我们的使命：
内燃机、混合动力和电动汽车驱动系统解决方案的全球领先供应商
BorgWarner’s Hybrid Vehicle Technology*

* Includes mild, full and plug-in hybrid

Mild, full and plug-in. With a comprehensive product portfolio, we offer vehicle manufacturers around the globe advanced solutions for all hybrid architectures.
Electric Vehicle Technology*

* Includes battery electric vehicles, range extenders and fuel cells.

Our growing product portfolio covers virtually all electric propulsion areas including electric motors, power transmission, power electronics, and thermal management.
# Electrical Machines

<table>
<thead>
<tr>
<th>Characteristics*</th>
<th>48V MGi – SW130</th>
<th>SW270-045 48V</th>
<th>HVH146</th>
<th>SW200 S/M/L</th>
<th>SW270-045/060 HV</th>
<th>90-SOM / 115-DOM</th>
<th>75-DOM / 150-DOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Power</td>
<td>15 kW</td>
<td>15 kW</td>
<td>28 kW</td>
<td>60/75/120 kW</td>
<td>80/80 kW</td>
<td>130 kW / 185 kW</td>
<td>220 kW / 250 kW</td>
</tr>
<tr>
<td>Peak Power</td>
<td>25 kW</td>
<td>25 kW</td>
<td>40 kW</td>
<td>100/130/160 kW</td>
<td>107/107 kW</td>
<td>170 kW / 300 kW</td>
<td>270 kW / 300 kW</td>
</tr>
<tr>
<td>Continuous Torque</td>
<td>35 / 45 / 60 Nm</td>
<td>160 Nm</td>
<td>45 N-m</td>
<td>150/180/275 Nm</td>
<td>160/210 Nm</td>
<td>270 Nm / 340 Nm</td>
<td>840 Nm / 1,550 Nm</td>
</tr>
<tr>
<td>Peak Torque</td>
<td>50 / 65 / 80 Nm</td>
<td>245 Nm</td>
<td>61 N-m</td>
<td>260/300/375 Nm</td>
<td>245/325 Nm</td>
<td>325 Nm / 425 Nm</td>
<td>850 Nm / 2000 Nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Features</th>
<th>High Power Density</th>
<th>Low end turn length</th>
<th>Low AC loss winding</th>
<th>High Speed</th>
<th>Low end turn length</th>
<th>Oil or WEG cooling</th>
<th>Oil or WEG cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicability</td>
<td>P0, P1, P2, P3, P4</td>
<td>P1, P2</td>
<td>P0, P1, P2</td>
<td>BEV, P3/P4</td>
<td>P1, P2</td>
<td>BEV, P4</td>
<td>P1, P2, BEV</td>
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<tr>
<td>Status</td>
<td>A-Sample</td>
<td>Early Concept</td>
<td>2019 SOP</td>
<td>Early Concept</td>
<td>2019 SOP</td>
<td>Production</td>
<td>Production</td>
</tr>
</tbody>
</table>
PACE Awards for E-Motor Innovation

2008: HVH Winding

2018: S-Winding

Design & Manufacturing Process Innovations
Stator Winding Options

Concentrated winding

BorgWarner Types of Stator Windings

Hairpin winding

S-winding
High Slot Fill Stator Technologies

Conventional Round Wire

Rectangular Wire & Radial Insertion

Slot fill

Lower Resistance Winding Means Lower Copper Loss
High Efficiency & Power Density Stator

High Slot Fill S-wind Stator

Slot fill → ~50%

• Rectangular Conductors
• Stacked Conductors in Slot
• Less Force - thinner Insulation
• Wire Length Reduction

Conventional

S-Series

Slot fill → ~65%

Coil End Turn Height Reduction
# S-Wind Torque Density Advantage

<table>
<thead>
<tr>
<th>Motor Type</th>
<th>Concentrated</th>
<th>Distributed - S-wind</th>
<th>Distributed - Hairpin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak torque</td>
<td>Nm</td>
<td>332</td>
<td>340</td>
</tr>
<tr>
<td>Total stator length</td>
<td>mm</td>
<td>134</td>
<td>93</td>
</tr>
<tr>
<td># of Poles</td>
<td>--</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Stator OD</td>
<td>mm</td>
<td>270</td>
<td>270</td>
</tr>
<tr>
<td>Torque Density</td>
<td>Nm/L</td>
<td>54.4</td>
<td>85.0</td>
</tr>
</tbody>
</table>
HVH 250 Motor

High Voltage Hairpin (HVH) 250 Electric Motor

**DESCRIPTION**

- 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

**BENEFITS**

- Industry leading power & torque densities
- Internal permanent magnet rotor
- Oil cooled standard, WEG options
- Proprietary insulation system for unsurpassed durability
- 95% peak efficiency

<table>
<thead>
<tr>
<th></th>
<th>250-090-SOM</th>
<th>250-115-DOM</th>
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</thead>
<tbody>
<tr>
<td>Continuous Power</td>
<td>130 kW</td>
<td>185 kW</td>
</tr>
<tr>
<td>Peak Power</td>
<td>170 kW</td>
<td>300 kW</td>
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<td>Status</td>
<td>Production</td>
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</tbody>
</table>
SW270 – eMotors for P2 On-Axis

- Next-generation e-motor for plug-in hybrid applications
- 270 mm OD stator with rectangular wire
- S-wind stator for minimum axial length and maximum continuous performance
- Large rotor ID enables integrated clutches, planetary gears, etc.
- Distributed-wound stator and skewed rotor to minimize NVH and torque ripple
- High torque and power density for compact build
- Combined water/oil cooling for maximum continuous performance
- 95% peak efficiency
MGi Product Overview

**DESCRIPTION**
- Interior permanent magnet electric machine intended for high efficiency operation in 48V P0, P2, P3, P4 HEV applications with axially mounted power electronics

**SPECIFICATIONS**
- Continuous Power: 15 kW
- Peak Power (mot/gen): 21/27 kW
- Continuous Torque: 40 Nm
- Peak Torque: 72 Nm
- Nominal Voltage: 48 V<sub>DC</sub>
- Max Phase Current: 600 A<sub>rms</sub>
- Cooling: WEG
- Peak efficiency: 94%

**BENEFITS**
- Water cooled motor & inverter
- Compact size with 130 mm stator OD
- Operation up to 20,000 rpm
- S-wind motor technology
Product Features
- High efficiency helical gear train
- Low system backlash
- Compact and low weight
- Adaptable flange interface and drop angle
- Integral electronic park pawl actuation

Vehicle Level Benefits
- Extended electric driving range
- Smooth and quiet operation
- Reduced vehicle weight
- Enhanced vehicle adaptability
- Electric park lock system
eDM Integration Design feature

Motor + Gearbox

\[ 493 \]

\[ 389 \]

eDM

BorgWarner Product Line Synergy (IDM)

Reducer + e Motor + Inverter

Integrated to IDM (Integrated Drive Module)
BorgWarner Integrated Drive Module iDM 200
System Specification & Requirements

- Connection iDM to Vehicle Class
  - iDM 90 mainly B/C-Class
  - iDM 120 mainly C-Class
  - iDM 160 mainly C/D-Class
  - Combinations of iDMs in AWD vehicles with higher performance
Modular Kit for P1 and P2 Hybrids

From Components to Modules to Systems
博格华纳新能源市场策略
如何在快速变化的市场实现增长？

通过:

1. 模块化和可选择的解决方案
2. 全系统集成，高效，节能。
3. 扩展性更高的解决方案。
Thank you!