Statement for Use of Mechanical Seals in Slurry Applications

With mechanical seals there is often the choice to use an open or a closed frame plate liner. AESSEAL® frequently recommend the use of a closed frame plate liner to increase mechanical seal life.

AESSEAL® are part of a reliability group dedicated to doing the right thing for our customers.

Open, seldom preferred by AESSEAL®

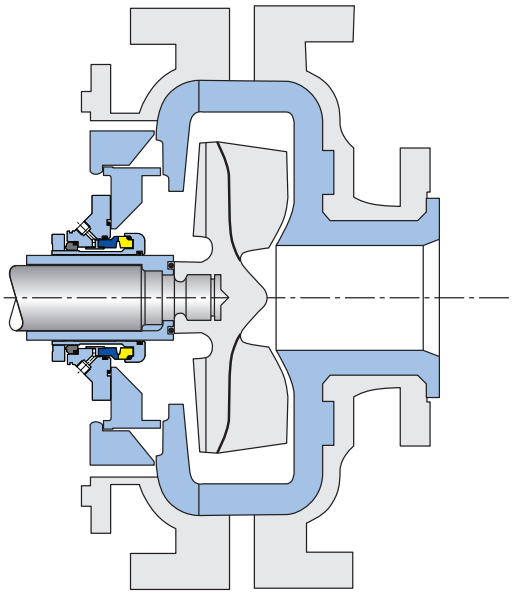

Figure 1: diagram of a conventional 'open throat seal chamber' using an 'open frame plate', which exposes the seal to the full velocity of the slurry.

Closed, often AESSEAL® choice

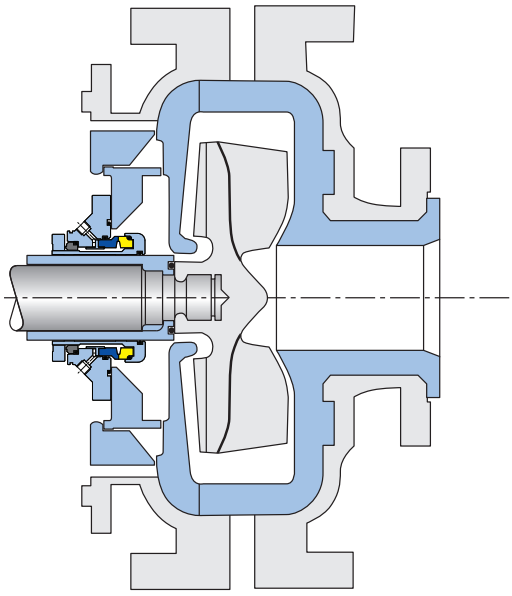

Figure 2: alternate 'closed frame plate' pump design, which hides the seal from the full velocity of the slurry, thus reducing the need for expensive, exotic metallurgy for the seal components.

Our extensive experience with end users globally is that an open frame plate liner can expose the mechanical seal to the full velocity of the slurry and allows too much swirling and erosive action of abrasive slurries in and around the sealing chamber and using an open liner, particularly in large pumps used in minerals and mining, reduces both single and double mechanical seal life.

There are, however, exceptions especially in small pumps used in general industry, which is why it is always better to provide full application details and a recommendation from a person or persons with experience of your application.

MINING AND MINERALS PROCESSING

Pumps are generally larger in this industry in regions like Latin America, South Africa and Australia so it is likely that the “best” solution for sealing a mining slurry is to use a closed liner for both single seals and dual seals. This minimises wear on the softer metal parts of the seal when compared to the hard chrome white irons and rubber linings used for impellers and liners.

The exception will be on small pumps (pumps comparable to Warman® 4/3 CAH (60mm shaft) and smaller) where the use of a closed liner can become problematic as the seal rotating parts can be too close to the stationary liners and due to their close proximity can create unusual wear patterns and early seal failure.

The solution on these small pumps may be to open the liner and remove/fill the back vanes on the impeller.

GENERAL INDUSTRY SLURRIES

What do we mean by general industry slurries? Well, anything which is non mining related such as Flue Gas Desulphurisation (FGD) in Power Stations, Cement Industry, Chemical Processing, Sugar, Oil and Gas and Clay Reclamation to name a few.

There may be applications where it is advantageous, irrespective of the seal design employed that we open the liner and remove the back vanes from the impeller.

Any applications where the media readily sets, such as cement, which forms a “product stuffing box” around the seal, should always be fitted with an open liner with back vanes removed from the impeller wherever possible. This allows the pump and the area around the seal to be washed out especially if the process is a batch process and not continuous.

The FGD process slurries in the Power Industry are generally regarded as “soft” slurries that are low on the Mohs scale of mineral hardness in comparison to heavy mining. Due to the potential ingestion of air around the seal areas due to the process, 100% of these pumps need to use an open frame plate liner and have the impeller back vanes removed, as these two steps allow self-venting of the seal area.

In general, on the smaller pumps like the Warman® 4/3 CAH (60mm shaft) and smaller where we use dual seals, such as CDPH™ and DMSF™, they will often not even fit with a closed frame plate liner installed, leaving no other option than to fit the open liner with back vanes removed from the impeller due to dimensional clashes.

Summary

Our extensive experience with mineral and mining end users globally is that an open frame plate liner exposes the mechanical seal to the full velocity of the slurry and allows too much swirling and erosive action of abrasive slurries in and around the sealing chamber. This reduces both single and double mechanical seal life, but there are exceptions with small pumps and especially in general industry slurry process.

Slurry Classification and Acceptable Seal Arrangements:

Before recommending a seal for a slurry application it is critical to know the classification of the slurry which should be readily available from the EPCC or end user customer.

Slurry Service Class	Typical Slurry Type	Single Seal Acceptable?	Dual Seal Recommended?	Notes / Limitations
Class 1 & 2	Non-settling, light/medium	Yes	Optional	For non-settling slurries, single seals are standard.
				For wear service classes 1 & 2, single seals are suitable if above conditions met.
Class 3 & 4	Settling, high-wear, coarse	No	Yes	Dual (pressurized) seals are required for high-wear, settling, or coarse slurries.
				Single seals are not recommended for these classes.

- Single mechanical seals are suitable for wear service classes 1 and 2 (non-settling, light/medium slurries) and must not be used in settling, high-wear, or coarse slurry applications (classes 3 and 4).
- Dual mechanical seals (with appropriate API Plan 53A, 53B, or 54 support systems) are required for wear service classes 3 and 4, and for any application where a Plan 32 flush is not available or acceptable.

SINGLE MECHANICAL SEALS CAN ONLY BE USED IN CLASS 1 AND 2 SLURRIES

Single seals, especially when used with an open frame plate liner are intolerant to the following abuses listed, even when applied to Slurry Service Class 1 and 2. Single seals in a closed plate liner often work better. For the most fault tolerant solution, use double seals and Water Management Systems. But even when misapplied, the AESSEAL® FGDSS-N™ single seal will work as well or better in slurry applications as any competitor product and is often repairable.

1. Conditions of Use

- The seal must be installed, operated, and maintained in accordance with the manufacturer's instructions and best engineering practices.
- The seal chamber must provide a minimum liquid pressure of 35 kPag (0.35 barg / 5 psig) at all times for correct seal operation.
- For single seals not using an external flush, a large bore, open-end seal chamber is required to maximize flow around the faces.
- Both a closed and open frame plate liner have a large bore open-end seal chamber to maximize flow around the faces, but the open frame plate liner exposes the mechanical seal to the full velocity of abrasive slurries and reduces seal life.
- Shaft deflection must remain within the application limits of the specific seal design.
- The process fluid and flush water (if used) must meet recommended quality standards (e.g., pH 6–8, dissolved solids <1000 mg/L, suspended solids <100 mg/L, 100% of 60 µm or larger particles removed).
- The seal must not be exposed to coarse particles with d50 above 1000 µm, or fine particles with d50 below 50 µm, unless specifically approved for such service.

Warranty Applicability and Limitations for Mechanical Seals Slurry Use

- **Scope of Coverage:** Covers defects in material and workmanship for manufactured seals.
- **Exclusions (Misuse):** Damage or failure caused by misuse is not covered. Misuse includes, but is not limited to:
  - Failure to follow installation instructions.
  - Operating the product beyond the specified parameters.

Typical and frequently witnessed abuse of mechanical seals which invalidates any cover includes but is not limited to:-

- Users not flushing/washing out pumps and lines in accordance with the pump manufacturer's Operation and Maintenance instructions. **Washing out pumps is critical.**
- Running pumps outside the pump manufacturer's recommended BEP window.
- Running mechanical seals dry.
- Running pumps beyond the mechanical seals allowable shaft deflection and axial allowances.
- Flush and barrier make up water not meeting the recommended quality standards in conditions of use.
- Cavitation.
- Pumps in series running in reverse, due to bypassed or leaking NRVs (turbining).
- Pumps rotating when driver is switched off or disengaged (windmilling).
- Water hammer.
- Using mechanical seals not prescribed for the Class of slurry being handled.

2. Performance Exclusions:

The seal performance does not cover failures due to:

- Use in slurry classifications or service classes outside the stated limits.
- Operation with inadequate seal chamber pressure or improper chamber design.
- Exposure to process or flush fluids outside recommended quality limits.
- Excessive shaft deflection, misalignment, or improper installation.
- Use in applications with coarse or fine particles outside the recommended d50 range.
- Failure to use a dual seal where required by slurry classification.

3. General Limitations:

- No warranty is provided for running life, as seal life is highly dependent on duty, equipment, and application specifics.
- This Statement provides general technical guidance and is not intended to form part of any offer or commitment by AESSEAL®, nor to constitute a recommendation, as suitability depends on the application details provided. Where this Statement is referenced in an AESSEAL® quotation, it will apply to that transaction and shall, in all such circumstances, be governed by AES's Worldwide Terms and Conditions of Sale, available at www.aesseal.com. Your attention is drawn to Condition 13 concerning warranty. In the event of any inconsistency, AES's Worldwide Terms and Conditions of Sale shall prevail.
- Guidance and suitability depend on the application details provided for the duty.