How do I evaluate and control my fluid sealing costs?

First, we need to consider the cost elements associated with pump packings and mechanical seals. There are the obvious ones:

- Acquisition cost
- Installation cost

Then, the not-so-obvious or easy to quantify:

- Down time – lost production
- Energy cost
- Inventory cost
- Flush Water
  - Acquisition cost
  - Waste water treatment
  - Evaporation cost
  - Heating cost
- Surveillance

The Fluid Sealing Association developed the *Seal Life Cycle Cost Estimator* (available on www.fluidsealing.com), which does an excellent job of quantifying these cost elements. Often, particularly with packing, the acquisition cost is the smallest cost element. The cost of flush water is separated into four components. Acquisition and disposal are straightforward, but evaporation costs and heating costs can be substantial if ambient temperature flush water is introduced into the process.

In the paper industry, for example, water in the pulping process must be removed in the paper making area. A ¼-in flush operating at a 15-psi differential can deliver 433-gph to the stuffing box. If half of the flush flows to the process, energy must be added to evaporate or heat over 200 gallons of water per hour.

Packings vs. Mechanical Seals

The next consideration is whether to use packing or a mechanical seal. That decision has probably already been made, but it never hurts to question the basics. If you can tolerate slight leakage, handling water borne slurries or abrasives, pumping water at high temperatures and pressures (condensate), or can't tolerate pulling a pump off line, then packing may be the right sealing product for your operation.

Investments in mechanical seals are cost justified on consistent, long-term reliability. The longer a mechanical seal runs, the greater its payback. If installation and operational parameters do not provide acceptable conditions for the seal, then its life will be compromised and its chances of being justified will quickly diminish, making packing the most economical sealing solution.

Recent advances in packing technology include materials and designs that routinely last from outage to outage, require minimum adjustments, and are quite stingy in flush water usage. Graphite-PTFE composites, carbon, flexible graphite, aramid, acrylic, and other fiber combinations allow service across the full spectrum of acids and bases. Temperature capabilities can exceed 500-deg F. Packing constructions incorporating braid design and rubber cores have even been used to solve problems associated with shaft misalignment and equipment wear.

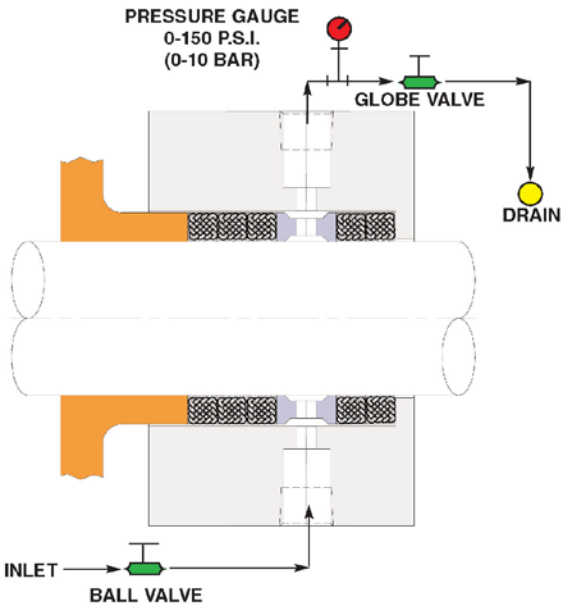

Figure 1. Diagram of typical pump stuffing box with packing.

Where Do I Start?

Recognizing that hundreds of thousands of dollars can literally be going down the drain, how do you evaluate and control the problem? A full line packing and seal manufacturer can help. The steps to the solution include:

1. Plant survey of all pumps and other sealed or packed equipment.
2. Selection of the right sealing product.
3. Training – operator & maintenance personnel.

4. Tracking sealing product performance.
5. Failure analysis.

Tracking or score keeping determines whether you are winning the cost reduction battle. Failure analysis ultimately leads to overall improvement. Key factors to consider during the plant survey include all aspects of the conditions under which the equipment operates. It is fairly easy to determine the basics on size, speed, pressure, and temperatures, but what are the upset conditions? Can the pump run dry? Lose flush? Is the pump put through cleaning cycles that demand more than normal service?

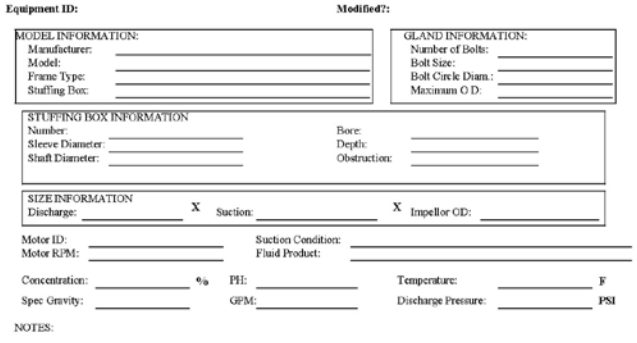

Figure 2. Sample survey form.

Once the survey is completed, sealing recommendations are made for each piece of equipment. Your supplier should be able to evaluate the survey and make optimum product recommendations for your plant.

Training is Key

Training is the most neglected area for cost improvement. Maintenance personnel and operators must be included for optimum results. A typical training program includes:

- Packing and Seal Designs
- Materials of Construction
- Capabilities of Materials
- Installation Procedures
- Environmental Controls
- Pump Alignment Issues
- Operator Concerns

The next step to controlling costs is to track sealing product performance, using either a tagging system or data base management system. Tracking information that can be identified to a particular piece of equipment is important. The 80/20 rule applies here: 80 percent of the problems relate to 20 percent of the equipment. Tracking identifies the bad actors that consume maintenance time and dollars. Failure analysis of the sealing product on these problem pumps or applications completes the feedback loop. Again, your supplier should provide this valuable service.

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Fluid Sealing Association

Sealing Sense is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs, and reps. As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump systems technology issues on rational Total Life Cycle Cost principles.

The **Compression Packing** division of the FSA is one of five with a specific product technology focus. As part of their mission they develop publications such as the joint *FSA/ESA Guidelines for the Use of Compression Packings* and *Pump & the Valve Packing Installation Procedures* pamphlet. These are primers intended to complement the more detailed manufacturer's documents produced by the member companies. In addition to English they are available in a number of other languages, including Spanish and German. The following members of the **Compression Packing** division sponsor this *Sealing Sense* series:

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Finally, assuming that a piece of equipment is stopped before the bearings catastrophically fail, an analysis of those bearings can readily identify lubrication issues. The bearing shown in Figure 17 was caught very close to the point of seizure.

The coloration (bluing) of the raceway in this cylindrical roller bearing indicates that this bearing reached 400-deg C to 500-deg C (750-deg F to 930-deg F). This type of failure is indicative of an over-greasing problem, where grease was continuously added to the bearing in an attempt to cool it.

During the discussion on mounting, scuffing was identified as an indicator of excessive interference if found on the bore of the bearing. Scuffing can also be found on the thrust ends of cylindrical, tapered or spherical thrust roller bearing rolling elements (see Figure 18).

This internal scuffing is an indication that the sliding surfaces of the roller ends were not properly lubricated. These sliding surfaces demand that these type of bearings use a more viscous lubricating oil, as was shown earlier in Figure 4.

In the course of this discussion, we have run the gambit from insuring proper shaft and housing fits, to pre-mounting inspections, to correct mounting techniques through proper lubrication selection and regreasing do's and don'ts.

Changing fitting practices and mounting techniques will undoubtedly run into negative comments such as 'I've always done it this way and it works.' Establishing and operating a comprehensive maintenance schedule can be a hard sell due to set up costs and time. The whole concept can also be a quite daunting task. However, the cost of not making these proactive changes could result in unexpected equipment, line or plant shut downs which could run into the tens – if not hundreds – of thousands of dollars.

P&S

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FSA Sealing Sense

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The condition of the used products and their components can indicate a number of failure modes. For packing, you can usually determine whether there is a size problem, chemical exposure problem, heat, insufficient flush, or an equipment issue. Failure analysis on mechanical seals yields similar results.

One example of this approach to reducing fluid sealing costs is a paper mill that implemented the program above. This bleached pulp mill had the following:

- Capacity: 2,550 metric tons per day
- Three digesters
- Two pulp driers
- Two recovery boilers
- Rotating equipment: 800+ units

The results speak for themselves. Pump failures decreased from 360 (in the base year) to 136 (in year 4), with associated cost reductions (excluding product and repair) of $314,000. Sealing product usage declined by approximately $600,000 during the same period.

Next Month: *How do I choose the right gasket for pumps in chemical service?*

Figure 3. Packing failure from over compression and insufficient flush.

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingquestions@fluidsealing.com.

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