



# Flywheel Energy Storage Technology (20150060-2)

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## Bearingless AC Homopolar Motor

A low-cost AC homopolar motor design combined with flywheel energy storage technology maximizes efficiency and energy density while reducing the self-discharge rate as well as the costs associated with such technology. The bearingless AC homopolar motor uses a single winding to provide torque and suspension without permanent magnets. The electric machine uses dual purpose no voltage windings that allow the same iron and copper to be used for both radial forces (magnetic bearing operation) and torque (motor operation). This design could be used in a wide range of applications aside from flywheel energy storage, such as superconducting machines, agitator/mixing devices, industrial blowers, down-hole pump applications or high speed/ultra-high speed applications.

## Flywheel Energy Storage

Comparable industrial electric motors incur significant operating expenses and high maintenance costs; real-time, remote status reporting of motor health is desired. This unique technology features armature winding that uses the same coils to create both suspension forces and torque, which provides the same performance benefits at a lower cost. In a flywheel energy storage application, this design could potentially replace chemical batteries as energy storage with high efficiency, low discharge rate and low environmental impact.

### **BENEFITS AND FEATURES OF BEARINGLESS AC HOMOPOLAR MOTOR:**

- Dual purpose winding provides both torque and magnetic suspension, offering greater efficiency and a reduced footprint
- Bearingless design without permanent magnets is more easily manufactured and boasts higher rotational speeds with greater tolerance to high operating temperatures
- High energy efficiency, high reliability
- The AC motor paired with the flywheel nearly eliminates self-discharge due to the machine's iron losses during idling times
- Contact-free, magnetic levitation provides lower cost, less maintenance, and monitors health in real time using integrated sensors

## POTENTIAL APPLICATIONS OF BEARINGLESS AC HOMOPOLAR MOTOR:

- Flywheels
- Waste heat energy recovery
- Industrial blowers i.e. waste water aeration
- Turbines – Large, micro and high speed
- HVAC systems
- Medical
- Defense
- Oil and gas refining compressors
- Natural gas transportation

**Phase of Development** Validated proof of concept complete

### Researchers

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