

# Power management for Rail

## Technical details supplement

### BAE Systems: A leader in power management

- 8,000 equipped locomotives, 500 million revenue hours, MTBF greater than 200,000 hours
- Investing in new technology to improve customer value and adapt to the future
- Mature energy storage systems and advanced energy management maximize energy reuse through regenerative braking
- BAE Systems’ proven power management experience reduces development time and risk, and allows for quicker time to market
- Power management for rail provides a path to lighter weight, higher energy efficiency, and improved performance



### System configuration and specifications

	Power	Specifications	Dry Weight/size
Energy storage system	Building block +/- 200 kW peak, 11.2 kWhr	<ul style="list-style-type: none"> <li>• Lightweight, nano-phosphate-based lithium ion technology</li> <li>• High power and charge capacity</li> <li>• Longer life with extended warranty</li> <li>• Best power and energy density of any commercially available solution</li> </ul>	365 kg
Propulsion control system	465 kW	<ul style="list-style-type: none"> <li>• Integrates control of the propulsion system</li> <li>• Customized performance for optimal fuel economy and emissions</li> <li>• Standard vehicle multiplex interface</li> <li>• Controls generator and traction motor</li> <li>• Onboard diagnostics</li> </ul>	79 kg Liquid-cooled – WEG
Motor	200 kW peak Torque: 5,100 Nm	<ul style="list-style-type: none"> <li>• Compact, oil-cooled, high-power-density machine design</li> <li>• AC induction motor eliminates brush maintenance</li> <li>• Self-contained cooling</li> </ul>	RATINGS SIZE 361 kg Liquid-cooled – integrated WEG and oil
Integral starter-generator	200 kW continuous	<ul style="list-style-type: none"> <li>• Compact, brushless machine design</li> <li>• Optimized for high efficiency, lightweight, low maintenance, and low emissions</li> <li>• Integrated starter</li> <li>• Fully sealed and liquid-cooled standardized interface to engine</li> </ul>	145 kg
Auxiliary power system	17 kW DC/DC 600 V to 28 V 30 kW (208V AC inverter, 37.5 kVA, 3-phase, 50/60 Hz) 60 kW Inverter (3-phase, variable voltage/variable frequency)	<ul style="list-style-type: none"> <li>• Eliminates oil blow-by in air compressor, which contaminates the pneumatic system</li> <li>• Eliminates the need for belt drives</li> <li>• Provides capability for electric accessories</li> <li>• Increased fuel economy with electric accessories</li> <li>• Safer — no engine fires due to hydraulic leakage</li> <li>• Reduced emissions</li> </ul>	102 kg Liquid-cooled – WEG
System cooling package	Heat rejection of 24 kW	<ul style="list-style-type: none"> <li>• Integrated water-ethylene-glycol-based cooling system</li> <li>• Flexible mounting options</li> <li>• Built-in fluid level sensor</li> <li>• SAE J1939 CAN-based controls</li> </ul>	41 kg

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Diesel electronic fuel injection (currently in use in rail and mining vehicles)	N/A	<ul style="list-style-type: none"> <li>Provides direct control of the injector solenoids of 6- to 18-cylinder diesel engines Controls fueling to prevent smoke discharge and protects the engine against:               <ul style="list-style-type: none"> <li>• Overspeed</li> <li>• Overload</li> <li>• Low oil pressure</li> <li>• Low coolant pressure</li> <li>• Crankshaft overpressure</li> </ul> </li> <li>Provides diagnostic capability to support engine maintenance</li> </ul>	Operating temperature: 40 deg. C to +85 deg. C
Battery charger (currently in use in rail and mining vehicles)	Power rating: 18 kW	<ul style="list-style-type: none"> <li>Input:               <ul style="list-style-type: none"> <li>• 480 VAC, 60Hz</li> </ul> </li> <li>Outputs:               <ul style="list-style-type: none"> <li>• Three output connections</li> <li>• Externally controlled load contactors</li> <li>• 72 VDC +/-1% nominal at 0 to 250 A</li> <li>• Software adjustable from 40 VDC to 85 VDC</li> </ul> </li> <li>Vibration and shock in accordance with IEC77</li> </ul>	73 kg
Logic power supply (currently in use in rail and mining vehicles)	1.6 kW peak	<ul style="list-style-type: none"> <li>Used to supply regulated power to electronics onboard AC and DC locomotives</li> <li>Provides six independently regulated outputs</li> <li>All outputs are phase-shifted to reduce EMI Input voltage range: 25 VDC to 85 VDC</li> </ul>	Convection cooling
Cycle skipper (3X) (currently in use in rail and mining vehicles)	120 kW continuous	<ul style="list-style-type: none"> <li>Input power:               <ul style="list-style-type: none"> <li>• Three-phase AC-generator-supplied power</li> <li>• 21 to 115 Hz (105 Hz nom.)</li> <li>• 80 to 440 VAC (402 VAC nom.)</li> </ul> </li> <li>Outputs:               <ul style="list-style-type: none"> <li>• Three-phase silicon-controlled rectifier variable output</li> </ul> </li> <li>Constant V/Hz motor control</li> <li>Full-synchronous speed operation (reverse)</li> <li>Phase currents up to 165 A continuous at 105Hz (nom.)</li> <li>Microcontroller-based design</li> </ul>	33 kg
Phase controller (3X) (currently in use in rail and mining vehicles)	Power rating: 44 kVA	<ul style="list-style-type: none"> <li>Converts three-phase variable voltage and variable frequency source power to variable-voltage DC power</li> <li>Programmable output to:               <ul style="list-style-type: none"> <li>• Charge a battery</li> <li>• Control the field current of an AC generator z</li> </ul> </li> <li>Input voltage: 0 Vrms to 1212 Vrms</li> <li>Output phase current: 110 Arms</li> <li>Output frequency: 30 Hz to 60 Hz</li> <li>Output voltage: 230 Vrms L-L</li> </ul>	68 kg

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