

News Release



BorgWarner's growing hybrid and electric product portfolio delivers clean, efficient vehicle propulsion

- *BorgWarner delivers a growing lineup of propulsion solutions for customers' electric vehicles as well as mild, full and plug-in hybrid vehicles*
- *The company offers products for the full range of hybrid architectures incorporating advanced technologies and manufacturing processes*
- *BorgWarner provides flexible, cost-effective options for propelling hybrid and electric vehicles with individual components or fully-integrated propulsion system solutions*

Auburn Hills, Michigan, September 26, 2018 – BorgWarner is developing solutions for nearly every propulsion equation an Original Equipment Manufacturer (OEM) is trying to solve. The company is leveraging its in-house technology development to deliver clever hybridization and electrification technologies to assist OEMs in producing high-performing, energy-efficient vehicles. As the push to lower emissions and increase efficiency continues to intensify globally, BorgWarner's complete range of propulsion products is designed to address three primary challenges: answer current and future OEM requirements for every form of powertrain; satisfy evolving consumer desires and governmental regulations; and consider the cost implications of more advanced systems. Whether it's a compact hybrid architecture, electric boosting, a complete electric drive module, or superior thermal management, BorgWarner has an innovative solution.

"In creating our comprehensive portfolio of hybrid and electric systems, we draw from our deep background and industry-recognized expertise in propulsion technologies to assemble a full-array of world-class products," said Hakan Yilmaz, Chief Technology Officer, BorgWarner. "Our unique focus on solutions to propel hybrid, electric and internal combustion vehicles with greater efficiency sets us apart from other manufacturers, and showcases our leadership in, and commitment to, developing the cleaner and more efficient vehicles of tomorrow."

Electrification is a growing trend for both passenger and heavy-duty vehicles, with many OEMs planning to electrify a substantial portion of their vehicles in the next five to 10 years. As a global leader in clean, efficient propulsion technology, BorgWarner estimates that by 2023 it will have content on about half of the hybrids and over 30 percent of the electric vehicles (EV) produced globally.

Hybrid Technology

Whether mild, full, or plug-in hybrid, BorgWarner has potential drive architectures to fit all varieties of passenger and commercial hybrid vehicles, giving automakers complete freedom in selecting the propulsion technology that best fits their needs. The company provides options for every dominant hybrid powertrain design: P0, P1, P2, P3, P4, and Power-split. These technologically-advanced, high-performing solutions can be integrated into existing architectures or incorporated into new platforms. For example, to enable full hybridization at a lower cost, BorgWarner's P2 drive module gives OEMs the flexibility to place the electric motor where they have space in existing architectures, either on- or off-axis, between the engine and transmission, or attached to the transmission.

By using BorgWarner's award-winning S-wind wire-forming process to create the motor, the P2 drive module produces high power and torque densities in an extremely compact package. In addition, the innovative solution offers the possibility of integrating up to three clutches all managed by BorgWarner's proven hydraulic controls system. The solution offers pure electric drive and many other driving modes as well as other functional benefits including stop/start, regenerative braking and supplemental electric propulsion. It is available for 48-volt and high-voltage hybrid systems. BorgWarner is a leading supplier of 48-volt mild hybrid technologies with an expanding lineup of products, including the eBooster® electrically driven compressor, eFan, and efficient motor generator units that can be utilized in a variety of positions throughout the propulsion system.

Electric Technology

Along with its hybrid technologies, BorgWarner's EV portfolio demonstrates the company's ability to design and develop all parts in house. The company was one of the first to launch a fully integrated electric drive module (eDM) by combining two of its superior EV components: the powerful High Voltage Hairpin (HVH) 250™ electric motor and eGearDrive® electric-drive transmission. As a result, the eDM is a compact, easy-to-install, high-efficiency solution that features class-leading power and torque to enable more miles per charge for battery-powered and P4 (the hybrid motor is located on the rear axle of the front-wheel-drive vehicle) hybrid vehicles. As an individual component, the eGearDrive was developed to extend electric

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driving range. This advanced transmission incorporates a high efficiency helical geartrain and adaptable motor flange interface for ease of motor integration. Alternatively, BorgWarner's patented HVH Series electric motors come in a variety of configurations and are available as fully-housed motors or rotor/stator assemblies. These durable, rugged motors can be used in virtually any situation including light-duty, heavy-duty, and on- and off-highway vehicle applications with more than 95 percent efficiency for increased driving range. Building on the eDM, the company's iDM system includes the components of the eDM along with integrated power electronics that control the system.

Thermal Management

Since thermal management is a major concern in hybrid and EVs, BorgWarner capitalizes on its keen awareness of the latest engine technology developments and regulatory mandates to assemble a range of thermal management solutions that are high performing and efficient. This acute understanding of the thermal requirements for propulsion technologies is coupled with the company's in-house manufacturing excellence, to design a range of systems, including cabin and battery heaters and electronic fans (eFans).

The company's high-voltage cabin heaters create a comfortable interior made possible by its dual-zone heating and core temperature sensing abilities, while increasing functionality by quickly defrosting windows without wasting excess heat. Similarly efficient, BorgWarner's battery heater's fast response time enables optimal battery and cabin temperature management with a compact size and weight for the respective heaters.

BorgWarner's high-performance 48V electric fan portfolio creates a foundation for current and future automotive cooling requirements including mild and plug-in hybrid and full electric vehicles. The 48V light weight eFan delivers high airflow with minimal speed and low noise. The innovative integral motor concept with active cooling permits operating temperatures of up to 120 degrees Celsius (248 degrees Fahrenheit) which results in an extended operating life. With a potential power range of 500W to 1,500W, 48V eFans are a solution for passenger cars, sport utility vehicles or light commercial hybrid and electric vehicles.

Power Electronics

The acquisition of Sevcon in 2017, complemented BorgWarner's organic power electronics capability for its hybrid and electric vehicle product portfolio. Leveraging Sevcon's 60-year history and expertise in controller technologies, BorgWarner offers a range of High Power

High Voltage (HPHV) controllers that are designed to fit common motor types, such as 3-phase AC induction motors or permanent magnet machines, and are recognized for their high-power densities. With applications for light-duty, heavy-duty, off-highway and commercial vehicles, the HPHV controller technologies deliver lightweight and compact solutions for electrified powertrains. By adding power electronics to its diverse product portfolio, BorgWarner has complete in-house technology development and production across the entire hybrid and electric propulsion systems. This enables BorgWarner to provide whatever the customer needs for hybrid and electric propulsion systems, from individual parts to full propulsion systems.

About BorgWarner

BorgWarner Inc. (NYSE: BWA) is a global product leader in clean and efficient technology solutions for combustion, hybrid and electric vehicles. With manufacturing and technical facilities in 66 locations in 18 countries, the company employs approximately 29,000 worldwide. For more information, please visit borgwarner.com.



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