

## Are lip seals obsolete?

Pulp & Paper, Nov 2006 by Orlowski, David C

THIRTY-EIGHT MILLION RUBBER LIP SEALS are produced for industrial use in the U.S. each year. At least half of them are probably misapplied and should not be installed in industrial rotating equipment.

According to their manufacturers, even the best lip seals have a median life to failure of only 1,844 hours or 77 days of operation. Half last longer than that and half last less than the mean time hours to leakage. More than 90% of them will quit sealing within the first 3,000 hours of operation.

After that, they either groove the shaft or burn to a crisp at the point of contact with the rotating shaft. Why, then, are they applied to protect rotating equipment that is designed to run uninterrupted for five years and bearings that are rated for much longer than that?

On average, each lip seal consumes 147 watts of power. A plant with 600 pumps, assuming two lip seals per pump, consumes 176.4 kW/hr of operation. Assuming 7.56 cents per kWh, that amounts to \$117,041/year spent just to overcome lip seal drag. The low initial purchase price of lip seals represents only a tiny percentage of their total operating cost.

### Undesirable events

When the lip seal quits sealing and loses contact with the shaft, undesirable things are liable to happen. Lubricant is free to exit the bearing enclosure and as the equipment cycles, moisture in the environment is drawn into the enclosure where it condenses and contaminates the lubricant.

Sometimes it is nearly impossible to avoid the use of lip seals in industrial equipment. When shafts are flooded with lubricant or the total area for sealing is restricted to 0.5 in. (12 mm) or less, there is a compelling reason for their use, but care must be taken to cope with their frailty and extremely short life expectancy. Read: "Change them out every month or so and thereby avoid leakage in or out of the bearing enclosure."

Advocates of lip seals will theorize that they do not come in contact with the shaft and that they "hydroplane" on a thin film of oil at the sealing point. Another theory is that the lip seal acts as a small pump at the point of contact to maintain lubricant in the bearing enclosure, but also at that point ingests contaminants that are present in the near environment. Both theories may or may not have merit, but in practice shafts are grooved and sealing lips are carbonized by heat.

Lip seals were first introduced for use in the process industries in the 1930s, when they were the only sealing devices conveniently available for general use. Until now, they have been inexpensive to purchase and command more than 99% of the industrial rotating equipment sealing market, in sheer numbers.

Lip seals have their place in the mechanical universe, but it may not be on industrial rotating equipment. Automobiles have a series of lip seals that are found on the wheel bearings and power train. If they survive for 3,000 hours, you've had a good run (3,000 hours @ 40 miles [64 km] per hour equals 120,000 miles [193,000 km]). Washing machines, lawn mowers, electric drills, and even farm tractors are adequately served by common rubber lip seals because of their relatively short service life. None of these are continuous duty machines as are pumps, motors, and gearboxes in the process industries.

A better alternative

Lip seals are cheap, but not as cheap as they sometimes are perceived to be. The cost of installation is as much as for a bearing isolator. One pump failure after a lip seal burns out will cost as much as dozens of bearing isolators. Lip seals may already be functionally obsolete in the process industries, but hardly anyone realizes it.

It was not until the late 1970s that alternative, permanent, sealing devices for industrial/process rotating equipment were made available with the invention of the bearing isolator by what is now the Inpro/Seal Company. Bearing isolators are made to order for the various sizes and shapes of industrial rotating equipment

To service the customers as well as the lip seal manufacturers with 25,000 part numbers in their catalogs, bearing isolators must be able to be shipped the same day that they are ordered. Rotating equipment repair, as stated before, usually has a very short-term deadline for completion.

No one will benefit from casual installation of bearing isolators in place of lip seals on a one-at-a-time schedule. To maximize results, a structured program of some magnitude is needed to produce quantitative outcomes.

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