We enable the switch – to highly efficient electric drives.

BorgWarner Electric Vehicle Technologies

Electric vehicles can potentially make the vision of a future with emission-free mobility a reality. With a focus on creating a clean, energy-efficient world, BorgWarner is well-positioned to lead the way. By offering expertise in a variety of technology for electric applications, we provide vehicle manufacturers the ability to easily and efficiently electrify the next generation of mobility.

Whether power electronics, electric motors, thermal management, or battery solutions, we provide the technology needed for the future. Through these products, we help to optimize the weight, size, and cost of electric vehicles. While providing increases in energy efficiency, our technology also improves the comfort and driving experience of our customers.
By offering our technology as individual products and integrated solutions, we provide automakers flexibility in the electrification of future vehicles. Our integrated modules feature in-house products and simplified designs that provide global vehicle manufacturers with efficient propulsion solutions in compact, easy-to-install packages. Through this, global customers are able to simply and efficiently electrify their vehicles and build toward an increasingly clean, energy-efficient world.
**EV Transmission**

Transferring power from the motor to the wheels requires an efficient propulsion system. With a compact, low-weight design and highly efficient gear train, BorgWarner’s eGearDrive transmission uses less battery energy. Through this design, electric and hybrid vehicles drive farther on a single battery charge.

### 31-03 eGearDrive®
**Transverse Electric Drive Transmission**

The BorgWarner 31-03 eGearDrive® electric-drive transmission is the next generation of technology developed for adaptability across a broad range of applications for the emerging vehicle electrification market.

**FEATURES AND BENEFITS**
- Single-speed transverse drive transmission
- High-efficiency helical geartrain
- Wide range of gear reduction ratios:
  - 6.54, 7.17, 8.28, 8.76, 9.07
- Rated input torque: 300 Nm max.
  - Optional: 360 Nm max.
- Installation orientation:
  - 10 to 90 degrees
- Electronic park pawl actuation
- High speed/log drag design
- Adaptable to a broad range of vehicle and motor applications
- High efficiency (>97 %) for extended drive range
- Shift-by-wire park lock for ease of vehicle integration

### 32-01 eGearDrive®
**Longitudinal Electric Drive Transmission**

The BorgWarner 32-01 eGearDrive® is a single-speed longitudinal drive transmission with a high-efficiency helical geartrain.

**FEATURES AND BENEFITS**
- Wide range of gear reduction ratios:
  - 2.12, 2.68, 3.05, 4.05
- Rated input torque: 350 Nm peak
- Electronic park pawl actuation
- Adaptable motor flange interface
- Adaptable to a broad range of vehicle and motor applications
- High efficiency (>98 %) for extended drive range
- Shift-by-wire park lock for ease of vehicle integration
BorgWarner’s HVH motors provide industry-leading efficiency, power and torque density for a variety of electric vehicle applications. The scalable design of the motors allows them to meet application-specific requirements.

**HVH 250 Motor**
*High Voltage Hairpin (HVH) 250 Electric Motor*

The HVH 250 is a powerful, durable and rugged electric motor/generator for use in on- and off-highway vehicles, power generation and other special high power demand applications.

**FEATURES AND BENEFITS**
- EV/HEV drivetrain ready solutions
- Operation to 700+Vdc system
- Direct drive, chain drive, belt drive, or integrated options
- Multiple electromagnetic variants exist to meet varying performance requirements
- Industry leading power & torque densities
- Internal permanent magnet rotor
- Oil cooled standard, WEG options
- Proprietary insulation system for unsurpassed durability
- 95 % peak efficiency

**HVH 410 Motor**
*High Voltage Hairpin (HVH) 410 Electric Motor*

The HVH 410 series motors come in various stack length, cooling and winding configurations. They are available in fully housed motors or as rotor/stator assemblies.

**FEATURES AND BENEFITS**
- Heavy duty EV/HEV drivetrain for bus, truck, off-highway and marine applications
- Operation to 700+Vdc system
- Direct drive with SAE interface
- Multiple electromagnetic variants exist to meet varying performance requirements
- Industry-leading power & torque densities
- Internal permanent magnet rotor
- Oil-cooled standard, WEG options
- Proprietary insulation system for unsurpassed durability
- 95 % peak efficiency
Electric Drive Module

BorgWarner’s state-of-the-art electric drive motor technology and proven eGearDrive transmission are an innovative combination which form an integrated, efficient propulsion solution in one compact, easy-to-install package. While also offering an option with integrated power electronics, BorgWarner’s electric drive modules optimize weight, cost and size, while focusing on low NVH with full-torque capability for electric vehicles.

Electric Drive Module (eDM)

The eDM is a compact, easy-to-install package including BorgWarner’s state-of-the-art electric drive motor technology and proven eGearDrive® transmission.

FEATURES AND BENEFITS

- Integrated electric machine and single-speed transmission for EV drivetrain
- Wide range of gear ratios:
  - 6.54, 7.17, 8.28, 8.76, 9.07
- Rated input torque: 300 Nm max.
- Rated 250V+Vdc nominal operating system
- Compact design, weight saving
- Industry-leading power & torque densities
- Internal permanent magnet rotor
- WEG cooling options
- High system efficiency
- Optional e-park lock system

Integrated Drive Module (iDM)

BorgWarner’s iDM is a complete system with a motor, transmission, power electronics, and controls and offers a simplified design which reduces costs, overall weight and space required and optimizes NVH.

FEATURES AND BENEFITS

- Drive module for electrical vehicles with integrated electrical machine and power electronics
- Operating Voltage 250 - 450VDC
- WEG cooling
- Optional e-park lock system
- Integrated electronics
- High-torque and power density
- High-efficiency
- Easy vehicle integration
BorgWarner has applied its expertise in high speed turbomachinery, bearing systems and motors to produce air supplies for fuel cell applications. Systems are available in single stage and dual stage compressors to meet customer specifications. Single stage compressors can be enhanced with fixed or variable turbines to increase energy density and improve efficiency of fuel cells by recovering a portion of energy lost through reformulation of hydrogen and oxygen. Systems are available with oil-free air foil bearings, sealed greased ball bearings and leak-free oil supplied bearings for high durability applications.

**FEATURES AND BENEFITS**
- Provide compressed air to fuel cells
- Low exhaust gas energy content
  - Assistance by E-Motor needed
  - Usage of BWTS PM motor technology
- Integrated power electronics (PE) available
- Airfoil bearings to supply hydrocarbon-free air
- Alternate bearing systems available
- 2000 h reached in durability driving cycle
Power Electronics

BorgWarner’s range of motor controllers utilizes a highly-flexible control logic architecture to deliver a unique, feature-rich set of functions and is well-matched to satisfy automotive, commercial and construction markets’ electrification needs.

High Voltage Motor Controllers

BorgWarner offers two voltage family classes of 400V and 800V. The High Voltage Motor Controllers are a new family of AC motor controllers/inverters designed to meet the high performance requirements of on-road and off-road Electric (EV) and Hybrid Electric Vehicles (HEV).

FEATURES AND BENEFITS
- 3-phase 400V and 800V product ranges
- Applications: IDM, P1, P2, P4, PS
- High performance, field-oriented control for permanent magnet or induction machines
- High efficiency
- Continuous power range: 55-120kW
- Peak power: 120-250kW
- Nominal voltage: 350/800V
- Flexible and robust design for integrated applications
- Flexible and full ability to calibrate AUTOSAR motor controls, SW and diagnostics
- DPWM, SVPWM and Six-Step switching options for performance optimization
- Automotive standard diagnostics and current and voltage protection
- ISO 26262; 16750 and 6469 compliant
48V Motor Controllers

BorgWarner offers a family of three-phase 48-volt high power AC Motor Controllers designed to meet the high performance requirements of on-road and off-road Electric (EV) and Hybrid Electric Vehicles (HEV).

FEATURES AND BENEFITS

- Applications: P0, P1, P2, P3
- High performance, field-oriented control for permanent magnet or induction machines
- High efficiency
- Continuous power: 12kW
- Peak power: 25kW
- Nominal voltage: 350/800V
- Flexible and robust design for integrated applications
- Flexible and full ability to calibrate AUTOSAR motor controls, SW and diagnostics
- DPWM, SVPWM and Six-Step switching options for performance optimization
- Automotive standard diagnostics and current and voltage protection
- ISO 26262; 16750 and 6469 compliant
Battery Modules and Packs

BorgWarner’s Battery Modules deliver crucial improvements in driving range and charging time for the next generation of vehicles. Developed with thermal management expertise, these modules provide leading performance and a scalable design for automakers.

Battery Module

BorgWarner’s compact battery packs for electric vehicles perform better and last longer thanks to industry-leading energy density and battery management.

FEATURES AND BENEFITS

- Intelligent battery management systems with proprietary algorithms for enhanced performance and cycle life
- Proprietary thermal engineering for active and passive cooling
- Scalable design means faster go-to-market for customers with custom modules
- Highest energy density, longest range and fastest charging time
- 2,000+ cycles
- 10+ years
- 300,000 miles
Thermal Management

BorgWarner delivers innovative flow control products to improve fuel economy and consumer comfort through precise temperature management of powertrain systems. The product portfolio includes all smart components and systems which optimize energy efficiency through direct and indirect management of the engine operating temperature by modulating air and coolant flow.

Battery Heaters

The Battery Heater is a plug-and-play solution that is placed within the cooling water system and shifts no secondary costs to an OEM.

FEATURES AND BENEFITS
- Operating voltage: 250 – 500V
- Heating power range: 5 – 9 kW
- Thick Film Heating Element technology
- No local overheating
- ASIL B/C safety capability
- Compact dual-plate heater design achieves efficiency >97%
- Closed loop control
- LIN communication

Cabin Heaters

The proprietary designs of BorgWarner’s Cabin Heater deliver industry-leading safety performance. True dual zone heating and full power delivery with low air turbulence provide passenger comfort with minimal energy use for extended battery-powered driving range.

FEATURES AND BENEFITS
- Operating voltage: 250 – 500V
- Heating power range: 3.7 – 6.7 kW
- Odorless heating
- PTC stone-based heaters intrinsically safe against overheating
- Compact, modular packaging
- Quick, efficient heating for extended battery-powered driving range
- Low air turbulence for nearly silent operation
- Continuously adjustable heating control
- Dual zone driver/passenger controls
- CAN and LIN communication
Paving the way for a clean, energy-efficient world.

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