

Magna Drive™

C O R P O R A T I O N

*The Next
Industrial
Revolution*



**"Green"
Energy Saving
Technology**



FGC

Fixed Gap Coupling

3 — 5,000 Hp

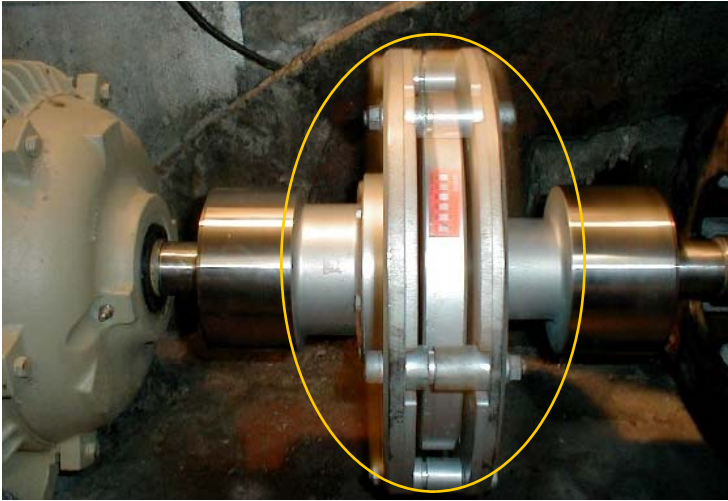
Key Features & Benefits:

- **Substantial Energy Savings**
- **"Green" Technology**
- No Physical Connection Between Motor and Load
- No Lubrication Required
- Lowest Total Cost of Ownership
- Efficient Torque Transfer
- Accepts Misalignment
- Cushioned Start
- Eliminates Vibration Transfer Between Motor and Load
- Low Maintenance
- Simple Installation & Operation
- Increases Seal & Bearing Life

Ideal for Applications Subject to:

- Vibration
- Periodic Load Seizure
- Pulsating Loads
- Thermal Expansion
- Shock Loading
- Tight Space Constraints
- **Fluid Coupling Problems**

Principle of Operation



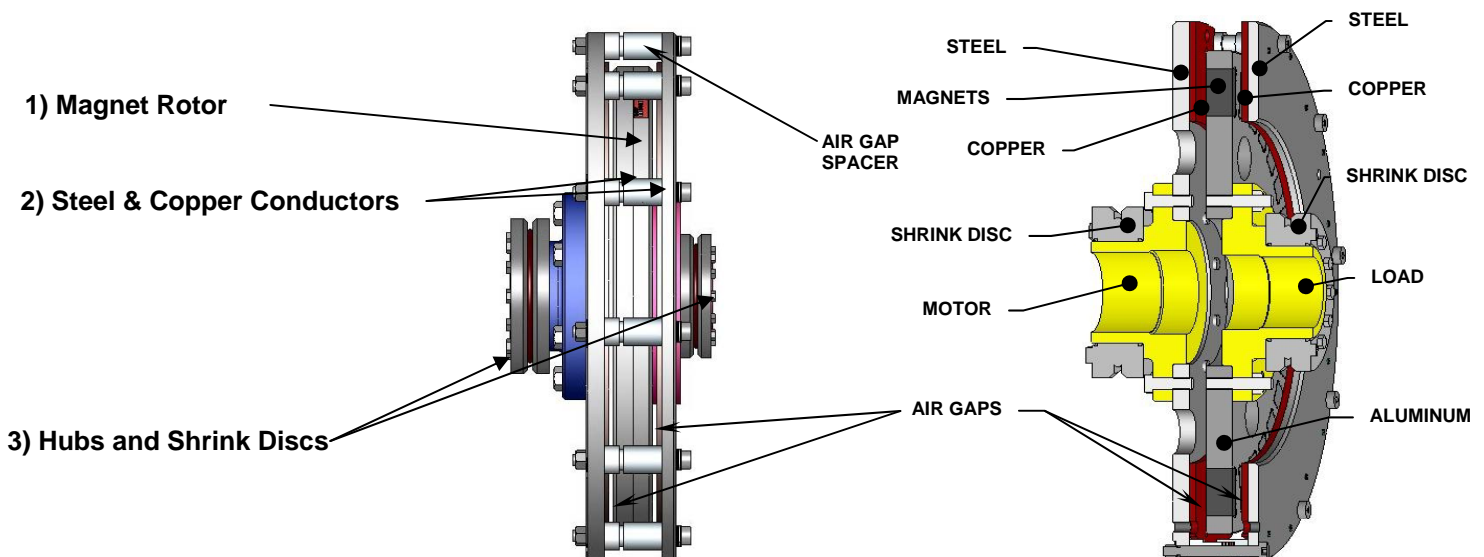
The MagnaDrive family of disconnected magnetic couplings is available in four different styles, each providing unique motor-to-load torque transfer and protection features. These couplings are the MagnaGuard Economizer (MGE, see specific brochure for more information), Fixed Gap Coupling (FGC), MagnaGuard Delay (MGD), and MagnaGuard Torque Limiting (MGTL, see specific brochure for more information). In general, each of these couplings transmits torque from the motor to the load using the same principles of operation with NO PHYSICAL CONNECTION of the driver shaft to the load shaft.

The main components of FGC magnetic couplings are a Magnet Rotor that is surrounded by a Conductor Rotor.

The Magnet Rotor and Conductor Rotor are NEVER IN CONTACT with each other. Torque is transmitted through an air gap 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.

In addition to the Conductor Rotor and Magnet Rotor, FGC couplings have two hubs that are connected to the motor shaft and load shaft with a unique locking mechanism called a shrink disc. The shrink disc is a compression fitting that grips the shaft with tremendous compression forces. No keyways or pins are required. Like all MagnaDrive couplings, the FGC couplings also provide a cushioned start.

- 1) **Magnet Rotor** – A precision-machined aluminum Rotor that contains powerful rare-earth magnets. The magnets are manufactured from a Neodymium-Iron-Boron (NdFeB) alloy with a half-life of more than 2,000 years. The Magnet Rotor is usually mounted to the load hub.
- 2) **Steel Conductor** – The Conductor Rotor assembly is made of a fabricated steel housing with copper conductor rings attached to the inside surface facing the Magnet Rotor. The Conductor Rotor assembly is usually mounted to the motor shaft.
- 3) **Hubs and Shrink Discs** – The coupling hubs are attached to the motor shaft and load shaft using high strength shrink discs. The shrink disc applies radial compression forces to fasten the hubs to the shafts. These forces are so high that no keyway or pins are required for installation.



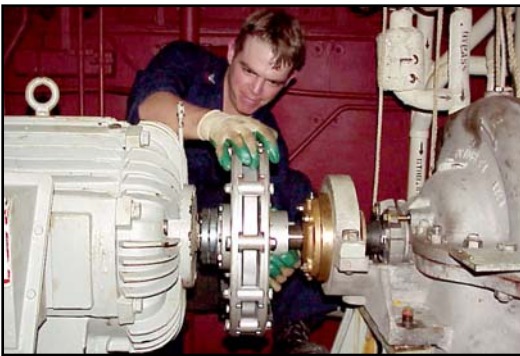
Typical Industries

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

Typical Applications

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

US Navy Program

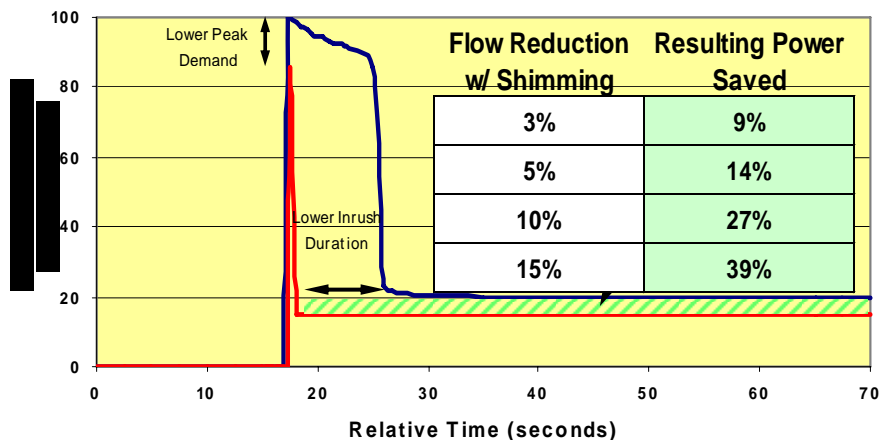


The United States Naval Sea Systems Command (a.k.a. NAVSEA) develops showcase engineering improvements for the United States Navy. Under this program, the Navy is purchasing MagnaDrive couplings for a variety of critical pump applications. MagnaDrive's FGC's have passed the Navy's rigorous 9-G Shock Test and are currently placed on guided missile cruisers, destroyers and aircraft carriers, with plans to install these couplings on pumps and other rotating equipment fleet wide, on all ship classes.

Many of MagnaDrive's couplings are placed on pumping equipment where reliability is critical to ship operations such as JP5 Fueling, Catapult Water, Fire Water, Hydraulic Elevators, and Chilled & Sea Water Circulation. The Navy spent 29 sailor-days per year, per pump repairing and replacing seals, couplings and bearings when using fluid couplings. With MagnaDrive technology maintenance and repair on the system has been reduced to 8 sailor-days per year. The Navy calculates that using MagnaDrive Technology will reduce their annual staffing needs by over 1,700 sailors. They currently operate more than 1,500 of these couplings. The Navy estimates that each aircraft carrier has nearly 5,000 uses for MagnaDrive Technology.

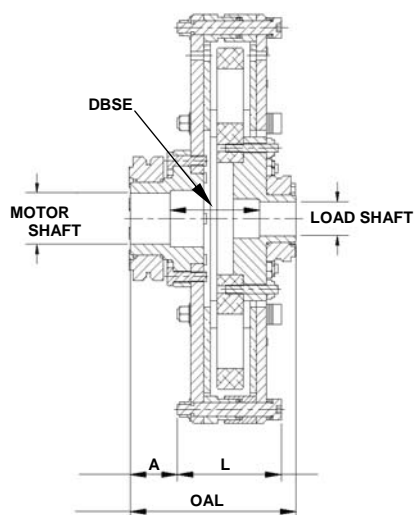
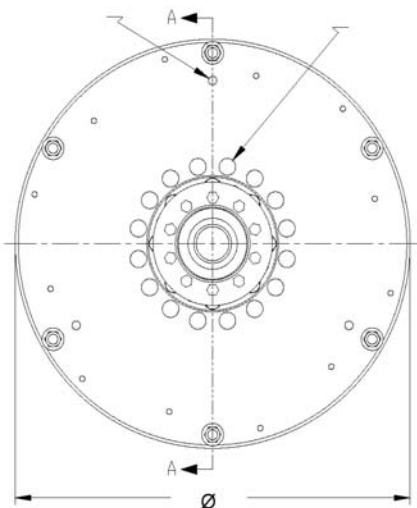
MagnaDrive Couplings provide a disconnected, cushioned start. Because the motor does not need to overcome load inertia, the Peak Demand Current and duration of Inrush are reduced significantly. This Cushioned Start results in energy savings (see Graph) and reduced equipment wear. For many applications a lower Peak Demand Current may contribute to lower electrical power rates as well. 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

Energy Saving Coupling Comparison — Direct Coupled (Blue line) — MagnaDrive Coupling (Red line)



Technical Data

Note: This data is not intended for design purposes. Please contact Magna-Drive Corporation for details. This information is subject to change without notice.



FGC Model	Conductor Side Assembly					
	Ø	Length L	A *	Weight (est.)	Driver Shaft end to CG (at min. shaft engagement)	WR ²
Size	(inch)	(inch)	(inch)	(lb)	(inch)	(lb*inch ²)
4.5S		2.91	0.76	9	0.75	35
6.5S		2.91	0.76	15	0.75	330
8.5S	11.00	3.81	1.07	36	1.40	550
10.5S	13.00	3.69	1.44	55	1.38	1,165
12.5S	15.00	3.69	1.51	71	1.75	2,025
14.5S	17.00	3.94	2.19	96	1.16	3,340
16.5S	19.00	3.94	2.19	110	1.65	5,025
18.5S	21.00	3.94	1.77	147	1.44	7,990
20.5S	23.00	3.94	2.01	173	1.38	11,140
22.5S	25.00	3.94	3.09	201	1.55	15,650
24.5S	27.00	3.94	2.40	224	1.32	20,380
26.5S	29.00	3.94	2.40	300	1.32	28,500
28.5S	31.00	3.94	2.40	309	1.32	37,890

10.5D	13.00	5.44	1.75	80	2.25	1,500
12.5D	15.00	5.44	1.75	105	2.67	3,500
14.5D	17.00	5.44	1.75	140	2.50	5,000
16.5D	19.00	5.44	1.75	160	2.50	8,000
18.5D	21.00	5.44	1.75	187	2.31	11,787
20.5D	23.00	5.69	2.88	224	2.66	16,630
22.5D	25.00	5.69	3.00	273	2.27	23,103
24.5D	27.00	5.69	3.00	290	2.30	29,866
26.5D	29.00	5.94	3.00	320	2.25	35,000
28.5D	31.00	5.94	3.00	390	2.38	50,000

17.0S	20.75	6.38	2.25	214	2.51	10,830
19.0S	22.75	6.38	2.24	271	2.55	15,840
21.0S	24.75	6.38	2.24	313	2.55	23,000
25.0S	28.75	6.38	3.28	428	3.19	41,860
29.0S	32.75	6.38	3.37	535	3.03	69,340
33.0S	36.75	6.38	3.34	674	2.69	108,000
37.0S	40.75	6.38	3.97	876	2.44	170,610

21.0D	24.75	12.50	3.50	500	5.00	41,000
25.0D	28.75	13.50	3.50	640	5.25	80,000
29.0D	32.75	13.50	3.50	865	5.95	126,427
33.0D	36.75	13.50	4.00	1020	6.00	191,890
37.0D	40.75	13.50	4.00	1300	6.00	250,000

Magnet Side Assembly			Coupling	Coupling				
Weight (est.)	Load Shaft end to CG (at min. shaft engagement)	WR ²	Total Weight (est.)	DBSE (Typical) (at min. shaft engagement)	Coupling OAL*	Angular Misalignment Capacity (Limit)	Coupling Internal Radial Clearance (for Parallel Shaft MAL)	Peak Torque (at min. air-gap)
(lb)	(inch)	(lb*inch ²)	(lb)	(inch)	(inch)	(degrees)	(inch)	(inch*lb)
5	0.61	10	14	2.63	5.16	2.39	0.25	215
7	0.61	58	22	1.91	4.61	1.65	0.25	484
12	0.91	85	48	3.20	5.97	1.68	0.25	1,377
20	0.90	195	75	3.23	6.29	1.36	0.25	2,667
28	0.73	379	99	3.28	6.17	1.15	0.25	4,130
39	0.60	725	135	2.79	6.52	0.99	0.25	6,309
55	0.46	1,310	165	3.35	7.05	0.87	0.25	8,947
76	1.30	1,900	223	4.36	8.00	0.77	0.25	12,045
76	0.59	2,590	249	3.04	6.50	0.87	0.25	13,931
101	0.64	4,130	302	4.44	9.49	0.80	0.25	17,517
107	1.14	5,250	331	3.87	8.14	0.73	0.25	21,512
160	1.14	8,480	460	3.87	8.14	0.81	0.25	22,918
150	1.14	10,130	459	3.87	8.14	0.75	0.25	27,175

40	2.00	700	120	5.00	9.00	1.36	0.25	5,334
52	2.19	800	150	5.50	9.00	1.15	0.25	8,259
60	2.25	1,100	188	6.00	9.00	0.99	0.25	12,618
90	2.25	2,500	250	6.00	9.00	0.87	0.25	17,895
108	2.17	3,645	306	6.00	9.50	0.77	0.25	24,089
123	1.80	5,270	362	6.00	10.50	0.87	0.25	27,863
148	1.27	7,590	407	6.00	11.00	0.80	0.25	35,033
160	1.40	10,335	436	6.00	11.00	0.73	0.25	43,023
190	1.40	15,000	510	6.00	11.00	0.81	0.25	45,836
240	1.40	20,000	630	6.00	11.00	0.75	0.25	54,351

92	2.12	2,590	306	6.00	10.38	0.84	0.25	14,353
126	2.51	4,030	397	6.32	10.17	0.75	0.25	20,184
170	2.51	6,050	483	6.32	10.17	0.85	0.25	23,579
256	2.79	13,700	684	8.38	13.30	0.72	0.38	42,667
297	2.05	22,560	832	7.37	12.88	0.74	0.38	57,757
403	1.40	38,060	1077	6.17	11.83	0.65	0.38	81,910
586	1.98	67,060	1462	7.39	14.05	0.58	0.38	110,262

250	5.00	12,000	750	12.00	20.00	0.85	0.25	47,158
300	4.50	26,000	940	12.00	20.00	0.72	0.38	85,334
565	4.00	47,280	1430	12.75	20.00	0.74	0.38	115,515
750	5.50	76,630	1770	14.00	21.00	0.65	0.38	163,821
900	5.50	100,000	2200	14.00	22.00	0.58	0.38	220,528

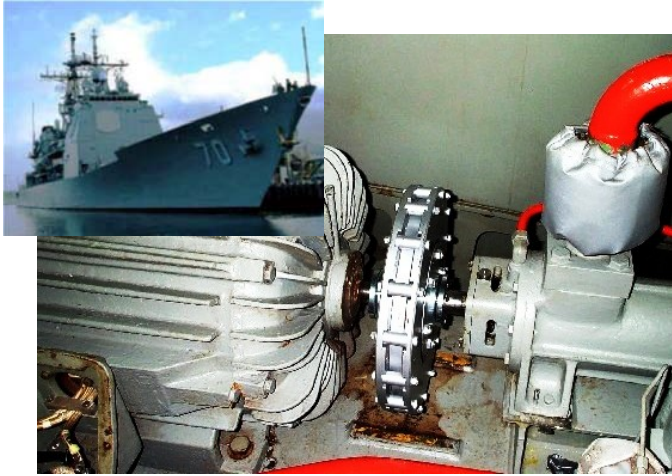
MagnaDrive = Lowest Total Cost of Ownership

	 Fluid Couplings	 Rigid Couplings	 Flexible Couplings	MagnaDrive FGC
Direct Coupled	Yes	Yes	Yes	No
First Cost	High	Low	Medium	Medium
Total Cost of Ownership	High	High	High	Low
Environmental Issues	Oil contamination and disposal problems	Uses grease	Uses petroleum-based products	None. Completely clean / Green technology
Installation Issues	Usually very heavy and bulky equipment requiring extra labor and time to install as well as setting-up oil levels	Time spent with alignment	Time spent with alignment	Easy to install
Space Requirements	High	Low	Low	Less than Fluid Couplings- Easy to retrofit into most existing installations
Alignment Issues	Needs periodic laser alignment	Needs periodic laser alignment	Needs periodic laser alignment	None
Overload Torque Protection	Some, but likely will melt / blow off fusible plug ejecting oil	No	Moderate– Coupling is destroyed, but only after seized system is shocked under full torque	Yes
Cushioned Start	Moderate	No	No	Yes
Energy Savings	Minimal	None	None	Dramatic energy savings by adjusting air gap and fine tuning the system
System / Maintenance Requirements	Medium– Requires spare parts and oil	High– Requires spare parts	High– Requires spare parts	Low
Equipment Life Issues	Vibration transfer causes lower equipment life	Vibration transfer causes lower equipment life	Vibration transfer causes lower equipment life	MagnaDrive offers the longest life on bearings, seals, and other equipment

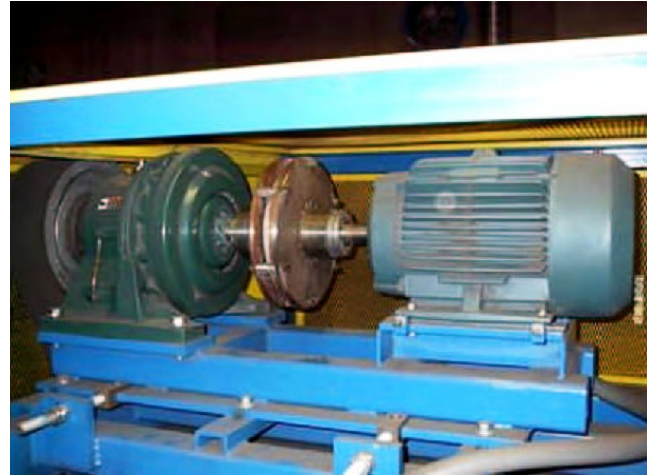
MagnaDrive's "**Green**" disconnected torque-transfer technology reduces your total cost of ownership by lowering maintenance and operating costs, increasing process availability, and improving system reliability.



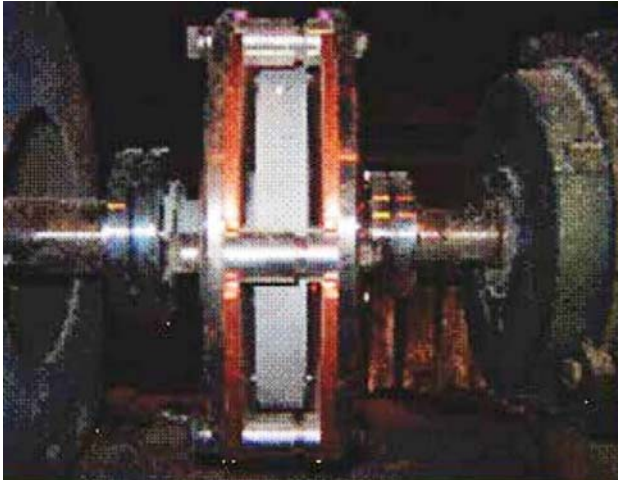
Sample Installations



FGC 12.5S, 40 hp, 1800 rpm, Maritime, Fire Pump on US Navy ships, USA



FGC 12.5S, 25 hp, 1800 rpm, Manufacturing, Bulk Handling Conveyor, Minneapolis, MN, USA



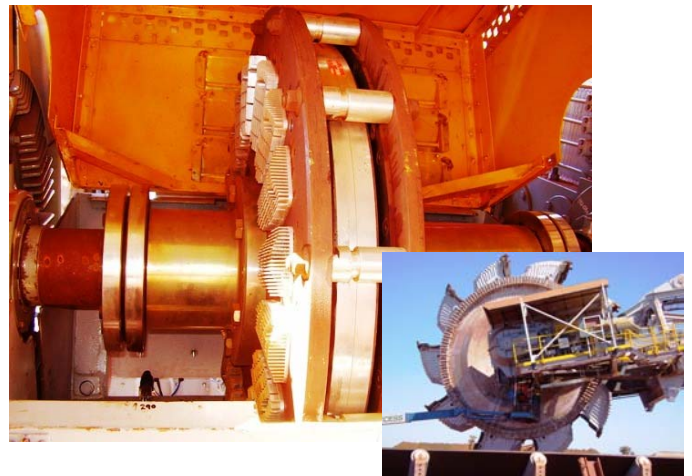
FGC 8.5S, 10 hp, 1800 rpm, Chemical Processing, Conveyor, KY, USA



FGC 21.0D, 500 hp 1200 rpm, Pulp & Paper, Debarking Drum, Jay, ME, USA



FGC 29.0, Manufacturing, Fan, Veracruz, Mexico



FGC 29.0, 800 hp, 1500 rpm, Mining, Conveyor System, Australia

MagnaDrive

C O R P O R A T I O N

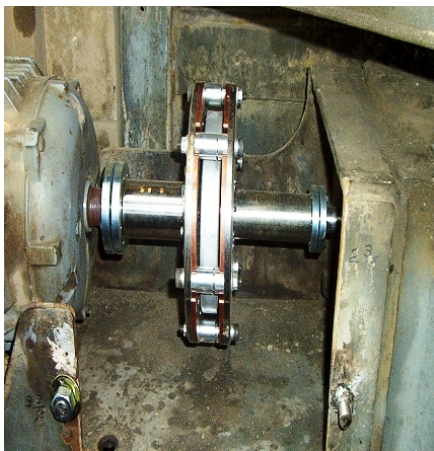
FGC Sample Installations



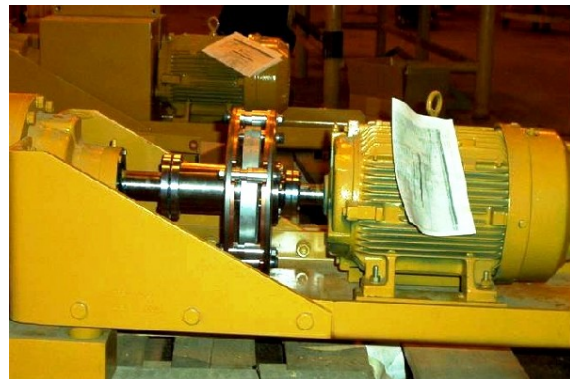
FGC 4.5S, Amusement Park, Roller Coaster, Orlando, FL, USA



FGC 29.0D, 1100 hp 1600 rpm,
Oil & Gas, Pump, Canada



FGC 10.5, 25 hp, 1800 rpm,
Power Generation,



FGC 8.5, 15hp, 1800 rpm., Power Generation, Clinker Grinder, CO, USA

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 the 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.

Deloitte.
Technology Fast 100

Inc.
500

IndustryWeek 
Technology of the Year



MagnaDrive Corporation

600 108th Avenue NE, Suite 1014, Bellevue, Washington 98004

Tel. (425) 463-4700 Fax (425) 463-4747

info@magnadrive.com / www.magnadrive.com

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