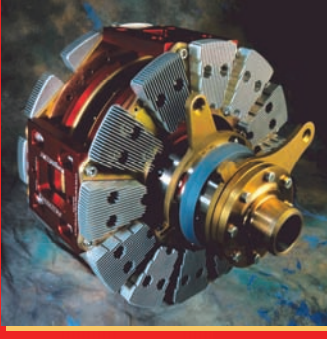


MagnaDrive™

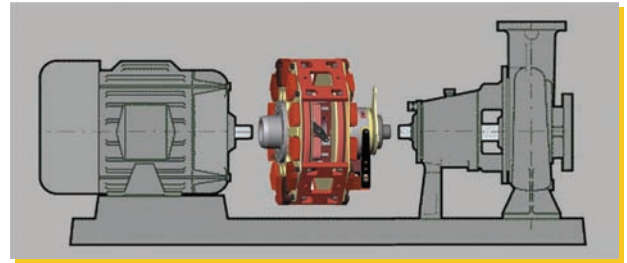
The Next Industrial Revolution

Permanent Magnetic Couplings and Adjustable Speed Drives



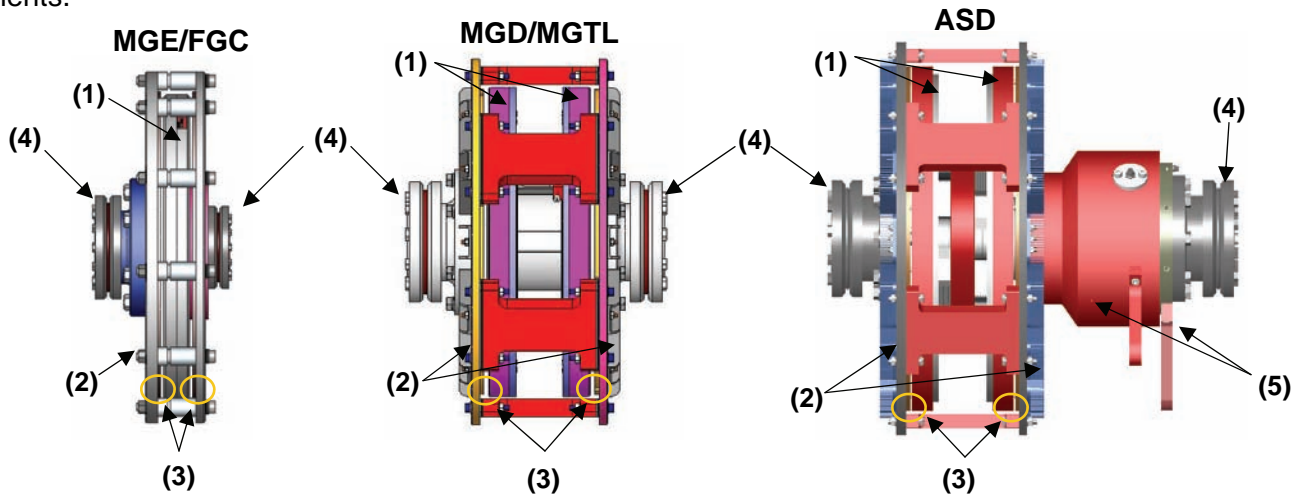
Breakthrough Technology

MagnaDrive replaces the physical connection between motors and loads with a gap of air. This air gap eliminates harmful vibration, wear and tear, enhances energy efficiency, increases motor life and protects equipment from overload damage. MagnaDrive's patented technology transmits power across an air gap with motor and load completely disconnected. The result? Improved reliability, money saved on energy and maintenance, and a big change in the way factories and other industrial and commercial facilities operate.



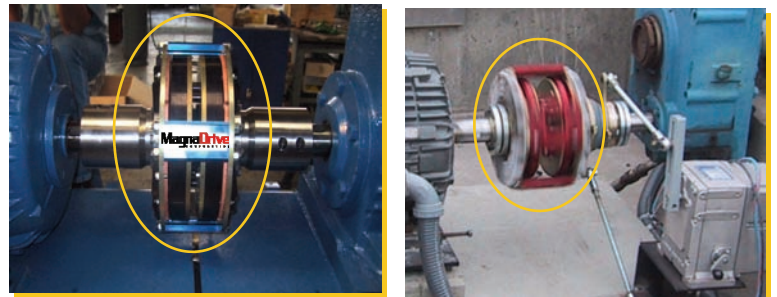
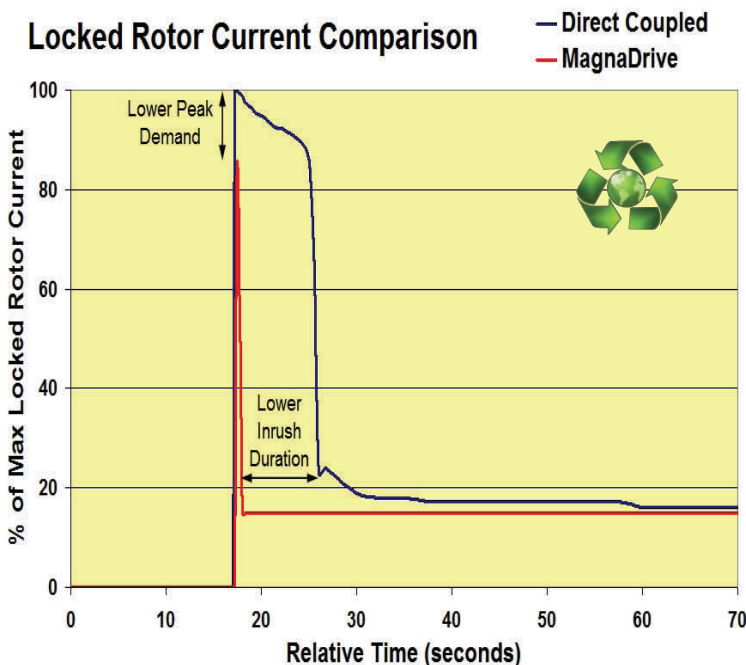
Principle of Operation

The main components of the MagnaDrive constant speed and delay start magnetic couplings (MGE, FGC, MGD/MGTL) are a Magnet Rotor (1) that is surrounded by a Conductor Rotor (2). The Magnet Rotor and Conductor Rotor are NEVER IN CONTACT with each other. Torque is transmitted through an air gap (3) in the coupling by the relative motion between the Conductor Rotor and extremely powerful permanent magnets contained in the Magnet Rotor. This relative motion creates a magnetic field in the Conductor that forms a very strong flux field with the magnets thereby transmitting torque across the space between the Magnet Rotor and Conductor Rotor components.



The couplings also have two hubs (4) that are connected to the motor and load shafts with a unique locking mechanism. In addition to all of the components above, the MagnaDrive Adjustable Speed Drives (ASD) also include an actuator mechanism (5) to adjust the air gap spacing between the Conductor Rotor and the Magnet Rotor thus permitting speed control.

Locked Rotor Current Comparison



MagnaDrive Couplings provide a disconnected, Cushioned Start. Because the motor does not have to overcome load inertia, the Peak Demand Current and duration of Inrush are reduced significantly. This Cushioned Start results in energy savings (see Graph) and reduced equipment wear. For many applications a lower Peak Demand Current may contribute to lower electrical power rates. Also, the Coupling air gap can be adjusted during installation to operate a pump, fan or blower at less than maximum flow, with sizable energy savings based on the centrifugal Affinity Laws.

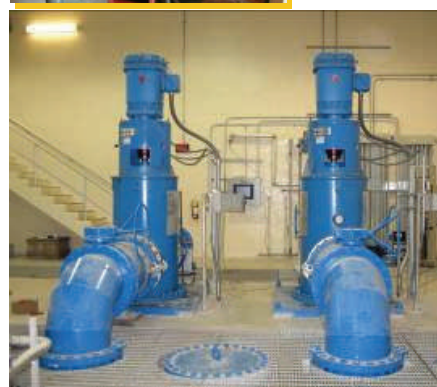
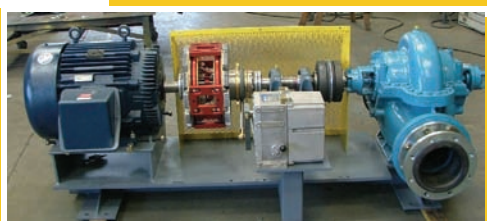
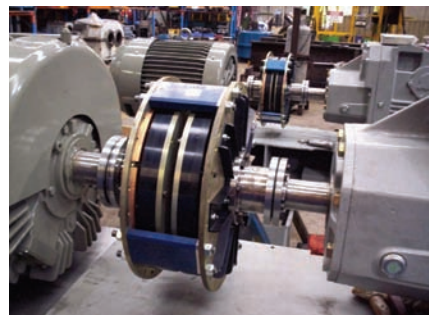
A Wide Range Of Industries And Applications

Typical Industries and Markets

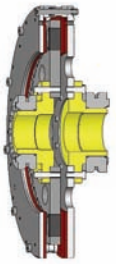
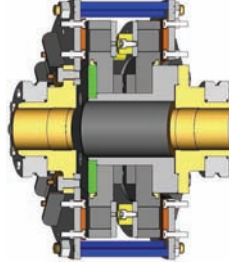
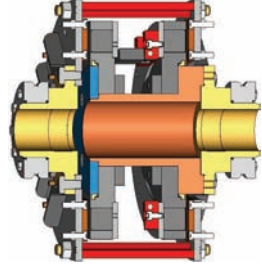
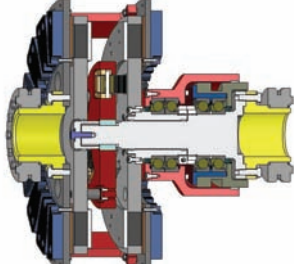
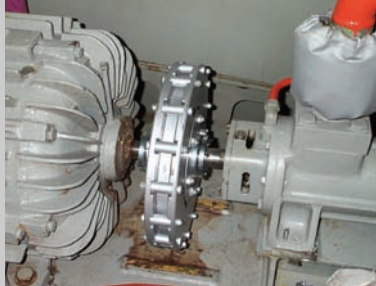

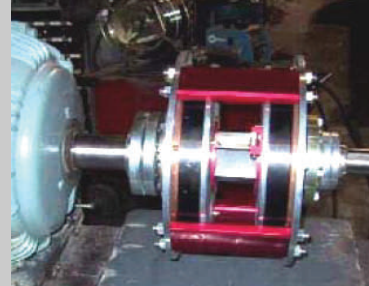
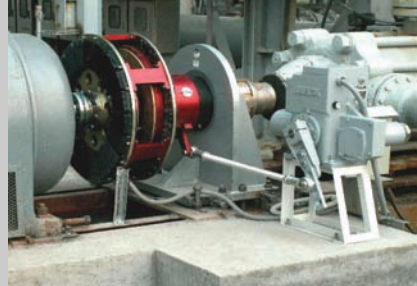
- Mining & Cement
- Power Generation
- Oil & Gas
- Chemical Processing
- Pulp & Paper
- HVAC
- Water & Wastewater
- Irrigation
- Maritime
- General Manufacturing
- And many more

Typical Applications

- Pumps
- Fans, Blowers
- Conveyor Belts, Bucket Elevators & Other Bulk Handling Equipment
- Compressors
- Centrifuges
- Chippers, Shredders
- Pulpers, Re-Pulpers
- Crushers, Hammermills
- Mixers



Product Range

MagnaGuard Standard Couplings (MGE / FGC)	MagnaGuard Delay Couplings (MGD)	MagnaGuard Torque Limiting Couplings (MGTL)	MagnaDrive Adjustable Speed Drives (ASD)
			
			

Technical Data

<ul style="list-style-type: none"> • 1/2 to 5,000 Hp • 0.37 to 3,700 kW 	<ul style="list-style-type: none"> • 10 to 2,000 Hp • 7.5 to 1,500 kW 	<ul style="list-style-type: none"> • 10 to 2,000 Hp • 7.5 to 1,500 kW 	<ul style="list-style-type: none"> • 10 to 4,000 Hp • 7.5 to 3,000 kW
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Benefits

- | | |
|--|--|
| <ul style="list-style-type: none"> • No Physical Connection Between Motor and Load • Eliminates Vibration Transfer Between Motor and Load • Permits Shock Loading • Increases Seal and Bearing Life • Cushioned Start / Stop • Low Maintenance | <ul style="list-style-type: none"> • Lower System Downtime • Accepts Misalignment • Simple Installation • Efficient Torque Transfer • Up to 70% Energy Savings • Lowest Total Cost of Ownership • Green Technology |
|--|--|



Special Features

<ul style="list-style-type: none"> • Meets ANSI B73 and API 610 Standards (MGE only) 	<ul style="list-style-type: none"> • Advanced Soft Start & Stop 	<ul style="list-style-type: none"> • Advanced Soft Start & Stop • Advanced Overload Torque Protection • Self-resetting 	<ul style="list-style-type: none"> • Variable Speed Control • Completely Disengaged Start-up
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Ideal For Applications Subject to:

<ul style="list-style-type: none"> • Vibration, Pulsating Loads, Periodic Load Seizure, Thermal Expansion, and Shock Loading 			
<ul style="list-style-type: none"> • Tight Space Constraints 	<ul style="list-style-type: none"> • Tight Space Constraints • Higher Starting Inertia / Torque 	<ul style="list-style-type: none"> • More Frequent Load Seizures • Higher Starting Inertia / Torque 	<ul style="list-style-type: none"> • A Need For Process Control • Higher Starting Inertia / Torque

MagnaDrive = Lowest Total Cost of Ownership



	Valves & Dampers	Mechanical Couplings (Rigid, Flexible, Disk, Gear, Grid, etc.)	Fluid Couplings and Drives	Variable Speed Drives (VFD's, Eddy Current)	MagnaDrive Couplings and Adjustable Speed Drives
Motor and Load Directly Coupled	Yes. Creates vibration transfer and misalignment problems. All couplings that use a physical / mechanical connection suffer from inefficiencies with any misalignment. The energy spent flexing an elastomer, disc, or spring is energy that is not being used by the process.				No. Torque is transmitted through an air gap, which minimizes vibration and tolerates misalignment.
Increases Bearing, Seal and Equipment Life	No. Greater vibration transfer and misalignment stresses decrease life of seals, bearings, and equipment in general. Increased wear in motor and bearings leads to additional friction losses in the system.				Yes. Air gap minimizes the harmful effect of vibration transfer and misalignment, increasing equipment life.
Installation Issues and Special Requirements	Require extensive alignment of motor and load equipment. Requires extensive alignment of motor and load equipment.		Require extensive alignment of motor and load equipment. Bulky and heavy equipment requiring added time for extra labor, install and oil level set-up. Require oil storage and handling. Oil Disposal and Contamination issues.	VFD's require extensive infrastructure such as cooling and dust / environment protection cabinets, power filters (VFD's are susceptible to "dirty power"), Inverter Duty Motors (not easy to retrofit), and other peripheral equipment. Eddy Current Drives are very heavy and bulky requiring extra infrastructure.	Due to the "disconnected" nature, MagnaDrive products are much more tolerant of misalignment, and require low infrastructure, and simple mechanical installation. No electronic components. Not affected by "dirty power". Does not require special cooling cabinets or power control equipment. Works with any motor (easy to retrofit).
Operational and Maintenance Issues	Multiple failure points with very high maintenance and expensive spare parts. Susceptible to hysteresis & deadband. Cavitation, vibration and flashing are common. Frequent seal and bearing failures. No overload protection.	Multiple failure points with very high maintenance and expensive spare parts. Continuous need to align equipment. Frequent seal and bearing failures. No overload protection.	Fluid Couplings and Drives have High maintenance and expensive spare parts. Use hazardous materials (i.e. oil) and environmental contamination and disposal are normal issues.	Harmonics and electronic system interference. Bearing " fluting " decreases motor life and creates harmful vibration. Frequent seal and bearing failures. Rapid component obsolescence. No quick restart capability. Short service life. Environmental disposal issues. No overload protection.	MagnaDrive is a " Green " product. Efficient torque transfer. Simple to operate and maintain. No physical connection between motor and load with resulting increased equipment life (e.g. seals, bearings). No Harmonics or electronic interference. Rapid restart capability. Long motor life due to low inrush current, while operating at its most efficient speed.
System Efficiency and Energy Savings	Very low to moderate. Energy is wasted due to restricted flow and additional load on the motor.	As seals and bearing life decreases and equipment wear increases, loss of efficiency is common from extra drag on equipment and misalignment.	Fluid Couplings and Drives have low efficiency due to frictional losses between impeller and rotor, and between the oil and housing walls. Losses also from system misalignment.	Standalone VFDs are efficient. However, dramatic energy efficiency losses occur with filters, transformers, cooling systems and other power conditioning equipment. Inherent losses from system misalignment. Eddy Current Drives have moderate efficiency due to losses incurred by additional power required to energize magnets.	High. MagnaDrive Couplings and ASDs are approximately 98% efficient with no additional losses for ancillary equipment. MagnaDrive Coupling air gaps can be tuned to provide desired process performance, reducing motor load and offering significant energy savings. All MagnaDrive couplings save energy by lowering peak demand current and duration of inrush.

MagnaDrive's "Green" disconnected torque-transfer technology reduces your total cost of ownership by lowering maintenance and operating costs, increasing process availability, and improving system reliability.



About MagnaDrive

MagnaDrive Corporation was founded in 1999, and is based out of Bellevue, WA. The company's breakthrough magnetic technology provides a cost effective solution to increase reliability and lower maintenance expense while achieving energy savings and process control. The impact and potential of MagnaDrive's world-wide patent protected technology was recognized by Industry Week magazine, which selected MagnaDrive as Technology of the Year in 2001. MagnaDrive was selected by Inc. Magazine as one of the 500 fastest growing private companies in the United States. Recently, Deloitte named MagnaDrive one of the 100 fastest growing technology companies in North America. MagnaDrive offers a family of products to accomplish a broad range of operating objectives: Reliability, Speed Control, Torque Management, Cushioned Start, Vibration Control and Misalignment Tolerance.

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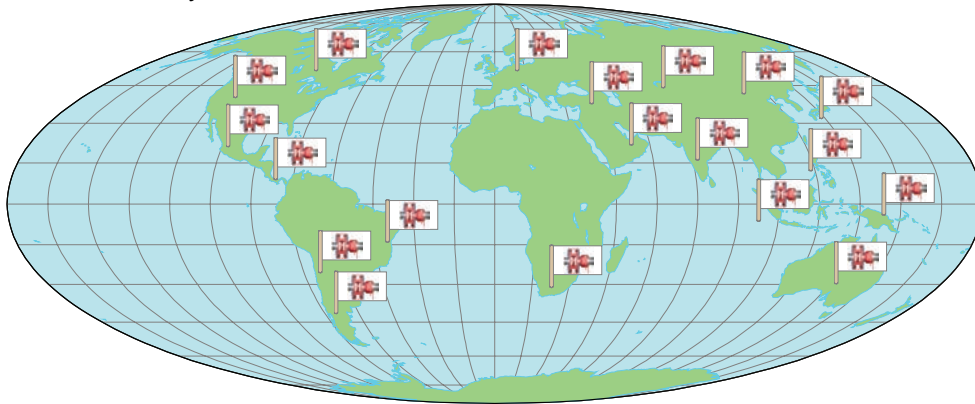
Inc.
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IndustryWeek
Technology of the Year

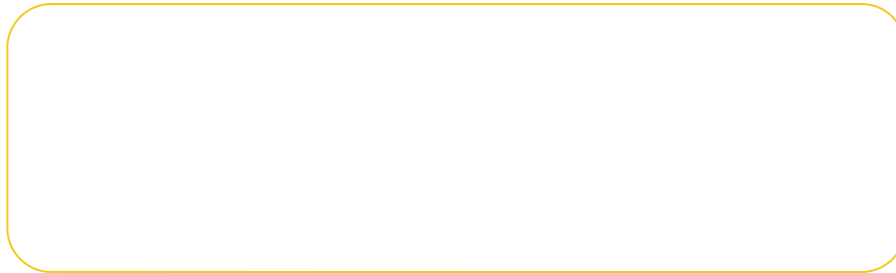


Worldwide Distribution and Service

MagnaDrive Corporation sells its products through an existing and rapidly expanding network of authorized sales and service Partners throughout the world. All MagnaDrive Partners are required to attend extensive training at the MagnaDrive University on sales, application, installation, operation, and service of our products. Consult us for information on the Partner closest to you.

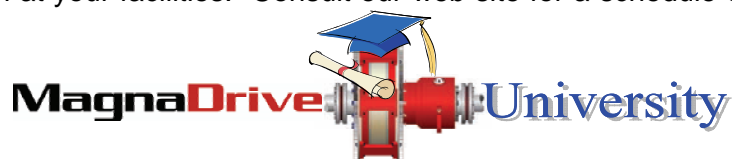


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MagnaDrive
Partner



Training and Education

MagnaDrive offers all of its Partners, OEM's, Engineering Firms, and End-Users the opportunity to attend MagnaDrive University seminars which take place on a regular basis at our facilities in Bellevue, WA, USA. We are also available to conduct seminars on location at your facilities. Consult our web site for a schedule of seminars and information on how to sign-up.



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