Mechanical Seals: Open Seal Chamber vs. Closed Stuffing Box Design

Mechanical seal chamber design has been the focus of several recent articles by various pump manufacturers. "Ours is best" is a claim repeated by several companies with absolutely opposite design solutions. The facts, as tested by an independent source and as reported at Texas A&M during the 10th International Pump User Symposium, succinctly show that stuffing box design pumps are *inadequate for maintaining the longevity of the mechanical seal.* A little history here is beneficial.

Previous pump design required mechanical seals to fit into stuffing boxes designed specifically for compression packing. Requiring the mechanical seal to fit into such a tight space seriously undermined overall seal performance. Excessive heat buildup, inadequate flow, and poor installation practices, contribute to premature seal failures.

In order to determine the precise impact the stuffing box environment has on a mechanical seal, an independent analysis was conducted where investigators utilized high speed video and laser doppler velocimertry to monitor conditions within an acrylic pump. The results of the study revealed that an open, enlarged seal chamber removes heat and debris better than a compressed stuffing box assembly that retains particles and heat that are damaging to seals. Figures 1 and 2 below depict the path of the liquid within an open seal chamber (standard on all B&G pumps) versus the restricted path for a stuffing box (standard on competitors' designs).

The analysis showed that particles follow a helical path as they flow toward the gland face in a region close to the mechanical seal chamber. These particles then reverse direction and return toward the open throat area by the rotating shaft. The videotaped analysis revealed that particles were being trapped in the bottom of the seal chamber as depicted in Figure 2. The velocities at this point were insufficient to overcome the centrifugal force acting on the particles. The captured particles then became the catalyst for erosion at the seal faces, and eventual seal failure.

Further analysis was conducted to determine whether flow disruption (with a rib or protrusion, features standard on B&G pumps) of these vortices would extend and prolong seal life. Tests revealed that these rib protrusions significantly reduced the accumulation of solids at the seal faces.

The results of these tests verified that seal face erosion, as well as heat transfer between the seal faces, is superior in an enlarged seal chamber.

The results are clear: End suction pumps that utilize stuffing box designs to hold their mechanical seals are far more susceptible to accelerated seal wear and/or failure than the Bell & Gossett designed, open, internally self-flushing seal chamber design.

Incorporated into this design feature is a unique ceramic seat material utilized only by B&G, made of 99.5% pure alumina oxide which provides a hard surface and superior corrosion resistance. This high ceramic purity level, only 0.5% glass, provides superior performance and life in hot water applications.

For additional information, contact your Bell & Gossett representative.

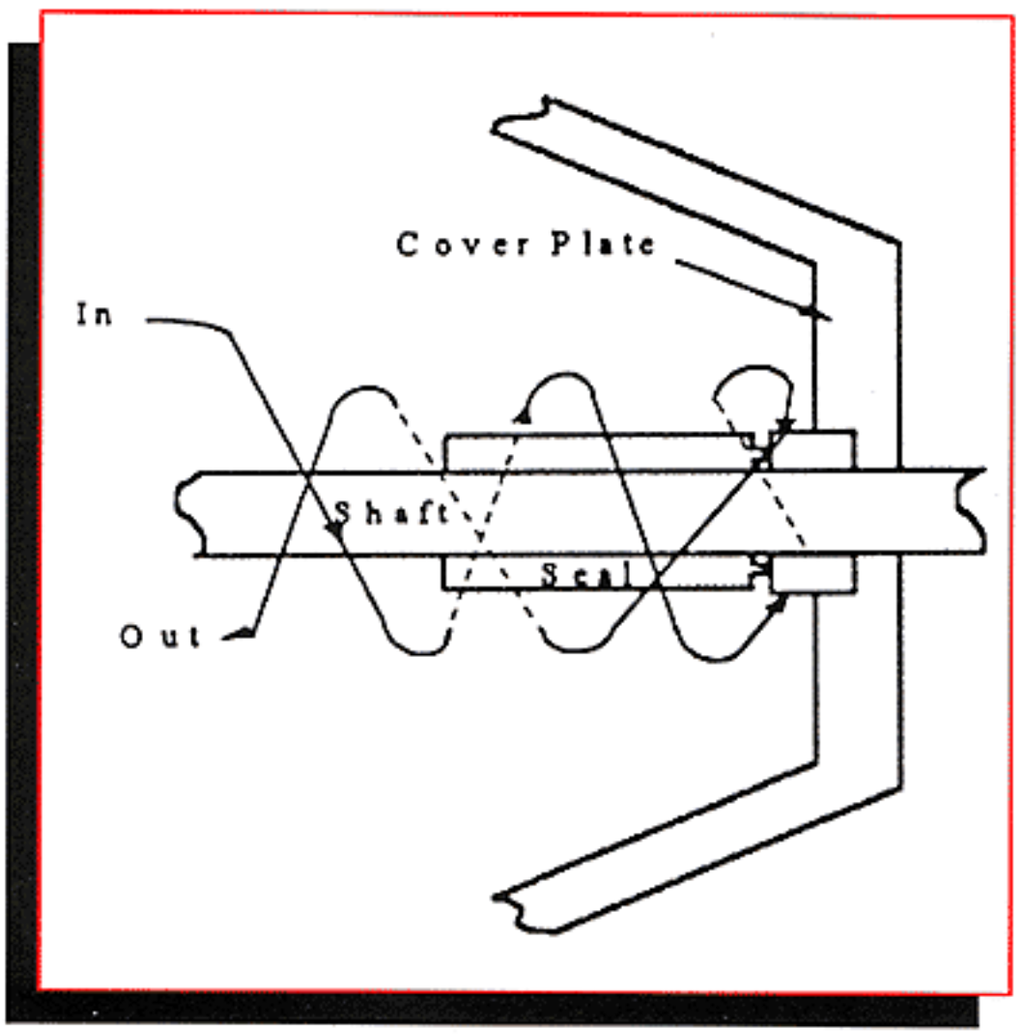

Figure #1 Open flow path on Bell & Gossett Series 1510 design.

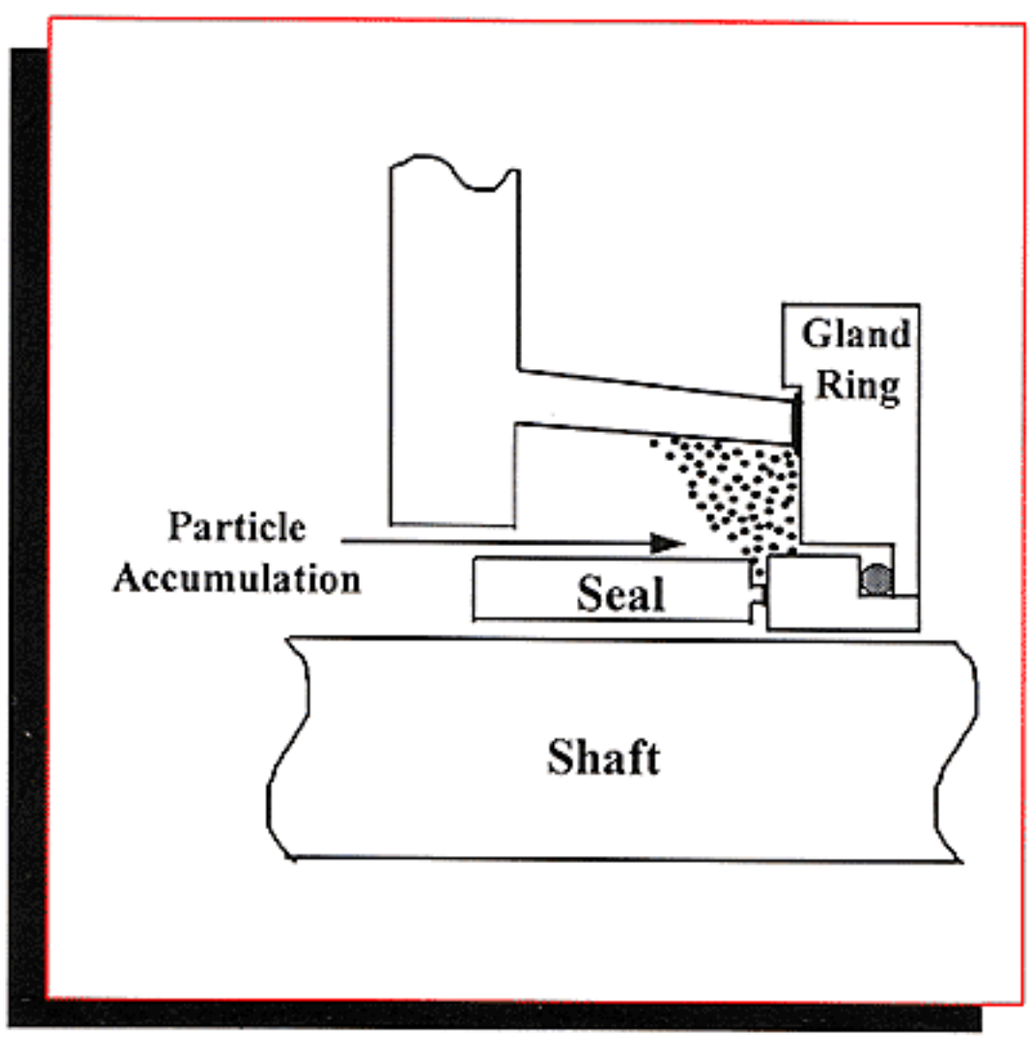

Figure #2 Competitor design with restrictive flow path.