

Future-proof Technologies



Knowledge Library

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BorgWarner offers numerous drivetrain technologies for improved handling and vehicle dynamics to meet current and future demand for drivability-enhancing technologies.

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Introduction

Due to recent trends, all-wheel drive (AWD) and advanced drivetrain solutions which provide enhanced drivability enjoy great popularity. With its complete line of transfer cases, AWD couplings, electronic limited-slip differentials, torque vectoring technology and hybrid/electric vehicle driveline systems, BorgWarner has the right technology for virtually any circumstances, as can be seen in Figure 1.

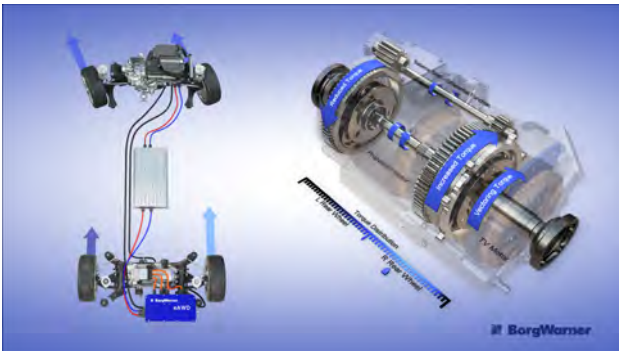


Figure 1. While improving fuel economy by up to 25 percent compared with a mechanical AWD system, BorgWarner's eAWD system provides increased vehicle stability and dynamics.

The success story of BorgWarner PowerDrive Systems

The story of BorgWarner's PowerDrive division commences in the early 20th century

in Muncie, Indiana, where Tom and Harry Warner designed a differential gear for automobile transmissions which allowed a vehicle's two drive wheels to turn at different speeds during cornering. Being established in 1901, the Warner Gear Company had great success with the first standard transmission for all makes of cars in 1919. The Borg-Warner Corporation was founded in 1928 by merging Warner Gear with Borg & Beck and two other companies. Twelve years later, BorgWarner's Warner Gear division expanded its portfolio by adding innovative transfer cases. While customer expectations with regard to high quality and outstanding performance have never changed, the technologies themselves have advanced considerably.

Growing popularity of AWD systems

Since 1990 in particular, the automotive industry has witnessed tremendous growth in the demand for vehicles with AWD systems. Besides the established markets of North America, Western Europe, Japan and South Korea, the main drivers of this growth are the so-called BRIC countries Brazil, Russia, India and China. All-wheel drive applications, originally reserved for



Figure 2. Compared with previous technologies, BorgWarner’s well-proven GenV AWD coupling features a light and compact design for reduced vehicle complexity and easier integration into the drivetrain.

sport utility vehicles (SUVs) because of their advantages off the road, are now in great demand across all vehicle segments. In particular, drivers value the improved handling, dynamics and stability resulting from these technologies.

AWD solutions for enhanced safety

The dominant AWD architecture continues to be active on-demand AWD, in which one axle is the primary driven axle and torque is transferred to the secondary axle when needed. In this context, BorgWarner offers the GenV electronically controlled AWD coupling, a well-proven technology which automatically distributes power between the front and rear wheels, see Figure 2. To accomplish this, a new lightweight and compact design for reduced vehicle complexity and easier integration into the drivetrain is used. BorgWarner’s AWD coupling delivers an immediate pre-emptive response with a high torque accuracy. Calculation is carried out by the integrated elec-

tronic control unit based on data provided by the on-board electronics. If required, full locking torque is available at any time and any speed, depending on road conditions and vehicle load distribution.

This widely respected all-wheel drive coupling was the first major product launch after BorgWarner acquired the Swedish-based Traction Systems division of Haldex AB in 2011. Originally patented by Sigvard Johansson in 1998, it was based on a unique differential pump that created a hydraulic flow proportional to the difference in velocity over the coupling. Using a linear throttle valve that was activated by a stepper motor, the stiffness could be varied and the torque transfer controlled.

FXD – Electronic limited-slip differential system for FWD vehicles

Another future-oriented technology from BorgWarner PowerDrive Systems is the industry-first electronic limited-slip diffe-

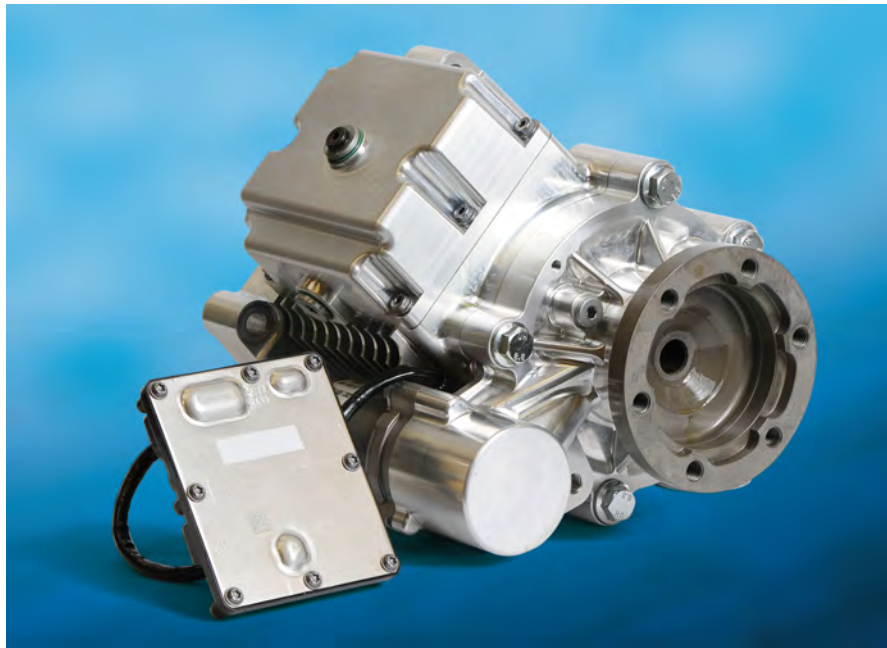


Figure 3. Controlling the locking torque between the front wheels and directing power to the wheel with the best traction, BorgWarner's industry-first electronic limited-slip differential system for FWD vehicles offers enhanced stability.

rential system for vehicles with front-wheel drive (FWD), commonly known as front cross differential (FXD), which is being displayed in Figure 3. Launched in the Volkswagen Golf GTI with Performance Pack, the system constantly communicates with on-board electronics as well as vehicle sensors, using data such as steering angle, engine torque or yaw rate to adapt the torque to practically all possible driving situations. FXD prevents wheel slip before it occurs by controlling the locking torque between the front wheels and directing power to the wheel with the best traction. During cornering, it delivers a torque vectoring effect to prevent understeering. To reduce oversteering, FXD provides a yaw-damping effect. The result in both cases is enhanced vehicle stability.

Future-proof product portfolio

Finally, BorgWarner's disconnect coupling allows the secondary axle to be disconnected from the driveline, and a synchro-

nization function in conjunction with a power transfer unit (PTU) provides mechanical disconnection for improved fuel economy. It features the rationally designed Centrifugal Electro-Hydraulic (CEH) actuator. With its long-established competencies resulting from over a hundred years of experience, BorgWarner PowerDrive Systems is able to offer a large product portfolio which can meet the constantly growing demand for enhanced driveline solutions. Following current major trends such as all-wheel drive and driveline disconnect technologies; GenV, FXD, eAWD and the Disconnect Coupling provide a fun-to-drive, highly efficient experience across all vehicle segments and under practically all driving conditions.

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