Electric and Hybrid Electric Drivetrain Solutions
Building Blocks of Parker Drivetrain Systems

Breakthrough Performance

**Traction Motor / Generator**
Parker’s PMAC traction motor/generator design incorporates permanent magnets, segmented laminations, innovative heat transfer optimization, advanced automated winding processes and patent-pending cooling technology. These synergistically produce advanced output power.
- **Peak power density** — 4.17 kW/kg
- **Continuous power density** — 2.3 kW/kg

**Traction / Range Extender Inverters**
High performance IGBT based electronics provide the most control and versatility of any motor controller available.
- **Supports PMAC and AC induction motors**
- **Bi-directional, AC to DC, and DC to DC configurations available**
- **Fully programmable drivetrain control**
- **Full regen capabilities**

### PMAC Motor Data

<table>
<thead>
<tr>
<th>Specifications*</th>
<th>Air Cooling</th>
<th>External Liquid Cooling</th>
<th>Internal Liquid Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor Dimensions</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Length (mm)</td>
<td>170 – 584</td>
<td>178 – 584</td>
<td>197.5 – 609</td>
</tr>
<tr>
<td>Cross-Section (mm)</td>
<td>143/185/267</td>
<td>28/38/48</td>
<td></td>
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<tr>
<td>Shaft Diameter (mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>22 – 168</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>System Performance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Power Output (kW)</td>
<td>16 – 180</td>
<td>21 – 230</td>
<td>35 – 350</td>
</tr>
<tr>
<td>Rated Power Output (kW)</td>
<td>up to 55</td>
<td>up to 155</td>
<td>up to 285</td>
</tr>
<tr>
<td>Peak Torque Output (Nm)</td>
<td>85 – 750</td>
<td>85 – 750</td>
<td>85 – 750</td>
</tr>
<tr>
<td>Stall Torque Output (Nm)</td>
<td>19 – 306</td>
<td>16 – 400</td>
<td>20 – 640</td>
</tr>
<tr>
<td>Peak Efficiency (%)</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Max Speed (rpm x1000)</td>
<td>5/3.5/2</td>
<td>12/12/7.5</td>
<td>12/12/7.5</td>
</tr>
<tr>
<td>Rated Speed (rpm x1000)</td>
<td>3.2</td>
<td>4.5</td>
<td>6</td>
</tr>
<tr>
<td>Input Voltage (VDC)</td>
<td>24 – 750</td>
<td>24 – 750</td>
<td>24 – 750</td>
</tr>
<tr>
<td>Max Current (A&lt;sub&gt;rms&lt;/sub&gt;)</td>
<td>250</td>
<td>750</td>
<td>1250</td>
</tr>
<tr>
<td><strong>Motor Thermal Limit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>155</td>
<td>155</td>
<td>155</td>
</tr>
<tr>
<td><strong>Cooling Flow Rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>5 m/s</td>
<td>8 L/min</td>
<td>8 L/min</td>
</tr>
</tbody>
</table>

*Specifications illustrate performance range of traction motors/generators.

**Highest Efficiency — 95%**

Only when using the best component technology and optimal design characteristics do traction motors/generators and controllers minimize losses both during motoring and power generation – increasing vehicle range.
- **Automated winding assembly produces very dense, high copper fill**
- **Low pole-count rotor design minimizes rotational losses during motoring and while regenerating**
- **Ultra-thin stator laminations with reduced slots virtually eliminates eddy currents**
- **Very efficient IGBT power platform**
- **Air cooling, liquid cooling (water/glycol or hydraulic fluid), or an advanced 2-phase refrigerant cooling systems are available.**
Traction Inverters and Motors

Power to Solve...
(without emissions)

Traction Inverters
- AC induction or 3-phase PMAC
- Feedback: sensorless, encoder, resolver
- Analog/digital/relay inputs and outputs
- Traction/generator compatibility
- Regenerative braking
- CAN communications
- Liquid cooled
- Very low EMI

Traction Motor
- 3-phase PMAC
- Sensorless, encoder, resolver
- Removable phase leads
- Dual internal/external Liquid cooling
- Traction motor/generator
- High efficiency
- Internal/external spline

ALL ELECTRIC SERIES HYBRID
PARALLEL HYBRID
Range Extender Inverter Drives and Generators

**Broatest Scalability — largest power range**

**Traction Motor / Generator**
- Three mechanical motor/generator frame sizes
- The extrusion-based housing, internal design and assembly methods give unmatched flexibility to scale the output power quickly.
- Peak output power from 25 kW to 250 kW in 12 lengths.
- Voltage from 24 to 750 VDC
- Current up to 1000 A+

**Traction / Range Extender Inverters**
- Five pre-engineered frame sizes cover a range power range of 5 kW to 300 kW, up to 1000 amps peak
- 24 VDC – 1000 VDC

**Proven Quality and Manufacturability**

Parker produces motors and drives for some of the most recognizable manufacturers of vehicles. It is through manufacturable designs with facilities capable of large quantity production and rigorous quality control, that Parker ensures success.

- Field-proven quality yielding 55,000+ hours of operation
- State-of-the-art manufacturing facilities offering cost-effective, US-based production of all traction motors and inverters
- Fully automated PCB assembly and test
- ISO 9001:2000

![Building blocks: motor and drive combination for 175kW system](image)
Vehicle Hardened Battery Rack with Local BMS Modules

Hybrid electric platforms require a substantial amount of energy storage.

Parker provides pre-engineered mobile hardened battery racks, using a variety of standard cell types from traditional lead-acid to advanced Lithium Ion.

Battery management systems (BMS), which ensure safety and battery longevity, are integrated into these energy storage units.

BMS Monitors / Manages:
- Loading
- Temperature
- System Health
- Charging and cell-to-cell balancing
- Real-time communications for battery status to the supervisory system