrogen-fueled heavy-duty engines

- Important test results achieved
- MAHLE Jet Ignition (MJI) active prechamber technology is key to efficient and stable hydrogen combustion
- Development paves the way for hydrogen to be used in heavy-duty and off-road applications, such as excavators, track vehicles, and wheeled loaders

MAHLE Powertrain, the development service provider of automotive supplier MAHLE is supporting Liebherr Machines Bulle SA in their research aimed at developing hydrogen-fueled internal combustion engines. Their work involves the use of MAHLE's prechamber jet ignition system (MJI). Engine tests have shown that by using this technology, the mixture of hydrogen and air can be ignited and burned at a high compression ratio, which makes the combustion process very efficient and stable. This paves the way for hydrogen generated in climate-neutral processes to be used in heavy-duty and off-road applications, such as excavators, track vehicles, and wheeled loaders.



The MAHLE Jet Ignition makes hydrogen combustion in Liebherr motors possible.

“The use of hydrogen as a combustion fuel has the potential to make many heavy-duty and off-road applications climate-neutral quickly,” says Peter Wieske, Director Corporate Advanced Engineering at MAHLE. “A large number of studies in recent decades have shown that hydrogen can be used in internal combustion engines without any problems.”

“The expertise of Liebherr’s engineering teams in off-highway engine combustion and research on alternative fuels has been critical in this project,” adds Bouzid Seba, Head of Predevelopment at Liebherr Machines Bulle. He underscores Liebherr’s open approach to all technologies, whereby the company explores various methods of energy conversion and the fuels that are most suited to them.

“The challenge is to stop engine knocking and premature ignition without reducing the compression ratio and thus efficiency and performance yield. Our joint tests suggest that we have found the right solution with MAHLE Jet Ignition,” notes Mike Bunce, Head of Research for MAHLE Powertrain US.

In order to achieve stable operation with a high compression ratio whilst avoiding engine knock and pre-ignition, hydrogen engines must be operated with a large amount of excess air. The energy from a conventional spark plug is not enough to ignite such a mixture. MAHLE Jet Ignition solves the problem by burning a small amount of an ignitable mixture in a prechamber cylinder. The resulting gas plasma is passed through small openings into the main combustion chamber and, due to its high energy content, rapidly and evenly ignites the main gas mixture. Tests with H966 and H964 engines from Liebherr have delivered excellent results in terms of combustion speed, performance, and emissions.

Hydrogen engines are ideal for high load cycles with sudden load changes and cope well with heat, dust, and vibrations. This makes them an excellent choice for use in heavy-duty and off-road applications, where fuel cells hit their limits more quickly.

MAHLE traditionally has strong expertise in air management, filtration, thermal management, and power electronics. The Stuttgart-based technology group already has around 100 employees working on hydrogen-related projects. MAHLE has been a supplier for fuel cell vehicles for more than ten years and operates a hydrogen test center on a 1,400-square-meter site in Stuttgart. As a member of the Hydrogen Council, it also campaigns at a political level for the expansion of hydrogen technology.

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About MAHLE

MAHLE is a leading international development partner and supplier to the automotive industry. The technology group is now broadly positioned in the areas of powertrain technology and thermal management with a clear focus on future topics relating to mobility. As part of its dual strategy, MAHLE is working both on the intelligent combustion engine for the use of hydrogen and other nonfossil fuels and on technologies that will help the fuel cell and e-mobility achieve broad acceptance in the markets. The product portfolio of the company, which was founded in 1920, addresses all the crucial aspects of the powertrain and air conditioning technology. Half of all vehicles in the world now contain MAHLE components. #weshapefuturemobility

In 2020, MAHLE generated sales of approximately EUR 9.8 billion and is represented in over 30 countries with more than 72,000 employees in 160 production locations and 12 major research and development centers. (Last revised: 2020-12-31)

About the Liebherr Group

The Liebherr Group is a family-run technology company with a highly diversified product portfolio. The company is one of the largest construction equipment manufacturers in the world. It also provides high-quality and user-oriented products and services in a wide range of other areas. The Liebherr Group comprises over 140 companies across all continents. In 2020, it employed more than 48,000 people and generated total consolidated sales of over EUR 10.3 billion. Liebherr was founded in Kirchdorf an der Iller in southern Germany in 1949. Ever since then, its employees have pursued the goal of meeting customer needs by providing sophisticated solutions while helping to shape technological progress.