



Magnaforce™ Electric High-Speed Motor Generators

Calnetix Technologies designs, develops and manufactures a wide range of Magnaforce™ permanent magnet (PM) motors and Magnaforce™ permanent magnet (PM) generators for a variety of applications and industries. These high frequency motor generators range from only a few watts to megawatt power levels with speeds ranging from 4,000 rpm to 450,000 rpm. Whether converting mechanical power to electrical or converting electrical power to mechanical, Calnetix high-speed electric motors and electric generators provide the following advantages:

High-speed Motor Operation

The thermal management of high-speed, and therefore high operational frequency, machines is always a challenge and requires rigorous trade-offs to achieve optimization and to ensure reliable operation. As an example, in the direct-mount, electric-assist turbocharger application, minimizing the use of auxiliaries is highly desired. Calnetix's Magnaforce™ PM motors and generators are optimally designed in such cases to be compatible with high frequency electronic drives by the use of special materials and techniques. In an application requiring oil-free air, the Calnetix Magnaforce™ electric motor and electric generator technology is integrated hermetically with the Calnetix Powerflux™ magnetic bearings into a special housing resulting in an oil-free, maintenance-free system. The ability of coherent technologies to be integrated seamlessly into a reliable, user-friendly product is unique to the Calnetix high-speed motor machines at the system level.

High-efficiency and High-temperature Operation

Calnetix's Magnaforce™ permanent magnet motors and permanent magnet generators are designed with processes and material selection that reduce loss components while keeping material costs in line with the requirements of each application. Special coatings and manufacturing methods reduce losses at each component level, while very innovative thermal management techniques and high performance encapsulation techniques allow the machines to operate in harsh ambient environments up to 90 °C.

High Power Density

Our most power dense machines are rated at 100 kW in a .75 liter volume (the equivalent of about a half of a loaf of bread) with a complete machine weight under 5.5 kgs (11.2 lbs).



Optimized Performance by Application

A unique feature of Calnetix's Magnaforce™ high-performance motors and high-performance generators is that they can be designed along with magnetic bearings and high efficiency variable speed drives (VSD) in-house to achieve compact, optimized solutions for each application without compromising any of their inherent benefits- high-speed, high-efficiency operation and zero maintenance requirements. This is achieved by the special construction features and the fabrication of our high-performance stators and rotors. A variety of in-house tools are used to optimize the stator configuration, including fill factor, end-turn bundle, neutral termination techniques. Stators are fabricated both by Calnetix technicians and by qualified and approved vendors to whom the techniques of our stator manufacturing processes are carefully transferred, resulting in flexible and economical production to meet a wide range of volume and schedule requirements. The rotors of each Calnetix permanent magnet motor and permanent magnet generator are specially designed to provide high magnetic coupling to the stator with very minimal flux fringing both in the axial and transverse directions, creating a very high back EMF per magnet volume, with the highest magnetizing efficiency. Rotor harmonic currents are minimized by a variety of surface mounting techniques that keep circulating electrical paths isolated without loss of electromagnetic or structural integrity. The Calnetix proprietary high strength composite sleeve used to retain the magnets is near-zero loss from harmonic eddy currents, thus enabling the rotor physical air gap and the air-gap cooling requirements to be minimized. Together, the technologies in the Calnetix permanent magnet rotors provide advanced electromagnetic efficiency, rotor tip-speeds and therefore industry-leading power densities.

Customization for Special Applications

Calnetix Magnaforce™ high-performance motors and high-performance generators provide the best combination of small size, high efficiency, integration flexibility, and unique features to meet the requirements of special applications, such as:

- Hermetical sealing
- Oil-free operation
- In-line motor generator configurations
- Direct mount bearingless motor configurations