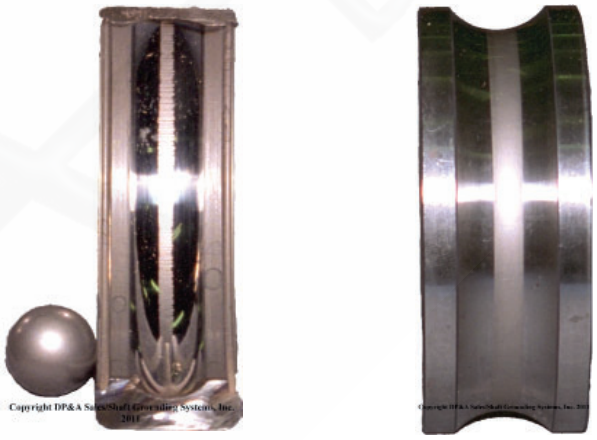
Electrical Bearing Damage and Shaft Grounding:
Can you afford to skimp on your shaft grounding needs?

Perhaps the two most prevalent obstacles we come across are 1) field skepticism regarding the prevalence of electrical bearing damage and 2) there is not a perceived appreciable difference between available shaft grounding options for fixing the problem. This article addresses both issues.

Prevalence:

To our knowledge, we are the only company to have completed a large-scale field study using vibration analysis to determine the incidence rate of electrical bearing damage. Of the 1,150 motors we surveyed in the field, 1000 were on VFDs and 150 were powered across the line. After 18 months of operation, the motors powered across the line had an electrical bearing failure rate well less than one percent. The VFD powered motors after 18 months of operation had a 25% electrical bearing failure rate. A 30-month follow-up of 150 motors showed 65% of those motors succumbing to electrical bearing damage. Electrical bearing damage is independent of motor and VFD brand. Extrapolating out to 4-5 years of continuous operation, it's reasonable to expect that electrical bearing failure could reach near one-hundred percent.

This is a real problem that is relatively slowly developing (compared to greasing, thrust and alignment issues) and consequently will often go unnoticed by maintenance crews. If the above prevalence study is not enough to convince the field that this is a ubiquitous problem, then our recommendation is to remove a failed bearing from a VFD powered motor, cut it open and inspect it for the unique damage caused by current passing through the bearing. You will see the damage.



Shaft Grounding Differences:

There are myriad of shaft grounding options on the market. Perhaps most common are carbon brush systems that run directly on the shaft as well as microfilament products that also run directly on the shaft. Both these systems are exposed to the environment and are very light duty. Even if installed internal to the motor the grounding system will experience environmental contamination leading to premature grounding system failure and ultimately electrical bearing failure.

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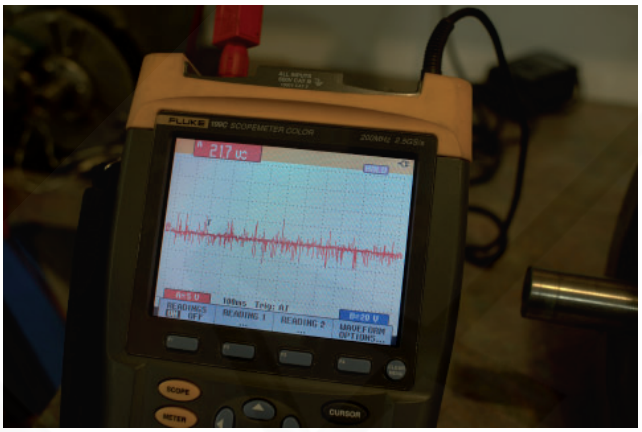
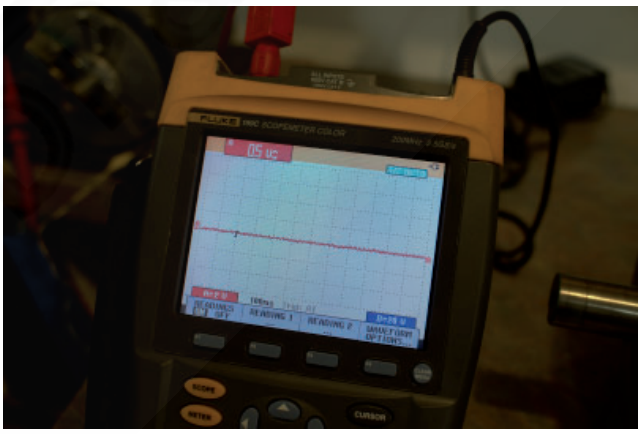
In short, a shaft grounding device must bring down shaft-to-frame voltages to 3 volts or less and MAINTAIN that level of performance over time. Our extensive lab studies and continual field feedback show that the above mentioned products do marginally well at achieving 3 volts or less when new, but cannot MAINTAIN that voltage for the long-term. That last sentence is absolutely critical when considering your options. Once shaft voltages get above 3 volts, then electrical bearing damage ensues. These inferior products take advantage of the fact that electrical bearing damage is relatively slowly developing and if the bearings last past the motor's warranty, then the grounding system is perceived as having done its job. If the bearings make it to even two years, then maintenance crews will be less likely to question the effectiveness of their shaft grounding despite the bearing failure. Removing and replacing bearings without question is a natural thing to do as the main goal is to simply get that motor up and running again and as quickly as possible and at the expense of root cause analysis.

The photo below left is a shaft voltage reading of a microfiliament style shaft grounding system that had run for 6 months on a small AC motor in a relatively clean environment. The reading shows 21 volts shaft-to-frame which is more than enough to cause bearing damage. The photo below right is an SGS™ non-drive end device on the same motor and running for the same amount of time. It shows 0.5 volts shaft-to-frame. The SGS™ device is protecting the motor from electrical bearing damage and that voltage reading will REMAIN the same for the entire wear life of the brush (10 years at 1800rpm).





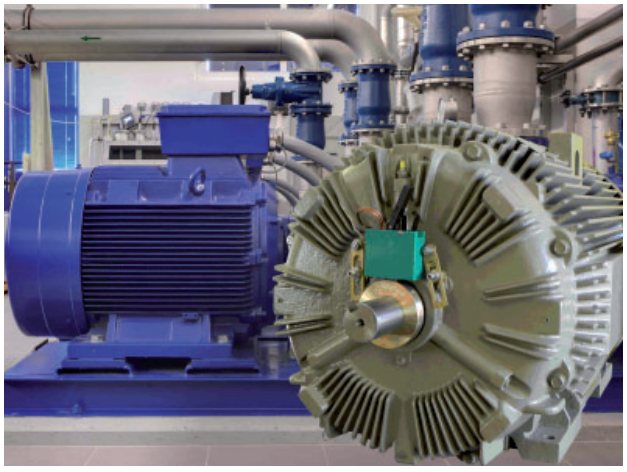
We continually question the worth of SGS™ products relative to the true costs of electrically induced bearing damage and also in the context of cheaper shaft grounding options. The economics of providing shaft grounding become very clear when considering factors well beyond the initial cost of a grounding system. SGS™ products, particularly when looking at smaller horsepower motors, may not seem at first like a sound economical decision. However, if looking more deeply into the true cost of electrical bearing damage, then SGS™ products become very economical. For example, we regularly have potential customers that balk at the idea of purchasing a grounding system for a small motor that costs 1/3 what the motor costs. It's easy to balk at that cost when not considering the long-term costs of electrical bearing failure. For an unprotected motor continually running, we would expect those bearings to have failed anywhere from 3-10 times over the 10-year service life of the motor. While the bearings are relatively inexpensive for a small motor, the true cost is the labor and associated downtime of that motor. Just the labor alone over that period of time stacks-up to many thousands

of dollars or several times the initial cost of the motor. As an extreme example, there are end users who if they experience electrical bearing failure leading to downtime, can cost them millions of dollars per day in lost production. We have developed and maintained a clientele that is slanted towards those types of end users as they have studied for themselves what works and doesn't work. They couldn't afford to choose an inferior product and is why we have continued to be able to help those end users for decades.

When considering larger motors relative to the economics of shaft grounding, as the motor size increases so does the cost of maintaining that motor. We conducted an internet survey of replacement bearing parts for 400 NEMA frame size motors. Just for the bearings, the cost ranges from approximately $500.00 to nearly $1000.00 per bearing. That's just for a standard bearing! Replacing a bearing in a larger motor can take 8 to 16 labor hours to perform that maintenance in the field. Maintenance costs continue to sky rocket even more if the motor is sent to a repair shop. Motor shops love and depend on this type of business. Not being protected by a shaft grounding system or having an inferior shaft grounding product becomes a disastrously expensive proposition, particularly when the size of the motor increases and the criticalness of the operation rises.

There is a reason why SGS™ products are more expensive than the competition. They simply work and work for the long-term. This long-term performance is reflected in the design and materials of our products as we actually understand what it takes to operate in an industrial environment. When holding a microfilament product in one hand and an SGS™ system in the other, the first question that pops into your mind should be, "Why in the world is there such a difference in weight, materials, robustness, etc?" The short answer is there needs to be that difference in order to actually be a long-term fix for electrically induced bearing failure. It's that simple.

If your frame of reference is an operation that is continuous, where the cost of downtime is painful, when you'd rather your maintenance crews be working on projects other than changing bearings, then you should be okay with paying a bit extra for a shaft grounding device that works as advertised; especially now that you know electrically induced bearing damage will occur if not adequately protected. We continue to support originally installed SGS™ shaft grounding products from 25 years ago and that have outlasted the service life of the motor it's installed on 3 times over. We challenge you to find another example of that level of performance.



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