

## ■ WHITE PAPER

# Saving energy with bearing isolators

## INPRO/SEAL'S DEVICES ARE NON-CONTACTING REPLACEMENTS FOR SEALS THAT CONSUME ZERO POWER

Inpro/Seal Company — a Rock Island, IL based supplier of bearing isolators — may have the key to energy conservation and be able to alleviate the need for immediate new power plant construction in the U.S. and increase productivity and plant reliability in the process.

Inpro/Seal Company, is a leader in the manufacture and application of non-contact, non-energy consumptive bearing protectors that are designed to replace contact sealing devices that have proven to consume electrical energy while operating.

Contacting lip seals were introduced over 70 years ago. Convenient and cheap, when it came to protecting bearings, they went on to capture a 99% market share. Today, in the U.S., about thirty eight million of them are manufactured for thousands of industrial applications in the U.S. including: pumps, gearboxes, fans, paper machine rolls and other types of rotating equipment. Most of these can be replaced with non-contact labyrinth style bearing isolators that consume zero power.

In the 1970s, the bearing isolator was invented by David C. Orłowski (patent #4,022,479). A non-contacting labyrinth seal, it gave the end-user the choice of permanent bearing protection and eliminated the need for continual maintenance. The size range of bearing isolators is 0.625 inches - 57 inches.

Comprised of a unitized rotor and stator that do not come into contact with each other, it operates without contact and thus does not consume energy. Because they never wear out, bearing isolators can be used over and over for many years. Contact seals have a 100% failure rate.

Lip seals consume power — lots of it. In fact, it costs more to operate a lip seal than it does to procure one. When effectively sealing and protecting bearings, each lip seal consumes, on average, 147 watts of power. After about 2,000 hours of operation (2.7 months), a lip seal will fail, lose contact with the rotating shaft and stop consuming power.

At that point in time they either must be replaced or the rotating equipment operates until the bearings become contaminated or run out of oil. This is something like running your car on a flat tire until it self-destructs. Other contacting

bearing protection devices, such as magnetic face seals are also sold. Combined with lip seals, they account for some 6,000 MW of power consumption while functioning and effectively sealing.

### Use with electric motors

Since their inception by Edison and Steinmetz back in the 1920s, industrial electric motors were manufactured and put into severe-duty services without adequate bearing protection. Until recently, only a close clearance between the shaft and end-bell served to limit contamination ingress into the bearing environment. Reliability suffered as lifecycle costs for energy and maintenance had significant negative impact on the process industries' production numbers.

In 1994, Institute of Electrical Engineers introduced their IEEE-841 Motor, an industrial-duty motor that was designed to improve reliability, efficiency and performance by establishing simple guidelines. Immediately after its introduction, forward-looking process plants found that by switching to IEEE-841 Motors energy consumption also improved. In 1995, after a process plant switched to 2,000 of these new motors, they directly attributed \$5 million in savings in efficiency and enhanced reliability.

As part of its specification, all IEEE-841 motors incorporate non-contact Inpro/Seal bearing isolators as standard equipment. Recently the newer NEMA Premium motor, which has at least a one point energy edge, has become readily available with Inpro/Seal bearing isolators as a standard option. This kind of permanent bearing protection greatly enhances reliability and reduces Mean Time Between Failures (MTBF). Documentation shows that the investment for enhanced efficiency and reliability regularly yields an internal rate of return of more than 100%.

It has been said there are some 40,000,000 industrial-grade electric motors in use in the United States. These motors, on average will last about 5.7 years before they need to be repaired or replaced. This decision is usually based around an energy analysis.

Will a new motor have an energy-saving return on investment great enough to rationalize the capital outlay? The differ-

ential cost for power over time is weighed against the cost of a new motor and the benefits of greater efficiency and enhanced reliability. The vast majority of the time, the root cause of electric motor failures have been because of mechanical rather than electrical problems.

Add to that the fact that bearing-protected motors have proven to last at least twice as long as the motors that they replaced. This is because the major, documented cause of motor failure remains bearing deterioration. It has been estimated that the insulation on the windings is good for 130 years because it was designed for severe resistive heating that does not present itself in the modern day super-efficient motor.

### A savings windfall

If the 38 million contacting lip seals addressed above were replaced with non-contacting, non-energy consuming bearing isolators, the savings would be substantial. The net energy savings in the U.S. would be some 5,586 MW or the equivalent of about 10 fossil-fueled power plants.

The process industries would save over \$3.7 billion every year in electrical power costs. Tons of carbon dioxide, a greenhouse gas (GHG) that is said to be a major contributor to global warming, would no longer be produced.

The bearing isolators would stay in service for at least 20 years, eliminating the duty cycle and replacement expense. Operating costs would stabilize and process industry manufacturers would realize productivity increases and remain competitive on a global basis.

For more information, "Introduction To Bearing Isolators", "Are Lip Seals Obsolete?" or a complete CD interactive package are available from Terri Hageman at: Inpro/Seal Company, P.O. Box 3940, Rock Island, Illinois 61204. Phone numbers are: (800) 447-0524 or (309) 787-4971. Fax number is: (309) 787-6114. In addition, an Excel module: Motor Energy Savings Justification Worksheet and other information can be found at: [www.inpro-seal.com](http://www.inpro-seal.com) or [www.bearingisolators.com](http://www.bearingisolators.com)