Dynamic Seal for Ahlstar Pumps

JUKKA VANHALA
SULZER PUMPS

Under normal circumstances, the shaft seal is the component that causes the highest maintenance costs by centrifugal pumps. Dynamic seals, such as those that have been fitted in the Ahlstar™ range of pumps by Sulzer Pumps Finland Oy for more than ten years, operate contact- and leak-free and thus enhance the operating reliability of the pumps.

1■ Dynamic seals like those that Sulzer Pumps Finland fits in its Ahlstar pumps are maintenance- and leak-free. More than 23 000 pumps are already operating with these seals.

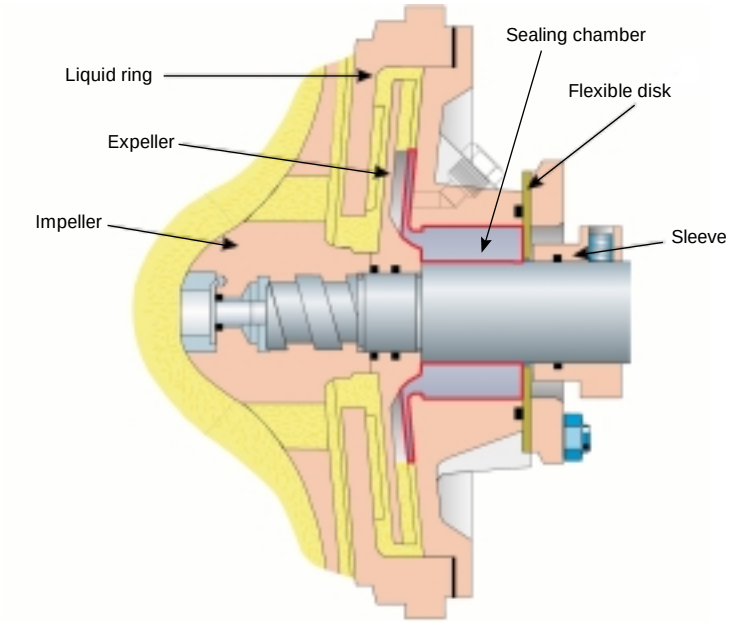
Up to now, the seals on the shaft have been the weakest point of centrifugal pumps. Since the sealing effect results from friction, component wear is inevitable and leads, sooner or later, to leaks. Stuffing box packings or mechanical seals require a continuous and reliable supply of sealing fluid for lubrication and cooling purposes. If the seal runs dry, the wear increases dramatically and can result in the failure of the seal. The unforeseen downtimes of individual pumps caused in this manner lead to extensive costs especially in the case of large installations, because the failure of only a few pumps can already lead to the stoppage of complete process cycles.

Such unforeseen failures can only be averted through regular maintenance of the packings and the mechanical seals and, if necessary, the external lubrication supply system.

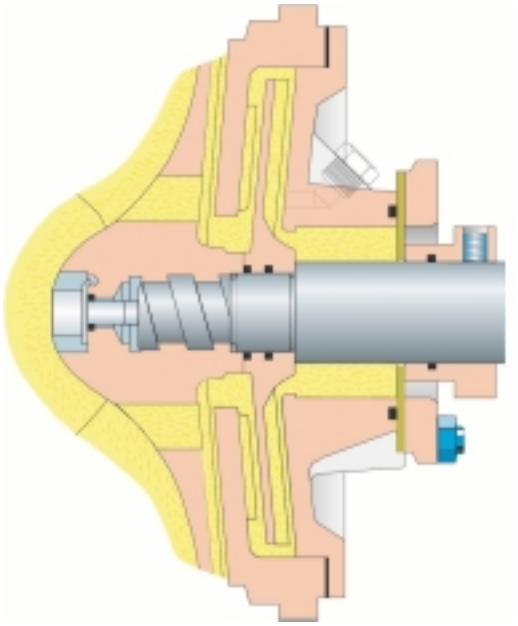
The problem has been largely overcome through the introduction of contactless dynamic seals for the Ahlstar pumps from Sulzer Pumps Finland. This type of seal has proven successful over more than ten years (Fig. 1■).

HIGH RELIABILITY

In the main, Sulzer Pumps equips pumps for the handling of wood pulp or paper stock having different contents of water with dynamic seals. This type of seal can be employed for numerous solids-loaded liquids.



2■ During the operation of the pump, an auxiliary wheel pumps the medium being handled out of the sealing chamber. The operating costs of a dynamic seal are lower than those of a conventional seal.



3■ The inherent pressure of the medium being handled ensures the seal in the standstill condition. The internal pressure in the pump, however, must be higher than the atmospheric pressure.

Thanks to the robust design, the service life of the dynamic seal is just as long as all the other components in contact with liquids. Since the subassembly is made of the same cast material as the other parts of the pump that are impinged with pressure, compatibility is ensured under corroding circumstances.

The seals operate free of mechanical wear or leakage. The seal is effected without the use of sealing or lubricating fluid. Consequently, there are no operating risks which originate through the monitoring of an external lubricating system.

The dynamic seal from Sulzer Pumps operates reliably with any medium that is usually handled with Ahlstar pumps in the papermaking process.

INVESTMENT WELL WORTHWHILE

One has to observe a sufficient long period of operation for a cost balance (see box). In addition to very low operating costs, a comparison with the conventional methods over a period of ten years shows that the dynamic seal is definitely superior. Furthermore, the dependability contributes to a reduction in costs.

Noteworthy items in the cost balance sheet include the monitoring costs and the expenditure for the replacement of parts subject to wear, which are unavoidable with conventional seals. Moreover, costs are incurred for the procurement of the sealing fluid and the energy supply for the sealing fluid system. The high operating reliability averts emergency shutdowns and is therefore a definite advantage especially with process systems. In a typical papermaking mill, the costs – resulting from a single stoppage of the plant with corresponding production outfall caused by the mechanical seal – are almost as high as those needed for the operation of a dynamic seal over a period of ten years.

SIMPLE WORKING PRINCIPLE

In comparison with conventional seals, the sealing effect is not attributable to friction. An additional auxiliary expeller is mounted on the shaft in the sealing space. On rotation of the shaft, this expeller pumps the medium being handled out of the sealing chamber. The so-created liquid ring serves as a seal and prevents leaks (Fig. 2■). In the standstill condition, the medium fills the sealing space, and its inherent pressure forces a flexible disk against the sleeve on the shaft (Fig. 3■). When the pump is started again, the expeller forces the medium out of the sealing chamber. The flexible disk is no longer pressed against the sleeve and rotates without any contact.

WIDE RANGE OF APPLICATION

The dynamic seal is suitable for the majority of industrial applications. The medium being handled,

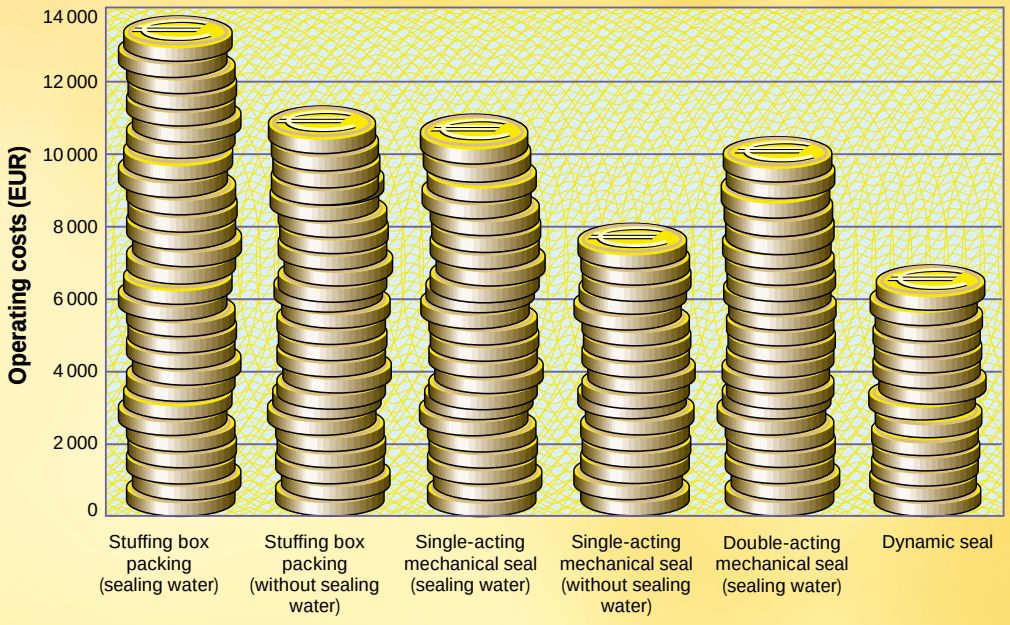
A COST COMPARISON: CLEAR-CUT ADVANTAGES FOR THE DYNAMIC SEAL

Service life	
Stuffing box packing	6 months
Single-acting mechanical seal	3 years
Double-acting mechanical seal	5 years
Dynamic seal	10 years

The dynamic seal is assumed to have a service life of ten years. The real life time, however, is as long as that of the impeller and casing.

Sealing fluid requirement	
Stuffing box packing	4 l/min
Single-acting mechanical seal	2 l/min
Double-acting mechanical seal	2 l/min
Dynamic seal	0 l/min

Power requirement	
Stuffing box packing	0.4 kW
Single-acting mechanical seal	0.15 kW
Double-acting mechanical seal	0.3 kW
Dynamic seal	0.8 kW



Within a period of ten years, a conventional stuffing box packing results in costs amounting to almost 14 000 Euro. The cost of operating a dynamic seal is only 50% of this figure (Assumptions: 0.08 EUR per m^3 sealing fluid, 0.045 EUR per kWh energy).

its temperature and the pressure on the inlet side of the pump, however, are decisive parameters for the selection of a sealing principle.

By the employment of a contactless dynamic seal, the temperature of the medium may not exceed the boiling point. Likewise, the pressure in the sealing space behind the impeller must be higher than the ambient pressure, and thus impede the build-up of the liquid ring. The shaft speed of the pumps and the diameter of the expeller determine the permissible height of the operating pressure against which the seal is to be effected.

If reactive or poisonous fluids are being handled, the possibility of employing dynamic seal has to be considered with the utmost care, since the medium will make contact with the ambient atmosphere.

Sulzer has been supplying pumps with a dynamic seal since 1987. Almost 50% of all Ahlstar pumps that leave the works in Finland are equipped with this type of seal. Numerous installations have also been retrofitted. With the conversion set on offer for Ahlstar pumps, type APP, NPP and WPP, operators can also benefit from the advantages of the contactless shaft seal even if their pumps have been in operation for a number of years. Ω

FOR MORE DETAILS

Sulzer Pumps Finland Oy
Jukka Vanhala
P.O. Box 18
Fl-48601 Karhula
Finland
Telephone +358 (0)5-224 31 89
Fax +358 (0)5-224 30 06
E-mail jukka.vanhala@sulzer.com