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Friday, 12 December 2008 03:44 - Last Updated Thursday, 17 February 2011 04:28

Mechanical Seals Introduction

Mechanical seals are being used increasingly on fluid pumps to replace packed glands and lip seals. Pumps with mechanical seals perform more efficiently and generally perform more reliably for extended periods of time.

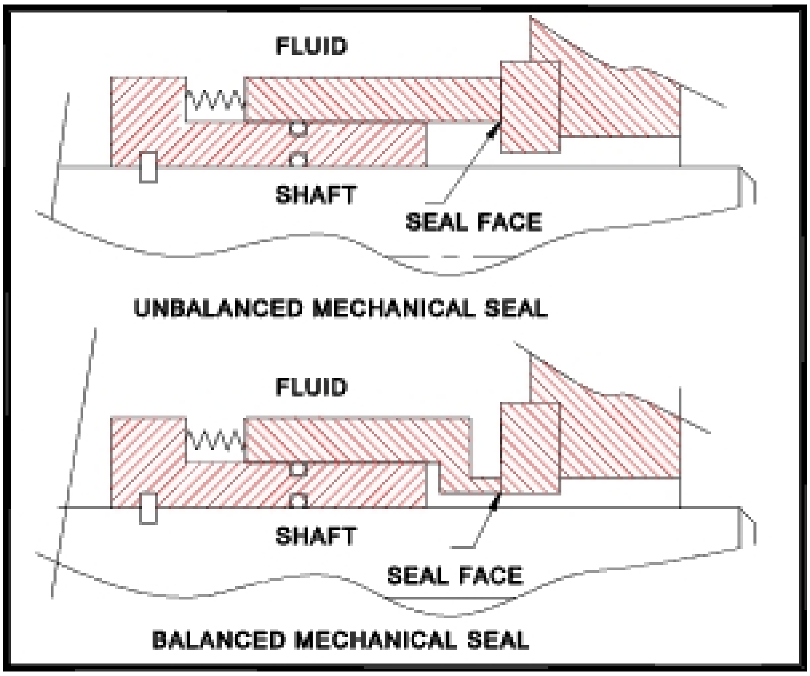
Mechanical seals are provided to prevent pumped fluids from leaking out along the drive shafts. The controlled leakage path is between two flat surfaces associated with the rotating shaft and the housing respectively. The leakage path gap varies as the faces are subject to varying external loads which tend the move the faces relative to each other.

The mechanical seal requires a different shaft housing design arrangement compared to that for the other type of seals because the seal is a more complicated arrangement and the mechanical seal does not provide any support to the shaft.

In order for the mechanical seal to perform over an extended time period with low frictional the faces are generally hydrodynamically lubricated. The fluid film will need to carry substantial load. If the load becomes to high for the film surface contact will take place with consequent bearing failure. This lubricating film is generally of the order of 3 micrometres thick , or less. This thickness is critical to the required sealing function. Mechanical seals often have one face of a suitable solid lubricant such that the seal can still operate for a period without the fluid film.

Pressure Balance Mechanical Seals

It is possible to reduce the seal contact pressure by using a pressure balanced seal design of off-set a proportion of the force generated by the pumped fluid pressure. This principle is illustrated in the sketch below.



Design Features

The mechanical seal generally includes a three static seals.

- The sleeve seal - this is usually an O-Ring
- The seal between the moving seal member and the shaft or sleeve.- This is often an o-ring but can be a wedge or vee seal. This seal may not be used for bellows type mechanical seals
- The housing seal is generally an o-ring of a gasket.

All of these seal must be compatible with the fluid being contained and the associated environment. These seals may limit the design for high temperature applications. In this case the bellows type alternative may be the best option.

The sealing faces are generally pressed together using some form of spring loading. Several different spring loading systems are available.

- Single spring
- Multiple springs distributed around seal body
- Disc Springs
- Disc Springs
- Bellows
- Magnetic

For conventional mechanical seals the single spring arrangements is used. The other spring arrangements are used in the space is restricted.

It is vitally important that the sealing surfaces perfectly flat and are parallel.

The seal faces are usually dissimilar materials with the softer face being the narrower surface. For abrasive applications similar hard materials are used e.g tungsten carbide. The seal surfaces must have sufficient strength to withstand the hydrostatic fluid forces and must be able to remove the heat generated by sliding action. Carbon is often used against bronze, cast iron, stainless steel etc.

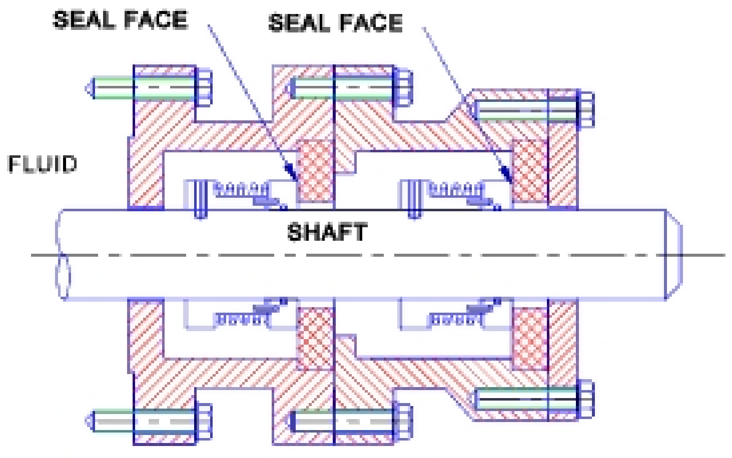
The seal surface must be flat, smooth and square to the shaft. Both surfaces a normally lapped to a high quality finish. The harder surface is most important because the softer surface is designed to run-in over the initial operating period.

The shaft design is critical. It must be rigid enough to support the seal in the correct position and the shaft surface finish must be suitable to ensure good sealing on the static seals (0.4 micrometers CLA or better). The shaft Total Indicated Runout (TIR) should not exceed 0.125mm. There should be minimum shaft vibration. The shaft may be subject to fretting corrosion as a result of micro-movements of the seal and is is often desireable to have locally hardened surfaces or to use sleeves.

Assembly Options

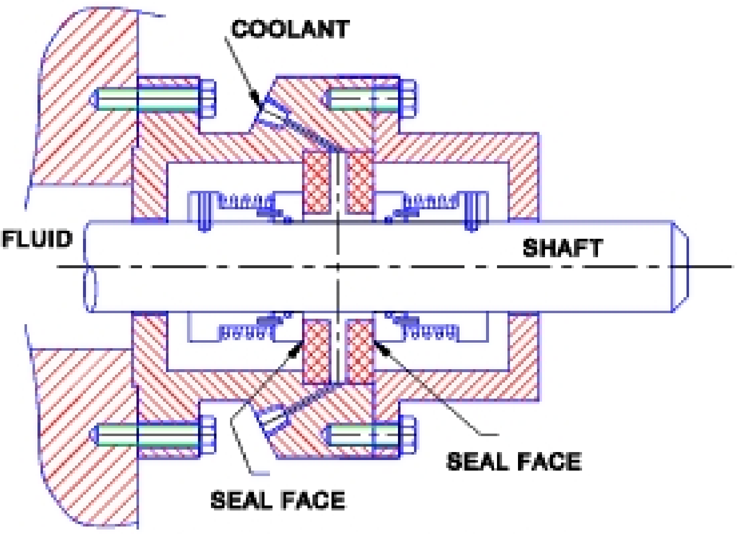
There are a number of mechanical seal options

- External Seal.. This design is installed on the outside of the stuffing box with the sealed pressure inside. This provides good access allowing the seal components to be be cleaned.
- Internal Seal.. Generally mechanical seals are mounted inside the stuffing box with the sealed pressure outside the seal.
- Double Seals.. Mechanical seals mounted in pairs are used for sealing hazardous, toxic or abrasiv fluids and are often provided with clean flushing fluid between the seals. Double seals also provide an additional degree of safety were the pressure differentials are likely to reverse and/or there is a high risk of the sealing failing. There are a number of double seal assembly options as listed below
- In Series - Used primarily to overcome the risk of failure of a single seal.



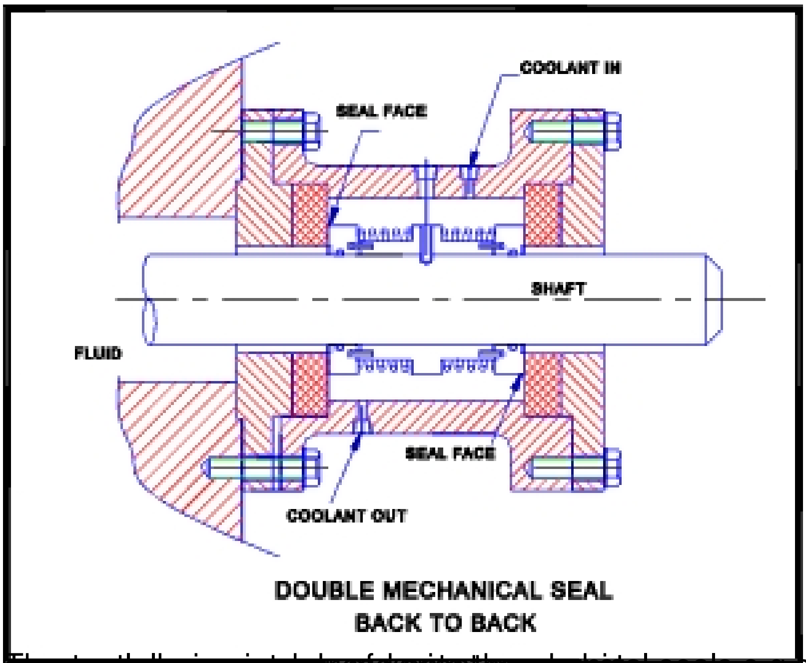
DOUBLE MECHANICAL SEALS
SERIES MOUNTED

proc… is required . One seal is used for the



DOUBLE MECHANICAL SEAL
FACE TO FACE

with a… fluid



[illegible] seals e.g split seals. Improved systems are constantly being introduced onto the market.

Additional Equipment

The use of mechanical seals generally involve the use of additional equipment primarily for the flushing /coolant systems. This includes pumps, coolers, strainers, filters etc.